Mutineer Exeter Field Operations

Environmental Plan Summary

ME-7000-REP-0185

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ABBREVIATIONS & ACRONYMS

AFMA	Australian Fishing Management Authority
AFS	Anti-Fouling System
AHS	Australian Hydrographic Service
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Marine Oil Spill Centre
AQIS	Australian Quarantine Inspection Service
DEC	Department of Environment Conservation (WA)
DMP	Department of Mines and Petroleum (WA)
DoE	Department of Environment (Cth)
DoF	Department of Fisheries (WA)
DoT	Department of Transport (WA)
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (now Department of Environment
EHS	Environment Health & Safety
EHSMS	Environment Health & Safety Management System
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
ESP	Electric Submersible Pump
FPSO	Floating Production Storage and Offloading Unit
GDA	Geodetic datum of Australia
HFO	Heavy Fuel Oil
H_2S	Hydrogen sulphide
IMS	Invasive Marine Species
ISO	International Standards Organisation
IMS	Invasive Marine Species
JHA	Job Hazard Analysis
MPRA	Marine Parks and Reserves Authority
MGA	Map Grid of Australia
ME	Mutineer Exeter
MV-11	MODEC Venture 11
NEBA	Net Environment Benefit Analysis
NOPSEMA	National Offshore Safety and Environment Management Agency
NOx	Nitrogen oxides
ODS	Ozone Depleting Substances
OIW	Oil In Water
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OPGGS (Environment) Regulations	Offshore Petroleum and Greenhouse Gas Storage Environment Regulations
OSCP	Oil Spill Contingency Plan
OSMP	Operational and Scientific Monitoring Program
OSRA	Oil Spill Response Atlas
OSRL	Oil Spill Response Limited
PFW	Produced Formation Water
POB	People on Board

RCC	Rescue Coordination Centre
ROV	Remotely Operated Vehicle
SOPEP	Shipboard Oil Pollution Emergency Plan
SOx	Sulphur oxides
UXO	Unexploded Ordnance
WA	Western Australia
WAFIC	Western Australia Fishing Industry Council

1 INTRODUCTION

Santos Limited (Santos) is the operator of the Mutineer Exeter (ME) Development, which is situated on Western Australia's North West Shelf at the northern end of the Dampier Sub-Basin (Figure 2.1). The development consists of four fields; Mutineer, Exeter, Fletcher and Finucane, which produce light crude and are tied into the MODEC Venture 11 (MV-11) Floating Production Storage Offloading (FPSO) facility.

The ME Field Operations Environment Plan (EP) covers the operation of the MV-11 FPSO and associated subsea infrastructure for the processing, storage and offloading of petroleum, within the operational area which incorporates petroleum production licences WA-26-L, WA-27-L and WA-54-L.

As the ME Field Operations EP was submitted to the regulator (National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)) prior to 28 February 2014 and the regulator accepted the EP on the 3 July 2014 it was assessed in accordance with the old Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (Environment) Regulations).

In accordance with Regulation 6(1) of OPGGS (Environment) Regulations, an accepted EP is required by the operator before carrying out an activity. The term "*Petroleum activity*" is defined under Regulation 4(1) of the OPGGS (Environment) Regulations. For the ME Field Operations the activity is summarised as:

"*The operation of the MV-11 FPSO and associated subsea infrastructure for the processing, storage and offloading of petroleum, within the operational area*."

This EP Summary has been prepared in accordance with Regulation 11 (7) and (8) of the OPGGS (Environment) Regulations.

2 ACTIVITY LOCATION

The ME Development is located within Commonwealth waters on the North West Shelf, approximately 150 km north-north-east of Dampier.

The location of the activity, referred to as the 'operational area', is defined by the location of the petroleum instruments WA-26-L, WA-27-L and WA-54-L, as shown in Figure 2.1. Coordinates of the wells associated with the ME Development are shown in Table 2.1.

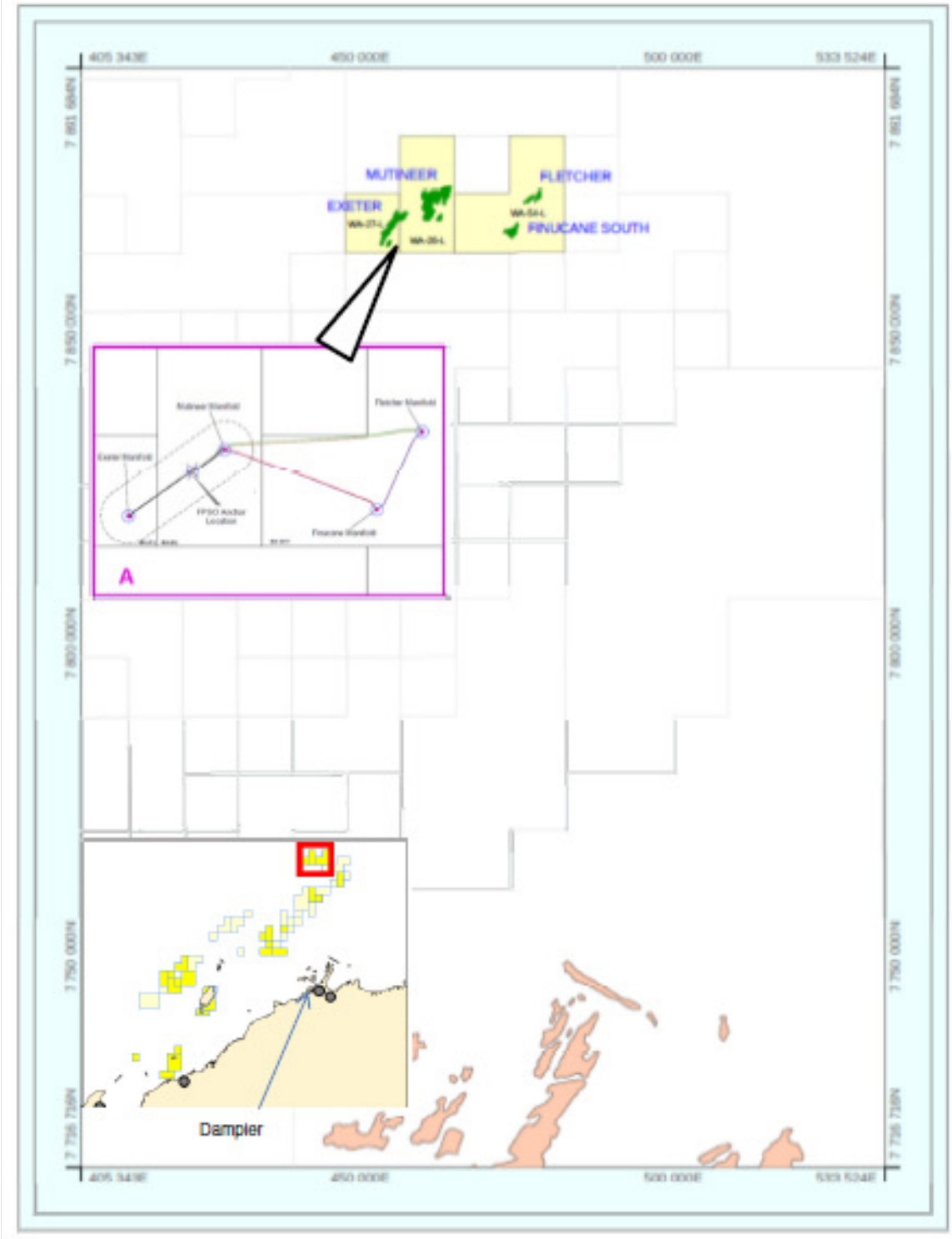

Figure 2.1: Mutineer Exeter Field Operations Location

Table 2.1: ME Development Well Coordinates

	Coordinates*					
	Latitude			Longitude		
	degrees	minutes	seconds	degrees	minutes	seconds
Exeter-4AH	19	18	36.1908	116	33	40.6584
Exeter-8	19	18	36.28	116	33	41.1192
Finucane-2H	19	17	34.08	116	45	49.41
Finucane-3H	19	17	35.8116	116	45	50. 4792
Fletcher-5H	19	14	46.2084	116	47	43.8612
Mutineer-4	19	45	32.1984	116	38	15.3204
Mutineer-5	19	15	32.7492	116	38	15.2916
Mutineer-15	19	15	33.2784	116	38	15.2916
Muntineer-12	19	15	33.7716	116	38	16.35
Mutineer-9H	19	15	33.48	116	38	15.8388

* GDA 94, MGA 50

3 DESCRIPTION OF ACTVITY

The ME Development comprises a subsea production system and an FPSO. The subsea production system has a production centre in each of the Mutineer, Exeter, Fletcher and Finucane fields. The reservoirs are tied into the FPSO and contain light crude oil with very low gas-oil ratios. The FPSO is located between the Mutineer and Exeter fields and is moored via a disconnectable turret mooring.

3.1 FPSO Hook-up and Commissioning

The FPSO may be required to hook-up to the riser turret mooring system following disconnection for adverse weather avoidance, maintenance or other operational or safety requirements. The hook-up or reconnection to the mooring is a routine activity and involves the connection of the FPSO's winch to the submerged turret buoy and pull in of the mooring and risers to re-establish the connection of the FPSO to the mooring system.

Commissioning and / or production restart activities are carried out following shut down of wells, reconnection of the FPSO or start-up of new wells or wells which have been subject to intervention works.

3.2 FPSO Operations

The FPSO consists of a crude processing facility, utilities, marine systems and living quarters.

FPSO operations consist of:

- Receipt of crude oil from the reservoirs by flowline/risers.
- Processing of crude oil to remove water/gas and stabilise it for storage in the FPSO cargo tanks at atmospheric pressure.
- Periodic export of stabilised crude oil to an off-take tanker via an export hose.

3.2.1 *Crude processing*

Processing of the crude oil is carried out on the FPSO with fluids being separated into:

- Crude oil stored in the FPSO cargo tanks prior to offloading (i.e. product) with a small amount of the crude treated for use as fuel.
- Limited amounts of gas which is flared.
- Produced formation water (PFW) which is treated and discharged overboard (refer to Table 5.1).

3.2.2 *Utilities*

The FPSO utilities comprise the PFW treatment system, flare system, inert gas system, power generators, fuel oil treatment system, drainage systems, fresh water makers, fire water deluge system, sewage system and greywater system.

3.2.3 *Marine Systems*

The marine systems include the ballast and bilge system, navigational aids and weather monitoring and propulsion system.

3.2.4 *Living Quarters*

The FPSO is a continually manned facility with a maximum personnel on board (POB) of 40.

3.3 Subsea Production System

The subsea production system comprises of:

- Wells: designed for natural and electric submersible pump (ESP) assisted flow which tie into the production manifolds via rigid spools.
- Production manifolds: four production manifolds, one each at Mutineer, Exeter, Fletcher and Finucane.
- Well service system: well service lines run from the FPSO to the production manifold then to each well to allow control of the well annular pressure.
- Flowlines and risers: two dynamic, flexible risers extend to the spider buoy from the attachment at the rigid flowlines. Flexible flowlines run from Mutineer to Fletcher and Finucane manifolds.
- Umbilicals: run from the FPSO to each production centre providing power, control signals, hydraulic fluids, chemicals for chemical injection and barrier fluids for the multi phase pump (MPP) seals.

3.4 Off-take Tanker Operations

The off-take tankers are trading tankers which tandem moor to the FPSO stern for the offloading, and transport of the crude oil. Maximum expected offtake occurs at a rate of once every 28 days. During off-take, the off-take tanker is assisted by a support vessel. Off-take operations take between 24 and 30 hours after which the tanker departs the field.

3.5 Support Vessel Operations

Supplies and equipment for the FPSO (e.g. food, maintenance stores, process chemicals, fuel) is mainly transported by support vessel from the Dampier shorebase. Support vessels visit the

facility approximately once per month. Steaming time between Dampier and the FPSO is about 8 hours. Support vessels remain “vessels” under the Navigation Act at all times.

3.6 Helicopter Operations

Personnel are transferred to and from the FPSO by helicopter from Karratha Airport. A helideck is located at the aft end of the FPSO. During normal operations, return flights may occur up to three times per week and carry up to 16 passengers.

3.7 Diving and Remotely Operated Vehicle Operations.

Subsea inspections of the FPSO hull, disconnectable turret mooring and subsea production system are planned over the life of the field. Subsea interventions may also be conducted. These inspections and interventions are performed by remotely operated vehicle (ROV) or diving either from the FPSO or from a separate vessel.

4 DESCRIPTION OF RECEIVING ENVIRONMENT

To describe the receiving environment two areas were identified based on the spatial extent of potential impacts associated with operational activities and spill events. For operational activities the operational area was identified as the permit boundaries as shown in Figure 2.1. For spill events a wider regional area was used based on oil spill modelling predictions.

A summary of the receiving environment within the operational area and key localities within the regional area is detailed in Table 4.1.

Table 4.1: Receiving Environment Summary

	Operational Area	Regional Area								Particular Values Or Sensitivity
		Dampier Archipelago	Dampier/Onslow Coast	Montebello Islands	Barrow and Lowendal Island	Nearshore Is (includes Thevenard & Serrurier Is b/w Dampier & Exmouth)	Ningaloo Coast (including Murion Islands)	Rowley Shoals	General Offshore Environment	
Benthic Receptor										
Coral Reef Communities		x		x	x	x	x	x		• Shallower waters within the regional area contain an array of small barrier reefs, including the Dampier Archipelago. • Rowley Shoals consist of three atoll reefs that support enhanced biological productivity and include unique sponge faunal assemblages. • Barrow/Montebello/Lowendal Islands and many of the nearshore Islands between Dampier and Exmouth are fringed with coral reefs. • Ningaloo coral reefs are diverse and represent the 2nd largest reef system in Australia.
Seagrasses		x		x	x	x	x			• Barrow (east and south) Montebello/Lowendal (east, west and south) sparse patches interspersed between macroalgae. Important food source for dugongs. • Dampier archipelago sparse patches found between Keast and Legendre islands and between West Intercourse Island and Cape Preston (CALM & MPRA, 2005). • Ningaloo - generally patchily distributed within the reserves (CALM & MPRA, 2005).
Soft Sediment	x								x	• Operational area is featureless with a flat bottom and fine to medium grained sands (Neptune Geomatics, 2011). • Sediment texture within the region is relatively homogenous and dominated by sands, with a small proportion of gravels. Muds

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										increase within 100 km of the coast and within 100 km of the shelf break but is mostly absent from the area.
Pelagic (Marine) Receptors										
Whales	x	x		x	x		x	x	x	• Listed threatened and migratory humpback whales likely to be present in the operational area with migration route present in regional area. • Southern right and blue whales may be present but no important aggregation, feeding or calving areas identified in the region. • Montebello, Lowendal and Barrow Islands are resting areas for humpback whales.
Dolphins	x		x	x	x				x	• Listed migratory Indo-Pacific and spotted bottlenose dolphins are known to occur along north Australian coast to Exmouth Gulf (DSEWPC, 2012a; DSEWPC, 2012b). • Spotted bottlenose - no known aggregation or breeding areas in the region. • Indo-Pacific humpback dolphin – known resident populations at Montebello, Lowendal and Barrow Islands.
Dugongs		x	x			x	x			• Small populations observed in seagrasses around the Dampier Archipelago between Keast and Legendre islands and between West Intercourse Island and Cape Preston. • Sightings and feeding grounds around Montebello Islands. • Sightings around Murion, Serrurier Islands and Ningaloo (Woodside, 2005).

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										• Large population along eastern side of Exmouth Gulf which is a biologically important dugong habitat area (DoE).
Marine Reptiles	x	x	x	x	x	x	x		x	• Listed threatened and migratory loggerhead, green, leatherback, hawksbill and flatback turtles known to occur in the region. • Murion Island critical nesting and interesting habitat for loggerhead turtles, major green turtle rookery. • Serruier Island major nesting and foraging area for green turtles. • Thevenard Island flatback rookery, green turtle rookery and feeding area. • Montebello, Lowendal and Barrow Islands critical nesting and internesting habitat for green, flatback, and hawksbill turtles, occasional nesting by loggerhead turtles at Barrow. • West of Barrow Island and within the Montebello Islands summer green turtle mating aggregation. • Rosemary Island and the Dampier Archipelago critical nesting and interesting habitat for flatback turtles, and most significant hawksbill rookery in WA. Also support major green and flatback nesting sites. • Waters to the south of Barrow Island include feeding and foraging areas for green and hawksbill turtles. • No threatened or migratory sea snakes likely to occur in the region.
Fish and Sharks	x	x	x	x	x	x	x	x	x	• Listed threatened and migratory whale shark may occur in the operational area and region. Aggregation area around Ningaloo Coast (March – June). • Migratory short and long fin mako sharks likely to occur in

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										operational area and region. No known aggregation, feeding or breeding areas. • Rowley Shoals have diverse fish and shark assemblages.
Seabirds and Shorebirds	x	x		x	x	x		x		• Dampier Archipelago region provides important undisturbed nesting/breeding/refuge sites for listed migratory species. • Montebello, Lowendal and Barrow Islands are internationally significant breeding sites for migratory shorebirds • Rowley Shoals – sandy cays provide important resting and feeding sites for migratory species. Red tailed and white-tailed tropicbirds and little terns breed in the area.
Shoreline Receptors										
Rocky Shoreline		x	x	x	x	x	x	x		• No rocky shorelines in the operational area. • Rocky shores are common throughout the region.
Mangroves		x	x	x	x	x	x			• No mangroves in the operational area. • Mangroves are common in the region, fringing the coast and near shore islands. • Montebello mangroves considered globally unique as they occur in lagoons on offshore islands.
Sandy Beaches		x	x	x	x	x	x			• No sandy beaches in the operational area. • Sandy beaches are found within the region and are predominantly surrounded with a fringing coral rim. This is representative of most of the islands in this region. • Thevenard and Airle Islands have been mapped (OSRA) as being

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										fringed with fine to medium grained sandy beaches.
Socio-Economic Receptors										
Settlements		x	x		x	x	x			• Key Settlements in the region include Dampier, Onslow, Exmouth.
Tourism and Recreation		x	x	x	x	x	x	x	x	Key tourism and recreational activities include in the region include; • Whale watching • Recreational boating and fishing • Charter fishing • Snorkelling/diving • Surfing • Montebello – small seasonal charter vessel tourism industry operates between April and November • Ningaloo - significant area for nature based tourism • Dampier – activities are concentrated around population centres such as Dampier, Onslow, Point Samson where there are boat launching facilities.

Commercial Fisheries		x	x	x	x	x	x	x	x	• Licenced fisheries overlap with the operational area, however, no activity recorded in 2012/2013.
										• State and Commonwealth fisheries active in the regional area in 2012/2013:
										  • North West Slope Trawl Fishery (Region – west of the 200m isobath and operational area)
										  • Western Tuna and Billfish Fishery (Region – north of the

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										Rowley Shoals) • Pilbara Demersal Scalefish Fishery (Region – east of operational area) • Mackerel Fishery (Region – east of operational area around coastal areas, reefs, shoals and headlands) • North Coast Prawn Managed Fishery (Region – east of the operational area from Broome to Onslow) • Pearl Oyster Fishery (Region – east of the operational area in shallow coastal waters) • Bluefin Tuna spawning ground to the north-east of the operational area. • Mackerel may spawn in coastal areas within the region.
Recreational Fisheries		x	x	x	x	x	x	x	x	• Montebello group is a significant area for recreational fishing. • Waters off Ningaloo Reef and the Muiron Islands considered an important fishing location largely concentrated around major settlements at Coral Bay and Exmouth and boat ramps at Tantabiddi and Bundegi. • Dampier/Dampier Archipelago area is well utilised by recreational fishers.
Petroleum Exploration and Production	x	x			x	x			x	• Key developments in the region include: • NW Shelf Joint Venture • Gorgon and Wheatstone developments • Pluto Development.
Shipping									x	• Ports at Dampier, Onslow and Cape Lambert are in the regional

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										area. • Dampier Shipping Fairway is approx. 3.3 km west of the operational area.
Defence Activities	x				x	x	x		x	• Learmonth Royal Australian Air Force base maintains a restricted airspace area, which overlaps the region.
Cultural heritage		x		x	x					• No registered Aboriginal Heritage sites within the operational area. • Registered Aboriginal Heritage sites in the region along the coast line and nearshore islands, including Barrow and Montebello Islands and Dampier Archipelago. • Dampier Archipelago is on the National Heritage list in recognition of rock art and engravings.
Maritime Heritage		x	x		x	x	x		x	• No protected shipwrecks present in the operational area. • Registered shipwrecks in regional area mainly in Dampier region. • Registered shipwrecks along the Ningaloo coast.
Protected Areas										
World Heritage Sites							x			• Ningaloo Coast World Heritage Area is the only World Heritage Area in the region.

National Heritage Sites		x			x		x			• Three National Heritage Sites in the region.
										  • Dampier Archipelago (listed 3 July 2007)
										  • The Ningaloo Coast (listed 6 January 2010)
										  • Barrow Island and the Montebello-Barrow Islands Marine Conservation Reserves (nominated for listing)

Commonwealth Marine		x		x			x	x	x	• Six Commonwealth Marine Reserves within the region:

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Reserves										• Dampier Commonwealth Marine Reserve. • Montebello Commonwealth Marine Reserve. • Argo-Rowley Terrace Commonwealth Marine Reserve. • Mermaid Reef Commonwealth Marine Reserve. • Ningaloo Commonwealth Marine Reserve. • Gascoyne Commonwealth Marine Reserve.
State Marine Reserves Areas		x		x	x		x	x		• Four State Marine Parks and one proposed State Marine Park in the region: • Ningaloo Marine Park • Rowley Shoals Marine Park • Montebello Marine Park • Barrow Island Marine Park • Proposed Dampier Archipelago Marine Park
Wetlands of International Importance (Ramsar)										• No Ramsar Wetlands in the region.
Key Ecological Features	x						x	x	x	• Ancient coastline at the 125 m depth contour is the only Key Ecological Feature in the operational area. • Six Key Ecological Features in the regional area: • Glomar Shoals (approx. 25km south of operational area) • Commonwealth waters adjacent to the Ningaloo Reef • Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals

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										• Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula • Continental Slope Demersal Fish Communities • Exmouth Plateau

5 ENVIRONMENTAL HAZARDS AND CONTROLS

Environmental risk assessment refers to a process where hazards associated with an activity are assessed to determine their impact on the environment (physical, biological, and socio-economic) at a defined location and specified period of time.

The environmental risk assessment process applied to the ME Field Operations is based on the Santos Environment Health and Safety Management System (EHSMS) Standard 09 "Hazard Identification, Risk Assessment and Control", which describes the Santos standard and process with respect to risk assessment for all Santos activities. The methodology is based upon the risk management process described in AS/NZ ISO 31000. Table 5.1 summarises the environmental hazards and their associated controls.

Table 5.1: Mutineer Exeter Field Operations Hazards and Controls

Environmental Hazard	Controls
Planned Activities	
Planned Atmospheric Emissions	**Exhaust gases from combustion equipment** • SOx emissions minimised through the use of treated crude fuel where practicable or marine grade diesel. • Operation of the FPSO generators must meet low NOx specification. • Emissions are managed within forecast. • FPSO and support vessels are MARPOL VI compliant with respect to combustion emissions. • Helicopters are maintained per aviation industry requirements.
	Vent and fugitive emissions • The crude rundown temperature is controlled minimising vented emissions. • Design features minimise vent and fugitive gas emissions. • The cumulative volume of vented gases and fugitive are monitored and managed within forecast target levels. Any deviation which is not ALARP requires a revision of the EP. • Routine inspections are undertaken in accordance with planned maintenance schedules.
	Flare emissions • Flare volumes are monitored and managed within forecast target levels. Any deviation is risk assessed and if found not to be ALARP requires a revision of the EP. • A greenhouse gas inventory is maintained for all air emissions. • The flare tip shall be designed for low flow rates and smokeless operations. • The flare system shall include high reliability flare pilot and ignition system.
	Ozone depleting substances • No disposal of waste ozone depleting substances (ODS) to atmosphere or drains during maintenance and repair operations. • ODS are recovered using vacuum pumps and recovery bottles for safe onshore disposal. • When carrying out maintenance activities on equipment MODEC procedures will

Environmental Hazard	Controls
	be followed requiring ODS to be recovered and sent onshore for disposal at facilities authorised to disposal of ODS. • The Maintenance Supervisor ensures regular inspections of systems containing ODS to identify any potential source of loss of containment. • Only personnel trained for carrying out maintenance and repair on equipment containing ODS substances will be permitted to work on ODS containing equipment. • Appropriate replacement refrigerants and fire suppression agents are selected. No halon or Chlorofluorocarbon based systems are selected.
Planned Marine Discharges	**Produced formation water** • PFW discharged to the marine environment is ≤ 30 mg/L Oil in Water (OIW). • The OIW monitor is calibrated. • OIW concentration is tested in the FPSO laboratory every 12 hours (once per shift). • When the high OIW alarm sounds at 25 ppm, action is taken to ensure the produced water system is operating effectively. • OIW concentration data, new production chemicals and dosing rates are reviewed on a monthly basis and changes managed in accordance with the Santos PFW Management Framework. • Samples of PFW taken quarterly for laboratory analysis. • An infield monitoring program will be conducted to validate the modelled PFW mixing zone and assess the potential for accumulation of contaminants.
	Production chemicals • All new process chemicals are assessed and handled in accordance with the Santos Offshore Environmental Chemical Selection Process. • Chemicals will be injected in accordance with the dosage rates in the Modec Chemical Injection System Description procedure. • Chemical dosing rates are monitored on a monthly basis and managed in accordance with the Santos PFW Management Framework. • Process chemicals will be reviewed annually to identify opportunities to optimise chemical use.
	Sewage, grey water and putrescible wastes • FPSO and support vessels are MARPOL compliant. • No untreated sewage shall be discharged to sea. • All sewage discharges will be recorded. • Food waste shall be managed as per non-hazardous waste, bagged and transferred to shore for disposal. • Oils and grease used for cooking shall be contained and transported back to shore for disposal.
	Cooling water and brines from freshwater makers • Cooling water systems and fresh water makers shall be subject to routine inspection. • Process cooling water discharges will be maintained at 1,600m^3/hr and 60^{o}C.
	Leaching of anti-foulant • All anti-fouling coatings on vessel hulls and equipment will comply with a current International Anti-fouling System Certificate.

Environmental Hazard	Controls
Physical Presence	**Footprint of subsea production system and vessel mooring system** • No anchoring is planned in the area. • A decommissioning EP will be developed and accepted prior to decommissioning. • Routine ROV survey will be conducted to monitor any potential for sensitive seabed disturbance.
	Introduction of another source of light • Lighting is kept to a minimum safe operational level in line with AMSA (Marine Order Part 30 – Prevention of Collisions) navigation requirements. • Overside lighting pointing towards the water shall be limited to that required for safe operations. • Quarterly lighting inspection carried out to identify any potential for reduction in overside lighting whilst maintaining the level required for safety and navigation.
	Introduction of another source of noise/vibration • FPSO Noise surveys are conducted and remediation actions are taken to maintain compliance with occupational health standards (National Standard for Occupational Noise, NOHSC:1007(2000)). • A Noise Management Plan is in place to ensure that noise on the FPSO is managed in accordance with occupational health standards. • Off-take tankers and other vessels will comply with relevant maritime standards with respect to noise, as required to maintain their classification status or vessel licensing.
Unplanned Activities	
Atmospheric Emissions	**Discharge of increased levels of H_2S emissions to the atmosphere** • Samples of reservoir fluids taken to confirm composition of fluids and H_2S content does not show any trends which would indicate sulphur reducing bacteria contamination. • Samples of produced gas taken monthly and analysed for contaminants.
Marine Discharges	**Chemical and oil spills to the marine environment** • Chemicals are stored in designated containers and storage locations on the FPSO with suitable bunding. • Chemical tote tanks are located in the chemical storage area and are restrained in steel frames designed to withstand the FPSO vessel motions. • Chemicals are managed in accordance with the MODEC Chemical Handling Procedure. • Equipment is provided to allow spills of chemicals to be cleaned up immediately and not washed overboard. • Chemical spills shall be investigated and reported.
	Contaminated deck and bilge water to sea • Equipment with potential for loss of containment located to prevent loss directly overboard, either by bunding or by location (i.e. within engine room). • Oily water from FPSO machinery space bilges is directed to the slops tanks. • All drainage/bilge discharges monitored and ≤ 30 mg/L OIW.

Environmental Hazard	Controls
	• Site Safety Inspections including potential spill hazards identification, bunding performance and spill kit locations, are undertaken on a monthly basis. • Plans are in place defining the procedures for response to a spill to deck. • Oil spills to deck shall be further cleaned up using the Shipboard Oil Pollution Emergency Plan (SOPEP) kits on board if necessary. • Spill response drills are conducted. • Crew are trained in SOPEP procedures. • Accidental discharge or spills of contaminants to sea will be reported and investigated.
	Loss of sub-sea hydraulic and equipment fluids to sea • The subsea valves are inspected and tested. • Volume of hydraulic fluid used during the routine operation shall be monitored, recorded and reported. • All hydraulic hoses have self-sealing connectors to minimise the potential for release during connection and disconnection. • The diving equipment and ROV is inspected prior to deployment to confirm no damage or potential leak sources are present as part of routine ROV operations. • There is a diving and ROV contractor selection process to ensure contractors have maintenance procedure in place and compliance is demonstrated.
Waste Discharges	**Loss of non-hazardous waste to the marine environment** • Waste generating activities must comply with the Waste Management Plans to manage planned disposal of waste which address waste segregation, waste transferred to shore for disposal, waste transfer notes, licensed shore based waste disposal contractors. : • On completion of work, the head of department must confirm worksite has been left clean and tidy before signing off the permit to work. • Information regarding waste management procedures will be included in the FPSO induction completed by all vessel personnel. • Weekly housekeeping inspections. • Waste audits undertaken as required by the Audit Schedule • Accidental loss of waste overboard investigated and reported.
	Loss of hazardous process solids wastes and sludges to the marine environment • Process solids and sludges will be treated as hazardous wastes and managed in compliance with the Waste Management Plan. • Regularly monitor the produced fluids for evidence of sand and scale production. • Monitoring PFW for scale potential conducted during the early production life. • Each wellhead includes a sand monitoring detector. • If production sands are produced, these will be shipped to shore for disposal as hazardous waste. • Sand screens installed in all lower completions and all well heads have ultrasonic sand monitoring detectors. • Accidental loss of waste overboard shall be investigated and reported.
	Loss of other hazardous waste to the marine environment. • Sludge and other hazardous wastes stored in closed container in a bunded area

Environmental Hazard	Controls
	before being transported to shore for disposal. • Housekeeping inspections carried out weekly to ensure waste segregation, storage and transportation are compliant with waste management procedures. • Permit to work requires worksite to be left clean and tidy on close out of task. • Maintain inventory showing that paint and solvent containers and rags are being containerised and returned to shore. • Document, track and segregate hazardous waste from other streams of operational waste. • Keep personnel aware of housekeeping requirements via inductions and updates/ reviews. • Maintain inventory of all chemicals on the vessel (including MSDS sheets, labelling and handling procedures). • Maintain records of all spent oils, lubricants and solid wastes demonstrating appropriate packaging, labelling and consignment to shore for disposal. • Transfer of waste oil to slops tank record in the Machine Space Oil Record Book. • Accidental loss of waste overboard shall be investigated and reported.

Unplanned Effects due to Physical Presence	**Vessel interacting with marine fauna**
	• Vessel crews conducting manoeuvring of the vessels are competent.
	• Procedures in place to at least include the following requirements:
	  ○ Whilst conducting activities within the 500m exclusion zones, support vessels shall be slow moving or stationary.
	  ○ Within the permit area vessels will be slow moving (<12 kts) and able to respond to cetacean sightings.
	• The Australian Guidelines for Whale and Dolphin Watching (2005) for sea-faring activities will be implemented.
	• Any collisions with cetaceans or marine fauna will be investigated and reported.

	Seabed interactions due to dropped objects • Dropped objects into the sea will be reported, investigated and where possible retrieved. • Cranes and lifting equipment are designed to recognised industry design code to ensure integrity and operability. • Routine inspections of the cranes and lifting equipment are carried out to maintain the classification and certification. • MODEC Facility Crane Operations procedure in place and communicated to all relevant personnel to minimise the risk of dropped objects. These procedures define the criteria for planning and executing lifts to minimise likelihood of objects. • ROV survey will be conducted routinely to identify anomalies such as dropped objects as part of the sub-sea asset integrity management system. • Dropped objects to sea shall be investigated and reported.
	Ditched helicopter on the seabed • All aircraft used by Santos obtain valid certificates and operating license granted/ endorsed by the Civil Aviation Safety Authority. • FPSO Helideck is designed to recognised codes (CAP437). • Helicopter operations on the FPSO managed in compliance with the procedures described in the NOPSEMA accepted FPSO Safety Case.

Environmental Hazard	Controls
	• Incidents resulting in helicopter ditching to sea in the area will be investigated and reported.

	Interference with shipping, fishing and recreational users
	• Petroleum safety zones in place.
	• A cautionary zone of 2.5 nm is around the FPSO and is shown on navigational charts.
	• Notice to Mariners issued and distributed to other marine users prior to any changes or new field operations which could impact on other users.
	• 24-hour visual, radio and vessel radar watch from the FPSO.
	• Vessels presence and field operation activities are alerted to other marine users by:
	  ○ Lighting systems are on 24 hours a day in accordance with maritime safety requirements.
	  ○ Marine navigation equipment such as radar and communication equipment are provided in accordance with maritime requirements.
	• Stakeholder engagement and consultation conducted and ongoing.
	• MODEC MV-11 Emergency Response Plan includes procedure for managing incidents involving other vessels.
	• Crew are trained in vessel emergency response procedures.
	• Emergency response exercises / drills have been undertaken for the field operation prior to commencement of the Activity.
	• A log is maintained of vessel interactions in the field.

Introduction of Invasive Marine Pests	• Vessels used to support normal operations shall be based in Australian Ports and shall maintain the necessary clearance for operation in Australian waters.
	• Prior to deployment of vessels from overseas locations to the operational area Santos and the vessel contractor shall:
	  ○ Develop and implement an IMS risk assessment procedure based on the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry to prevent the import of IMS.
	  ○ Ensure that an AFS approved antifouling coating is applied to the vessel.
	• Prior to deployment of vessels from overseas locations to the operational area, Santos and the vessel operator / contractor shall:
	  ○ Comply with AQIS Australian Ballast Water Management Requirements.
	  ○ Complete ballast water exchange as required by AQIS prior to arrival in Australian waters.
	  ○ Have all necessary AQIS clearances to operate in Australian waters.
	  ○ Maintain ballast water logs.
	• Any known or suspected marine pests or diseases shall be reported to the relevant authorities.

Hydrocarbon Spills	**Vessel collision releasing hydrocarbons (diesel, treated crude fuel and crude oil)** • FPSO shall adhere to the FPSO Safety Case and Marine Orders with regard to providing navigation aids and ensuring these are functioning properly. • FPSO is of double hulled construction with segregated tanks. • Cargo tanks are located away from areas where there is greatest potential for vessel to vessel contact e.g. vessel offloading/loading areas.

Environmental Hazard	Controls
	• Vessel bridge or control room watch keeping shall be maintained. • Design and construction and ongoing inspections of cargo tanks reviewed and certified by independent classification society. • All FPSO and support vessel crew will be trained and competent for their operational and emergency procedures. • All breaches of petroleum safety zones are reported to the regulatory authority. • Vessel collisions resulting in spills of hydrocarbon shall be investigated, reported and notified in accordance with the MV-11 Emergency Response Plan and the EP. • Hydrocarbon spill response arrangements shall be undertaken in accordance with the Oil Spill Contingency Plan (OSCP) until the termination criteria in the OSCP are met. • OSCP readiness will be tested.
	Crude export offloading spill • All offloading activities are undertaken in accordance with the Terminal Handbook and Offtake Operational Procedure and the associated checklists and procedures which includes controls for: o Radio communication with the support vessel. o Valve line-up. o Quantities offloaded are adhered at all times. o Hawser operating and maintenance procedures. • Transfer logs for tanker off takes must be retained for audit. • Equipment used in offloading activities shall be inspected prior to use in order to minimise the likelihood of equipment failure leading to loss of containment • Off-take hose is pressure tested / leak tested. • Offtake administrative controls in place such as watchkeeping during loading, shutdown of export system if required, monitoring of hawser loads. • Design features of the export system includes: o Fully welded export line on board the FPSO. o Scuppers and scupper plugs at both the off-take tanker and FPSO o Dry breakaway coupling installed in the export line. o SDV fitted at the discharge outlet on the FPSO. • Any spills of hydrocarbon to sea during offloading shall be reported, investigated and notifications shall be made in accordance with the ERP and OSCP. • Hydrocarbon spill response arrangements shall be undertaken in accordance with the OSCP until the termination criteria in the OSCP are met. • OSCP readiness will be tested.
	Diesel spill (e.g. bunkering) • Diesel bunkering undertaken in accordance with MODEC Diesel Bunkering Operations Procedure and Diesel Pre-bunkering Checklist which includes requirements such as: o Bunkering shall occur in calm weather and daylight hours. o Continuous monitoring of diesel transfers. o Hoses for diesel bunkering are inspected in preparation for diesel bunkering operations. o Bunker tanks will be identified to ensure there is sufficient space to safely

Environmental Hazard	Controls
	accommodate the bunkers to be transferred. • When a tank has reached its predetermined level and the valves have been closed, a sounding shall be taken a few minutes later to check that the valves are fully closed and no more fuel is flowing to the tank. • A joint agreement on the quantity and grades of bunkers to be transferred, together with agreed transfer rates and the maximum line back pressures will be established between the FPSO and the support vessel.
	Loss of subsea infrastructure integrity (well heads and flowlines) • The sub-sea system is designed to resist corrosion or erosion. • Risers and moorings are designed for 100 year non-cyclonic conditions or 10 year cyclonic conditions with the loss of one mooring line when the FPSO is both connected and disconnected. • Flowline, riser and subsea equipment design is certified by an independent agency. • Design of subsea production system includes a reservoir isolation system validated by an independent competent party. • Procedures are in place for critical testing of well integrity and flow lines and of the emergency shutdown and isolation of the system to prove functional and effective shutdown. • Computer data acquisition is in place on the FPSO (via the subsea control system) to monitor and record system properties and will trigger alarms if process upsets are encountered, allowing remedial actions to be implemented.

6 MANAGEMENT APPROACH

The ME Field Operations will be managed in compliance with the accepted EP. The objective of the EP is to ensure that the potential environmental impacts associated with the activity, during both routine and non-routine operations are identified, are reduced to ALARP and are of an acceptable level. This includes the definition of risk controls that are in place to manage each of the identified risks.

The EP defines environmental performance objectives and environmental performance standards that are used as a basis for managing environmental risks identified through the risk assessment process. Specific measurement criteria have been determined, which are used to demonstrate these performance objectives and standards are achieved.

An implementation strategy is described within the EP and provides a summary of the Santos systems, practices and procedures in place to manage the environmental risk associated with its activities to ALARP. The implementation strategy details:

- Santos' EHS Management System
- Contractor Management System
- Roles and responsibilities
- Training and competencies
- Chemical selection process
- Management of change
- Emergency response
- Management of non-compliance
- Incident recording and reporting
- Monitoring and record keeping
- Audit and review
- Performance report
- Ongoing consultation

7 OIL SPILL RESPSONSE ARRANGEMENTS

Santos has in place an Oil Spill Contingency Plan (OSCP) for the ME Field Operations to enable timely response to a hydrocarbon release during operation of the facility. As a participating member of the Australian Marine Oil Spill Centre (AMOSC) and Oil Spill Response Limited (OSRL), Santos has access to oil spill recovery and response equipment, dispersant and technical capabilities required to respond to a an oil spill on a 24 hour, 7 day a week basis.

8 STAKEHOLDER CONSULTATION

Santos has been actively involved in stakeholder engagement and consultation in the Dampier region since the initial development of the Mutineer Exeter production facility in 2005. Santos is committed to continuing to consult with appropriate stakeholders to ensure concerns associated with the ME Field Operation are incorporated into the management of the activity wherever practicable.

Santos EHSMS07, Consultation and Communication Guideline, has been used to develop the stakeholder consultation strategy. This guideline defines a stakeholder as:

'*Any affected persons, interested persons or organisations that are impacted by, or can impact, a project*.'

In relation to the revision of the ME Field Operations EP, stakeholders were emailed an 'Invite to Comment' flyer on 4 January 2013. The flyer provided details on the ME Development and a summary of the environmental impact assessment to ensure that stakeholders were aware of all the known and potential environmental risks.

Following the initial consultation and taking into account the feedback from WAFIC that it was unable to provide feedback on behalf of the fisheries it represents, Santos contacted individual licence holders of the active fisheries in the *operational area*. The approach taken, based on advice from WA Department of Fisheries (DoF), was to engage the licence holders in the Pilbara Trawl, Trap and Line managed fisheries as these are the fisheries that have activity in the area. This engagement included a tailored information flyer intended to highlight the specific impacts to the interests and activities of fishermen in the area. No issues were raised from these fisheries.

A summary of consultation, responses and actions undertaken are detailed in Table 8.1 and ongoing consultation requirements identified within the EP are detailed in Table 8.2.

Table 8.1: Summary of Consultation, Responses and Action Undertaken

Stakeholder	Date of Contact	Summary of Response	Action Undertaken
Lead Government Regulatory Authorities			
DSEWPC – Offshore Marine Section, Environment Assessment Branch	21/08/03 20/10/11	EPBC Referral assessed as 'Not a Controlled Action Particular Manner'. The conditions of approval related to drilling.	No further action required.
Referral Government Regulatory Authorities			
AFMA – Environmental Assessments Division	23/1/13	Stated that AFMA doesn't have any concerns or comments regarding known or potential environmental impacts. Recommended continual consultation with commercial fishing operators.	Santos will continue ongoing consultation with fishing organisations.
Australian Hydrographic Service (AHS)	6/12/12	AHS stated no issues. Requested field layout files to expedite chart updates.	Notices to mariners and chart in place for the existing Mutineer-Exeter facilities. Field layout files forwarded to AHS for the Fletcher Finucane tieback.

Stakeholder	Date of Contact	Summary of Response	Action Undertaken
AMSA – Rescue Coordination Centre (RCC)	10/12/12	AMSA acknowledged the ongoing consultation following the drilling campaign and construction consultations in 2012. Requested continuation of relevant updates and that Santos ensure where ongoing activities (drilling and construction), it continue to keep the Rescue Coordination Centre (RCC) advised of vessel movements.	Santos will keep the RCC informed of any developments and associated vessel movements.
AMSA – Marine Environmental Pollution Response	17/2/14 18/2/14	Santos and AMSA signed a Memorandum of Understanding regarding support for oil spill preparedness and response arrangements. The MoU is the result of consultation between Santos and AMSA and sets out respective roles and responsibilities when responding to ship-sourced and non-ship-sourced marine pollution incidents. This MoU supersedes any previous agreements and understandings between Santos and AMSA regarding oil spill response.	The salient points from the MoU have been incorporated into the OSCP. Santos acknowledges that access to the National Plan for Maritime Environmental Emergencies arrangements and support is contingent upon AMSA acknowledging receipt of NOPSEMA accepted OSCP. The requirement for this to be provided is detailed in the EP Section 8.11.1 Ongoing Consultation.
Border Protection Control (BPC) Command	6/12/12	No response received.	No further action required.
Department of Mines and Petroleum (DMP) – Petroleum Environment Branch	21/12/12	DMP Requested notification once production from Fletcher Finucane fields commenced.	Santos notified DMP upon the start of production from Fletcher Finucane and will continue to keep DMP notified, as requested.
Department of Defence	15/02/2013	Response stated no objection and indicated that the Australian Hydrographic Service would require advance notifications of any proposed seismic survey and infrastructure development within the designated area. Response also noted that the activity is within an area where	The subsea infrastructure associated with the Mutineer-Exeter operations is in place and the sea bed previously disturbed and on this basis the risk of disturbing a UXO is considered to be unlikely.

Stakeholder	Date of Contact	Summary of Response	Action Undertaken
		unexploded ordnance (UXO) may be present.	
WA Department of Transport (DoT), Oil Spill Response Coordination	7/3/13	DoT reviewed the OSCP and provided guidance on roles and responsibilities of the DoT. Requested that in the event of a spill, DoT be informed so that they can monitor the situation as it develops.	EP updated to include informing DoT in the event of a spill that has the potential to impact on State waters.
WA Department of Environment and Conservation (DEC)	10/12/12	DEC requested confirmation on whether the operation or an unintentional spill from this operation might affect State coastal waters.	Santos confirmed that the operations would not affect State coastal waters and that modelling of credible spill scenarios suggested that there is a low likelihood of impact on State waters.
Museum of WA (Maritime Heritage)	7/12/12	Requested inclusion of the potential for discovery of historic shipwrecks found in the course of the works be included in Santos considerations and stated that contractors should be briefed on the potential for finds and reporting requirements.	Santos will ensure that any activities with a potential for discovery of shipwrecks will be included in Santos reporting requirements and contractor briefings.
WA Department of Fisheries (DoF)	6/12/12	Pilbara Fish Trawl Fishery has reported commercial fishing activity in the permit area. Although exclusion zones limit access, there is likely to be no direct impact to fishing operations. In the unlikely event of an emergency all relevant stakeholders are notified and consulted. Recommends initiation and maintain communication with WAFIC, Recfishwest and identified fishers about any future activity prior to and throughout to mitigate potential impacts. Advised that all vessels must undertake appropriate measures to minimise risk of translocating aquatic pests and diseases in	EP updated to capture requirement for reporting and minimising risks of translocating aquatic pests and diseases. Further consultation with DoF (April 2013) confirmed that the Pilbara Trawl, Trap and Line fishery is the only active fishery in the area. On this basis, Santos has engaged directly with those fishers.

Stakeholder	Date of Contact	Summary of Response	Action Undertaken
		accordance with the Fish Resources Management Act 1994 and Fish Resources Management Regulations 1995. Requested Santos informed vessel owners/operators for the activity immediately report known or suspected introduced aquatic pest or disease detected in WA waters.	
Commercial Fisheries and Representatives			
Recfishwest	6/12/12	Recfishwest stated they had no concerns with the operational activities.	No further action required.
WA Fishing Industry Council (WAFIC)	20/12/12	WAFIC requested that all fishing organisations that have the potential to fish in the area be consulted and provided with specific details on how the development may impact fishing.	As requested by WAFIC, Santos has engaged directly with potentially affected fishers.
Pilbara Trap Fishery permit holders	17/04/13	Stakeholder information flyer provided and tailored to identify specific potential concerns to fishing interests and activities. No response received.	No further action required.
Pilbara Trawl Fishery permit holders	17/04/13	Stakeholder information flyer provided and tailored to identify specific potential concerns to fishing interests and activities. Response received from one permit holder stating that Pilbara Fish Trawl Fishery activities are currently only landside of the 100m depth contour.	No further action required.
Commonwealth Fisheries Association	6/12/12	No response received.	No further action required.

Stakeholder	Date of Contact	Summary of Response	Action Undertaken
Conservation Agencies			
Centre for Whale Research (Western Australia) Inc.	6/12/12	Telephone discussion held with respect to Fletcher Finucane Construction phase on 6/7/12 when the following advice was provided: Noise generated from dredging, pile driving and seismic activities are considered potential hazards for humpback whales.	Activities identified as potential hazard to humpback whales are not undertaken as part of the ME Field Operations.
WA Marine Parks and Reserves Authority (MPRA)	6/12/12	Referred to DEC, which requested information relating to the impact on State waters. (See DEC record).	No further action required.
Industry Stakeholders			
Australian Marine Oil Spill Centre (AMOSC)	20/12/12	AMOSC reviewed the draft OSCP. AMOSC confirmed they could provide the resources noted in the plan. AMOSC provided guidance on the plan content and provided clarification on roles and responsibilities. AMOSC also noted that Santos should regularly seek from AMOSC a current equipment stock and service list along with current numbers of trained personnel.	Updated the OSCP as suggested by AMOSC and requested its service list.

Table 8.2: Ongoing Stakeholder Consultation Requirements

Stakeholder	When	Ongoing Consultation Requirement	Status
AMSA – Marine Environmental Pollution Response	EP acceptance	Send copy of the ME Development OSCP to AMSA.	Complete
Department of Transport Oil Spill Response	EP acceptance	Send copy of the ME Development OSCP to AMSA.	Complete
AMOSC	EP acceptance	Send copy of the ME Development OSCP to AMSA.	Complete
OSRL	EP acceptance	Send copy of the ME Development OSCP to AMSA.	Complete

9 CONTACT DETAILS

The Santos environmental contact for this activity is:

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Additional information regarding Santos can be obtained from its website at: www.santos.com

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