

# **Regional Interests Development Application Assessment Report**

**Petroleum Lease 1047** 

### **Table of Contents**

1.0	Introduction 4				
	1.1	Applicant and Related Approvals	4		
	1.2	Non-Notifiable Application	. 4		
	1.3	Landholder Copy of the Application	. 4		
	1.4	Referable Application	. 5		
2.0	Prop	osed Activity – Cherokee and Piute	6		
	2.1	Conventional Petroleum Well	. 6		
	2.2	Buried Pipeline	10		
	2.3	Access Tracks	10		
	2.4	Borrow Pit	11		
3.0	Prop	osed Activity - Okotoko North 1	12		
4.0	Envir	onmental Attributes	14		
	4.1	Land Use	14		
	4.2	Climate	14		
	4.3	Riparian Process	15		
		4.3.1 Regional Ecosystem Descriptions	16		
	4.4	Wildlife Corridors	17		
	4.5	Water Quality	20		
	4.6	Hydrological Processes	21		
	4.7	Geomorphic Processes	22		
	4.8	Beneficial Flooding	22		
5.0	Poter	ntial Impacts to Environmental Attributes	24		
	5.1	Riparian Process and Wildlife Corridors	24		
	5.2	Water Quality	25		
	5.3	Hydrological Processes and Beneficial Flooding	26		
	5.4	Geomorphic Processes	26		
6.0	Requ	ired Outcome Assessment	27		
Арре	ndice	S	29		
Арре	ndix A	A – Proposed Drilling Pay Layout	30		
Арре	ndix E	3 – Typical Right-of-Way for Buried Steel Pipeline	31		
Арре	ndix C	C – Typical Road Cross Section for Class D Roads	32		
Арре	Appendix D – RPI018-020 Okotoko North 1 Assessment Report				

### **Tables**

Table 1: Proposed Surface Disturbance	6
Table 2: Proposed Surface Disturbance	12
Table 3: Regional Ecosystems Descriptions	15
Table 4: Cooper Creek Surface Water Quality (1956-2016)	20
Table 5: Land System at Proposed Activity Location	22
Table 6: Schedule 2, Part 5 RPI Reg	27

### **Figures**

Figure 1: Location of Proposed Infrastructure within PL 1047	8
Figure 2: Location of Proposed Infrastructure and Construction Boundaries	9
Figure 3: Example Borrow Pit Ripping for Rehabilitation	11
Figure 4: Location of Pre-Existing Infrastructure	13
Figure 5: Monthly Average Rainfall and Temperature for Ballera Gas Field Station (2002-2017)	15
Figure 6: PL 1047 Regional Ecosystems	18
Figure 7: PL 1047 Wildlife Corridors	19
Figure 8: PL 1047 Wetlands and Waterways	23

### **Abbreviations and Units**

Acronym	Description		
ATP	Authority to Prospect		
DES	Department of Environment and Science, Queensland		
DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning, Queensland		
DNRM	Department of Natural Resources and Mines		
EA Environmental Authority			
ESA	Environmentally Sensitive Area		
P&G Act 2004 Petroleum and Gas (Production and Safety) Act 2004			
PL	Petroleum Lease		
RE	Regional Ecosystem		
RIDA	Regional Interests Development Approval		
RPI Act	Regional Planning Interests Act 2014		
RPI Reg	Regional Planning Interests Regulation 2014		
SEA	Strategic Environmental Area		

### 1.0 Introduction

Santos Limited is the principal holder of Petroleum Lease (PL) 1047, located approximately 22.5 km north-east of the Ballera Gas Plant, in the Queensland Cooper Basin. PL 1047 is wholly located within the Channel Country Strategic Environmental Area (SEA) as per Part 2, Division 2 of the *Regional Planning Interests Act 2014* (RPI Act). PL 1047 is due to be granted within the coming weeks and consequently, all future development activities on PL 1047 will be subject to approval under s29 of the RPI Act.

Santos is proposing a two well development on PL 1047 in 2019. This assessment report has been prepared to support the assessment application as required by s29(b) of the RPI Act. It has been prepared in accordance with the RPI Act Statutory Guideline 01/14: How to make an assessment application for a regional interests development approval under the Regional Planning Interests Act 2014 and the RPI Act Statutory Guideline 05/14: Carrying out resource activities and regulated activities within a Strategic Environmental Area.

This assessment report provides the following:

- Description of the proposed activities;
- Identification of the relevant environmental attributes of the land subject to the application;
- Evaluation of the potential impacts on the identified relevant environmental attributes; and
- An assessment of how the proposed activities meet the required outcome for SEAs as detailed in the *Regional Planning Interests Regulation 2014* (RPI Reg).

#### 1.1 Applicant and Related Approvals

Santos Limited, is the holder of PL 1047 and the associated Environmental Authority (EA) EPPG03518115, and is therefore an *eligible person* under s28 of the RPI Act.

Other Regional Interests Development Approvals (RIDA) associated with PL 1047 include:

• RPI18-020/Santos – Okotoko North 1

#### **1.2 Non-Notifiable Application**

In accordance with Section 34(2) of the RPI Act, and Section 13 of the RPI Reg, notification of the assessment application is not mandatory, as the activities are not proposed to be carried out in an area of regional interest that is a priority living area.

The proposed activities will be located solely on Lot 1 SP133822 forming part of Durham Downs Pastoral Station, a 8,910 km<sup>2</sup> cattle station operated the same landholder (S Kidman & Co Ltd). Discretionary notification under s34(4) would not be necessary given that separate regulatory systems are in place that require Santos to notify the landholder of petroleum activities occurring within their properties, the very large size of the cattle station relative to the activities, and that the landholder will receive a copy of the application as described below.

#### **1.3 Landholder Copy of the Application**

In accordance with Section 30 of the RPI Act and Schedule 5 of the RPI Reg, a copy of the application will be given to the landowner within 5 business days after the application is made.



#### 1.4 Referable Application

In accordance with Section 12(2) and Schedule 1 of the RPI Reg, the application is referrable to the Department of Environment and Science (DES) and the Department of Natural Resources, Mines and Energy (DNRME).

### 2.0 **Proposed Activity – Cherokee and Piute**

Santos Limited proposes to undertake the following resource activities on PL 1047 within the Channel Country SEA:

- Construction and operation (production) of two conventional petroleum wells;
- Construction and operation of two buried pipelines;
- Construction and operation of two access tracks;
- Construction and operation of one borrow pit; and
- Operation of one existing borrow pit with extension.

The anticipated location of the above listed infrastructure is shown in Figure 1. Exact locations are subject to final ground truthing, which may result in slight changes to ensure that:

- Any identified cultural heritage constraints are avoided;
- Mature trees are avoided, where practicable;
- Dry crossing sites for linear infrastructure are chosen; and
- Crossing locations for linear infrastructure are selected to minimise earthworks.

For non-linear infrastructure, a construction boundary has been set in the case that slight location changes are required post-ground truthing, (see Figure 2). The purpose of this construction boundary is to accommodate any necessary location changes post ground truthing, while ensuring that infrastructure will remain adequately set back from environmental attributes (i.e. waterways, wetlands) as much as practicable. All non-linear infrastructure will remain within the specified construction boundary, should a slight location change be necessary.

The total proposed surface disturbance for the above infrastructure will not exceed, irrespective of exact final location, that which is listed within Table 1.

#### **Table 1: Proposed Surface Disturbance**

Proposed Infrastructure	Length (km)	Proposed Disturbance (ha)
Petroleum Wells	N/A	3.0
Buried Pipelines	3.12	4.99
Access Tracks*	4.2	5.48
Borrow Pits**	N/A	2.18
		15.65 ha

\* Existing access track disturbance is approximately 0.52 ha.

\*\*Existing borrow pit disturbance is approximately 0.4 ha.

Descriptions of the above resource activities are provided in Sections 2.1 to 2.4 below.

#### 2.1 Conventional Petroleum Well

Two drilling pads are proposed to be constructed to accommodate modular drilling and ancillary equipment, including a derrick, power generators, pipe handling equipment, tanks, drilling sumps and associated stockpile, flares, and office areas. The layout of a typical drilling pad is provided in Appendix A.

Both drilling pads have been orientated to minimise the amount of clearing required and to avoid removing mature trees as far as practicable. In addition, the drilling pad locations have been set back from waterways as much as possible, while maintaining economic feasibility of the wells.

#### Construction

Once the drilling rig is in place on the well pad, drilling will be undertaken for approximately 11 days. Drilling fluid will be continuously circulated down the drill pipe and back to the surface equipment to balance underground pressure (if required), cool the drill bit and flush out rock cuttings. A drilling sump with an operating volume of approximately 384 kL will be used to contain drilling fluids (1 metre of freeboard will be maintained, total volume 576 kL). This drilling sump is designed with 300 mm windrow around all sides (as shown in Appendix A) to exclude overland flow.

Following the completion of drilling, the rig will be dismantled and transported from site and partial rehabilitation will commence, including the removal of drilling fluids from the drilling sump and backfilling of the drilling sump. It is expected that sumps will be emptied of drilling fluids and backfilled within 6 months of drilling completion. Nevertheless, flood alerts will be monitored to ensure affected sumps are emptied and backfilled before forecast floodwater has the potential to impact the site.

Drilling activities will be scheduled to be completed when no surface water is expected to be present on site and outside of flood events / inundation periods. Drilling will be undertaken in accordance with Santos Management System (SMS) Onshore Drilling and Completions technical standards. These standards provide the minimum construction requirements and good industry practice for petroleum production and are consistent with industry standards, such as, American Petroleum Institute (API) and NORSOK. The preliminary well design will be a 2-string design with 7-5/8" steel surface casing and 3-1/2" chrome steel tubing. Both of these strings will be cemented either back to surface or to inside the previous casing.

#### Operation

During operation of the well, surface facilities will be utilised for the purpose of petroleum production. Surface facilities will include a wellhead, which comprises of equipment on the surface that supports the various pipe strings, seals off the well, and controls the paths and flow of reservoir fluids, and a tie-in riser, which will connect the well to the pipeline, enabling transportation of the extracted petroleum.

It is feasible that workover operations will be required for the well in the future. Workover operations include activities such as, cleaning out of production conduits and replacing tubing, retrieving or drilling out obstructions in the well, and well bore decommissioning. For some workovers, a workover rig and associated infrastructure (i.e. a drilling fluids sump) will need to be set up within the proposed disturbance footprint for a temporary duration. Workover activities will also be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods.

Both wells will be restored at end-of-life in accordance with the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act 2004) and the relevant EA conditions.



Figure 1: Location of Proposed Infrastructure within PL 1047



Figure 2: Location of Proposed Infrastructure and Construction Boundaries

#### 2.2 Buried Pipeline

Two 100 mm diameter buried steel pipelines (DN 100) are required to connect each of the wells, via a tie-in riser, to the gathering network in the adjacent Greater Okotoko North field (ATP 1189). Each pipeline will be co-located with the associated access track for each well, as much as practicable. Sections of each pipeline may deviate from the associated access track, where necessary, for functionality (i.e. goes to a different corner of the well pad) and to minimise vegetation clearing.

A maximum right-of-way (ROW) width of 16 m is required for the installation of each pipeline. This area comprises the topsoil bank on either side of the ROW, access for pipe truck and side boom tractor / excavator, the pipeline trench, and a trench spoil bank (see Appendix B). ROW widths will be restricted to the smallest extent practicable (approximately 11 m), through waterway crossings. A maximum of 2 km of trench length will be open at any one time. This will not be continuous as breaks / bridges are employed at least every 800 m for cattle / wildlife egress.

#### Construction

Once the pipelines are laid within the trench, they will be bedded with padding placed around them, backfilled and compacted. The ROWs will then be reinstated to the condition and profiles existing at the commencement of activities. All wheel and equipment ruts along the pipeline routes shall be filled in and levelled by grading. Top soil and seed stock removed during installation will be re-spread over the ROW and all windrows removed. Where seed stock has not been displaced during installation, the area will be lightly scarified to promote regrowth. The constructed pipelines will have no midline risers or other unique features.

#### Operation

Once operational, the pipelines will transport petroleum to the Ballera Gas plant via the Wippo to Okotoko Spineline (Pipeline Licence (PPL) 39) and associated gathering network. At Ballera, the product will be processed for domestic and export markets.

The pipelines will be decommissioned at end-of-life in accordance with the *Petroleum and Gas* (*Production and Safety*) *Act 2004* (P&G Act 2004) and the relevant EA conditions.

#### 2.3 Access Tracks

Access tracks have been planned on desktop and continually refined to minimise the amount of environmental impact or disturbance caused. Existing roads will be utilised to access the PL 1047 field to within a few kilometres of the proposed well locations. There are no existing tracks that provide direct access to the well sites, and as such, two access tracks are proposed to provide drilling equipment access from the existing roads to the proposed well locations. One of these access tracks follows a pre-existing seismic line route, as to minimise new disturbance as much as possible. In addition, the proposed access tracks will be co-located with the proposed pipeline ROWs where practicable (as discussed in Section 2.2 above).

#### Construction

The proposed access tracks will be up to 13 m wide. This includes 6 m of roadway and allowance for 3.5m table drains placed on each side of the roadway, spaced out as per Class D spacing recommendations (see Appendix C). The 6 m roadway will be constructed by lightly grading the route and capping the surface with clay or similar locally available borrow pit material. The width of the proposed access tracks will be restricted to the smallest extent practicable (approximately 6m), through waterway crossings.

#### Operation

The proposed access tracks will be used for ongoing access to each of the well sites and to carry out surveillance and maintenance on each of the pipelines. The proposed access tracks are not designed to be used during wet weather conditions and will therefore not be constructed to any flood immunity, and will facilitate the passage of surface water keeping with existing hydrology while operational.

The proposed access tracks will be restored at end-of-life in accordance with the relevant EA conditions.

#### 2.4 Borrow Pit

An existing borrow pit is proposed to be used to provide a source of material required to construct a stable and supportive surface for well leases and access tracks. Additional material is likely to be required, and thus extension of the existing borrow pit and construction of another borrow pit is proposed. The location of the existing borrow pit and the proposed extension, and the location of the proposed borrow pit is shown in Figure 2.

The side batters of the borrow pits will be maintained at a slope of approximately 3:1, and the batters of the entrance / exit will be maintained at a slope of approximately 7:1. The borrow pits will be stabilised by ripping the floor and sides of the borrow pit to a depth of approximately 300 mm generally along the contour (Figure 3). During restoration stockpiled topsoil and vegetation is then respread to a uniform depth over the entire area from which it was removed. The sides and floor of the pit are graded to give a contoured finish, as required by the relevant EA conditions. All borrow pits will be restored at end-of-life in accordance with the relevant EA conditions.



Figure 3: Example Borrow Pit Ripping for Rehabilitation

### 3.0 **Proposed Activity - Okotoko North 1**

*RPI18-020/Santos* – *Okotoko North 1* was approved on 18 January 2019. This approval authorises the petroleum production from pre-existing infrastructure on PL 1047 within the Channel Country SEA. On 12 February 2019, Santos submitted a request to DNRME to amend the proposed boundaries of PL 1047 by adding three (3) partial sub-blocks to the application area. The addition of these partial sub-blocks was required due to historical joint venture boundaries, which no longer align with sub-block boundaries. Without the additional partial sub-blocks, an approximately 200 m gap would remain along the western boundary of PL 1047, limiting use of the PL 1047 area and the activities that could be carried out there.

Within the additional three partial sub-blocks, some existing infrastructure associated with the Okotoko North 1 well required for production is present. As such, Santos is seeking as part of this application to include this infrastructure and disturbance, as listed in Table 2 and shown in Figure 4:

#### Table 2: Proposed Surface Disturbance

Proposed Infrastructure	Length (km)	Proposed Disturbance (ha)
Existing Borrow Pit - Partial	N/A	0.15
Existing Access Tracks - Partial	0.3	0.09
		0.24

As detailed within the assessment report for *RPI018-020/Santos* – *Okotoko North 1* (a copy is provided in Appendix D), the infrastructure listed in Table 2 is pre-existing infrastructure, constructed and operated for the purposes of exploration and production testing activities as authorised by ATP 1189 and EA EPPG03518215. Santos now intends to utilise this infrastructure for the purpose of 'petroleum production' as evidenced by the submission of an application for PL 1047 on 2 February 2018 and an amendment application to EA EPPG03518115 to add PL 1047 on 23 July 2018.

The activity of petroleum production will not change the nature of the activities already conducted at these locations. 'Production' primarily refers to the ongoing commercialisation of the petroleum product generated from the activity. No new surface disturbance to land is required as part of this activity at this location. Activities will be limited to 'production' operational maintenance and restoration at their end-of-life. Descriptions of the activities are provided in Appendix D.



Figure 4: Location of Pre-Existing Infrastructure

### 4.0 Environmental Attributes

Section 7 of the RPI Reg prescribes the following environmental attributes relevant to the Channel Country SEA:

(a) the natural hydrologic processes of the area characterised by-

(i) natural, unrestricted flows in and along stream channels and the channel network in the area; and

(ii) overflow from stream channels and the channel network onto the flood plains of the area, or the other way; and

(iii) natural flow paths of water across flood plains connecting waterholes, lakes and wetlands in the area; and

*(iv)* groundwater sources, including the Great Artesian Basin and springs, that support waterhole persistence and ecosystems in the area;

(b) the natural water quality in the stream channels and aquifers and on flood plains in the area;

(c) the beneficial flooding of land that supports flood plain grazing and ecological processes in the area.

The Department of Infrastructure, Local Government and Planning's (DILGP) *RPI Act Statutory Guideline 05/14* summarises the above attributes to broadly relate to:

- Riparian process;
- Wildlife corridors;
- Water quality;
- Hydrologic processes;
- Geomorphic processes; and
- Beneficial flooding.

The relevance of the above environmental attributes to the proposed activities is described below.

#### 4.1 Land Use

The proposed activities are located on the Durham Downs Pastoral Station (Lot 1 on Plan SP133822) within PL 1047. Durham Downs is a pastoral lease that operates as a cattle station with a capacity of up to 21,500 head of cattle<sup>1</sup>. The primary land uses are cattle grazing and petroleum activities. Sections of pastoral lease have been extensively overgrazed from pastoral operations.

#### 4.2 Climate

The Channel Country SEA is located in an arid to semi-arid region of central Australia where the average rainfall is low. Seasons in the area are characterised by dry, hot summers and short, very dry winters as shown on Figure 5. Climate data from the closest weather station (Ballera Gas Field Station (045009)) shows that the mean rainfall for the project area since 2000 is 181.8 mm/year. The mean number of days of rain more than or equal to 1 mm is 20.3 days/year; that is on average, the project area can expect 344 days each year of less than 1 mm of rainfall. The El-Nino Southern Oscillation (ENSO) exerts significant influence on inter-annual climate variability across the area, produced marked fluctuations in

<sup>&</sup>lt;sup>1</sup> S. Kidman & Co Ltd (2018) *Durham Downs*, https://www.kidman.com.au/properties/5/durham-downs

the amount, timing and distribution of rainfall. As such, there is considerable year-to-year variation, particularly during the summer months, ranging from 'failed' wet seasons, to 'normal' and above average rainfall and tropical cyclone activity.





#### 4.3 Riparian Process

Regional Ecosystem (RE) mapping and aerial photography indicate that vegetation present in the project area is typical of the elsewhere in the bioregion (Channel Country) and subregion (Cooper – Diamantina Plains) - dominated by variable to sparse herblands and low open *Chenopod* shrublands supporting predominantly Lignum (*Duma florulenta*) and Queensland Bluebush (*Chenopodium auricomum*), with sporadic Coolibah (*Eucalyptus coolabah*) low open woodlands on more defined drainage channels.

REs mapped to be present within the proposed infrastructure area are shown in Figure 6, and detailed in Table 3 and Section 3.3.1. All REs are listed as No Concern at Present (NCAP) and are mapped within the tenure (PL 1047) as having 100% of their pre-cleared extent remaining. These REs are known to include riparian vegetation, particularly within the Cooper Creek and its braided channels, which surround the proposed activity. At its closest point, the Cooper Creek is located >100 m to the northeast of the northern drilling location. These areas are subject to long-term grazing operation of the Durham Downs pastoral lease.

There are no mapped Environmentally Sensitive Areas (ESAs) or permanent waterholes present within or surrounding the proposed activity.

RE	RE Short Description	VM Act	BD	Structural
Code		Class	Status	Category
5.3.8a	<i>Eucalyptus coolabah</i> low open woodland +/- <i>Duma</i> <i>florulenta</i> on braided channels, drainage lines, flood plain lakes and claypans	LC	NCAP	Very sparse

#### **Table 3: Regional Ecosystems Descriptions**

RE Code	RE Short Description	VM Act Class	BD Status	Structural Category
5.3.13a	<i>Duma florulenta</i> open shrubland in depressions on flood plains, interdune flats, clay pans and clay plains	LC	NCAP	Mid-dense
5.3.18a	Braided channel complex of major alluvial plains, includes <i>Chenopodium auricomum</i> open shrubland and variable sparse to open-herbland	LC	NCAP	Very sparse
5.3.18b	Braided channel complex of major alluvial plains, includes <i>Chenopodium auricomum</i> open shrubland and variable sparse to open-herbland	LC	NCAP	Very sparse

#### 4.3.1 Regional Ecosystem Descriptions

# 5.3.8a - *Eucalyptus coolabah* low open woodland +/- *Duma florulenta* on braided channels, drainage lines, flood plain lakes and claypans

*Eucalyptus coolabah* low open woodland with a distinct and semi-continuous, low shrub layer dominated by *Duma florulenta*. Scattered shrubs including *Acacia stenophylla, Eremophila bignoniiflora* and *Chenopodium auricomum* occur frequently. The ground cover is dominated by the perennial grasses *Eragrostis setifolia* and *Sporobolus mitchellii* and/or seasonally abundant ephemeral herbs. The latter includes the grasses *Dactyloctenium radulans, Dichanthium* spp. and *Iseilema vaginiflorum* which occur infrequently and the forbs Alternanthera nodiflora, Calotis hispidula, Centipeda thespidioides, *Stemodia glabella, Cullen cinereum, Senecio depressicola* and *Streptoglossa adscendens,* which are frequently present. A number of other ephemeral forbs, including species from the *Apiaceae, Convolvulaceae, Fabaceae, Goodeniaceae,* and *Malvaceae* occur infrequently but may be seasonally prominent. Widespread on and between braided channels where water backs up on frequently flooded alluvial plains. Associated soils are very deep, grey and brown cracking clays with a self mulching surface. Surface silt and sand bands are common in soil profile. Riverine wetland or fringing riverine wetland. (BVG1M: 16a) (DSITI, 2016).

# 5.3.13a - *Duma florulenta* open shrubland in depressions on flood plains, interdune flats, clay pans and clay plains.

Duma florulenta open shrubland commonly with Chenopodium auricomum, Maireana aphylla and occasional low trees and tall shrubs including Acacia stenophylla, Acacia victoriae, Eremophila bignoniiflora, Eucalyptus coolabah. The ground layer composition and density varies in response to incidence of flooding and may be dominated by perennial grasses, sedges and/or ephemeral forbs including Eragrostis setifolia, Sporobolus mitchellii, Eleocharis pallens, Cyperus spp., Eleocharis plana, Echinochloa turneriana, Eriochloa pseudoacrotricha and Panicum laevinode, Cullen cinereum, Marsilea drummondii, Ipomoea diamantinensis, Alternanthera nodiflora, Senecio depressicola and Ethuliopsis cunninghamii. Forbs commonly dominate after inundation in cooler months and legumes/grasses including Aeschynomene indica and/or Sesbania cannabina +/- Echinochloa turneriana commonly dominate after soils are very deep, neutral to moderately alkaline, crusted, grey cracking clays. Soils may be self mulching and may have sand bands in the profile. Moderate gilgai micro relief. Palustrine wetland (e.g. vegetated swamp). (BVG1M: 34g) (DSITI, 2016).

## 5.3.18a - Braided channel complex of major alluvial plains, includes *Chenopodium auricomum* open shrubland and variable sparse to open-herbland.

*Chenopodium auricomum* open shrubland, frequently with pure stands of *Chenopodium auricomum*, however, scattered *Eucalyptus coolabah* low trees and *Eremophila bignoniiflora* tall shrubs may be present. The ground layer is usually sparse, and seasonally dominated by grasses, sedges and forbs.



The sedge *Eleocharis pallens* or perennial grass *Eragrostis setifolia* frequently dominate the ground layer. *Sporobolus mitchellii* is frequently dominant in the channels. Occurs on braided channels on alluvial plains of major rivers. Associated soils are very deep, crusted, red, brown and grey cracking clays that are subject to scalding. Surfaces may be weakly self mulching. Palustrine wetland (e.g. vegetated swamp). (BVG1M: 34g) (DSITI, 2016).

# 5.3.18b - Braided channel complex of major alluvial plains, includes *Chenopodium auricomum* open shrubland and variable sparse to open-herbland.

Variable sparse to open-herbland with either grasses or forbs dominating the ground layer depending on incidence of flooding and seasonal conditions. At times extensive areas may be denuded of any species. *Sporobolus mitchellii* occurs frequently and may be prominent, while *Eragrostis setifolia* is locally common. After favourable seasons, herbs form a distinct but discontinuous ground cover. The dominant ephemerals include *Iseilema vaginiflorum, Arabidella nasturtium, Atriplex velutinella, Brachyscome dentata, Pycnosorus pleiocephalus, Ethuliopsis cunninghamii, Euphorbia drummondii, Goodenia fascicularis and Senecio depressicola. Scattered low shrubs may occur with emergent trees fringing the association. Scattered low shrubs may occur. After summer local flooding, <i>Dactyloctenium radulans, Panicum laevinode, Iseilema* spp. and *Chloris pectinata* usually predominate. *Atriplex spp., Sclerolaena* spp., and *Asteraceae* are conspicuous after winter local flooding. *Echinochloa turneriana* usually predominates after early summer (general) flooding with *Pycnosorus pleiocephalus* and *Trigonella suavissima* conspicuous after early winter flooding. Occurs on braided channel systems on alluvial plains of major rivers. Associated soils are very deep, crusted, red, brown and grey cracking clays that are subject to scalding. Surfaces may be weakly self mulching. Floodplain (other than floodplain wetlands). (BVG1M: 31a) (DSITI, 2016).

#### 4.4 Wildlife Corridors

The proposed activities intersect mapped riparian corridors, as shown in Figure 7. These riparian corridors, which represent major channels and minor channels (250k geodata hierarchy 1, 2 and 3) necessary to capture permanent waterholes, buffered by 1km either side and clipped to land zone 3<sup>2</sup>, are associated with the Cooper Creek. There are no mapped terrestrial corridors present within or surrounding the proposed activity.

<sup>&</sup>lt;sup>2</sup> DERM 2009 Biodiversity Planning Assessment, Channel Country Bioregion, Landscape Expert Panel Report, Version 1.1







Figure 7: PL 1047 Wildlife Corridors

#### 4.5 Water Quality

#### Surface Water

The braided channels associated with the Cooper Creek surround the proposed activity. Generally, the Cooper Creek is confined to the main channels, but every 3-4 years, flows are sufficient to inundate parts of the Cooper floodplain via a network of tributary channels. During extended periods of no flow, the Cooper Creek contracts to a series of waterholes. Very large Cooper Creek flood events with the potential to inundate the broader Channel Country region, and flow water into the lower Cooper Creek in South Australia, occur on average once every 10 years, reaching Lake Eyre North in an estimated 1 in every 20 years

Historical (1965-2016) water quality data from the QLD Government's Cooper Creek gauging station 003103A, located approximately 96km south west, is summarised in Table 4.

Parameter	Average Value
Conductivity @ 25°C	345 µS/cm
Turbidity	512 NTU
рН	7.4
Total Nitrogen	1.4 mg/L
Total Phosphorus as P	0.4 mg/L
Sodium as Na	44.6 mg/L
Magnesium as Mg	7.4 mg/L
Chloride as Cl	62.6 mg/L
Fluoride as F	0.2 mg/L

Table 4: Cooper Creek Surface Water Quality (1956-2016)

#### Groundwater

The main GAB aquifers (i.e. in the Eromanga Basin stratigraphy) in relation to PL 1047 are the Winton Formation, Cadna-owie Formation, Hooray Sandstone, Hutton Sandstone and Poolowanna Formation (Precipice Sandstone equivalent). The aquifers of the Eromanga Basin are considered highly productive aquifers over most of the GAB. Shallow groundwater is generally found within the Quaternary and Tertiary alluvium formations associated with the very flat structures of flood plains and is absent where the Winton Formation occasionally outcrops. Groundwater from Tertiary sediments and the Winton Formation are characterised by a higher proportion of sodium and magnesium ranging in EC values from 3,000 to  $13,000 \,\mu$ S/cm<sup>3</sup>.

The aquifers of the Cooper Basin, which underlies the GAB sediments of the Eromanga Basin, are not considered sandstone aquifers of the GAB. Groundwater yields from the Cooper Basin may be feasible

<sup>&</sup>lt;sup>3</sup> Golder Associates 2013 Underground Water Impact Report For Santos Cooper Basin Oil & Gas Fields, SW QLD

from the Wimma Sandstone, Toolachee Formation, Epsilon Formation, Patchawarra Formation and Tirrawarra Formation.

Both wells primarily target the Permian-aged Toolachee Formation, which is interpreted to consist fully of fluvially derived sediment consisting of fining upward channel sandstones. These reservoir intervals are thought to be interbedded with coal and floodplain shales, which act as intraformational seals. The Toolachee Formation is overlain by basal Nappamerri Group shales, which forms the main regional seal to the Toolachee Formation.

Within the Santos Cooper Basin tenements, only the upper aquifers of the Eromanga Basin sequence are of economic interest to the local community. This is due to the significant depth of the water bearing formations in the Cooper Basin and the general unreliability of the groundwater quality that may be encountered (i.e. it may have a high salinity and contain free and dissolved hydrocarbons).

No registered groundwater bores are located nearby to the proposed activity. There are no GAB ROP discharge or recharge springs located within PL 1047. The closest GAB springs are located more than 200km from PL 1047. Terrestrial groundwater dependent ecosystems may be present within the project area.

#### 4.6 Hydrological Processes

#### Regional

Topography is limited to low undulating topography between the drainage channel system. The Channel Country is characterised by vast flat-lying, braided, flood and alluvial plains surrounded by gravel or gibber plains, dunefields and low ranges. The low resistant hills and tablelands are remnants of the flat-lying Cretaceous sediments.

The drainage system is dominated by the Cooper Creek Basin draining towards Lake Eyre. During periods of high rainfall, the flat topography and drainage channel system becomes a largely flooded plain with water flow concentrating where Cooper Creek crosses the QLD-SA border. The Cooper Creek system catchment covers an area of approximately 300,000 km<sup>2</sup>. Generally, Cooper Creek streamflow is confined to the main channels, but every 3-4 years, flows are sufficient to inundate parts of the Cooper floodplain via a network of tributary channels. During extended periods of no flow, the Cooper Creek contracts to a series of waterholes. Very large Cooper Creek flood events with the potential to inundate the broader Channel Country region, and flow water into the lower Cooper Creek in South Australia, occur on average once every 10 years, reaching Lake Eyre North in an estimated 1 in every 20 years

#### Local

The braided channels associated with the Cooper Creek surround the proposed activity; at its closest point, the Cooper Creek is located >100 m to the north-east of the northern drilling location (Figure 8). The proposed activity is subject to intermittent flows associated with Cooper Creek flood events. The area of the proposed activity will experience intermittent surface water flows during storm events, causing localised ponding of surface water, as discussed above. The proposed activity is located within an area classed as arid / semi-arid floodplain lignum swamp under Department of Science, Information Technology and Innovation's *Queensland wetland data*.<sup>4</sup>

<sup>&</sup>lt;sup>4</sup> DSITI 2016 Queensland wetland data version 4 – wetland lines; Queensland wetland data version 4 – wetland areas; Queensland wetland data version 4 – wetland points

#### 4.7 Geomorphic Processes

#### Regional

Surface geology is dominated by Quaternary alluvium deposits associated with flood plains, with consolidated Tertiary sediments or Winton Formation on the higher ground. Cooper Creek is a large sedimentary sump accreting over a vast floodplain.

#### Local

The proposed activities are located in the Channel Country bioregion and Cooper Diamantina Plains sub-region. The area is entirely located within Landzone 3 (recent quaternary alluvial systems).

Land systems mapped at the location of the proposed activities are consistent with Landzone mapping. The proposed activity location is entirely mapped as an alluvial plain with gradients less than 1:5000 and anastomosing channels, main channels and shallow flood depressions. The area is associated with the irregularly flooded Cooper Creek main channel area. Land systems present within the proposed activity location is summarised in Table 5. Soils are entirely mapped as grey clays and grey cracking clays (Map Code: CC87).

#### Table 5: Land System at Proposed Activity Location

Map Code	Land System Description	Agricultural Land Class	% of Proposed Project Area
C1	Alluvial plains with gradients of less than 1:5,000; with anastomosing channels (0.1 to 1 m relief), main channels (<10 m relief), shallow flood depressions, waterholes, billabongs and swamps, and slightly elevated more stable alluvial islands. Isolated sand dunes.	C1 - Pasture Land - native pastures	100 %

#### 4.8 Beneficial Flooding

The braided channels associated with the Cooper Creek surround the proposed activity; at its closest point, the Cooper Creek is located >100 m to the north-east of the northern well site (Figure 8). Notwithstanding, the area of the proposed activity will experience intermittent surface water flows during storm events, causing localised ponding of surface water.

Generally, the surrounding Cooper Creek streamflow is confined to the main channels, but every 3-4 years, flows are sufficient to inundate parts of the Cooper floodplain via a network of tributary channels. During extended periods of no flow, the Cooper Creek contracts to a series of waterholes. Very large Cooper Creek flood events with the potential to inundate the broader Channel Country region, and flow water into the lower Cooper Creek in South Australia, occur on average once every 10 years, reaching Lake Eyre North in an estimated 1 in every 20 years.



Figure 8: PL 1047 Wetlands and Waterways

### **5.0 Potential Impacts to Environmental Attributes**

#### 5.1 Riparian Process and Wildlife Corridors

The proposed activities will involve minimal clearing of vegetation, since the majority of vegetation to be disturbed contains REs that are typical of the vegetation communities in the Channel Country SEA having a sparse, very sparse or grassland structural categories. These REs are naturally ephemeral, disturbance tolerant and resilient having naturally adapted to respond to the periods of boom and bust associated with the Channel Country Bioregion. In addition, all of the REs presently mapped within PL 1047 have >99% of their pre-clear extent mapped in the 2015 remnant mapping. This indicates the level of historic vegetation clearing for replacement land cover in PL 1047 is minimal and any additional clearing required for the proposed activities will not significantly reduce the area of occupancy of the existing RE vegetation. As such, the proposed activities will not compromise riparian function or critically impede the use of the riparian vegetation for migration, shelter and habitat associated with watercourses.

Notwithstanding, Santos will adopt the following measures to ensure that the proposed activities will not comprise riparian function or the preservation of wildlife corridor function:

- Disturbance of vegetation will be avoided as far as practicable, particularly the removal of mature native tree species;
- Where practicable, branches will be lopped rather than the removal of vegetation;
- Pre-existing infrastructure will be preferentially utilised in favour of new infrastructure, in order to minimise additional disturbance;
- Drilling pad area will be restricted to 1.5 ha disturbance;
- Linear infrastructure corridors will maximise co-location to minimise additional disturbance;
- Linear infrastructure corridor widths will be restricted to the smallest extent practicable through waterway crossings;
- Any fuels / chemicals will be stored and handled in accordance with Australian Standards and spill kits will be located onsite to contain any spills if required;
- Measures shall be adopted to prevent fauna entrapment within excavation work areas and infrastructure developments, such as:
  - Restricting the length of open trench to 2 km at any one time, and ensuring breaks / bridges are employed at least every 800 m for cattle egress;
  - Utilising branches, ropes, hessian sacks, ramped gang planks or similar to create 'ladders' to enable fauna to exit the excavations; and
  - Ensuring cellar covers are installed as soon as reasonably practicable.
- Access to and from authorised activities will occur along designated access tracks only;
- Rehabilitation to promote conditions suitable for the natural revegetation of disturbed areas will occur progressively;
- Infrastructure / disturbances with no ongoing use (e.g. by the landholder / pastoral leaseholder)
  will be rehabilitated as soon as reasonably practicable following the cessation of petroleum
  activities to promote the natural re-establishment of vegetation of similar species composition
  and density to the surrounding undisturbed land in accordance with the relevant EA.

Given the extent of the REs present, the characteristics of RE vegetation communities involved and the typical boom/bust lifecycles associated with the RE vegetation communities of South Western Queensland, the scope of the proposed activities and the above management measures, the proposed activities will not cause a widespread or irreversible impact on riparian function or wildlife corridors within the Channel Country SEA.

#### 5.2 Water Quality

The proposed drilling locations are adequately set back from the surrounding Cooper Creek channels and drilling will be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods. Some clearing of vegetation when crossing tributaries will be required for the construction of the proposed linear infrastructure. In order to minimise disturbance to the greatest possible extent in these tributaries, Santos will:

- Utilise existing linear infrastructure in the first instance;
- Utilise pre-disturbed areas preferentially, as much as practicable;
- Maximise opportunities to co-locate linear infrastructure corridors;
- Restrict the width of linear infrastructure corridors through waterway crossings; and
- Preferentially select dry crossing sites with minimal earthwork requirements.

No activities proposed involve the discharge of water (point or diffuse sources) or the construction or operation of regulated dams and other major infrastructure (i.e. separator ponds, permanent camps). Any fuels / chemicals used on site will be stored and handled in accordance with Australian Standards and spill kits will be located onsite where required to contain any spills should they occur. All waste materials and non-essential infrastructure will be removed at the end of the petroleum activities as soon as reasonably practicable, minimising risks associated with contamination, or a reduction in water quality, in accordance with EA conditions. Rehabilitation to promote conditions suitable for the natural revegetation of disturbed areas will occur progressively.

Contingency measures for unplanned releases of contaminants will be implemented in accordance with EA conditions. Moreover, due to the slow nature of the encroachment of flood waters in the Cooper Creek, sufficient time is generally available to prepare areas for potential flood impacts e.g. in these situations all non-essential materials present on site at the time (e.g. hydrocarbons, chemicals, infrastructure) shall be removed from construction and/or operational areas prior to the arrival of floodwaters.

The petroleum wells will be completed with steel surface casing, steel production casing, and cement in accordance with the SMS Onshore Drilling and Completions technical standards, to isolate the well from aquifers, including the Great Artesian Basin, and other geological units that may contain terrestrial groundwater dependent ecosystems.

Terrestrial groundwater dependent ecosystems may be present within the project area. However, groundwater modelling<sup>5</sup> shows that the groundwater pressure in the shallowest formations, which may be hydraulically connected to and support terrestrial ecosystems will not be impacted by the development of any additional wells on PL 1047. This is due to the vertical separation of the target formation for the proposed wells (Permian-aged Toolachee Formation), which is greater than 1,500 m below the surface, and the location of any potential terrestrial ecosystems that may be dependent on groundwater.

The closest GAB springs are located more than 200km from PL 1047. These springs are too far away to be at risk of hydraulic impact due to the proposed activities.

Given the scope and nature of the proposed activities, combined with the implementation of the above management measures, the proposed activities will not cause a widespread or irreversible impact on water quality within the Channel Country SEA.

<sup>&</sup>lt;sup>5</sup> Golder Associates 2013 Underground Water Impact Report For Santos Cooper Basin Oil & Gas Fields, SW QLD

#### 5.3 Hydrological Processes and Beneficial Flooding

The proposed drilling locations are adequately set back from the surrounding Cooper Creek channels and drilling will be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods. Infrastructure associated with the drilling program is largely temporary (drilling fluids removed from site and sumps backfilled post completion of drilling) and all non-essential infrastructure will be decommissioned and rehabilitated prior to the onset to flood events/inundation periods. Access tracks will not be constructed to any flood immunity, allowing the natural passage of surface water to avoid impacts to the existing hydrology. The proposed pipelines will be buried underground and the surface rehabilitated to reinstated existing drainage. The wells will be completed with steel surface casing, chrome steel tubing, and cement in accordance with the SMS Onshore Drilling and Completions technical standards to ensure that the wells are isolated from aquifers, and other geological units. The vertical separation of the target formation for the proposed wells and the location of any potential terrestrial ecosystems that may be dependent on groundwater is too great to be at risk of hydraulic impact.

It is possible that surface infrastructure (i.e. drilling sump), may result in diversion or interception of a negligible amount of overland flow, when considering the small footprint of the proposed activity relative to the sub-catchment area (drilling sump has an operating volume of approximately 384 kL and is designed to exclude overland flow). However, these activities will be temporary in nature and will be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods.

Given the location and native of the proposed activities, and subject to appropriate management as described above, no widespread or irreversible impacts on hydrological processes or beneficial flooding are expected as a result of the proposed activities.

#### 5.4 Geomorphic Processes

No drilling is proposed in waterways, and the small areas of disturbance proposed will not significantly interfere with natural erosive processes. Existing tracks will be used where possible and the proposed pipelines and access tracks will be co-located are far as practicable, minimising the need to create additional disturbance in watercourses. Rehabilitation of the pipelines will be completed when no surface water is expected to be present on site and outside of flood events/inundation periods. Infrastructure associated with the drilling program is largely temporary (drilling fluids removed from site and sumps backfilled post completion of drilling) and all non-essential infrastructure will be decommissioned and rehabilitated prior to the onset to flood events/inundation periods. Access tracks will not be constructed to any flood immunity, allowing the natural passage of surface water to avoid impacts to the existing hydrology. Following the cessation of petroleum activities, disturbed land will be rehabilitated to promote the natural re-establishment of vegetation consistent with the surrounding undisturbed land. As such, no widespread or irreversible impacts on natural erosion, sediment transportation or deposition is expected as a result of the proposed activities.

### 6.0 Required Outcome Assessment

Schedule 2, Part 5 of the RPI Reg provides criteria for assessment by agencies. In accordance with Section 14(3) of the RPI Reg, if the application demonstrates compliance with either of the prescribed solutions stated in Part 5, Schedule 2, the proposed activity will meet the required outcome for the regional interest. Critically, the application demonstrates that the prescribed solution provided in s15(1)(b) will be met as outlined within Table 6.

#### Table 6: Schedule 2, Part 5 RPI Reg

Schedule 2, Part 5 RPI Reg		Relevance To Application
<b>14 Required outcome</b> The activity will not result in a widespread or irreversible impact on an environmental attribute of a strategic environmental area.	*	The proposed activities will not result in widespread or irreversible damage to the environmental attributes listed in s7 of the RPI Reg for the Channel Country SEA as described in Section 3.0 - 4.0, as the application demonstrates the proposed activities will be undertaken in accordance with the below prescribed solution.
<ul> <li>15 Prescribed solution</li> <li>(1) The application demonstrates either— <ul> <li>(a) the activity will not, and is not likely to, have a direct or indirect impact on an environmental attribute of the strategic environmental area; or</li> <li>(b) all of the following—</li> </ul> </li> </ul>	•	The application demonstrates the proposed activities will be undertaken in accordance with the prescribed solution provided in s15(1)(b).
(i) if the activity is being carried out in a designated precinct in the strategic environmental area—the activity is not an unacceptable use for the precinct;	•	The proposed activities do not include any of the unacceptable uses prescribed by Section 15(2) of the RPI Act.
(ii) the construction and operation footprint of the activity on the environmental attribute is minimised to the greatest extent possible;	*	In accordance with EA EPPG03518115, Schedule F – Land, Planning for Land Disturbance, conditions (F13) and (F14), the location of the proposed activities has been selected in accordance with the following site planning principles: - maximise the use of areas of pre-existing disturbance; - in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value; - minimise disturbance to land that may result in land degradation; - in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of vegetation; - in order of preference, avoid then minimise clearing of native mature trees; - maximise co-location of linear infrastructure corridors; and - minimise the width of linear infrastructure corridors to the greatest practicable extent. Application of these site planning principles has been demonstrated throughout Section 2.0 – 4.0. For example: - existing borrow pit and station tracks will be utilised; - proposed drilling pad has been restricted to 1.5 ha disturbance area; - proposed drilling pad has been orientated to avoid clearing mature trees as far as practicable, and to minimise the amount of clearing required; - proposed pipeline ROW and access track are co-located;

		<ul> <li>the width of the ROW for pipeline and access track has been restricted to the smallest extent practicable through waterway crossings;</li> <li>proposed borrow pit is adequately set back from waterways and referrable wetlands; and</li> </ul>
(iii) the activity does not compromise the preservation of the environmental attribute within the strategic environmental area;	•	Refer to Sections 3.0 – 4.0.
(iv) if the activity is to be carried out in a strategic environmental area identified in a regional plan— the activity will contribute to the regional outcomes, and be consistent with the regional policies, stated in the regional plan.	•	The South West Regional Plan does not identify the Channel Country SEA.

The application also demonstrates the proposed use of a temporary drilling sump does not constitute a *regulated activity* as defined by the RPI Act.

s11(3) of the Regional Planning Interests Regulation 2014		Relevance To Application
Water storage (dam) is storing water using a dam, other than storing water on land to be used only for any or all of the following purposes— (a) to meet the domestic water needs of the occupants of the land; (b) to water the stock that is usually grazed on the land; (c) to water stock that is travelling on a stock route on or near the land.	*	N/A – the application does not propose to store water in a dam; The application proposes the temporary storing of drilling fluids in drill sumps designed to exclude surface flow if/when construction or operational activities require it. Santos drilling sumps are designed to exclude surface flow and avoid the impounding of surface water as shown in Appendix A. In addition, construction and workover activities will be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods. Therefore, all non-essential surface infrastructure, including a drill sump, will be removed prior to Cooper Creek flood events.
Schedule 6 of the Regional Planning Interests Regulation 2014		Relevance to the application
dam— (a) means the following— (i) a barrier, whether permanent or temporary, that does, could or would impound water;	~	N/A – the drilling sumps will not impound water. Santos drilling sumps are designed to exclude surface water and avoid the impounding of surface water. Construction and workover activities will be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods. Therefore, all non-essential surface infrastructure, including a drill sump, will be removed prior to Cooper Creek flood events.
<ul> <li>(ii) the storage area created by the barrier;</li> <li>(iii) an embankment or other structure that is associated with the barrier and controls the flow of water; but</li> </ul>	*	N/A – the sumps will not constitute a barrier for the storage of water.
(b) does not include a water tank, including a rainwater tank, constructed of steel, concrete, fibreglass, plastic or similar material.	•	N/A – the proposed sumps does not constitute a water tank.



## Appendices



Appendix A – Proposed Drilling Pay Layout



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SUMP VOLUME576m³SUMP AREA192m²	SUMP VOLUME576m³SUMP AREA192m²		RIG HARDS	STAND	483m²	
SUMP AREA 192m <sup>2</sup>	SUMP AREA 192m <sup>2</sup>		SUMP VOL	UME	576m³	
			SUMP ARE	A	192m²	



Appendix B – Typical Right-of-Way for Buried Steel Pipeline





### Appendix C – Typical Road Cross Section for Class D Roads



AUTOCAD

7

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10 TYPICAL ROAD CROSS SECTIONS - CLASS D ROAD (FOR ELEVATED SECTIONSAISHEET

Appendix D – *RPI018-020* Okotoko North 1 Assessment Report



# **Regional Interests Development Application Assessment Report**

# **Okotoko North 1 Gas Well**

### **Table of Contents**

1.0	Introd	Introduction4						
	1.1	Landho	older Copy of the Application4					
	1.2	Non-No	otifiable Application4					
	1.3	Referal	ble Application					
2.0	Propo	osed Ac	ctivity5					
	2.1	Existing	g Conventional Petroleum Well and Lease5					
	2.2	Existing	g Access Tracks					
	2.1	Existing	g Borrow Pit7					
	2.2	Existing	g Buried Pipeline7					
3.0	Envir	onment	tal Attributes and Potential Impacts8					
	3.1	Riparia	n Process					
		3.1.1	Potential Impacts8					
	3.1	Wildlife	e Corridors					
		3.1.1	Potential Impacts10					
	3.2	Water (	Quality					
		3.2.1	Potential Impacts11					
	3.3	Hydrold	ogical Processes					
		3.3.1	Potential Impacts12					
	3.4	Geomo	prphic Processes					
		3.4.1	Potential Impacts13					
	3.5	Benefic	cial Flooding					
		3.5.1	Potential Impacts15					
4.0	Requ	ired Ou	tcome Assessment					
Appe	ndix A	A – Defir	nitions					

### **Tables**

Table 1: Pre-Existing Surface Disturbance	5
Table 2: Cooper Creek Surface Water Quality (1956-2016)	. 10
Table 3: Land System at Proposed Activity Location	. 13
Table 4: Schedule 2, Part 5 RPI Reg	. 16

### **Figures**

Figure 1: Location of Pre-Existing Infrastructure	6
Figure 2: Example Borrow Pit Ripping for Rehabilitation	7
Figure 3: Regional Ecosystems	9
Figure 4: Watercourses, Wetlands and Strategic Environmental Areas 1	14

### **Abbreviations and Units**

Acronym	Description
ATP	Authority to Prospect
DES	Department of Environment and Science, Queensland
DILGP	Department of Infrastructure, Local Government and Planning
DNRM	Department of Natural Resources and Mines
EA	Environmental Authority
ha	Hectares
km	Kilometre
m	Metres
N/A	Not Applicable
P&G Act 2004	Petroleum and Gas (Production and Safety) Act 2004
PL	Petroleum Lease
QLD	Queensland
RE	Regional Ecosystem
RIDA	Regional Interests Development Approval
RPI Act	Regional Planning Interests Act 2014
RPI Reg	Regional Planning Interests Regulation 2014
SEA	Strategic Environmental Areas

### **1.0** Introduction

Santos Limited (Santos) has prepared this assessment report to support an assessment application for a Regional Interests Development Approval (RIDA) as required under s29 of the *Regional Planning Interests Act 2014*) (RPI Act) to be submitted to the Department of Infrastructure, Local Government and Planning (DILGP).

This application is of an administrative nature. It seeks only to authorise petroleum production on Lot 1 on Plan SP133822 and PL1047 within the Channel Country SEA from the existing Okotoko North 1 petroleum well and associated infrastructure. This is a result of a change in tenure from Authority to Prospect (ATP) to a Production Licence (PL), and subsequent requirement for a new Environmental Authority (EA). The new tenure and EA are to allow for commercialisation of a petroleum product, following extended production testing, conducted under Authority to Prospect (ATP) 1189.

This assessment report has been prepared in accordance with the RPI Act Statutory Guideline 01/14: How to make an assessment application for a regional interests development approval under the Regional Planning Interests Act 2014 and the RPI Act Statutory Guideline 05/14: Carrying out resource activities and regulated activities within a Strategic Environmental Area.

This assessment report provides the following:

- Description of the proposed activities;
- Identification of the relevant environmental attributes of the land subject to the application;
- Evaluation of the potential impacts on the identified relevant environmental attributes; and
- An assessment of how the proposed activities meet the required outcome for Strategic Environmental Areas (SEA) as detailed in the *Regional Planning Interests Regulation 2014* (RPI Reg).

#### **1.1 Landholder Copy of the Application**

Separate regulatory systems are in place that require Santos to notify the landholder of petroleum activities occurring within their properties. Given the pre-existing nature of the activities (refer Section 2.0), notification to the landholder has already ensued. Notwithstanding, a copy of the application will be given to the landowner within 5 business days after the application is made, in accordance with Section 30 of the RPI Act and Schedule 5 of the RPI Reg.

#### **1.2 Non-Notifiable Application**

In accordance with Section 34(2) of the RPI Act, and Section 13 of the RPI Reg, notification of the assessment application is not mandatory, as the activities are not proposed to be carried out in an area of regional interest that is a priority living area.

The proposed activities would be located solely on Lot 1 SP133822 forming part of Durham Downs Pastoral Station, an 8,910 km<sup>2</sup> cattle station operated by S Kidman & Co Ltd. Discretionary notification under s34(4) would not be necessary given the pre-existing nature of the activities (notification to the landholder has already ensued), the very large size of the cattle station relative to the activities and that the landholder will receive a copy of the application as described below.

#### **1.3 Referable Application**

In accordance with Section 12(2) and Schedule 1 of the RPI Reg, the application is referrable to the Department of Environment and Science (DES) and the Department of Natural Resources, Mines and Energy (DNRME).

### 2.0 Proposed Activity

Santos is seeking to undertake 'petroleum production' on Lot 1 on Plan SP133822 and PL1047 within the Channel Country SEA from the infrastructure and disturbances listed in Table 1 and shown in Figure 1:

Dre Evicting Infractivisture	Pre-Existing	Disturbance		
Pre-Existing intrastructure	Length	Area		
Petroleum Well Pad (Okotoko Norht 1)	N/A	1.4 ha		
Buried Pipeline	3 km	0.3 ha		
Access Track	0.9 km	0.55 ha		
Borrow Pit	N/A	0.69 ha		
		2.94 ha		

Table 1: Pre-Existing Surface Disturbance

The infrastructure listed in Table 1 is pre-existing infrastructure, constructed and operated for the purposes of exploration and production testing activities as authorised by ATP 1189 and EA EPPG03518215. Santos now intends to utilise this infrastructure for the purpose of 'petroleum production' as evidenced by the submission of an application for PL 1047 on 2 February 2018 and an amendment application to EA EPPG03518115 to add PL 1047 on 23 July 2018.

The activity of petroleum production will not change the nature of the activities already conducted at these locations. 'Production' primarily refers to the ongoing commercialisation of the petroleum product generated from the activity. No new surface disturbance to land is required as part of this activity at this location. Activities will be limited to 'production' operational maintenance and restoration at their end-of-life. Descriptions of the activities are provided below (Section 2.1 to 2.4) with definitions provided in Appendix A.

Okotoko North 1 and associated infrastructure is located on the Durham Downs Pastoral Station (Lot 1 on Plan SP133822). Durham Downs is a pastoral lease that operates as a cattle station with a capacity of up to 21,500 head of cattle<sup>1</sup>. The primary land uses are cattle grazing and petroleum activities.

### 2.1 Existing Conventional Petroleum Well and Lease

The existing Okotoko North 1 well currently extracts petroleum for exploration and production testing purposes via surfaces facilities including a well head, which comprises of equipment on the surface that supports the various pipe strings, seals off the well, and controls the paths and flow of reservoir fluids. It is feasible that workover operations will be required for the Okotoko North 1 well in the future. Workover operations include activities such as, cleaning out of production conduits and replacing tubing, retrieving or drilling out obstructions in the well, and well bore decommissioning. For some workovers, a workover rig and associated infrastructure (i.e. a drilling fluids sump) would need to be set up within the existing disturbance footprint for a temporary duration. Workover activities would be scheduled to be completed outside of the wet season.

<sup>&</sup>lt;sup>1</sup> S. Kidman & Co Ltd (2018) *Durham Downs*, https://www.kidman.com.au/properties/5/durham-downs



Figure 1: Location of Pre-Existing Infrastructure

Extracting petroleum for 'production' will not change the nature of the activities already conducted at this location. The change in tenure is to enable the commercialisation of the petroleum product only. No new surface disturbance to land outside of the existing disturbance footprint is required at this location to facilitate ongoing production. The well will be restored at end-of-life in accordance with the P&G Act 2004 and the relevant EA conditions.

### 2.2 Existing Access Tracks

Access tracks are proposed to be used for ongoing access to the Okotoko North 1 well. No new access tracks are proposed. Pre-existing access tracks are not designed to be used during wet weather conditions, and therefore have not been constructed to any flood immunity, and will facilitate the passage of water keeping with existing hydrology. Maintenance of the tracks may be required over time (e.g. light grade). The access tracks will be restored at end-of-life in accordance with the *Petroleum and Gas* (*Production and Safety*) *Act 2004* (P&G Act 2004) and the relevant EA conditions.

#### 2.1 Existing Borrow Pit

The borrow pit is proposed to be used to provide a source of material required for ongoing well lease and access track maintenance. The existing side batters of the borrow pit are maintained at a slope of approximately 3:1, and the batters of the entrance / exit are maintained at a slope of approximately 7:1. The borrow pit will be progressively restored by ripping the floor and sides of the borrow pit to a minimum depth of 500 mm generally along the contour (Figure 2). Stockpiled topsoil and vegetation is then respread to a uniform depth over the entire area from which it was removed. The sides and floor of the pit are graded to give a contoured finish, as required by the relevant EA conditions.



Figure 2: Example Borrow Pit Ripping for Rehabilitation

#### 2.2 Existing Buried Pipeline

The existing pipeline is proposed to be utilised to transport extracted petroleum for production. The existing pipeline is buried underground and the surface has been rehabilitated to reinstate existing drainage. It is connected to the existing pipeline gathering network, to the Wippo to Okotoko Gas Spineline (PPL 39), and currently transports petroleum for exploration and production testing purposes. Transporting petroleum for sale will not change the nature of the activities already conducted at this location. No new surface disturbance to land is required. The pipeline will be restored at end-of-life in accordance with the relevant EA conditions



### 3.0 Environmental Attributes and Potential Impacts

Section 7 of the RPI Reg prescribes the following environmental attributes relevant to the Channel Country SEA:

(a) the natural hydrologic processes of the area characterised by-

(i) natural, unrestricted flows in and along stream channels and the channel network in the area; and

(ii) overflow from stream channels and the channel network onto the flood plains of the area, or the other way; and

(iii) natural flow paths of water across flood plains connecting waterholes, lakes and wetlands in the area; and

(*iv*) groundwater sources, including the Great Artesian Basin and springs, that support waterhole persistence and ecosystems in the area;

(b) the natural water quality in the stream channels and aquifers and on flood plains in the area;

(c) the beneficial flooding of land that supports flood plain grazing and ecological processes in the area.

DILGP's RPI Act Statutory Guideline 05/14: Carrying out resource activities and regulated activities within a Strategic Environmental Area summarises the above attributes to broadly relate to:

- Riparian process;
- Wildlife corridors;
- Water quality;
- Hydrologic processes;
- Geomorphic processes; and
- Beneficial flooding.

As discussed in Section 2.0, the proposed activity of petroleum production will not change the nature of the activities already conducted from existing infrastructure. The proposed activity is limited to production, operational maintenance and restoration of existing infrastructure at end-of-life. Notwithstanding, the relevance of the above environmental attributes to the activity is described below.

#### 3.1 Riparian Process

The proposed activity would be undertaken within Regional Ecosystems (REs) 5.3.18b/5.3.18a/5.3.8a (60/30/10) (see Figure 3). These REs are listed as of No Concern at Present (NCAP), are known to include riparian vegetation, and are subject to long-term grazing from operation of the Durham Downs pastoral lease. They consist of variable sparse to open-herbland with either grasses or forbs dominating the ground layer depending on incidence of flooding and seasonal conditions (5.3.18b); *Chenopodium auricomum open shrubland,* frequently with pure stands of *Chenopodium auricomum* (5.3.18a); and *Eucalyptus coolabah* low open woodland with a distinct and semi-continuous, low shrub layer dominated by *Duma florulenta.* The braided channels associated with the Cooper Creek surround the proposed activity; at its closest point, the Cooper Creek is located approximately 250m to the west.

#### 3.1.1 Potential Impacts

The activity is located within the existing infrastructure footprint. No new surface disturbance to land, such as clearing vegetation in or near streams, lakes, floodplains or wetlands, is required as part of the proposed activity. Access to and from the proposed activity will occur along the existing access tracks only.



Figure 3: Regional Ecosystems

Following cessation of petroleum production, existing infrastructure would be rehabilitated to promote the natural re-establishment of vegetation consistent with the surrounding undisturbed land in accordance with the relevant EA conditions. As such, there will be no new disturbance or change to riparian corridors along streams and lakes and within floodplains and wetlands as a part of this activity. Accordingly, the proposed activities would not cause a widespread or irreversible impact on riparian processes within the Channel Country SEA.

#### 3.1 Wildlife Corridors

The proposed activity is located within a pre-disturbed area of an existing vegetated corridor. The area where the Okotoko North 1 well is located has been extensively overgrazed from operation of the Durham Downs pastoral lease. The REs surrounding the location (REs 5.3.18b/5.3.18a/5.3.8a (60/30/10)) may provide suitable general habitat for a range of wetland water birds, and for the Western Taipan (*Oxyuranus microlepidotus*) (Least Concern). There are no mapped Environmentally Sensitive Areas (ESA) near the Okotoko North 1 well; the closest ESA, Category C ESA Essential Habitat, is located approximately 5 km to the southeast.

#### 3.1.1 Potential Impacts

No new disturbance(s) to aquatic and terrestrial fauna or wildlife corridors is to be undertaken as part of this activity. Measures will be adopted to prevent fauna entrapment within operational areas, and hygiene protocols will be implemented as appropriate to minimise the introduction, spread and persistence of weed species, in accordance with relevant EA conditions. Access to and from the proposed activity will occur along the existing access tracks only. Following cessation of petroleum production, existing infrastructure would be rehabilitated to promote the natural re-establishment of vegetation consistent with the surrounding undisturbed land, in accordance with relevant EA conditions. As such, there is no disturbance or change to wildlife corridors as a part of this activity and therefore the proposed activities would not cause a widespread or irreversible impact on wildlife corridors within the Channel Country SEA.

#### 3.2 Water Quality

#### Surface Water

The proposed activity is located within an area of the Cooper Creek basin that is not typically flowing and is subject to intermittent flows associated with Cooper Creek flood events; which have occurred five times since 1989 (using Landsat data). Historical (1965-2016) water quality data from the QLD Government's Cooper Creek gauging station 003103A, located approximately 95km south west, is summarised in Table 2.

Parameter	Average Value
Conductivity @ 25°C	345 µS/cm
Turbidity	512 NTU
pН	7.4
Total Nitrogen	1.4 mg/L
Total Phosphorus as P	0.4 mg/L
Sodium as Na	44.6 mg/L
Magnesium as Mg	7.4 mg/L
Chloride as Cl	62.6 mg/L

Table 2: Cooper	Creek	Surface	Water	Quality	(1956-2016)
					(



Fluoride as F	0.2 mg/L
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#### Groundwater

The main GAB aquifers (i.e. in the Eromanga Basin stratigraphy) in relation to PL 1047 are the Winton Formation, Cadna-owie Formation, Hooray Sandstone, Hutton Sandstone and Poolowanna Formation (Precipice Sandstone equivalent). The aquifers of the Eromanga Basin are considered highly productive aquifers over most of the GAB. Shallow groundwater is generally found within the Quaternary and Tertiary alluvium formations associated with the very flat structures of flood plains and is absent where the Winton Formation occasionally outcrops. Groundwater from Tertiary sediments and the Winton Formation are characterised by a higher proportion of sodium and magnesium ranging in EC values from 3,000 to  $13,000 \,\mu\text{S/cm}^2$ .

The aquifers of the Cooper Basin, which underlies the GAB sediments of the Eromanga Basin, are not considered sandstone aquifers of the GAB. Groundwater yields from the Cooper Basin may be feasible from the Wimma Sandstone, Toolachee Formation, Epsilon Formation, Patchawarra Formation and Tirrawarra Formation.

The Okotoko North 1 well primarily targets the Toolachee Formation, but also intersects the secondary Epsilon and Patchawarra formations of the Cooper Basin. Together with the Tirrawarra Sandstone, these formations are the main gas reservoirs within the Cooper Basin and are located at depths of 2000 m or more.

Within the Santos Cooper Basin tenements, only the upper aquifers of the Eromanga Basin sequence are of economic interest to the local community. This is due to the significant depth of the water bearing formations in the Cooper Basin and the general unreliability of the groundwater quality that may be encountered (i.e. it may have a high salinity and contain free and dissolved hydrocarbons).

No registered groundwater bores are located nearby to the proposed activity. There are no known groundwater dependent ecosystems, including Great Artesian Basin springs, which support permanent waterholes or aquatic ecosystems in the area. The closest Great Artesian Basin discharge / recharge springs are located greater than 200 km from Okotoko North 1.

#### 3.2.1 Potential Impacts

The activity does involve any new surface disturbance to land, such as clearing vegetation in or near streams, lakes, floodplains or wetlands. No activities proposed involve the discharges of water (point or diffuse sources) or the construction or operation of regulated dams and other major infrastructure (i.e. separation ponds, permanent camps).

Any fuels / chemicals used on site would be stored and handled in accordance with Australian Standards and spill kits will be located onsite where required to contain any spills should they occur. All waste materials and non-essential infrastructure will be removed at the end of the petroleum activities as soon as reasonably practicable, minimising risks associated with contamination, or a reduction in water quality, in accordance with EA conditions.

Contingency measures for unplanned releases of discharges of contaminants will be implemented in accordance with EA conditions. Moreover, due to the slow nature of the encroachment of flood waters in the Cooper Creek, sufficient time is generally available to prepare operational areas for potential flood impacts e.g. in these situations all non-essential materials present on site at the time (e.g. hydrocarbons, chemicals, infrastructure) shall be removed from operational areas prior to the arrival of floodwaters.

<sup>&</sup>lt;sup>2</sup> Golder Associates 2013 Underground Water Impact Report For Santos Cooper Basin Oil & Gas Fields, SW QLD

The petroleum well has been completed with steel surface casing, steel production casing, and cement to isolate the well from aquifers, including the Great Artesian Basin, and other geological units.

Given the scope of proposed activities, combined with the above management measures, petroleum production from pre-existing infrastructure is unlikely to disturb or alter the physical, chemical and biological quality of water in the watercourse channels and on floodplains that support and maintain the natural aquatic and terrestrial ecosystems. Accordingly, the proposed activities would not cause a widespread or irreversible impact on water quality within the Channel Country SEA.

#### 3.3 Hydrological Processes

#### Regional

Topography is limited to low undulating topography between the drainage channel system. The Channel Country is characterised by vast flat-lying, braided, flood and alluvial plains surrounded by gravel or gibber plains, dunefields and low ranges. The low resistant hills and tablelands are remnants of the flat-lying Cretaceous sediments.

The drainage system is dominated by the Cooper Creek Basin draining towards Lake Eyre. During periods of high rainfall, the flat topography and drainage channel system becomes a largely flooded plain with water flow concentrating where Cooper Creek crosses the QLD-SA border. The Cooper Creek system catchment covers an area of approximately 300,000 km<sup>2</sup>. Generally, Cooper Creek streamflow is confined to the main channels, but every 3-4 years, flows are sufficient to inundate parts of the Cooper floodplain via a network of tributary channels. During extended periods of no flow, the Cooper Creek contracts to a series of waterholes. Very large Cooper Creek flood events with the potential to inundate the broader Channel Country region, and flow water into the lower Cooper Creek in South Australia, occur on average once every 10 years, reaching Lake Eyre North in an estimated 1 in every 20 years

#### Local

The braided channels associated with the Cooper Creek surround the proposed activity; at its closest point, the Cooper Creek is located approximately 250m to the west (Figure 4). The proposed activity is subject to intermittent flows associated with Cooper Creek flood events, which have occurred five times since 1989 (using Landsat data). The area of the proposed activity would experience intermittent surface water flows during storm events, causing localised ponding of surface water (occurring on average once every 5 years). The proposed activity is within an arid / semi-arid floodplain lignum swamp.

#### 3.3.1 Potential Impacts

The proposed activity is located within the existing infrastructure footprint. The access tracks have not been constructed to any flood immunity, and will facilitate the passage of water keeping with existing hydrology. The existing pipeline is buried underground and the surface has been rehabilitated to reinstate existing drainage. Any surface infrastructure required as a part of future workover activities (i.e. a drilling sump), may result in diversion or interception of a negligible amount of overland flow, when considering the small footprint of the activity relative to the sub-catchment area (typical drilling sump has an operating volume of approximately 300kL and is designed to exclude surface flow). However, all workover activities would be temporary in nature and would be scheduled to be completed outside of the wet season (infrastructure removed prior to Cooper Creek flood events), therefore diversion or interception of overland flow is not expected. No new surface disturbance to land, such as clearing vegetation in or near streams, lakes, floodplains or wetlands, is required as part of the proposed activity. Given the nature of the proposed activities, and the implementation of the above design and management measures, there would be no widespread or irreversible impact on hydrological processes within the Channel Country SEA.

#### 3.4 Geomorphic Processes

#### Regional

Surface geology is dominated by Quaternary alluvium deposits associated with flood plains, with consolidated Tertiary sediments or Winton Formation on the higher ground. Cooper Creek is a large sedimentary sump accreting over a vast floodplain<sup>3</sup>.

#### Local

Land systems mapped at the location of the proposed activities are consistent with Landzone mapping. The proposed activity location is entirely mapped as an alluvial plain with gradients less than 1:5000 and anastomosing channels, main channels and shallow flood depressions. The area is associated with the irregularly flooded Cooper Creek main channel area<sup>4</sup>. Land systems present within the proposed activity location is summarised in Table 3. Soils are entirely mapped as grey clays and grey cracking clays (Map Code: CC87)<sup>5</sup>.

Map Code	Land System Description	Agricultural Land Class
C1	Alluvial plains with gradients of less than 1:5,000; with anastomosing channels (0.1 to 1 m relief), main channels (<10 m relief), shallow flood depressions, waterholes, billabongs and swamps, and slightly elevated more stable alluvial islands. Isolated sand dunes.	C1 - Pasture Land - native pastures

#### Table 3: Land System at Proposed Activity Location

#### 3.4.1 Potential Impacts

The proposed activity is located within the existing infrastructure footprint. No new surface disturbance to land, such as excavation, clearing or realigning the beds and banks of watercourse, cultivating soil or excavating on floodplains, are required as part of the proposed activity. No new structures are proposed to be placed in a watercourse, lake or spring or on floodplains as a part of this activity.

The proposed activities is located away from the sources / areas of significant geomorphic processes, approximately 250m from the closest watercourse. The access tracks have not been constructed to any flood immunity, and will facilitate the passage of water keeping with existing hydrology. The existing pipeline is buried underground and the surface has been rehabilitated to reinstate existing drainage. Any surface infrastructure required as a part of future workover activities (i.e. a drilling sump), may result in diversion or interception of a negligible amount of overland flow, when considering the small footprint of the activity relative to the sub-catchment area (typical drilling sump has an operating volume of approximately 300kL). However, all workover activities would be temporary in nature and would be completed outside of the wet season, therefore diversion or interception of overland flow is not expected.

<sup>&</sup>lt;sup>3</sup> Maroulis, J (undated) *Channel Country landforms and the processes that shape them.* University of Southern QLD Faculty of Education/Australian Centre for Sustainable Catchments.

<sup>&</sup>lt;sup>4</sup> DES (2018). Land systems – western arid region land use study – part 1 – AWA2 (spatial dataset), Accessed 14/05/2018. Available online at: <u>gldspatial.information.gld.gov.au</u>

<sup>&</sup>lt;sup>5</sup> ASRIS (2018). Atlas of Australian Soils (spatial dataset), Australian Soil Resource Information System (CSIRO), Accessed 14/05/2018. Available online at: <u>http://www.asris.csiro.au/downloads/Atlas/soilAtlas2M.zip</u>







Following cessation of petroleum production, existing infrastructure would be rehabilitated to promote the natural re-establishment of vegetation consistent with the surrounding undisturbed land. As such, the proposed activity would not alter the delivery of sediment to the river system from adjacent lands and the natural erosion of the bed, banks and floodplains. Accordingly, it is not envisaged that the proposed activity would not cause a widespread or irreversible impact on geomorphic processes within the Channel Country SEA.

#### 3.5 Beneficial Flooding

The braided channels associated with the Cooper Creek surround the proposed activity; at its closest point, the Cooper Creek is located approximately 250m to the west. Notwithstanding, the area of the proposed activity would experience intermittent surface water flows during storm events, causing localised ponding of surface water (occurring on average once every 10 years).

Generally, the surrounding Cooper Creek streamflow is confined to the main channels, but every 3-4 years, flows are sufficient to inundate parts of the Cooper floodplain via a network of tributary channels. During extended periods of no flow, the Cooper Creek contracts to a series of waterholes. Very large Cooper Creek flood events with the potential to inundate the broader Channel Country region, and flow water into the lower Cooper Creek in South Australia, occur on average once every 10 years, reaching Lake Eyre North in an estimated 1 in every 20 years.

#### 3.5.1 Potential Impacts

The proposed activity is located within the existing infrastructure footprint. No new surface disturbance activities, including placing new infrastructure within SEA, are proposed as part of this activity. Following cessation of petroleum production, existing infrastructure would be rehabilitated to promote the natural re-establishment of vegetation consistent to the surrounding undisturbed land. Given no new disturbance or activities other than 'production' from existing authorised infrastructure is proposed (as described in Section 2.0), altered natural flow paths and natural extent of flooding across floodplains will not occur. Accordingly, the proposed activities would not cause a widespread or irreversible impact on beneficial flooding within the Channel Country SEA.

### 4.0 Required Outcome Assessment

Schedule 2, Part 5 of the RPI Reg provides criteria for assessment by agencies. In accordance with Section 14(3) of the RPI Reg, if the application demonstrates compliance with either of the prescribed solutions stated in Part 5, Schedule 2, the proposed activity will meet the required outcome for the regional interest. Critically, the application demonstrates that the prescribed solution provided in s15(1)(a) will be met as the proposed activity, the production of gas from the Okotoko North 1 gas well will not impact on an environmental attribute of the Channel Country SEA. The application also demonstrates the prescribed solution provided in s15(1)(b) will also be met (Table 4).

#### Table 4: Schedule 2, Part 5 RPI Reg

Schedule 2, Part 5 RPI Reg		Relevance To Application
<b>14 Required outcome</b> The activity will not result in a widespread or irreversible impact on an environmental attribute of a strategic environmental area.	•	The proposed activities will not result in widespread or irreversible damage to the environmental attributes listed in s7 of the RPI Reg for the Channel Country SEA as described in Section 3.0.
<ul> <li>15 Prescribed solution</li> <li>(1) The application demonstrates either—</li> <li>(a) the activity will not, and is not likely to, have a direct or indirect impact on an environmental attribute of the strategic environmental area; or</li> </ul>	*	Refer to Section 3.0.
<ul> <li>(b) all of the following—</li> <li>(i) if the activity is being carried out in a designated precinct in the strategic environmental area—the activity is not an unacceptable use for the precinct;</li> </ul>	•	The proposed activities do not include any of the unacceptable uses prescribed by Section 15(2) of the RPI Act.
(ii) the construction and operation footprint of the activity on the environmental attribute is minimised to the greatest extent possible;	•	Existing operational footprint will be utilised entirely. No new disturbance footprint is proposed within this application.
(iii) the activity does not compromise the preservation of the environmental attribute within the strategic environmental area;	•	Refer to Section 3.0.
(iv) if the activity is to be carried out in a strategic environmental area identified in a regional plan— the activity will contribute to the regional outcomes, and be consistent with the regional policies, stated in the regional plan.	*	The South West Regional Plan does not identify the Channel Country SEA.

As discussed within Section 2.1, a drilling fluids sump may be required as a part of future temporary workover activities. The application also demonstrates the proposed use of a temporary drilling sump does not constitute a regulated activity as defined by the RPI Act.



s11(3) of the Regional Planning Interests Regulation 2014		Relevance To Application
Water storage (dam) is storing water using a dam, other than storing water on land to be used only for any or all of the following purposes— (a) to meet the domestic water needs of the occupants of the land; (b) to water the stock that is usually grazed on the land; (c) to water stock that is travelling on a stock route on or near the land.	*	N/A – the application does not propose to store water in a dam; The application proposes the temporary storing of drilling fluids in a drill sump designed to exclude surface flow if/when workover activities require it. Santos drilling sumps are designed to exclude surface flow and avoid the impounding of surface water. In addition, workover activities would be scheduled to be completed outside of the wet season, therefore all surface infrastructure, including a drill sump, would be removed prior to Cooper Creek flood events.
Schedule 6 of the Regional Planning Interests Regulation 2014		Relevance to the application
dam— (a) means the following— (i) a barrier, whether permanent or temporary, that does, could or would impound water;	*	N/A – the drilling sump would not impound water. Santos drilling sumps are designed to exclude surface water and avoid the impounding of surface water. Workover activities would be scheduled to be completed outside of the wet season, therefore all surface infrastructure, including a drill sump, would be removed prior to Cooper Creek flood events.
<ul> <li>(ii) the storage area created by the barrier;</li> <li>(iii) an embankment or other structure that is associated with the barrier and controls the flow of water; but</li> </ul>	✓	N/A – the sump would not constitute a barrier for the storage of water.
(b) does not include a water tank, including a rainwater tank, constructed of steel, concrete, fibreglass, plastic or similar material.	<b>~</b>	N/A – the proposed sump does not constitute a water tank.

### **Appendix A – Definitions**

Activity	Definition
Access Track	A cleared track approximately 6 m in width constructed of earthen material to facilitate ongoing operational maintenance access to the petroleum well.
Borrow Pit	A source of shallow earthen material excavated to provide material for well lease and access track maintenance.
Buried Pipeline	A pipeline buried underneath the ground used to transport petroleum.
Petroleum Production	A petroleum well operated under normal producing conditions to extract gas for ongoing commercial sale.
Production Testing	A petroleum well operated under normal producing conditions to capture key production measurements used to inform whether commercially viable quantities of gas are present for extraction.
Petroleum Well	A hole in the ground made by drilling through which petroleum or a prescribed gas is produced.
Petroleum Well Pad	An area of up to 1.4 hectares (e.g. approximately 120 m x 120 m) used to provide a stable platform for workover rigs and the operation of a petroleum well.