Corvus-2 Appraisal Drilling EP Summary

PROJECT / FACILITY	Corvus-2
REVIEW INTERVAL (MONTHS)	No Review Required
SAFETY CRITICAL DOCUMENT	NO

Acronyms

Abbreviation	Description
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
bbl	Barrel (unit of oil)
bbl/d	Barrels of oil per day
BIAs	Biologically Important Areas
BOP	Blowout preventer
CFA	Commonwealth Fisheries Association
DBCA	Department of Biodiversity, Conservation and Attractions
DFaT	Department of Foreign Affairs and Trade
DMIRS	Department of Mines, Industry Regulation and Safety
DoD	Department of Defence
DoEE	Department of Energy and Environment
DoT	Department of Transport (WA)
DPIRD	Department of Primary Industries and Regional Development
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DoEE)
DWER	Department of Water and Environmental Regulation
EF&LS	Exmouth Freight & Logistics Services
EMBA	Environment that May Be Affected
EP	Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ESD	Ecologically Sustainable Development
HSE	Health Safety Environment
IBC	Intermediate bulk container
IAP	Incident Action Plan

Abbreviation	Description
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMDG	International Maritime Dangerous Goods
IMS	Invasive Marine Species
IMT	Incident Management Team
IUCN	International Union for Conservation of Nature
JRCC	Joint Rescue Coordination Centre (AMSA)
JWA	Jet Wave Marine
KEF	Key Ecological Feature
KCl	Potassium chloride
km	Kilometre
LCM	Lost Circulation Material
LOWC	Loss of Well Control
m	Metres
m^3	Cubic Metres
m^3/h	Cubic Metres per hour
MARPOL	International Convention for the Prevention of Pollution from Ships
MC	Measurement Criteria
MDO	Marine Diesel Oil
MMA	Marine Management Area
MM Scf	Million standard cubic feet (of gas)
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOx	Oxides of Nitrogen
NWA	North West Alliance
NWMR	North West Marine Region
NWS	North West Shelf
ODS	Ozone Depleting Substance
OPEP	Oil Pollution Emergency Plan
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSCP	Oil Spill Contingency Plan

Abbreviation	Description
OSRL	Oil Spill Response Ltd
OSRT	Oil Spill Response Team
OWA	Oiled Wildlife Advisors
OWRP	Oiled Wildlife Response Plan
P&A	Plug and abandon
ROV	Remotely Operated Vehicle
SFRT	Subsea First Response Tool Kit
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plan
SOx	Oxides of Sulphur
TD	Total Depth
VSP	Vertical Seismic Profiling
WA	Western Australia
WAF	Water-accommodated fraction (hydrocarbon phase)
WAFIC	Western Australian Fishing Industry Council
WAOWRP	WA Oiled Wildlife Response Plan
WBM	Water-based Mud
WOMP	Well Operations Management Plan

Contents

1	**Introduction**	**7**
1.1	Compliance	7
2	**Activity Location**	**7**
3	**Description of Activity**	**9**
3.1	Duration and timing	9
3.2	Activities	9
3.3	Equipment Spread	9
4	**Description of Environment**	**10**
4.1	Environment that may be affected	10
4.2	Physical Environment and Habitat	11
4.3	Protected / Significant Areas	13
4.4	Socio-Economic Receptors	30
5	**Stakeholder Consultation**	**36**
5.1	Summary	36
5.2	Ongoing Consultation	40
5.3	OPEP Consultation	40
6	**Environmental Impact and Risk Assessment**	**41**
6.1	ALARP Evaluation	43
6.2	Acceptability Evaluation	43
6.3	Environmental Assessment Summary for Planned Events	44
6.4	Environmental Assessment Summary for Unplanned Events	52
7	**Management Approach**	**61**
7.1	Management of Change	61
8	**Hydrocarbon Spill Response Arrangements**	**62**
8.1	Preparedness and Implementation of Response Arrangements	62
8.2	Net Environmental Analysis Benefits (NEBA)	63
8.3	Oil Spill Response Resources	63
9	**Contact Details**	**64**
10	**References**	**65**

Figures

Figure 2-1:	**Location of the Corvus-2 well and operational area**	8
Figure 4-1:	**Australian Marine Parks and State Marine Parks and Reserves in the vicinity of the operational area and EMBA**	14
Figure 4-2:	**Key Ecological Features in the vicinity of the operational area and EMBA**	15
Figure 6-1:	**Environmental impact and risk assessment process**	41
Figure 6-2:	**Santos risk matrix**	43

Tables

Table 2-1:	**Well coordinates for Corvus-2 (+/- 500 m)**	7
Table 4-1:	**Summary of largest credible hydrocarbon spill scenarios**	10
Table 4-2:	**Habitats associated with receptors identified within the EMBA**	12
Table 4-3:	**Distance from the operational area boundary to protected areas, key ecological features and threatened ecological communities within the EMBA**	13
Table 4-4:	**Management Zones for the Australian Marine Parks found within the EMBA and the associated objectives**	13
Table 4-5:	**Protected species and communities in the operational area and EMBA**	17
Table 4-6:	**State and Commonwealth fisheries in the vicinity of the operational area and EMBA**	31
Table 4-7:	**Socio-economic activities in the vicinity of the operational area and EMBA**	34
Table 5-1:	**Summary of stakeholders consulted**	36
Table 5-2:	**Consultation summary for activity**	37
Table 6-1:	**Consequence level description**	42
Table 6-2:	**Likelihood description**	42

1 Introduction

Santos WA Northwest Pty Ltd (Santos) is the registered operator for the WA-45-R permit area in offshore Commonwealth waters on the North West Shelf (NWS) of Western Australia (WA) following the acquisition of Quadrant Energy (Quadrant) by Santos in 2018. Santos proposes to drill, evaluate and permanently plug and abandon (P&A) one appraisal well, the Corvus-2 well, using a jack-up mobile offshore drilling unit (MODU).

1.1 Compliance

The overall purpose of the *Corvus-2 Appraisal Drilling Environment Plan (QE-00-BF-20002.01)* (the EP) is to comply with statutory requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R); and to ensure that the activity is planned and conducted in line with Santos environmental policies and standards, including the corporate Environmental Management Policy. The EP was assessed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 21st January 2019. This EP summary has been prepared in accordance with the requirements of subregulation 11(4) of the OPGGS(E)R.

2 Activity Location

The Corvus-2 appraisal well will be located within Commonwealth permit area WA-45-R within a 500 m radius of the coordinates in **Table 2-1** and **Figure 2-1**. In the event of a re-spud, the well would be within 1 km of the initial well location.

The operational area is set as a 500 m radius around the final well location, corresponding to the gazetted safety exclusion zone around the MODU. The operational area is located approximately 58 km northeast of the Montebello Islands and approximately 62 km northwest of the Dampier Archipelago. The nearest protected area is the Commonwealth Montebello Australian Marine Park, approximately 6 km to the west. Water depth at the proposed well location is approximately 65 m.

Table 2-1: Well coordinates for Corvus-2 (+/- 500 m)

Well	Latitude	Longitude
Corvus-2	20° 07’ 04.91” S	116° 03’ 38.66” E

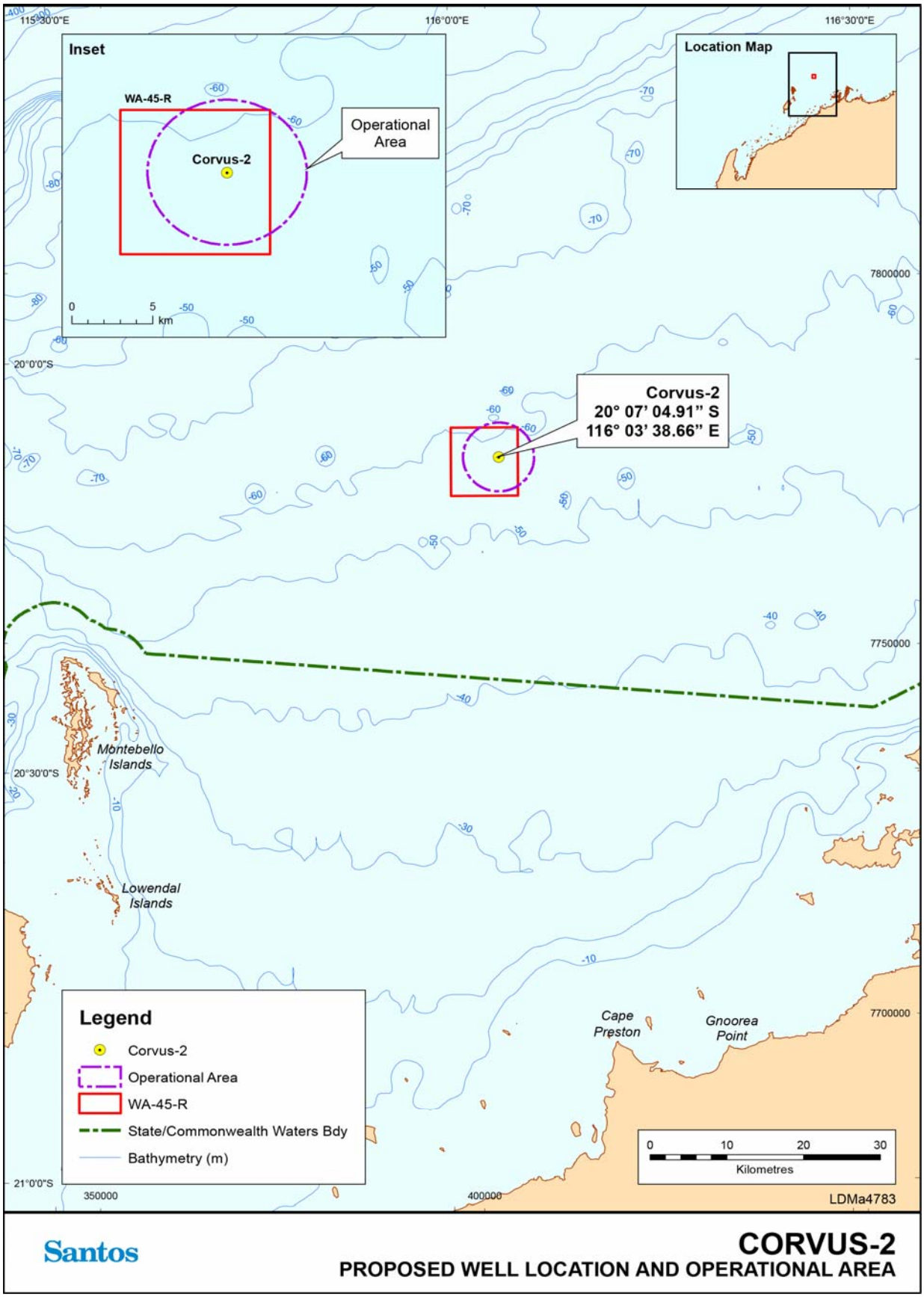

Figure 2-1: Location of the Corvus-2 well and operational area

3 Description of Activity

3.1 Duration and timing

Drilling activities are planned for approximately 42 days, but the EP accounts for over-run (~80 days). Activities will be conducted 24-hours per day, seven days per week. Over-runs may be caused by unfavourable weather, additional drilling (e.g. a re-spud) or operational challenges.

The earliest date for MODU arrival is 1st March 2019. To account for potential delays or schedule changes, the environmental assessment encompasses petroleum activities at any time of the year. Thus the activity will be undertaken between 1st March 2019 and 31st December 2019.

The petroleum activity will be deemed complete once the well has been plugged and abandoned and the MODU and all support vessels have departed the permit area.

3.2 Activities

The Environment Plan (EP) provides for appraisal drilling and associated activities including:

+ Pre-MODU positioning survey using a remotely operated vehicle (ROV) and/ or sidescan sonar. This may be undertaken by a vessel in advance of the MODU arriving or once the MODU is on location, but prior to positioning of the MODU legs on the seabed;
+ Move the MODU to location, position MODU, pre-load and jack-up to operational elevation;
+ Drill surface hole section riserless;
+ Run and cement surface casing.
+ Install surface wellhead and blowout preventer (BOP);
+ Drill intermediate hole section;
+ Run and cement intermediate liner;
+ Drill remaining section to well total depth (TD);
+ Run wireline evaluation program;
+ Plug and abandon (P&A) the well, including setting permanent cement barriers. The surface wellhead will be removed. No equipment will be left above the seabed;
+ Drill using water-based muds (WBM);
+ Contingency use of aqueous-based lost circulation material (LCM);
+ Use of chemicals for drilling and P&A activities;
+ Downhole formation evaluation. This may include wireline logging, vertical seismic profiling (VSP) and coring;
+ Side-tracking and re-spud drilling (contingent and unplanned activities);
+ Use of support vessels, helicopters and ROV; and
+ MODU refuelling in the operational area.

3.3 Equipment Spread

3.3.1 MODU

This is a one-well petroleum activity requiring the use of a jack-up MODU to drill the well. The jack-up MODU will remain at location (i.e. the well site) for the duration of the drilling activity and will be towed on and off location by one or more support vessels.

3.3.2 Support Vessels

The MODU will be assisted by support vessels (used for towing, equipment and material transfers, standby operations and emergency response). Typically only two support vessels will be required during the activity, however the EP accounts for up to four vessels.

At least one support vessel will remain on standby to the MODU within the distance defined in the Safety Case (nominally 3 nautical miles).

Support vessels will not anchor in the operational area during the activity.

3.3.3 Helicopters

Helicopters will be used primarily for crew change and medevac, and occasionally equipment and material transfers. Helicopter flights will occur several times a week dependent on the progress of the drilling program and logistical constraints.

3.3.4 Remotely operated vehicle

An observation-class remotely operated vehicle (ROV) will be available on site. It is likely that the ROV will be operated from the MODU, however, it could also be operated from a support vessel.

3.3.5 Waste Discharges

In addition to the drilling discharges to sea (WBM drilling fluids, cuttings, cement), other operational waste streams from the MODU and support vessels are likely to include:

+ Deck drainage;
+ Sewage, grey water and food waste;
+ Oily water;
+ Cooling water;
+ Desalination plan effluent (brine) and backwash water discharge; and
+ Ballast water.

4 Description of Environment

4.1 Environment that may be affected

The environment that may be affected (EMBA) will encompass the environment that could be affected by planned and unplanned events. Most planned and unplanned events associated with the activity may affect the environment up to a few hundred metres around the MODU. Stochastic hydrocarbon dispersion and fate modelling, applied to the largest credible 'worst-case' hydrocarbon spill scenarios identified as relevant to the activity, was undertaken to inform the EMBA and determine the spatial extent of potential risks and impacts to environmental values and sensitivities. The largest credible hydrocarbon spill scenarios are summarised in **Table 4-1**.

Table 4-1: Summary of largest credible hydrocarbon spill scenarios

Scenario	Hydrocarbon Type	Maximum Credible Volume	Comment
Hydrocarbon spill (condensate/gas) from a loss of well containment scenario – **surface release**	Gas/ Condensate	Condensate: 384,440 bbl (4,993 bbl/d averaged over 11 weeks) Gas: 64,100 MM Scf	Maximum credible volume modelled – with highest flow potential derived by combining the most optimistic reservoir flow parameters for the well.
Hydrocarbon spill (gas/condensate) from a loss of well containment scenario – **seabed release**		Condensate: 385,400 bbl (5,006 bbl/d averaged over 11 weeks) Gas: 64,200 MM Scf	

Scenario	Hydrocarbon Type	Maximum Credible Volume	Comment
Hydrocarbon spill - marine diesel oil (MDO) from vessel collision – surface release	MDO	329 m^3	Maximum credible volume based on predicted largest fuel tank on support vessel.
Hydrocarbon spill - MDO during MODU refuelling – surface release	MDO	37.5 m^3	Maximum credible volume based on 15 minutes of flow at a pumping rate of 150 m^3/h.
Minor hydrocarbon release – surface release	Hydraulic oil/ lubricating fluids	1 m^3	Bulk fluids stored in intermediate bulk containers (IBCs)
	Hydraulic fluid	0.05 m^3	ROV hydraulic lines

The outer extent of the EMBA was determined from the spill modelling as the spatial extent of four key physical and/or chemical phases of hydrocarbons that pose differing environmental risks: surface hydrocarbons, entrained oil, dissolved water-accommodated fraction (WAF) and shoreline accumulated hydrocarbons. The modelling used defined hydrocarbon contact thresholds for the various hydrocarbon phases at which potential impacts to fauna and/or habitats could result. The EMBA includes the offshore area that may be affected by hydrocarbons (the offshore EMBA), and the shoreline areas that may be affected by hydrocarbons (the shoreline EMBA).

The spatial data for the EMBA was used to identify the environmental values and sensitivities within the existing environment that may be at risk, including undertaking searches of matters of national environmental significance listed under the EPBC Act using the Department of the Environment and Energy (DoEE) Protected Matters Search Tool.

The existing environment within the operational area and EMBA (offshore and shoreline) is summarised in the following sections.

4.2 Physical Environment and Habitat

4.2.1 Physical Environment

The Corvus-2 drilling operational area is situated within Commonwealth waters of the North-west Marine Region (DSEWPaC, 2008). The North-west Marine Region (NWMR) is further divided into eight provincial bioregions defined under the Integrated and Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0 (DSEWPaC, 2008). The operational area lies completely within the Northwest Shelf Province; and the EMBA overlaps the Northwest Shelf Province and the Central Western Shelf Transition. The presence of marine and coastal habitats within the operational area and EMBA is summarised **Table 4-2**.

Table 4-2: Habitats associated with receptors identified within the EMBA

Receptors	Subtidal/Intertidal Habitats					Shoreline Habitats			EMBA					
											LOWC			
	Soft Sediments	Coral Reefs	Macroalgal Beds	Seagrass Beds	Hard Substrate (Flora/Fauna)	Rocky Shorelines	Sandy Beaches	Mangroves	Operational Area	Diesel Spills	Surface Oil (10 g/m2) Contact	Total WAF (500 ppb) Contact	Dissolved WAF (100 ppb) Contact	Shoreline Contact (>100 g/m^2)
Barrow Island	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	×	×	✓
Barrow-Montebello Surrounds (offshore)	✓	✓	✓	✓	✓	×	×	×	×	✓	✓	✓	✓	x
Dampier Archipelago	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	×	x	✓
Lowendal Islands	✓	✓	✓	✓	×	✓	✓	×	×	✓	×	×	×	✓
Montebello Islands	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	×	✓	✓
Muiron Islands	✓	✓	✓	✓	✓	✓	✓	×	×	✓	x	×	×	✓
Ningaloo Region (mainland)	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x	×	×	✓
Onslow Region (mainland)	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x	×	×	x
Thevenard Island	✓	✓	✓	✓	×	×	✓	x	x	x	x	×	×	✓

4.3 Protected / Significant Areas

Protected/significant areas identified in the EMBA are shown in **Table 4-3, Figure 4-1** and **Figure 4-2**. The management zones, associated with the Australian Marine Parks identified in the EMBA, and the relevant objectives are detailed in **Table 4-4**.

Table 4-3: Distance from the operational area boundary to protected areas, key ecological features and threatened ecological communities within the EMBA

Value/Sensitivity	Distance from operational area (km)	EMBA Presence
Australian Marine Parks	6	Montebello Australian Marine Park (Multiple Use Zone - IUCN Category VI)
State Marine Parks and Marine Management Areas	69	Barrow Island Marine Park
	67	Barrow Island Marine Management Area
	52	Montebello Islands Marine Park
	240	Muiron Islands Marine Management Area*
	257	Ningaloo Marine Park
World & National Heritage Places	236	Ningaloo World Heritage Area
	236	Ningaloo National Heritage Area
Commonwealth Heritage Places	-	None
Wetlands of International Importance	-	None
Wetlands of National Importance	-	None
Key Ecological Features	45	Ancient Coastline at 125 m Contour
	71	Glomar Shoals
Threatened Ecological Communities	-	None

*Ningaloo Marine Park and Muiron Islands MMA are within the shoreline EMBA, but not the offshore EMBA.

Table 4-4: Management Zones for the Australian Marine Parks found within the EMBA and the associated objectives

Management Zones	Objective
Multiple Use (IUCN VI)	To provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species. The zone allows for a range of sustainable uses, including commercial fishing and mining where they are authorised and consistent with park values. Mining operations are defined in the EPBC Act and include oil spill response.

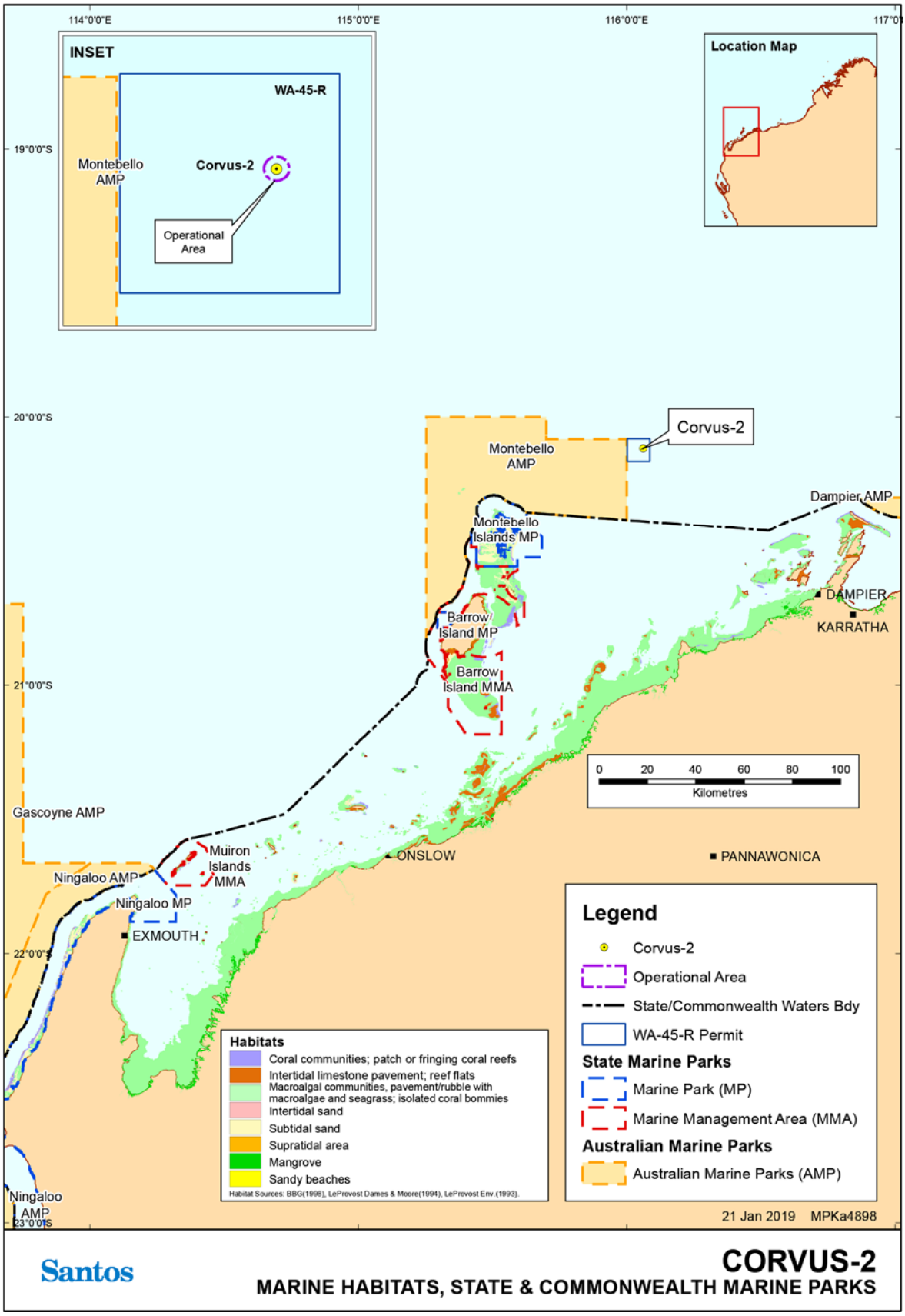

Figure 4-1: Australian Marine Parks and State Marine Parks and Reserves in the vicinity of the operational area and EMBA

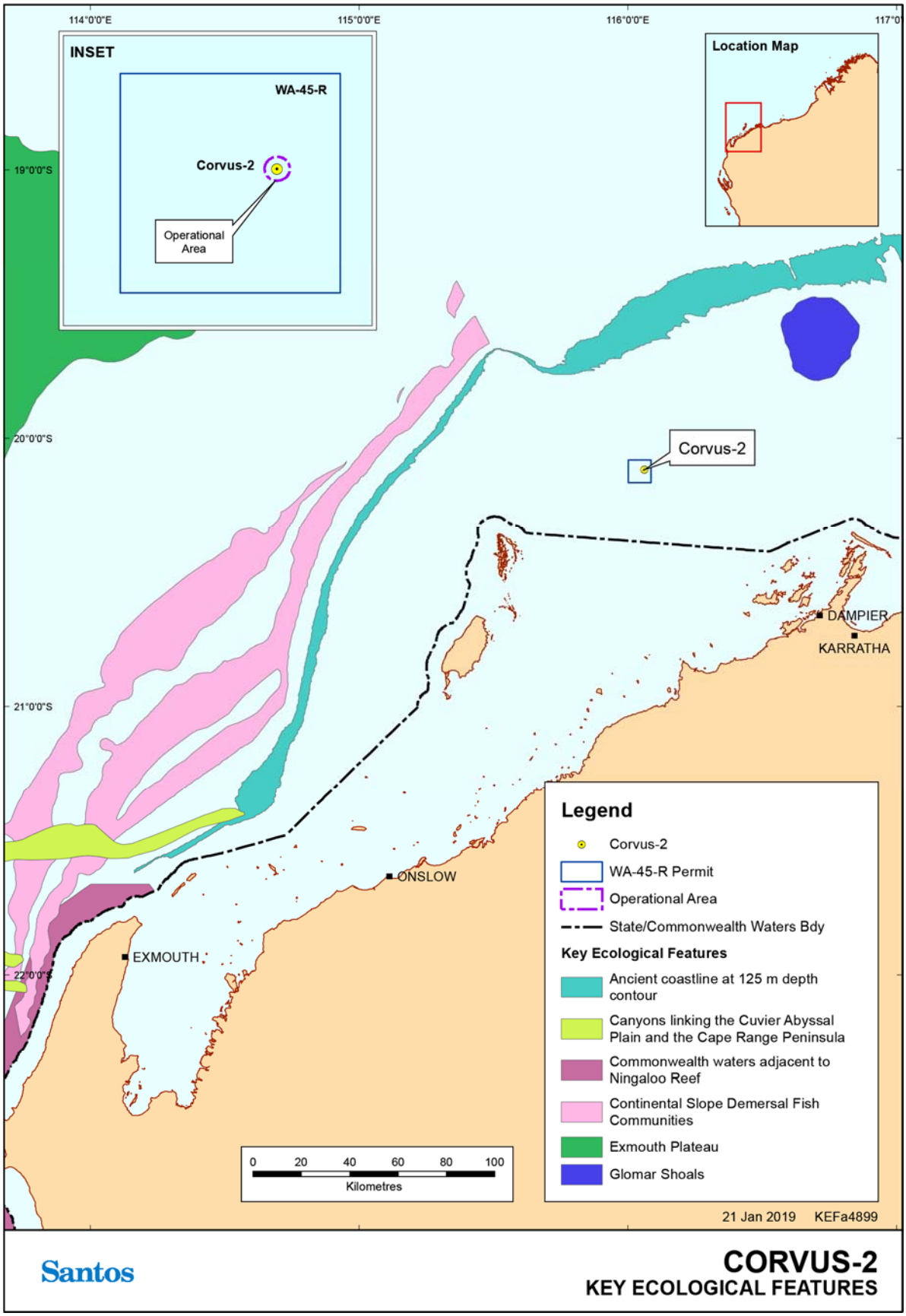

Figure 4-2: Key Ecological Features in the vicinity of the operational area and EMBA

4.3.1 Threatened and Migratory Marine Fauna

Environment Protection and Biodiversity Conservation (EPBC) protected matters searches were conducted for the EMBA (offshore and shoreline) and operational area. The searches of the operational area identified 18 `threatened' species of marine fauna, 17 of which are also listed as `migratory' (**Table 4-5**). In addition, two conservation dependent species may be found within the operational area. For each species identified, the nature of likely presence is provided, including any overlap with designated Biologically Important Areas (BIAs).

4.3.2 Marine Mammals

A search of the EPBC Act Protected Matters Database identified 11 mammal species within the operational area and/or EMBA. Of these, five are listed as threatened (four of which are also migratory) and six are listed as migratory under the EPBC Act.

4.3.3 Fish, Sharks and Rays

A search of the EPBC Act Protected Matters Database identified 12 fish species within the operational area and/or EMBA. Of these, seven are listed as threatened (four of which are also migratory) and five are listed as migratory under the EPBC Act. In addition, two conservation dependent species may occur within the operational area and EMBA.

4.3.4 Marine Reptiles

A search of the EPBC Act Protected Matters Database identified five marine turtle species listed as threatened and migratory which may occur within the operational area and/or EMBA, and one seasnake listed as threatened, which may occur within the EMBA.

4.3.5 Marine Birds

A search of the EPBC Act Protected Matters Database identified 29 marine birds which have a recognised range that overlaps the operational area and/or EMBA. Of these, 12 are listed as threatened (6 of which are also migratory) and 17 are listed as migratory under the EPBC Act.

Table 4-5: Protected species and communities in the operational area and EMBA

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
Protected Species and Communities: Fish and Sharks									
Whale shark	*Rhincodon typus*	V, M	✓	Foraging, feeding or related behaviour known to occur within area. Overlap with foraging BIA	✓	Foraging, feeding or related behaviour known to occur within area. Overlap with foraging BIA.	✓	Foraging, feeding or related behaviour known to occur within area. Overlap with BIA.	<u>Planned</u> • Light emissions • Noise emissions • Drilling and cement discharges • Planned operational discharges • Spill response operations <u>Unplanned</u> • Hydrocarbon releases • Non-hydrocarbon releases • Marine fauna collisions • Introduction of invasive marine species
Grey nurse shark (west coast population)	*Carcharias taurus* (west coast population)	V	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Great white shark	*Carcharodon carcharias*	V, M	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Dwarf sawfish	*Pristis clavata*	V, M	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
Green sawfish	*Pristis zijsron*	V, M	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Narrow sawfish	*Anoxypristis cuspidata*	M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Shortfin mako	*Isurus oxyrinchus*	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	X	N/A	
Longfin mako	*Isurus paucus*	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	X	N/A	
Reef manta ray	*Manta alfredi*	M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
Giant manta ray	*Manta birostris*	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Blind gudgeon	*Milyeringa veritas*	V	X	N/A	X	N/A	✓	Species or species habitat likely to occur within area	
Blind cave eel	*Ophisternon candidum*	V	X	N/A	X	N/A	✓	Species or species habitat likely to occur within area	
Scalloped hammerhead	*Sphyrna lewini*	CD	✓	Species or habitat may occur	✓	Species or habitat may occur	✓	Species or habitat may occur	
Bluefin tuna	*Thunnus maccoyii*	CD	✓	Species or habitat may occur	✓	Species or habitat may occur	✓	Species or habitat may occur	
Protected Species and Communities: Marine Mammals									
Humpback whale	*Megaptera novaeangliae*	V, M	✓	Species or species habitat known to occur within area. Overlap with BIA for migration.	✓	Species or species habitat known to occur within area.	✓	Species or species habitat known to occur within area.	<u>Planned</u> • Noise emissions

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
						Overlap with BIA for migration.		Overlap with BIA for migration.	• Planned operational discharges • Drilling and cement discharges • Spill response operations <u>Unplanned</u> • Hydrocarbon releases • Non-hydrocarbon releases • Marine fauna collisions
Blue whale	*Balaenoptera musculus*	E, M	✓	Species or species habitat likely to occur within area	✓	Migration route known to occur within area. Overlap with BIA for migration.	✓	Migration route known to occur within area. Overlap with BIA for migration.	
Sei whale	*Balaenoptera borealis*	*V, M*	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Fin whale	*Balaenoptera physalusk*	V, M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Bryde's whale	*Balaenoptera edeni*	M	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Orca, killer whale	*Orcinus orca*	M	✓	Species or species habitat may occur within area	✓	Species or species habitat may	✓	Species or species habitat may	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
						occur within area		occur within area	
Spotted bottlenose dolphin	*Tursiops aduncus* (Arafura/Timor Sea Populations)	M	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Sperm whale	*Physeter macrocephalus*	M	X	N/A	✓	Species or species habitat may occur within area	X	N/A	Unplanned • Hydrocarbon releases • Non-hydrocarbon releases • Marine fauna collisions
Indo-Pacific humpback dolphin	*Sousa chinensis*	M	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Dugong	*Dugong dugon*	M	X	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Southern Right Whale	*Eubalaena australia*	E	X	N/A	X	N/A	✓	Species or species habitat likely to occur within area	
Protected Species and Communities: Marine Reptiles									

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
Short-nosed seasnake	*Aipysurus apraefrontalis*	CE	X	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	<u>Planned</u> • Light emissions • Noise emissions • Planned operational discharges • Drilling and cement discharges • Spill response operations <u>Unplanned</u> • Hydrocarbon releases • Non-hydrocarbon releases • Marine fauna collisions
Loggerhead turtle	*Caretta caretta*	E, M	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area. Breeding known to occur within area.	✓	Species or species habitat known to occur within area. Breeding known to occur within area.	
Green turtle	*Chelonia mydas*	V, M	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area. Breeding known to occur within area.	✓	Species or species habitat known to occur within area. Breeding known to occur within area.	
Leatherback turtle	*Dermochelys coriacea*	E, M	✓	Species or species habitat likely to occur within area	✓	Foraging, feeding or related behaviour	✓	Foraging, feeding or related behaviour	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
						likely to occur within area. Breeding likely to occur within area.		likely to occur within area. Breeding likely to occur within area.	
Hawksbill turtle	*Eretmochelys imbricata*	V, M	✓	Species or species habitat known to occur within area	✓	Foraging, feeding or related behaviour likely to occur within area. Breeding known to occur within area. Overlap with internesting habitat (60 km of Barrow Island).	✓	Foraging, feeding or related behaviour likely to occur within area. Breeding known to occur within area. Overlap with internesting habitat (Barrow Island).	
Flatback turtle	*Natator depressus*	V, M	✓	Congregation or aggregation known to occur within area Overlap with internesting BIA (60 km of	✓	Congregation or aggregation known to occur within area. Breeding	✓	Congregation or aggregation known to occur within area. Breeding	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
				Montebello Islands and from Dampier Archipelago).		known to occur within area. Overlap with internesting BIA and the internesting habitat buffer critical to survival of species (60 km from Montebello Islands and from Dampier Archipelago; and 60 km of Barrow Island).		known to occur within area. Overlap with internesting BIA and the internesting habitat buffer critical to survival of species (Montebello Islands; Dampier Archipelago; Barrow Island).	
Protected Species and Communities: Marine Birds									
Curlew sandpiper	*Calidris ferruginea*	CE, M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	<u>Planned</u> • Light emissions • Noise emissions • Planned operational discharges
Red knot	*Calidris canutus*	E, M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to	✓	Species or species habitat known to	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
						occur within area		occur within area	• Drilling and cement discharges • Atmospheric emissions • Spill response operations <u>Unplanned</u> • Hydrocarbon releases • Non-hydrocarbon releases • Marine fauna collisions
Southern giant petrel	*Macronectes giganteus*	E, M	✓	Species or species habitat may to occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Eastern curlew	*Numenius madagascariensis*	CE, M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Common noddy	*Anous stolidus*	M	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Streaked shearwater	*Calonectris leucomelas*	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Lesser frigatebird	*Fregata ariel*	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
Common sandpiper	*Actitis hypoleucos*	M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Sharp-tailed sandpiper	*Calidris acuminata*	M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Pectoral sandpiper	*Calidris melanotos*	M	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Osprey	*Pandion haliaetus*	M	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Bar-tailed godwit	*Limosa lapponica baueri*	V, M	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	<u>Unplanned</u> • Hydrocarbon releases • Non-hydrocarbon releases
Northern Siberian bar-tailed godwit	*Limosa lapponica menzbierii*	CE, M	X	N/A	✓	Species or species habitat may	✓	Species or species habitat may	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
						occur within area		occur within area	• Marine fauna collisions
Australian fairy tern	*Sternula nereis nereis*	V	X	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Fork-tailed swift	*Apus pacificus*	M	X	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Wedge-tailed shearwater	*Ardenna pacifca*	M	X	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Greater frigatebird	*Fregata minor*	M	X	N/A	✓	Species or species habitat may occur within area	X	N/A	
Bridled tern	*Onychoprion anaethetus*	M	X	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Roseate tern	*Stern dougallii*	M	X	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
Oriental plover	*Charadrius plover*	M	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Oriental pratincole	*Glareola maldivarum*	M	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Crested tern	*Thalasseus bergii*	M	X	N/A	✓	Breeding known occur within area	X	N/A	
Common greenshank	*Tringa nebularia*	M	X	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
White-winged fairy-wren (Barrow Island), Barrow Island black-and-white fairy-wren	*Malurus leucopterus edouardi*	V	X	N/A	✓	Species or species habitat likely to occur within area	X	N/A	
Soft-plumaged petrel	*Pterodroma mollis*	V	X	N/A	X	N/A	✓	Species or species habitat may occur within area	

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent	Operational Area presence	Particular values or sensitivities within Operational Area	Offshore EMBA presence	Particular values or sensitivities within EMBA	Shoreline EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**								
Campbell albatross	*Thalassarache impavida*	V	X	N/A	X	N/A	✓	Species or species habitat may occur within area	
Flesh-footed Shearwater	*Ardenna carneipes*	V	X	N/A	X	N/A	✓	Species or species habitat likely to occur within area	
Caspian tern	*Hydroprogne caspia*	M	X	N/A	X	N/A	✓	Species or species habitat may occur within area	
Australian painted snipe	*Rostratula australia*	E	X	N/A	X	N/A	✓	Species or species habitat may occur within area	

4.4 Socio-Economic Receptors

The operational area is located approximately 90 km northwest from the Port of Dampier and 195 km north-north east from Onslow. Smaller regional settlements are further away at Port Hedland (265 km) and Exmouth (285 km).

Offshore and coastal waters in the North-west Marine Region support a valuable and diverse commercial fishing industry. The NWS fisheries are managed by either the Department of Primary Industries and Regional Development (DPIRD) (State fisheries) with specific management plans, regulations and a variety of subsidiary regulatory instruments under the *Fish Resources Management Act 1994*, or by Australian Fisheries Management Authority (AFMA) that manages Commonwealth fisheries (within the 200 nautical mile Australian Fishing Zone).

Table 4-6 identifies the relevant State and Commonwealth fisheries that overlap the operational area and EMBA.

Other socio-economic considerations such as shipping, recreational fishing, oil and gas industry, tourism and cultural heritage in relation to the operational area and EMBA are summarised in **Table 4-7.**

Table 4-6: State and Commonwealth fisheries in the vicinity of the operational area and EMBA

Value/Sensitivity	Description	Operational area presence	EMBA presence	Relevant events within the operational area and EMBA
Commonwealth Managed Fisheries				
Southern Bluefin Tuna Fishery	No current effort on NWS.	✓	✓	No active commercial fishing within the area in the past years; however fisheries overlap the EMBA and therefore fishing vessels could be encountered in low density.
Western Tuna and Billfish Fishery	Extends westward from Cape York Peninsula (142°30' E) off Queensland to 34° S off the WA west coast. It also extends eastward from 34° S off the west coast of WA across the Great Australian Bight to 141° E at the South Australian–Victorian border. No current effort on NWS	✓	✓	
Western Skipjack Tuna Fishery	No current effort on NWS.	✓	✓	
State Managed Fisheries (North Coast Bioregion)				
Pearl Oyster Managed Fishery	Mostly operate March to June. Operational area does occur within the boundaries of the fishery, but is restricted to shallow diving depths below 35 m.	✓	✓	Given the water depths of the operational area, disruption to fishing activities are unlikely to occur. Unplanned events which may occur in the operational area and EMBA will not disrupt pearl diving operations.
Onslow Prawn Limited Entry Fishery (Area 3)	The boundaries of the OPMF are 'all the Western Australian waters between the Exmouth Prawn Fishery and the Nickol Bay prawn fishery east of 114°39.9' on the landward side of the 200 m depth isobath'. Prawn trawling activities focus on inshore areas between Onslow and Karratha.	✓	✓	As prawn trawling activities focus on inshore, shallow waters, planned and unplanned events are not expected to impact fishing activities unless there is a LOWC resulting in shoreline accumulation of hydrocarbons.
Nickol Bay Prawn Limited Entry Fishery	The fishery targets key habitats in depths less than 40 m. Conservative harvesting strategies provide the protection from overfishing. Total allowable catches 90 t – 300 t. Annual catch is well below.	X	✓	As Nickol Bay Prawn trawling activities focus on inshore, shallow waters to the East of Dampier, planned and unplanned events will not impact fishing activities.

Value/Sensitivity	Description	Operational area presence	EMBA presence	Relevant events within the operational area and EMBA
	The Nickol Bay Prawn Managed fishery operates in inshore waters, East of Dampier.			
Mackerel Managed Fishery (Area 2)	Surface trolling or handline. Near-surface trolling gear from vessels in coastal areas around reefs, shoals and headlands.	✓	✓	The operational area for this activity does intersect the Mackerel Managed Fishery Area 2, however given a 500 m exclusion zone only, impact from planned activities is expected to be minimal. Unplanned events which may occur in the operational area and EMBA could disrupt Mackerel Managed Fishery activities.
Pilbara Demersal Scalefish Fisheries – Pilbara Fish Trawl (Interim) Managed Fishery, the Pilbara Trap Managed Fishery and the Pilbara Line Managed Fishery	Use a combination of vessels, effort allocations (time), gear limits, plus spatial zones (including extensive trawl closures) as management measures. The Trawl Fishery lands the largest component of the catch of demersal finfish in the Pilbara (and North Coast Bioregion) comprising more than 50 scalefish species. In comparison, the trap fishery retains a subset of about 45 to 50 scalefish species, and while the Line Fishery catch comprises a similar number it also includes some deeper offshore species.	✓	✓	The operational area for this activity does intersect line, trap and trawl fisheries however given a 500 m exclusion zone only, impact due to planned activities is expected to be minimal. Unplanned events which may occur in the operational area and EMBA could disrupt Pilbara Demersal fishing activities.
State Managed Fisheries (Whole of State)				
Marine Aquarium Fish Fishery	All year. Effort within the operational area and EMBA is unknown, but is unlikely due to the depth and the dive-based method of collection. Unlikely to occur.	✓	✓	Disruption to fishing activities unlikely given water depths fisheries operate within. Unplanned events which may occur in the EMBA are also unlikely to disrupt fishing activities.
Specimen Shell Managed Fishery	All year. Effort within the operational area and EMBA is unknown, but it is unlikely due to the depth and the dive based method of collection Unlikely to occur.	✓	✓	
West Australian Sea Cucumber Fishery	All year. Although permitted to fish within the operational area and EMBA, the fishery is restricted to	✓	✓	

Value/Sensitivity	Description	Operational area presence	EMBA presence	Relevant events within the operational area and EMBA
(formerly known as the Beche-de-mer fishery)	shallow coastal waters suitable for diving and wading. Unlikely to occur.			
West Coast Deep Sea Crustacean Managed Fishery	This fishery extends seaward from the 150m isobath, north of Augusta to the Northern Territory border which is outside the operational area but within the EMBA. Catch effort is concentrated in areas South of Exmouth therefore will not interact with planned and unplanned events for this activity.	X	✓	
Octopus	Caught as a by-product in region.	X	✓	Targeted fishing within the EMBA is unlikely with the octopus resource predominantly occurring from Shark Bay to the South Australian border.
South West Salmon Fishery	Although permitted to fish within the operational area and EMBA, the fishery is biogeographically limited to the South West Coast.	✓	✓	Disruption to this fishery will not result from planned or unplanned events.
Abalone Managed Fishery (Area 4 and 8)	The commercial fishery harvest method is a single diver working off a 'hookah' (surface-supplied breathing apparatus) using an abalone 'iron' to prise the shellfish off rocks.	✓	✓	Disruption is unlikely to occur in the operational area due to depths and method of collection. Unplanned events which may occur in the EMBA are also unlikely to disrupt fishing activities.

Table 4-7: Socio-economic activities in the vicinity of the operational area and EMBA

Value/Sensitivity	Description	Operational area Presence	Relevant events within the operational area	Relevant events within the EMBA
Shipping	Shipping using NWS waters includes iron ore carriers, oil tankers and other vessels proceeding to or from the ports of Dampier, Port Walcott and Port Hedland; however, these are predominantly heading north from these ports. The proposed operational area does not overlap any major shipping lanes (>20 km away), although vessel traffic may be encountered throughout the operational area as commercial vessels transit around the Montebello Islands and support vessel(s) conduct operations with the offshore infrastructure.	✓	Planned Interactions with other marine users	Unplanned Hydrocarbon release LOWC and MDO spill from vessel collision
Recreational fishing	Within the operational area there are no known natural seabed features that would aggregate fishes and which are typically targeted by recreational fishers. Given the water depths and distance from the nearest mainland, it is unlikely recreational fishing would occur in the vicinity. Recreational fishing does occur within the EMBA, and therefore could be impacted by a LOWC.	-	N/A	Unplanned Hydrocarbon release LOWC and MDO spill from vessel collision
Defence	In consultation Defence has advised no concerns with this proposed activity	-	N/A	N/A
Shipwrecks	Nine shipwrecks are found within the EMBA.	-	N/A	Unplanned Hydrocarbon release LOWC and MDO spill from vessel collision
Oil and gas	Various petroleum exploration and production activities have been undertaken within the NWS, however there are none in the vicinity of the operational area. Outside of the operational area, but within the permit area, the Pluto gas pipeline transects the southwest corner (~5 km from the operational area). Vessels servicing oil and gas operations in the region may pass through the area *en route* to facilities, however, since vessel transit is not classed as a petroleum activity, potential impacts to vessels are discussed under 'Shipping' above. Oil and gas facilities occur within the EMBA as do permits operated by other titleholders. As such, oil and gas activities could be impacted by unplanned events.	-	N/A	Unplanned Hydrocarbon release LOWC and MDO spill from vessel collision
Tourism	Owing to the water depths of the operational area, planned events are not predicted to have an impact on tourism. There are sources of marine-based tourism within the EMBA. Aquatic recreational activities such as boating, diving and fishing occur near the coast and Montebello	-	N/A	Unplanned Hydrocarbon release LOWC and MDO spill from vessel collision

Value/Sensitivity	Description	Operational area Presence	Relevant events within the operational area	Relevant events within the EMBA
	Islands. These activities are concentrated in the vicinity of the population centres such as Exmouth, Dampier and Onslow. The EMBA encompasses the Montebello Islands Marine Park, Montebello Islands Sanctuary Zone and also the Barrow Island Marine Park and Marine Management Area (MMA); shoreline accumulation of oil may also occur within the Ningaloo Marine Park and Muiron Islands MMA as such eco-tourism based on specific local values (game fish, nearshore reef snorkelling and diving) could be impacted by unplanned events.			
Cultural Heritage	No known sites of Aboriginal Heritage significance occur within the operational area or EMBA.	-	N/A	N/A

5 Stakeholder Consultation

Santos understands retaining a broad licence to operate depends on the development and maintenance of positive and constructive relationships with a comprehensive set of stakeholders across the community, Government, non-government and business sectors.

To allow an informed assessment by stakeholders of the potential impact of Santos' activities, Santos has established long-term and meaningful dialogue with those stakeholders who have demonstrated an interest in its present and planned future activities in Australia.

For the activities to be undertaken under the EP, a standardised approach was applied to identify key stakeholders for the activity, beginning with a review of the stakeholder database, and of the stakeholders consulted over other recent activities in the area. In particular, the operational area for the activity was used to identify relevant persons on an activity-by-activity basis, and will be used throughout the duration of the EP. The key stakeholders identified for the activity are provided in **Table 5-1**.

Table 5-1: Summary of stakeholders consulted

Group	Stakeholder
Fishing bodies	• Australian Fisheries Management Authority (AFMA) • Commonwealth Fisheries Association (CFA) • Department of Primary Industries and Regional Development (DPIRD) • Recfishwest • Western Australian Fishing Industry Council (WAFIC)
Karratha/ Port Hedland Stakeholder Reference Group	• Pilbara Port Authority
Marine conservation	• Department of Biodiversity, Conservation and Attractions (DBCA)
Shipping safety and security	• Australian Maritime Safety Authority (AMSA) • Department of Defence (DoD) • Department of Transport (DoT)
Adjacent regulator	• Department of Mines, Industry Regulation and Safety (DMIRS)
Commonwealth Government departments	• Department of Agriculture and Water Resources – Biosecurity • Department of Agriculture and Water Resources – Fisheries • Department of Foreign Affairs and Trade (DFaT) • Director of National Parks
Commercial fishers	• Fat Marine • RNR Fisheries • Westmore Seafoods
Neighbouring operators	• Woodside

5.1 Summary

Stakeholders for the Corvus-2 Appraisal Drilling EP (refer **Table 5-1**) were engaged by Quadrant Energy via an activity-specific consultation package distributed by email on September 14, 2018. Following Santos' acquisition of Quadrant Energy in November 2018, stakeholders were advised of Santos' proposed offshore Western Australia activities in 2019 via a Quarterly Consultation Update distributed on December 17, 2018. Corvus-2 drilling was listed within this Quarterly Consultation Update as an upcoming activity for 2019 and in a covering email, stakeholders were advised of the transition from Quadrant to Santos, and provided return contact details. No concern was received from stakeholders regarding Corvus-2 drilling during the consultation period for the EP or in relation to the transition from Quadrant to Santos. A summary of consultation material for the activity is summarised in **Table 5-2**.

Given the nature and short duration of this activity, Santos anticipates minimal interaction with mariners. Despite this Santos will provide relevant marine notices (refer to **Section 6.3.1**).

All correspondence with external stakeholders is recorded and Santos will remain available before, during and after the activity. Consultation material and feedback received will be provided to the appropriate internal Santos personnel when relevant.

Consultation, agreements or contracts that support Santos' oil spill response strategies and tactics have been put into place with agencies and organisations throughout the development of the Corvus-2 Appraisal Drilling Oil Pollution Emergency Plan (OPEP) so that roles and responsibilities are understood and accepted.

Table 5-2: Consultation summary for activity

Stakeholder	Assessment of Consultation Undertaken
Fishing bodies	
Australian Fisheries Management Authority (AFMA)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. This activity is expected to have no impact on Commonwealth fisheries, therefore no further action arising from this consultation for the EP.
Commonwealth Fisheries Association (CFA)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. This activity is expected to have no impact on Commonwealth fisheries, therefore no further action arising from this consultation for the EP.
Department of Primary Industries and Regional Development (DPIRD)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. No response regarding the activity has been received to date, however Santos has engaged extensively with the Department in recent years including the recent *Greater East Spar Installation and Commissioning EP* (GE-35-RI-10002.01). Santos has updated sections of the EP including fishing activities, fish spawning grounds in the area, pollution emergency plan advice and biosecurity according to advice provided by the Department for the EP.
Recfishwest	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. Recfishwest responded to consultation on September 14, 2018, by email, noting no concern with the activity. No action arising from this consultation for the EP.
Western Australian Fishing Industry Council (WAFIC)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. No response regarding the activity has been received to date. Given the low level of impact this activity is expected to have on commercial fishers, no further action arising from this consultation for the EP.
Karratha/Dampier Stakeholder Reference Group	
Pilbara Port Authority	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. No response regarding the activity has been received to date. No action arising from this consultation for the EP.

Stakeholder	Assessment of Consultation Undertaken
Marine Conservation	
Department of Biodiversity, Conservation and Attractions (DBCA)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. No response regarding the activity has been received to date. Given the distance of this activity to State managed marine parks, no action arising from this consultation for the EP.
Shipping Safety and Security	
Australian Maritime Safety Authority (AMSA)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. AMSA have not responded to this consultation, however, based on previous advice from AMSA, Santos commits to relevant marine notices (refer to **Section 6.3.1**). Santos has accessed shipping data, usually provided by AMSA in consultation.
Department of Defence (DoD)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. The Department responded to consultation via email with no objection on October 8, 2018, advising the AHO branch of the Department be notified three weeks prior to commencement.
Department of Transport (DoT)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. The Department acknowledged receipt of this email on September 27, 2018. The Department was provided by email with the Corvus-2 Drilling OPEP Revision 0 on November 27, 2018. The Department were provided via email with the revised Corvus-2 Drilling OPEP Revision 1 on December 21, 2018, to include updates to subsea dispersant application. Santos commits to ongoing consultation with the Department on all Santos activities as per the Departments Industry Guidance Note.
Adjacent Regulators	
State Department of Mines, Industry Regulation and Safety (DMIRS)	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. On request, Santos clarified the distance to the Montebello Multiple Use Zone on October 2, 2018. DMIRS responded by email on October 4, 2018, acknowledging the activity would occur in Commonwealth Waters under NOPSEMA's regulation. DMIRS request commencement and cessation notifications.
Commonwealth Government Departments	
Department of Agriculture and Water Resources – Biosecurity	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, as requested in the Australian Government Guidance on Offshore Petroleum and Greenhouse Gas Activities Consultation. No response has been received to date, and is not anticipated as Santos has consulted regularly with the State agency for biosecurity DPIRD.

Stakeholder	Assessment of Consultation Undertaken
Department of Agriculture and Water Resources – Fisheries	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, as requested in the Australian Government Guidance on Offshore Petroleum and Greenhouse Gas Activities Consultation. The Department responded with thanks on September 27, 2018, noting they have no concern with the activity and requesting Santos consults with fishing bodies including AFMA. Santos responded confirming AFMA and additional fishing representative bodies are regularly consulted on Santos' offshore activities. This activity is expected to have no impact on Commonwealth fisheries, therefore no further action arising from this consultation for the EP.
Department of Foreign Affairs and Trade (DFaT)	Santos contacted this stakeholder by email on December 12, 2018, as per the Australian Government Guidance on Offshore Petroleum and Greenhouse Gas Activities Consultation. Santos has updated the Corvus-2 Appraisal Drilling OPEP with contact details for DFaT, should an unplanned incident occur which may affect foreign territorial waters, as advised in consultation on previous activities.
Director of National Parks	This stakeholder was provided the Corvus-2 drilling consultation package on October 25, 2018, as requested in the Australian Government Guidance on Offshore Petroleum and Greenhouse Gas Activities Consultation. No response has been received to date. In an email response on December 7, 2018, the a Marine Parks Officer responded noting as this activity does not overlap an Australian Marine Park, no authorisation from the Director of National Parks is required and no further information is required in relation to this activity. As requested, Santos has included the contact details for the Director of National Parks in the Corvus-2 Appraisal Drilling OPEP should an unplanned event occur which is likely to impact a marine park. Santos responded with thanks on December 17, 2018.
Commercial Fishers	
Fat Marine	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. No response regarding the activity has been received to date. Given the low level of impact this activity is expected to have on commercial fishers, and the concern of stakeholder fatigue on fisherman, no further action arising from this consultation for the EP.
RNR Fisheries	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. No response regarding the activity has been received to date. Given the low level of impact this activity is expected to have on commercial fishers, and the concern of stakeholder fatigue on fisherman, no further action arising from this consultation for the EP.
Westmore Seafoods	This stakeholder was provided the Corvus-2 drilling consultation package on September 14, 2018, and receive all Santos' Quarterly Consultation Update documents including the Quarterly Consultation Update distributed on December 17, 2018, which outlined Santos' acquisition of Quadrant Energy. No response regarding the activity has been received to date. Given the low level of impact this activity is expected to have on commercial fishers, and the concern of stakeholder fatigue on fisherman, no further action arising from this consultation for the EP.

Stakeholder	Assessment of Consultation Undertaken
Neighbouring operator	
Woodside	As the operator of the Pluto pipeline, Woodside were provided notification of the proposed drilling activity via email on September 14, 2018. No response has been received at the time of submission.

5.2 Ongoing Consultation

Consultation activities covered by the EP comprises three tiers, the Activity Consultation Package distributed prior to EP submission (sent on September 14, 2018), a notification prior to activity commencement when timing and other details are confirmed, and within Santos' Quarterly Consultation Updates (last issued December 2018).

Stakeholder consultation will be ongoing and Santos will work with stakeholders to address any future concerns if they arise throughout the duration of the EP. Should any new stakeholders be identified, they will be added to the stakeholder database and included in all future correspondence as required, including specific activity notifications.

Prior to mobilisation, Santos will provide a notification to relevant stakeholders, and include specific timing, location and MODU and vessel details. Stakeholders who receive this notification document will be based on Santos' stakeholder list at the time, which may include additional stakeholders to those listed in **Table 5-1** if they have been identified by Santos, or have specifically requested the information through consultation.

Santos does not expect concerns to be raised regarding the activity given the consultation period that has occurred prior to EP submission. However if additional comments do arise, Santos will allow an appropriate amount of time to respond and address these comments.

If the MODU departs and returns to the operational area after the initial notifications, relevant stakeholders will be notified as appropriate.

5.3 OPEP Consultation

In preparing OPEPs, a number of parties are identified to provide spill response services and actions to support the implementation of the OPEP. These OPEP stakeholders are identified through evaluation of the activity and spill potential for all Santos OPEPs, including the *Corvus-2 Appraisal Drilling OPEP* (QE-00-BF-20002.02).

Consultation, agreements or contracts have been put into place with agencies and organisations throughout the development of Santos oil spill response strategies and tactics so that roles and responsibilities are understood and accepted.

6 Environmental Impact and Risk Assessment

Santos operates under an overarching risk management policy (QE-91-IF-10050). The Santos risk management framework (QE-91-IF-10051) underpins the risk management policy and is consistent with the requirements of AS/NZS ISO 31000 *Risk Management – Guidelines* (2018). The key steps to risk management are illustrated in **Figure 6-1** below.

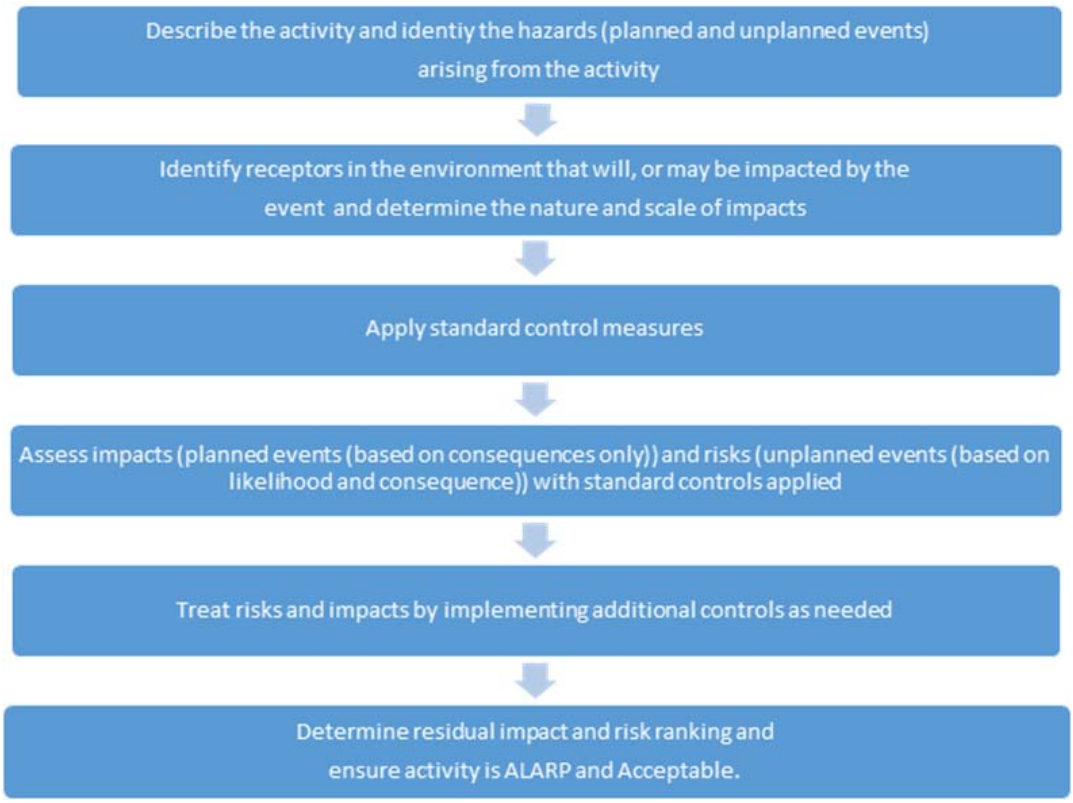

Figure 6-1: Environmental impact and risk assessment process

Santos has undertaken environmental impact and risk assessments for the Corvus-2 drilling activity's planned events (including routine, non-routine and contingency activities) and unplanned events in accordance with the OPGGS(E)R. An assessment against the activity was undertaken and the environmental hazards or aspects were then identified. The risk assessment identified eight planned events and seven potential unplanned events.

The extent of actual or potential impacts from each planned or unplanned event is assessed using, where required, predictive information such as modelling (e.g. hydrocarbon spills) and scientific reports. The duration of the event is also described including the potential duration of any impacts should they occur. Impact mechanisms and thresholds for impacts where relevant are determined and described, using scientific literature and modelling where required. Impact thresholds for different critical life stages are also identified where relevant. The consequence level of the impact is then determined for each planned and unplanned event based on the severity of the impact to relevant receptors.

This process determines a consequence level based on set criteria for each receptor category and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. The consequence definitions are outlined in **Table 6-1**.

Table 6-1: Consequence level description

Consequence Level		Consequence Level Description
A	Negligible	No impact or negligible impact. Environmental impact lasting days up to 1 week.
B	Minor	Detectable but insignificant change to local population, industry or ecosystem factors. Environmental impact lasting weeks up to 12 months.
C	Moderate	Significant impact to local population, industry or ecosystem factors. Environmental impact lasting 1 to 10 years.
D	Major	Major long-term effect on local population, industry or ecosystem factors. Environmental impact lasting 10 to 20 years.
E	Critical	Complete loss of local population, industry or ecosystem factors AND/ OR major wide-spread regional impacts with slow recovery to no full recovery. Environmental impact lasting more than 20 years to no recovery.

For unplanned events, a risk ranking is also determined using an assessment of the likelihood (likelihood ranking) of the event as well as the consequence level of the potential impact should that event occur. A description of likelihood as per Santos' Risk Matrix is shown in **Table 6-2**.

Table 6-2: Likelihood description

No.	Matrix	Description
5	Probable	1. Event has occurred frequently within the Company. 2. Between 1 and 10 incidents every 10 years (i.e. up to frequency 1/year).
4	Likely	1. Event has occurred frequently within the Industry. 2. Between 1 and 10 incidents every 100 years (i.e. up to frequency 10^{-1}/year).
3	Unlikely	1. Event has occurred occasionally within the Company. 2. Between 1 and 10 incidents every 1000 years (i.e. up to frequency 10^{-2}/year).
2	Very Unlikely	1. Has occasionally occurred within the Industry. 2. Between 1 and 10 incidents every 10,000 years (i.e. up to frequency 10^{-3}/year).
1	Rare	1. Could happen under exceptional circumstances only. 2. Between 1 and 10 incidents every 100,000 years (i.e. up to frequency 10^{-4}/year).

Risk rankings (consequence x likelihood) are assigned in accordance with Santos Risk Matrix as shown in **Figure 6-2**.

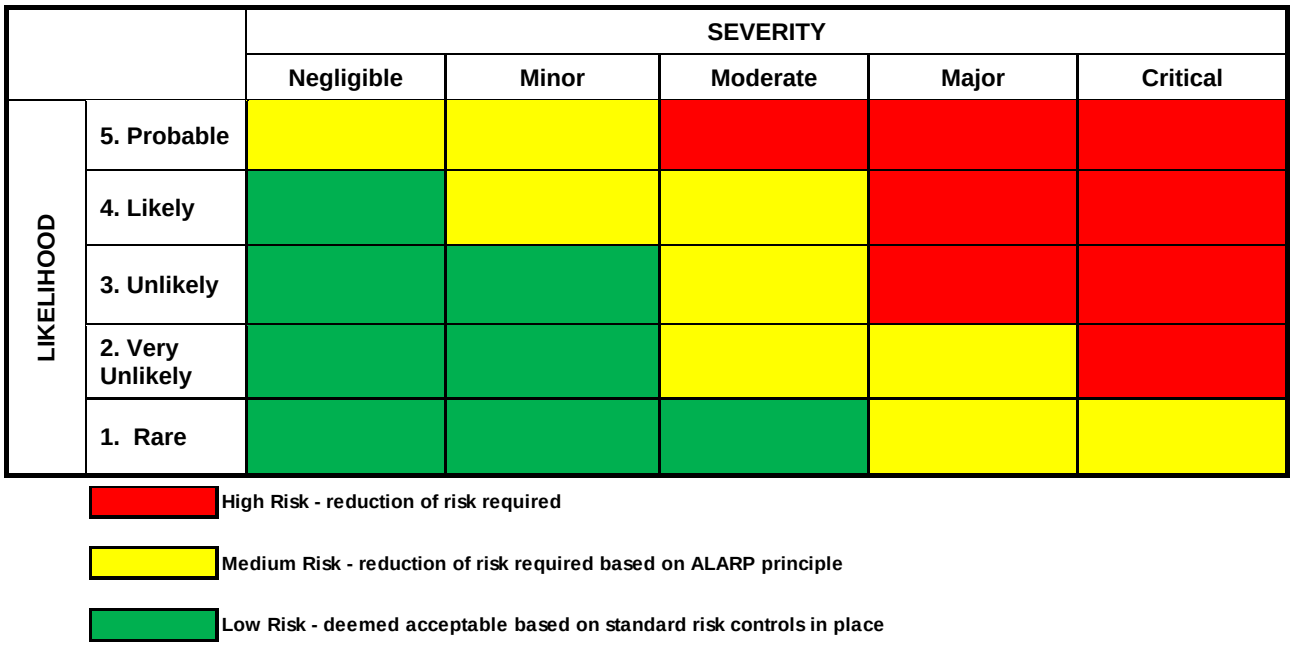

Figure 6-2: Santos risk matrix

For each planned and unplanned event, a set of Environmental Performance Outcome(s) (EPO), Environmental Performance Standards (EPS) and Measurement Criteria (MC) are identified. The definitions of the performance outcomes, standards and measurement criteria are consistent with the OPGGS(E)R. For planned and unplanned events, an ALARP and Acceptability assessment is also undertaken.

6.1 ALARP Evaluation

For planned and unplanned events, an as low as reasonably practicable (ALARP) assessment is undertaken to demonstrate that the standard control measures adopted reduce the impact (consequence level) or risk to ALARP. This process relies on demonstrating that further potential control measures would require a disproportionate level of cost/effort in order to reduce the level of impact or risk. If this cannot be demonstrated then further control measures are adopted. The level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact or risk. For example, more detail is required for a risk ranked as `Medium' compared to a risk ranked as `Low'.

6.2 Acceptability Evaluation

Santos considers an impact or risk associated with the proposed activity to be acceptable if the following criteria are met:

+ The consequence from a planned event is ranked as A or B; or a risk of impact from an unplanned event is ranked low to medium;
+ An assessment has been completed to determine if further information/studies are required to support or validate the consequence assessment;
+ Assessment and management of risks has addressed the principles of ecologically sustainable development (ESD);
+ Demonstration that the acceptable levels of impact and risks have been informed by relevant species recovery plans, threat abatement plans and conservation advice;
+ Performance standards are consistent with legal and regulatory requirements;

+ Performance standards are consistent with Santos Environmental Management Policy;
+ Performance standards are consistent with industry standards and best practice guidance (e.g. National Biofouling Guidance for the Petroleum Industry);
+ Performance outcomes and standards are consistent with stakeholder expectations; and
+ Performance standards have been demonstrated to reduce the impact or risk to ALARP.

6.3 Environmental Assessment Summary for Planned Events

The environmental assessment identified eight potential sources of environmental impacts associated with the planned events for the Corvus-2 appraisal drilling activity.

6.3.1 Interaction with other marines users

Potential Receptors	Marine user groups such as: commercial fishers, tourism, shipping traffic and other oil and gas activities
Impact Assessment	
Receptors	**Assessment**
Threatened / migratory / local fauna	Not applicable – related to socio-economic receptors only.
Physical environment/ habitat	
Threatened ecological communities	
Protected areas	
Socio-economic Receptors	The nearest charted shipping fairway lies well to the west of the operational area. Any risk to commercial shipping activities is mitigated through notifications the AMSA's Joint Rescue Coordination Centre (JRCC) for Auscoast warnings and the Australian Hydrographic Service (AHS) for Notices to Mariners. Tourism activity in the operational area is expected to be low, given the distance to the mainland. Commercial fishing in the operational area is low and would be excluded from an area of 500 m for a short duration, so unlikely to impact on them commercially. The Pluto pipeline crosses the permit area; the pipeline is not near the operational area and will not be impacted by the activity. Other operators may have vessels traversing the region that will need to avoid the operational area to access exploration and development sites, but the scale of exclusion area is small (500 m) and duration of the activities short. No concerns have been raised by stakeholders regarding the potential exclusion from the proposed operational area or temporary exclusion area.
Overall Consequence Ranking	A – Negligible
Control Measure	**Environmental Benefit**
Maritime notices	Ensure other marine users are aware of the presence of MODU and support vessels. Ensure other marine users are provided with information on timings of the activity including MODU arrival and departure, so that the maritime industry is aware of the petroleum activities (including how the site is left).
Santos stakeholder consultation strategy	

Standby vessel	Support vessel equipped with Automatic Identification System (AIS) to aid in its detection at sea, and radar to aid in the detection of approaching third party vessels. Reduces risk of environmental impact from vessel collisions.
MODU identification system	MODU has a RACON (radar transponder) or AIS to aid in its detection at sea. Reduces the risk of environmental impact from vessel collisions.

6.3.2 Seabed disturbance

Potential Receptors	Benthic habitats (soft sediments), and benthic fauna and commercial fisheries
Impact Assessment	
Receptors	**Assessment**
Threatened / migratory/ local fauna	No sensitive seabed features are expected within the permit area based on surveys at similar water depths in adjacent permit areas. The areas of seabed that will be impacted are expected to include calcareous sand underlaid by variably cemented calcarenite with little epifauna. These sediments are un-vegetated and likely to have sparse benthic and epi-benthic communities with low biodiversity and include species with widespread regional distributions. Therefore significant loss of habitat is not expected. Marine invertebrates may inhabit soft sediments and can contribute to the diet of some fauna. The area of soft sediment habitat that is potentially impacted is small compared to the amount of habitat available and therefore the disturbance is not expected to affect prey availability, and therefore protected fauna species. The area of disturbance has not been identified as a habitat that supports any protected species. Impacts will be temporary and the area potentially impacted is small compared to the size of the areas used by these species for foraging. Therefore no long-term impacts to these species are expected. No decrease in local population size, area of occupancy of species, loss or disruption of critical habitat or disruption to the breeding cycle of any of these protected matters is expected.
Physical environment/ habitat	The area of physical environment and habitat that will be impacted during the proposed activities is small compared to the area of similar habitat in the wider environment and is expected to re-establish following disturbance. As such, long-term or significant impacts to habitat values or ecosystem function are not expected.
Threatened ecological communities	Not applicable – No threatened ecological communities are identified in the operational area where seabed disturbance could occur.
Protected areas	Not applicable – No protected areas are identified in the operational area where seabed disturbance could occur.
Socio-economic receptors	Disturbance of the seabed will have no impact on socio-economic receptors. No stakeholder concerns have been raised regarding this aspect.
Overall Consequence Ranking	A – Negligible
Control Measure	**Environmental Benefit**
MODU move procedure	Ensures no accidental contact with the seabed and subsea infrastructure during the MODU move, limiting seabed disturbance.
Anchoring	Ensures no anchoring of vessels or MODU within the operational area, thus reduces seabed disturbance area as no anchor or anchor chain drag/placement.

6.3.3 Light emissions

Potential Receptors	Fish and sharks, marine turtles and seabirds

Impact Assessment	
Receptors	**Assessment**
Threatened / migratory / local fauna	Continuous lighting in the same location whilst the MODU and support vessels are on location at the well site may result in alterations to normal marine fauna behaviour. Sensitive receptors that may be impacted include fish and sharks at the sea surface, marine turtles and seabirds. Light emissions may be visible to turtles transiting or internesting in surrounding areas, but unlikely to affect nesting or hatchling sea finding / dispersal activity. Given that the activity will be a once off, of relatively short duration and is located nearly 60 km from the nearest coastline (island), impacts to significant numbers of any species are unlikely. Although the operational area overlaps with the internesting turtle BIA, impacts are not expected on a population level or to impact on turtle habitat. Cetaceans and marine mammals are not known to be significantly attracted to light sources at sea and therefore disturbance to behaviour is unlikely. Fish, sharks and birds have been shown to be attracted to artificial light sources, however, the short duration of the activity is unlikely to lead to large scale changes in species abundance or distribution. Impacts to transient fish, sharks and seabirds will therefore be limited to short-term behavioural effects with no decrease in local population size, area of occupancy of species or loss or disruption of habitat critical / disruption to the breeding cycle.
Physical environment/ habitat	Not applicable – No impacts to physical environments and/or habitats from light emissions are expected.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which light emissions are expected.
Protected areas	Negligible effects – Potential impacts to fauna that contribute to Montebello Marine Park values addressed above. No impacts to other light-sensitive values identified in the relevant Marine Park Management Plan (DNP, 2018).
Socio-economic receptors	Not applicable – Lighting is not expected to cause an impact to socio-economic receptors other than as a visual cue for avoidance of the area.
Overall Consequence Ranking	A – Negligible
Control Measure	**Environmental Benefit**
None – During the evaluation of the potential impacts of light emissions as a result of the activity, it was determined that no control measures were required as the inherent consequence of light emissions is expected to be negligible and does not compromise any management plans or objectives in place for protected fauna.	

6.3.4 Noise emissions

Potential Receptors	Cetaceans, marine turtles, fish and sharks
Impact Assessment	
Receptors	**Assessment**
Threatened / migratory / protected fauna	Given the generally low level of noise expected from the MODU, support vessels, helicopters and associated activities (e.g. VSP and ROV operations), and the short duration of noise emissions, significant impacts to threatened or migratory species are not expected. Some temporary and localised behavioural response may result from the noise levels emitted, but these will not be at levels that could cause mortality or injury to marine fauna, or cause a decrease in local population size / area of occupancy of species / loss or disruption of habitat critical or disruption to the breeding cycle. The potential impacts are therefore considered to be minor.

Physical environment/ habitat	Not applicable – Noise emissions will not impact the physical environment / habitats, apart from increasing ambient noise levels which is considered under other receptors.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which noise emissions are expected.
Protected areas	Negligible effects – The EMBA from VSP activities does not overlap with nearby marine parks. Potential impacts to fauna (cetaceans, turtles, fish and sharks) that contribute to the Montebello Marine Park values are addressed above. No impacts to the other noise-sensitive values identified in the relevant Marine Park Management Plan (DNP, 2018).
Socio-economic receptors	Noise levels are not expected to impact on socio-economic receptors due to their low activity level within the vicinity of the operational area. Impacts to fish may result in indirect impacts to fisheries in the area given the potential for temporary avoidance behaviour during VSP activities. However, given the short duration of the activity, limited impacts from the noise levels emitted from the activity (excepting VSP), the area available for the respective commercial fisheries and the area over which commercial species spawn, impacts to fisheries are considered negligible.
Overall Consequence Ranking	B – Minor
Control Measure	**Environmental Benefit**
Procedure for interacting with marine fauna	Reduces risk of physical and behavioural impacts to marine fauna from support vessels and helicopters, and from MODU seismic survey activities.
MODU seismic survey procedures	Includes controls that reduce the risk of harm to marine fauna. The checklist includes standards for: • Marine fauna observation. • Soft-start, operational and shut-down protocols. • Low visibility and night-time operations.

6.3.5 Atmospheric emissions

Potential Receptors	Seabirds and humans
Impact Assessment	
Receptors	**Assessment**
Threatened / migratory / local fauna	Short-term behavioural impacts to seabirds could be expected if they overfly the location; they may avoid the area. No decrease in local population size / area of occupancy of species / loss or disruption of habitat critical / disruption to the breeding cycle / introduction of disease.
Physical environment / habitat	No reduction in physical environment/ habitat area or function is expected.
Threatened ecological communities	Not applicable – these receptors will not be impacted by air emissions.
Protected areas	
Socio-economic receptors	As the activity occurs in offshore waters, the combustion of fuels, venting and ozone-depleting substances (ODS) releases in the remote location will not impact on air quality in coastal towns. The quantities of gaseous emissions are relatively small and will, under normal circumstances, quickly dissipate into the surrounding atmosphere. The highly dispersive nature of local winds (i.e. strong and consistent) is expected to reduce

	potentially harmful or 'noticeable' gaseous concentrations within a short distance from the MODU/vessels and therefore not impact on other marine users in the vicinity.
Overall Consequence Ranking	A – Negligible
Control Measure	**Environmental Benefit**
Bulk solid transfer procedure – tank venting during bulk product (powder) transfer	This is a health and safety requirement to prevent tank over-pressure.
Waste incineration	Reduces the probability of potential impacts to air quality from waste incineration to significantly impact air quality. Waste incineration is managed in accordance with MARPOL. No incineration within the 500-m exclusion zone around the MODU.
MARPOL-compliant fuel oil (diesel)	Potential for reduced sulphur emissions through the use of MARPOL-compliant fuel oil (diesel) during the activity.
Air pollution prevention certification	Reduces the probability of potential impacts to air quality due to ODS emissions, high NO_x and SO_x emissions.
Ozone-depleting substance handling procedures	Reduces the probability of potential impacts to air quality due to ODS emissions.

6.3.6 Drilling and cement discharges

Potential Receptors	Water quality; fish (pelagic) and sharks, marine mammals and marine turtles; benthic fauna and habitat
Impact Assessment	
Receptors	**Assessment**
Threatened / migratory / local fauna	No sensitive seabed features are expected within the area potentially impacted by drill discharges based on detailed surveys conducted in similar water depths within adjacent permit areas. The areas of seabed that will be impacted are expected to include soft sediments with little epifauna. These sediments are un-vegetated and likely to have sparse benthic and epi-benthic communities with low biodiversity and include species with widespread regional distributions. Therefore significant loss of habitat is not expected. Marine invertebrates may inhabit soft sediments and can contribute to the diet of some fauna. The area of soft sediment habitat that is potentially impacted is small compared to the amount of habitat available and therefore the disturbance is not expected to affect prey availability, and therefore protected fauna species, significantly. Ecological recovery of benthic habitat usually begins shortly after the end of drilling and often is well advanced within a year. Mobile marine species are expected either to avoid turbid stretches of water or pass through with no significant impacts. The operational area is in a high-energy, well mixed open water environment and significant discharge plumes are not expected to occur outside of the areas directly adjacent to the discharge location. Overall the consequence to marine fauna from any of the drilling discharges is considered *Negligible* given the low toxicity of the drilling and cement discharges and no significant impacts are expected to threatened and migratory fauna.
Physical environment / habitat	Local minor changes to soft sediment habitat will result from cuttings and associated drilling mud deposition near the MODU. Effects to benthic infauna communities from sedimentation resulting from drilling discharges have been determined to most likely be a result of a change in sediment texture as opposed to any toxicological effects, with increased clays and larger particles altering the habitat suitability for some species.

	For cement discharges, geomorphology of the habitat would be altered, with cement hardening over time and blanketing the existing habitat. Although impacts on the form of the seabed in the immediate vicinity of the MODU will be longer term, the impacts are low in magnitude owing to the small area that would be affected. Overall the consequence to the physical environment / habitat from any of the drilling discharges is considered *Minor*.
Threatened ecological communities	Not applicable – No threatened ecological communities are identified in the area where discharge effects could occur.
Protected areas	Not applicable – No protected areas are identified in the operational area where discharge effects could occur.
Socio-economic receptors	Not applicable – No stakeholder concerns have been raised regarding this aspect.
Overall Consequence Ranking	B – Minor
Control Measure	**Environmental Benefit**
Chemical selection procedure for drilling and cementing chemicals	Aids in the process of chemical management that reduces the impact of drilling discharges to sea. Only environmentally acceptable products are used.
Cuttings management system	Reduces the concentration of drilling mud on cuttings prior to discharge while drilling with a closed circulating system, thereby reducing the total volume of drilling mud discharged to sea.
Inventory control procedure	Restricts the type and volume of drilling discharges, and includes a decision-making framework for managing left-over bulk products.

6.3.7 Operational discharges

Potential Receptors	Water quality, fish (pelagic) and sharks, marine mammals, marine turtles and seabirds
Impact assessment	
Receptors	**Assessment**
Threatened / migratory / local fauna	Operational discharges in the same location for an extended period of time may result in significant water quality perturbations and alteration to marine fauna behaviour. Any effects on water quality are expected to be within the surface waters only and have no effect on seabed receptors. Given that the activity will be for a limited duration, and is located ~60 km from the nearest shoreline (the Montebello Islands), impacts will be limited to short-term water quality impacts and temporary behavioural effects observed in fish, sharks and seabirds. Impacts to water quality will be experienced in the discharge mixing zone which will be localised and will occur only as long as the discharges occur (i.e. no sustained impacts), therefore, recovery will be measured in hours to days. Consequently, only short-term behavioural impacts are expected with no decrease in local population size / area of occupancy of species / loss or disruption of habitat critical / disruption to the breeding cycle / introduction of disease. No physical environments and/or habitats identified in the area over which operational discharges are expected to disperse other than open water.
Physical environment/ habitat	
Socio-economic receptors	
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which planned discharges are expected.
Protected areas	Not applicable – No protected areas are identified in the area where planned discharges could affect water quality.

Overall Consequence Ranking	A – Negligible
Control Measure	**Environmental Benefit**
Waste (garbage) management procedure	Reduces probability of garbage being discharged to sea, reducing potential impacts to marine fauna. Stipulates putrescible (food) waste disposal conditions and limitations. Ensures compliance with MARPOL requirements.
Deck cleaning product selection procedure	Improves water quality discharge (reduces toxicity) to the marine environment. Those deck cleaning products planned to be release to sea meet the criteria for not being harmful to the marine environment according to MARPOL.
Sewage treatment system	Reduces potential impacts of inappropriate discharge of sewage. Ensures compliance with MARPOL requirements.
Oily water treatment system	Reduces potential impacts of planned discharge of oily water to the environment. Ensures compliance with MARPOL requirements.

6.3.8 Contingency spill response operations

Potential Receptors	Fauna (including threatened / migratory / local fauna). Physical environment/ habitat. Protected areas. Socio-economic receptors.
Impact Assessment	
Receptors	**Assessment**
Threatened / migratory / local fauna **Physical environment/ habitat** **Protected areas** **Socio-economic receptors**	While response strategies are intended to reduce the environmental consequences of a hydrocarbon spill, poorly planned and coordinated response activities can result in a lack of, or inadequate, information being available upon which poor decisions can be made, exacerbating or causing further environmental harm. An inadequate level of training and guidance during the implementation of spill response strategies can also result in environmental harm over and above that already caused by the spill. Spill response activities could occur anywhere within the EMBA for the worst-case spill scenarios. Spill response activities will be within offshore and coastal waters using vessels and aircraft. Some response strategies will be concentrated in the vicinity of sensitive receptors in coastal waters and along shorelines. The greatest potential for impacts additional to those already described for routine operations is from oiled wildlife response operations, and to shoreline habitats and fauna receptors within shallow waters or on shorelines from shoreline clean-up activities. Impacts from spill response activities may include, light emissions, noise emissions, atmospheric emissions, operational discharges and waste, physical presence and disturbance, disruption to other users of marine and coastal areas and townships and chemical dispersants. Potential impacts for these are described in the above sections, with the exception of chemical dispersant. The use of subsea chemical dispersants has the potential to increase the distribution and concentration of entrained oil and dissolved aromatic hydrocarbons within the water column. Entrained oil and dissolved aromatic hydrocarbons are expected to be elevated adjacent to the chemical dispersant release site with the potential for increased impacts to benthic and pelagic fishes, sharks and invertebrates. For benthic habitat around the well location, there could be a detectable increase in impact from subsea chemical dispersant operations. The use of subsea chemical dispersants would lead to a reduction in the spatial extent of floating oil, a reduction in the maximum concentration of floating oil arriving at shorelines, and a reduction in the volume of oil stranded on shorelines. These widespread positive effects to shoreline habitats and marine and coastal fauna are considered to outweigh the potential localised negative impacts to pelagic species and benthic habitat outlined above. Thus from an overall environment perspective, the use of subsea chemical dispersants (if required) is predicted to have a net benefit based on the available evidence.
	A – Negligible (Light, noise and atmospheric emissions; operational discharges and waste)

Overall Consequence Ranking	B – Minor (Physical presence and disturbance; chemical dispersant (subsea) application; and disruption to other users of marine and coastal areas and townships)
Residual Risk	Unplanned waste release – Low risk
	Introduction of invasive species – Medium risk

Control Measure	**Environmental Benefit**
Competent IMT and Oil Spill Responder personnel	Ensures that spill response strategy selection and operational activities consider the potential for additional environmental impacts
Use of competent vessel crew/personnel	Reduces potential for environmental impacts from vessel usage
Spill response activities selected on basis of a Net Environmental Benefit Analysis (NEBA)	Provides a systematic and repeatable process for evaluating strategies with net least environmental impact.
Noise and atmospheric emissions	
Vessels and aircraft compliant with Santos' *Protected Marine Fauna Interaction and Sighting Procedure*	Reduces potential for behavioural disturbance to cetaceans. Ensures compliance with Part 8 of the EPBC Regulations 2000 which is considered a standard spill response control (regulatory requirement).
If required under MARPOL, vessels will maintain a current International Air Pollution Prevention (IAPP) Certificate.	Reduces level of air quality impacts.
Operational discharges and wastes	
Vessels meet applicable MARPOL sewage disposal requirements	Reduces potential for water quality impacts from operational discharges and waste.
Vessel meet applicable MARPOL requirements for oily water (bilge) discharges	
Ballast water management plan for international vessels	Improve water quality discharge to marine environment to ALARP. Reduce risk of introduced marine species.
Compliance with controlled waste, unauthorised discharge and landfill regulations	Ensures correct handling and disposal of oily wastes.
Physical presence and disturbance	
Vessels and aircraft compliant with Santos' *Protected Marine Fauna Interaction and Sighting Procedure*	Reduces potential for behavioural disturbance to cetaceans. Ensures compliance with Part 8 of the EPBC Regulations 2000 which is considered a standard spill response control (regulatory requirement).
DPIRD vessel check tool applied to all spill response vessels on basis of the outcome of a Net Environmental Benefit Analysis (NEBA)	Reduce risk for introduction of invasive marine species as part of vessel biofouling.

Use of shallow draft vessels for shoreline and nearshore operations	Reduce seabed and shoreline disturbance.
Oil Spill Response Team (OSRT) Team Leader assessment/ selection of vehicle appropriate to shoreline conditions	Reduce coastal habitat and fauna disturbance.
Conduct shoreline/nearshore habitat/bathymetry assessment	Reduce shoreline habitat disturbance
Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat	Reduce coastal habitat and fauna disturbance
Operational restriction of vehicle and personnel movement to limit erosion and compaction	Reduce coastal habitat erosion and compactions.
Prioritise use of existing roads and tracks	Reduce coastal habitat and fauna disturbance.
Selection of temporary base camps in consultation with DoT and DBCA	
Soil profile assessment prior to earthworks	Reduce habitat disruption and erosion.
Pre-cleaning and inspection of equipment (quarantine)	Prevent introduction of invasive species.
Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance	Reduce disturbance to culturally significant sites.
Adhere to WA Oiled Wildlife Response Plan and Pilbara Regional Oiled Wildlife Response Plan	Oiled wildlife hazing, capture, handling and rehabilitation meet minimum standards as outlined within the WA Oiled Wildlife Response Plan.
Chemical dispersant (subsea) application	
Chemical dispersant plan	A standard control adopted by industry to reduce potential for additional impacts from dispersant application.
Disruption to other users of marine and coastal area and townships	
Stakeholder consultation	Early awareness of spill response activities which reduces potential disruption.
Utility resource assessment and support to be conducted if activity is of significant size in comparison to the size of the coastal community	Reduces potential impact due to higher utility demands causing disruptions to local community.
Accommodation assessment	Reduces strain on accommodation.
Security Management Plan	Reduces potential for security treat causing disruptions in the response activities.
Transport Management Plan	Reduces potential for traffic disruptions.

6.4 Environmental Assessment Summary for Unplanned Events

The environmental assessment identified seven potential sources of environmental risks associated with the unplanned events for the Corvus-2 appraisal drilling activity.

6.4.1 Hydrocarbon release from a loss of well control

Potential Receptors	Marine fauna – plankton, invertebrates (pelagic and intertidal), pelagic fish and sharks, marine mammals, marine reptiles, seabirds/shorebirds; shoreline habitats; protected areas and socio-economic receptors
Impact Assessment	
Receptors	**Assessment**
Physical environment/ habitat; **Threatened / migratory / local fauna;** **Protected areas;** **Socio-economic receptors**	Hydrocarbon spills will cause a decline in water quality and can cause chemical (e.g. toxic) and physical (e.g. coating of emergent habitats, oiling of wildlife at sea surface) and impacts to marine species. The severity of the impact of a hydrocarbon spill depends on the magnitude of the hydrocarbon spill (i.e. extent, duration) and sensitivity of the receptor. The magnitude of potential environmental impact from a condensate release (which behaves in a similar manner in the marine environment to MDO) is dependent on multiple factors including hydrocarbon type, release volume and rate, and ocean and weather conditions. In the event of a hydrocarbon release due to a loss of well control (LOWC), hydrocarbons have the potential to reach shorelines and may therefore impact nearshore environments and shoreline habitat and fauna. Impacts from oil will occur from smothering of marine flora, fauna and habitats or ingestion of oil by marine fauna. The degree to which impacts could occur will depend upon the level of coating (concentration of oil and/or loading of oil on shorelines) and how fresh or weathered the oil is. Owing to the predicted high volatility and lack of persistent compounds associated with the condensate, it is not expected to be a sticky hydrocarbon and hence the potential for physical coasting of marine fauna and benthic habitats is relatively low. Due to the relatively low shoreline loadings (per unit area) there are unlikely to be any long-term decline in local populations of fauna. Many of the environmental receptors potentially affected are values of protected areas and there could be moderate-term effect to them in the event of a LOWC. The socio-economic and heritage features in the region are of high value. Recreational fishing hotspots including the Montebello Islands, Barrow Island, the Muiron Islands, Dampier Archipelago and Ningaloo are of high value to recreational fishers. The potentially affected area is of high value for tourism and social amenities including camping locations and other beachside recreational activities. Some loss of value could occur to the local industry in the event of a LOWC and a short-term reduction of key natural features or populations supporting the local activity. Heritage values are not predicted to be impacted by floating hydrocarbons although in the short-term there would be an impact on the aesthetic value of the area. Pearling leases have been identified in the region, these are currently inactive and no stakeholder concerns have been raised. However, if these leases were to become active within the life of this EP, then some loss of value of the local industry could occur in the event of a LOWC. A LOWC has the potential to impact an array of receptors. Overall, it is expected that a LOWC would result in a moderate consequence.
Likelihood	The likelihood of a LOWC event occurring during the activity is extremely low when considering industry statistics, Santos statistics and the preventative control measures in place. Wells are designed with essential engineering and safety control measures to prevent a LOWC incident occurring. Additional industry standard and activity-specific control measures to reduce the chance of a LOWC event (and minimise impacts) have also been implemented including (but not limited to) procedures such as the WOMP, Safety Case, crew training and awareness and a spill response plan (OPEP). These control measures are considered to reduce the risk of a LOWC (and minimise impacts) occurring to a level that is acceptable. The likelihood of a LOWC releasing hydrocarbons to the environment which results in a moderate consequence is considered to be rare.

Likelihood Ranking	1 – Rare	**Consequence Ranking**	C – Moderate
Residual Risk	Medium		
Control Measure	**Environmental Benefit**		
Well operations management system – Well Operations Management Plan (WOMP), and MODU Safety Case	Includes control measures for well integrity and well control, and MODU Safety Case that reduce the risk of unplanned discharges to the marine environment.		
MODU and support vessel spill response plans (including pre-drilling well relief plan)	Implements response plan to deal with an unplanned hydrocarbon spills quickly and efficiently in order to reduce impacts to the marine environment.		
Oil pollution emergency plan (OPEP)			

6.4.2 Hydrocarbon spill – marine diesel oil

Potential Receptors	Marine fauna – plankton, invertebrates (pelagic and intertidal), pelagic fish and sharks, marine mammals, marine reptiles, seabirds/shorebirds; shoreline habitats; protected areas and socio-economic receptors.
Impact Assessment	
Receptors	**Assessment**
Threatened / migratory / local fauna; **Physical environment/ habitat;** **Protected areas;** **Socio-economic receptors**	This assessment covers hydrocarbon spills from a ruptured vessel fuel tank as a result of a collision, a MODU refuelling incident or other minor diesel spills. In the event of a vessel collision, the volume of hydrocarbons released would be a finite amount limited to the maximum credible spill of a full tank inventory release. Given the nature of the MDO, dilution and dispersion from natural weathering processes such as ocean currents indicate that the extent of exposure will be limited in area and duration. The susceptibility of marine fauna to hydrocarbons is dependent on hydrocarbon type and exposure duration. The high volatility of MDO will result in the rapid evaporation and loss of the more toxic aromatic components, resulting in a reducing toxicity threat to marine fauna with time. Shoreline habitats and associated fauna and flora may be impacted, as MDO from a ruptured vessel fuel tank from a vessel collision is predicted to contact shorelines, at relatively low loadings, with the exception of the Montebello Islands. Sensitive shoreline habitats such as mangrove and intertidal reef and seagrass areas may be impacted through exposure to the toxic components of the MDO, although exposure times will unlikely be significant given the weathering properties of MDO. Given that a vessel collision hydrocarbon spill could result in a decreased population size at a local, it is expected that a spill of this nature would result in a moderate consequence.
Likelihood	A hydrocarbon release resulting from a vessel collision is unlikely to have widespread ecological effects given the nature of the hydrocarbons on-board, the finite volumes that could be released, the depth and transient nature of marine fauna in this area. The likelihood of a hydrocarbon release occurring due to a vessel collision is limited given the set of management controls in place for the activity.

	Subsequently the likelihood of a vessel collision releasing hydrocarbons to the environment which results in a moderate consequence is considered to be rare.		
Likelihood Ranking	1 – Rare	**Consequence Ranking**	C – Moderate
Residual Risk	Low		
Control Measure	**Environmental Benefit**		
Dropped object prevention procedures	Impacts to environment are reduced by preventing dropped objects. Minimises drop risk during MODU lifting operations. Ensures lifting equipment certified and inspected.		
MODU move procedure	MODU move procedure contains a passage plan to reduce risk of collision.		
Dangerous goods managed in accordance with International Maritime Dangerous Goods Code	Reduces the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.		
Bulk liquid transfer procedure	Bulk liquid (hydrocarbon) transferred in accordance with bulk transfer procedure to reduce the risk of an unintentional release to the marine environment.		
MODU and support vessel spill response plans	Implements response plan for the effective management of an accidental hydrocarbon spill (discharge to sea) in order to reduce impacts to the marine environment.		
Oil pollution emergency plan (OPEP)			
Maritime notices	Ensure other marine users are aware of the presence of the MODU/support vessels and are provided with information on timings of the activity, including MODU arrival and departure, so that the maritime industry is aware of the petroleum activities and to reduce the risk of vessel collision.		
Standby vessel	Monitor the MODU 500 m exclusion zone and be equipped with an AIS to aid in its detection at sea, and radar to aid in the detection of approaching third party vessels. Reduces risk of vessel collision and subsequent unplanned release of hydrocarbons causing potential harm to the marine environment.		
MODU identification system	MODU has a RACON (radar transponder) or AIS to aid in its detection at sea. Reduces risk of environmental impact from vessel collisions through ensuring safety requirements are fulfilled.		

6.4.3 Minor hydrocarbon release (surface)

Potential Receptors	Water quality; marine fauna – fish and sharks, marine mammals, marine reptiles and seabirds
Impact Assessment	
Receptors	**Assessment**
Threatened / migratory / local fauna; **Physical environment/ habitat**	In the event of a minor hydrocarbon spill, the quantities would be limited to approximately 1 m^3 for the loss of the contents of an IBC, or 50 L for ROV hydraulic fluid. The small volumes and dilution and dispersion from natural weathering processes such as ocean currents indicate that the extent of exposure will be limited in area and duration. The number of receptors present at the activity location is expected to be limited to a small number of transient individuals. The susceptibility of marine fauna to hydrocarbons is dependent on hydrocarbon type and exposure duration however given that exposures would be limited in extent and duration, exposure to marine fauna from this hazard is considered to be low. The small volumes of

	worst-case discharges are such that the impacts to receptors will decline rapidly with time and distance at the sea surface. Rapid dilution at depth would also result in the impacts to receptors declining rapidly with time and distance. Given that a small hydrocarbon spill would not result in a decreased population size at a local or regional scale, it is expected that a spill of this nature would result in a negligible consequence.		
Likelihood	The likelihood of a small hydrocarbon release occurring is very unlikely given the set of control measures in place for this activity.		
Likelihood Ranking	2 – Very unlikely	**Consequence Ranking**	A – Negligible
Residual Risk	Low		
Control Measure	**Environmental Benefit**		
Dropped object prevention procedures	Impacts to environment are reduced by preventing dropped objects and by retrieving dropped objects where possible. Minimises drop risk during MODU lifting operations. Ensures lifting equipment certified and inspected.		
Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges) of hazardous chemicals to the sea by controlling the storage, handling and clean-up.		
General chemical management procedures	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals.		
Oil pollution emergency plan (OPEP)	Implements response plan for the effective management of an accidental hydrocarbon spill (discharge to sea) in order to reduce impacts to the marine environment.		
MODU and support vessel spill response plans			
Dangerous goods managed in accordance with International Maritime Dangerous Goods Code	Reduces the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.		
ROV inspection and maintenance procedures	Maintenance and pre-deployment inspection on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to the marine environment.		
Chemical selection procedure for drilling and cementing chemicals	Reduced toxicity to marine environment through ensuring only environmentally acceptable chemicals discharged to sea.		

6.4.4 Non-hydrocarbon and chemical release (surface) - liquids

Potential Receptors	Water quality; marine fauna - fish, sharks, marine mammals, marine reptiles and seabirds
Impact Assessment	
Receptors	**Assessment**

Threatened / migratory / local fauna; **Physical environment/ habitat**	In the event of a non-hydrocarbon liquid or chemical spill, the quantities of a worst-case liquid release is unlikely to be greater than 1 m^3 (the size of the largest storage container), but could possibly be up to 100 m^3. The small volumes, dilution and dispersion from natural weathering processes such as ocean currents indicate that the extent of exposure will be limited in area and duration. The susceptibility of marine fauna to non-hydrocarbon liquids and chemicals is dependent on the type and exposure duration however given that exposures would be limited in extent and duration, exposure to marine fauna from this hazard is not expected to result in a fauna fatality. Impacts from discharges to the marine environment to water quality would be short-term and localised, due to the nature and behaviour of the chemicals identified as being at risk of spilling; only pelagic fauna present in the immediate vicinity of the spill would likely be at risk of impact. Given that a small chemical spill would not result in a decreased population size at a local or regional scale, it is expected that a spill of this nature would result in a negligible consequence.		
Likelihood	The likelihood of a small non-hydrocarbon liquid release or chemical spill occurring is limited given the set of control measures in place for this activity. Consequently the likelihood of non-hydrocarbon liquids or chemical spills entering the marine environment is considered to be unlikely.		
Likelihood Ranking	3 – Unlikely	**Consequence Ranking**	A – Negligible
Residual Risk	Low		
Control Measure	**Environmental Benefit**		
Dropped object prevention procedures	Minimises dropped object risk during MODU lifting operations that may cause secondary spill resulting in reduction in water quality. Ensures lifting equipment certified and inspected.		
Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges) to the sea by controlling the storage, handling and clean-up of hazardous chemicals.		
Deck cleaning product selection	Improves water quality discharge (reduce toxicity) to the marine environment. Those deck cleaning products planned to be release to sea meet the criteria for not being harmful to the marine environment according to MARPOL Annex V.		
General chemical management procedures	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals.		
Dangerous goods managed in accordance with International Maritime Dangerous Goods Code	Reduces the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.		
Bulk liquid transfer procedure	Bulk liquid transferred in accordance with bulk transfer procedures to reduce the risk of an unintentional release to the sea.		
MODU and support vessel spill response plans	Effective management of an accidental spill (discharge to sea) to reduce impact to the environment.		
Chemical selection procedure for drilling and cementing chemicals	Reduced toxicity to marine environment. Only environmentally acceptable chemicals would be released in the event of an accidental discharge to sea.		

6.4.5 Non-hydrocarbon release (surface) – solids

Potential Receptors	Benthic habitats; marine fauna – marine mammals, marine reptiles, seabirds, sharks and fish		
Impact Assessment			
Receptors	**Assessment**		
Physical environment/ habitat (benthic) – Seabed disturbance	In the event of a dropped object or a non-hydrocarbon solid sinking to the seabed, there will be localised and short-term damage to the seabed. The extent of the impact is limited to the size of the dropped object or non-hydrocarbon solid released and given the size of standard materials transferred, any impact is expected to be very small. Previous surveys indicate the seabed is likely to comprise soft sediments with little epifauna. Subsequently any impacts are predicted to be short-term in nature. Any impact to seabed through dropped objects would result in a negligible reduction in habitat area/function impacted.		
Threatened / migratory / local fauna	In the event of a non-hydrocarbon solid release or dropped object, the quantities would be limited. The release could cause localised impacts to water quality and the benthic environment if the solid can degrade, leading to localised impacts on flora and fauna. Ingestion of solid wastes by marine fauna could occur in small quantities. Only small volumes of non-hydrocarbon solids would be generated during the activity, as a result, any accidental loss to the environment would be small in size. Any impacts would be restricted to a small number of individuals, if any. As such there is the potential for impacts only to a small proportion of a local population with no consequences for conservation status or reproductive success of cetaceans, marine turtles or fish species that may occur in the area. The limited quantities associated with this event indicate that even in a worst-case release of solid waste, the number of fauna fatalities would be limited to individuals and is not expected to result in a decrease of the local population size and the consequence level is therefore negligible.		
Likelihood	Control measures proposed to ensure that the risks of dropped objects, lost equipment or release of non-hydrocarbon solid waste to the environment has been minimised. The likelihood of transient marine fauna occurring in the operational area coincident with a release is limited and given the control measures in place, the likelihood of releasing non-hydrocarbon solids to the environment resulting in a negligible consequence is considered likely (assumes potential for a single loss of solid waste incident during the activity).		
Likelihood Ranking	3 – Unlikely (for dropped objects) 4 – Likely (for accidental release during transfers or waste matter blown overboard)	**Consequence Ranking**	A – Negligible
Residual Risk	Low		
Control Measure	**Environmental Benefit**		
Dropped object prevention procedures	Impacts to environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences are negligible or there are risks to safety. Minimises drop risk during MODU lifting operations. Ensures lifting equipment certified and inspected.		
Waste (garbage) management procedure	Reduces probability of garbage (waste) being accidentally discharged to sea, reducing potential impacts to marine fauna. Ensure compliance with MARPOL requirements.		
Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges) to sea by controlling the storage, handling and clean-up.		
General chemical management procedures	Aids in the process of chemical management that reduces the risk of accidental discharge to sea by controlling the storage, handling and clean-up of chemicals.		

Dangerous goods managed in accordance with International Maritime Dangerous Goods Code	Reduces the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.
Bulk solid transfer procedure	Bulk solids transferred in accordance with bulk transfer procedure to reduce the risk of an unintentional release to sea.

6.4.6 Marine fauna collisions

Potential Receptors	Marine fauna - Fish and sharks, marine mammals, marine reptiles and seabirds		
Impact Assessment			
Receptors	**Assessment**		
Threatened / migratory / local fauna	In the event of a collision with marine fauna, there is the potential for injury or death to an individual. The number of receptors present in the operational area are expected to be limited to a small number of transient individuals. The likelihood of turtles occurring in the operational area is moderate given the presence of the flatback turtle BIA, but given the distance from the nearest nesting areas, significant numbers are not expected. There is the potential for death or injury of EPBC Act listed individual species, however as they would represent a small proportion of the local population it is not expected that it would result in a decreased population size over what would usually occur due to natural variation, at a local or regional scale. It is expected that the loss of an individual would be a low consequence.		
Likelihood	The operational area overlaps the humpback whale northern and southern migration pathway, and as such migrating individuals may traverse the operational area. No known aggregation areas (breeding, resting or calving) occur within the operational area and therefore concentrations of milling individuals are unlikely. Pygmy blue whales may be encountered in the operational area. Vessels will be moving very slowly whilst inside the operational area, posing a low risk of collision with marine fauna. In addition, the noise generated from vessel operations will deter marine fauna from coming in close proximity to vessels. Subsequently the likelihood of a collision with marine fauna resulting in a very low/negligible consequence is considered to be very unlikely.		
Likelihood Ranking	2 – Very Unlikely	**Consequence Ranking**	A – Negligible
Residual Risk	Low		
Control Measure	**Environmental Benefit**		
Procedure for interacting with marine fauna	Reduces risk of physical and behavioural impacts to marine fauna from interactions with support vessels and helicopters Ensures compliance with Part 8 of the EPBC Regulations.		

6.4.7 Introduction of invasive marine species

Potential Receptors	Marine ecosystem as a whole and commercial / recreational users of the marine environment
Impact Assessment	
Receptors	**Consequence**

Threatened / migratory / local fauna; **Physical environment/ habitat;** **Socio-economic receptors**	Ballast water is responsible for up to 30% of all marine pest incursions into Australian waters, however, research indicates that biofouling (the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces) has been responsible for more foreign marine introductions than ballast water (DAFF, 2011). Invasive marine species (IMS), if they successfully establish, can out-compete native species for food or space, preying on native species or changing the nature of the environment and can subsequently impact on fisheries or aquaculture. In the event that an IMS is introduced into the operational area, given the lack of diversity and extensiveness of similar benthic habitat in the region, there would only be a minor reduction in the physical environment. No threatened ecological communities are present in the area that could be affected. The overall consequence level was assessed as minor.		
Likelihood	Given the depth of the operational area (~65 m) creating an unfavourable habitat for colonisation (i.e. light limiting and low habitat biodiversity with sparse epibiota) and distance from shallow coastal habitats, there is a very low likelihood that IMS would be able to survive translocation and subsequently establish and colonise. With control measures in place to reduce the risk of introduction of IMS, the likelihood of introducing an IMS is considered Very Unlikely.		
Likelihood Ranking	2 – Very Unlikely	**Consequence Ranking**	B – Minor
Residual Risk	Low		
Control Measure	**Environmental Benefit**		
DPIRD vessel check tool applied to MODU and vessels. Immersible equipment cleaned to low risk	Reduces the risk of introducing IMS through implementation of the vessel check tool and requirement for immersible equipment to be cleaned.		
Ballast water management plan	Reduces the risk of introducing IMS through procedures managing ballast water exchange and identifying high risk ballast water.		

7 Management Approach

The Corvus-2 well appraisal drilling activity will be managed in compliance with all measures and controls detailed within the EP accepted by NOPSEMA under the OPGGS(E)R, other environmental legislation and Santos' Management System (e.g. Environmental Management Policy).

The objective of the EP is to ensure that potential adverse environmental impacts from planned and unplanned events associated with the activity are identified and assessed, and to stipulate mitigation measures to avoid and/or reduce any adverse impacts to the environment to ALARP and acceptable levels.

The EP details specific performance outcomes, standards and procedures, and identifies the range of controls to be implemented (consistent with the standards) to achieve the performance outcomes. The EP also identifies the specific measurement criteria and records to be kept to demonstrate the achievement of each performance outcome.

As described in the EP, the implementation strategy includes the relevant details of the following:

1. Environmental Management System;
2. Environmental Management Policy;
3. Leadership, accountability and responsibility;
4. Workforce training and competency;
5. Hazard identification, risk and impact assessment and controls;
6. Environmental performance outcomes, control measures and performance standards;
7. Workforce involvement and stakeholder communication;
8. Information management and document control; and
9. Operations management.

During the period that activities described in the EP are undertaken, Santos will ensure environmental performance is monitored and managed through an inspection and monitoring regime undertaken by Santos representatives or delegates based on the MODU and support vessels.

Environmental compliance of an activity with the EP (and the EPOs) is measured using planned and systematic audits or inspections to identify weaknesses and non-conformances in the system and processes so that they can be identified. Continuous improvement opportunities identified through monitoring, audits and incident investigations are implemented in a controlled manner and communicated to all relevant workforce, contractors and relevant third parties. Audits and inspections are in place to identify possible hazards, incidents and actions taken to prevent them from happening.

Non-conformances found are addressed and resolved by a systematic corrective action process and are reported to NOPSEMA where relevant.

Senior Santos and MODU/vessel contractor personnel will be accountable for ensuring conformance with environmental performance outcomes and standards and all personnel will be empowered to 'stop-the-job' to ensure the activity is being implemented in an environmentally responsible manner. The EP identifies specific responsibilities for each role during the activity.

Incident notification and reporting to NOPSEMA and other regulators will be conducted as per the OPGGS(E)R, as detailed within the EP. Reported HSE incidents and hazards will be communicated to personnel during daily operational meetings, and HSE incidents and hazards will be documented in the incident management systems as appropriate. Significant HSE incidents will be investigated using root cause analysis.

7.1 Management of Change

Santos' *Environmental Management of Change Procedure (EA-91-IQ-10001)* (MoC) process provides a systematic approach to initiate, assess, document, approve, communicate and implement changes to EPs and OPEPs (currently in force) whilst meeting the requirements of the OPGGS(E)R.

The MoC process considers Regulation 7, 8 and 17 of the OPGGS(E)R, and determines if a proposed change can proceed and the manner in which it can proceed. The MoC procedure will determine whether a revision of the EP is required and whether that revision is to be submitted to NOPSEMA. For a change to proceed, the associated environmental impacts and risks must be demonstrated to be acceptable and ALARP. Additional stakeholder consultation may be required depending on the nature and scale of the change.

8 Hydrocarbon Spill Response Arrangements

In the event of a hydrocarbon spill, oil spill response strategies will be implemented where possible to reduce environmental impacts to ALARP and acceptable levels. The selection of strategies will be undertaken through the Net Environmental Benefit Analysis (NEBA) process, outlined in the OPEP.

The following response strategies may be applicable to the identified credible spill scenarios:

- Source control activities; including;
  - Vessel spill kits, secondary containment, pumping procedures, and applicable strategies contained within the Vessel's Shipboard Oil Pollution Emergency Plan (SOPEP);
  - Drilling a relief well (primary control);
  - Direct intervention using well control experts (if safe and technically feasible to do so);
  - Deployment of subsea first response tool kit (SFRT) – survey only (supporting control dependent on safety and technical considerations).
- Subsea chemical dispersant (via SFRT);
- Mechanical dispersion;
- Shoreline protection;
- Shoreline clean-up;
- Operational monitoring, including:
  - Vessel surveillance;
  - Aerial surveillance;
  - Tracking buoys;
  - Spill fate trajectory modelling;
  - Satellite imagery;
  - Initial oil characterisation;
  - Operational water quality monitoring (sampling and analysis, and continuous fluorometry surveys); and
  - Shoreline and coastal habitat assessments.
- Scientific monitoring, could include:
  - Water and sediment quality;
  - Shoreline and coastal habitat monitoring (sandy beaches, rocky shores and intertidal mudflats);
  - Mangrove monitoring;
  - Benthic habitat monitoring (seagrass, algae, corals);
  - Marine fauna monitoring (seabirds and shorebirds, marine mammals, marine reptiles including turtles, whales sharks at the Ningaloo Coast)
  - Seafood quality; and
  - Fish, fisheries and aquaculture.
- Waste management; and
- Oiled wildlife response operations including hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation.

8.1 Preparedness and Implementation of Response Arrangements

MODU and support vessels are required to have and implement incident response plans, such as an emergency response plan and SMPEP/ SOPEP. Regular incident response drills and exercises (e.g. as defined in emergency response plan, SMPEP/ SOPEP etc.) will be carried out on the MODU and support vessels to refresh the crew in using equipment and implementing incident response procedures.

Santos will implement the *Corvus-2 Appraisal Drilling Oil Pollution Emergency Plan (QE-00-BF-20002.02)* in the event of a significant hydrocarbon spill (Level 2 or 3). To maintain a state of oil spill preparedness, personnel with OPEP responsibilities will be made aware of their obligations, oil spill response equipment will be maintained, contracts with critical equipment and personnel suppliers will be managed, and agreements will be in place with national regulatory agencies for support in oil spill response. Santos will also implement its oil spill response exercise and training schedule.

8.2 Net Environmental Analysis Benefits (NEBA)

During any response incident, there is a documented decision making process to ensure that response strategies are identified and evaluated prior to implementation via the Incident Action Plan (IAP). The Control Agency Incident Management Team (IMT) will use a Net Environmental Benefit Analysis (NEBA) process to inform the development and refinement of the IAPs, so the most effective response strategies with the least detrimental environmental impacts are identified, documented and executed.

In the event of a spill, NEBA is applied with supporting information from situational awareness and information collected as part of the Monitor and Evaluate Plan to achieve the following:

+ Identify sensitivities within the area potentially affected by a spill at that time of the year;
+ Assist in prioritising and allocating resources to sensitivities with a higher ranking; and
+ Assist in determining appropriate response strategies with support of real time metocean conditions, oil spill tracking and fate modelling.

8.3 Oil Spill Response Resources

Oil spill response equipment and resources are a combination of Santos, AMOSC, AMSA, DoT, OSRL (Oil Spill Response Limited), and other operator resources available through the AMOSPlan mutual aid arrangements. Under the Memorandum of Understanding (MOU) between AMSA and Santos WA, AMSA will provide resources available through the National Plan for Maritime Environmental Emergencies to support a Santos spill response.

In the event of an oiled wildlife response, Santos will activate the West Australian Oiled Wildlife Response Plan (WAOWRP) and work with AMOSC and DBCA in determining resources and capability requirements. Oiled Wildlife Advisors (DBCA and Industry as relevant) ensure minimum standards for oiled wildlife response, as outlined within the WAOWRP, are met and ensure timely mobilisation of appropriate resources (equipment and personnel).

9 Contact Details

Further information about the Corvus-2 well appraisal drilling activity can be obtained from:

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