Santos

Dancer-1 Exploration Drilling Oil Pollution Emergency Plan

PROJECT / FACILITY	Drilling and Completions
REVIEW INTERVAL	No Review Required
SAFETY CRITICAL DOCUMENT	No

Rev	Owner	Reviewer/s Managerial/Technical/Site	Approver
0	Senior Oil Spill Response Coordinator	Team Leader – Security & Emergency Response	Manager – HSE Offshore Division

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A	20/10/2020	Internal review
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Drilling Supervisor	link only	
Senior Oil Spill Response Coordinator	link only	
Team Leader – Security & Emergency Response	link only	
Santos Company Site Representative (CSR)	●	
IMT Room – Perth office		● x 4
AMOSC	●	
DoT	●	
AMSA	●	
OSRL	●	

Contents

List of Tables

List of Figures

Acronyms and Abbreviations

Name	Description
AIS	Automatic Identification System
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
BAOAC	Bonn Agreement Oil Appearance Codes
BOP	Blow out Preventer
CEO	Chief Executive Officer
CM	Crisis Management
CMT	Crisis Management Team
CSR	Company Site Representative
CTD	Conductivity-Temperature-Depth
DBCA	Department of Biodiversity, Conservation and Attractions
DISC	Drilling Industry Steering Committee
DISER	Department of Industry, Science, Energy and Resources
DMIRS	Department of Mines, Industry Regulation and Safety
DO	Dissolved Oxygen
DOT	Department of Transport
DPIRD	Department of Primary Industry and Regional Development
DWER	Department of Water and Environmental Regulation
EAP	Employee Assistance Program
EHS	Environment, Health and Safety
EP	Environment Plan
ESC	Environmental Scientific Coordinator
ESD	Emergency Shutdown
ETL	Environment Team Leader
EVP	Executive Vice President
EVPO	Executive Vice President - Offshore Oil and Gas
FOB	Forward Operating Base
G&PA	Governmental & Public Affairs
GC	Gas Chromatography
GDS	Global Dispersant Stockpiles
GIS	Geographic Information System
GPS	Global Positioning System
HDPE	High Density Polyethylene

Name	Description
HMA	Hazard Management Agency
HQ	Hazard Quotient
HR	Human Resources
IAP	Incident Action Plan
ICC	Incident Command Centre
ICMM	Incident Command and Management Manual
IMT	Incident Management Team
IR	Industrial Relations
IRP	Incident Response Plan
IRT	Incident Response Team
ITOPF	International Tanker Owners Pollution Federation
JSCC	Joint Strategic Coordination Committee
KSAT	Kongsberg Satellite Services
LOWC	Loss of Well Control
m	Meters
m^3	Meters Cubed
MARPOL	International Convention for the Prevention of Pollution from Ships
MCT	Monitoring Coordination Team
MDO	Marine Diesel Oil
SHP - MEE	State Hazard Plan for Maritime Environmental Emergencies
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response
MMscf	Million standard cubic feet
MNES	Matters of National Environmental Significance
MOP	Marine Pollution Incidents
MODU	Mobile Offshore Drilling Unit
MOU	Memorandum of Understanding
MS	Mass Spectrometry
MSP	Monitoring Service Providers
NATA	National Association of Testing Authorities
NATPLAN	National Plan for Maritime Environmental Emergencies
NEBA	Net Environmental Benefit Analysis
NOK	Next of Kin
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NRT	National Response Team

Name	Description
NWA	North West Alliance
OASG	Operational Area Support Group
OCNS	Offshore Chemical Notification Scheme
OIM	Offshore Installation Manager
OIW	Oil in Water
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPICC	Oil Pollution Incident Command Centre
OSCP	Oil Spill Contingency Plan
OSR	Oil Spill Response
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organisations
OST	Oil Spill Trajectory
OSTM	Oil Spill Trajectory Modelling
OWA	Oil Wildlife Advisor
OWR	Oiled Wildlife Response
OWRP	Oiled Wildlife Response Plan
PAHs	Polycyclic Aromatic Hydrocarbons
PEARL	People Environment Assets Reputation Liability
POB	Persons on Board
PPE	Personal Protective Equipment
PS	People Support
RCC	Rescue Coordination Centre
ROV	Remotely Operated Vehicle
SAR	Synthetic Aperture Radar
SIMA	Spill Impact Mitigation Assessment
SITREP	Marine Pollution Situation Report
SLA	Service Level Agreement
SME	Subject Matter Expert
SMEEC	State Maritime Environmental Emergency Coordinator
SMP	Scientific Monitoring Plan
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plan

Name	Description
SRT	State Response Team
SSD	Species Sensitivity Distribution
SSDI	Subsea Dispersant Injection
TRP	Tactical Response Plan
UAV	Unmanned Aerial Vehicles
UHF	Ultra-High Frequency
VOC	Volatile Organic Compound
VOO	Vessels of Opportunity
WA	Western Australia
WAOWRP	Western Australian Oiled Wildlife Response Plan
WSP	Waste Service Provider

1 Quick Reference Information

<table>
<tr><th>Parameter</th><th colspan="3">Description</th><th>Further Information</th></tr>
<tr><td>Petroleum Activity</td><td colspan="3">The Dancer-1 exploration well will be drilled in permit area WA- 1- P, at the coordinates listed below, within a 2 km x 2 km Operational Area. In the event of a re-spud, the new well location would remain within the Operational Area, although is likely to be within 50 m.</td><td>Section 2 of the Environment Plan (EP)</td></tr>
<tr><td>Location (Lat/Long and Easting/Northing)</td><td colspan="3">431,892.31mE
7,791,481.81mN
Lat: 19° 58’ 19.30” S
Long: 116° 20’ 56.51” E</td><td>Table 2-1 of the EP</td></tr>
<tr><td>Petroleum Title/s (Blocks)</td><td colspan="3">WA-1-P (Commonwealth waters)</td><td></td></tr>
<tr><td>Water Depth</td><td colspan="3">63 m</td><td>N/A</td></tr>
<tr><td rowspan="4">Worst-case Spill Scenarios</td><td>Scenario</td><td>Hydrocarbon</td><td>Worst-case volume (m³)</td><td rowspan="4">Section 6.1</td></tr>
<tr><td>Loss of well control (subsea release)</td><td>Reindeer Condensate</td><td>273,130 STB (43,423 m³) liquid condensate and 54,618 MMscf (1,547 million sm³) gas at the seabed</td></tr>
<tr><td>Loss of well control (surface release)</td><td>Reindeer Condensate</td><td>271,436 STB (43,153 m³) liquid condensate and 54,289 MMscf (1,537 million sm³) gas at the sea surface</td></tr>
<tr><td>Surface diesel release (surface spill)</td><td>Marine Diesel Oil (MDO)</td><td>329 m³ of MDO as a result of a vessel collision</td></tr>
<tr><td>Hydrocarbon Properties</td><td colspan="3"><u>Reindeer Condensate (based on Intertek 2019)</u>
Specific gravity = 0.7862
Dynamic viscosity (cP) = 0.841 @ 20° C
API Gravity = 48.5
<u>MDO</u>
Density kg/m³ at 25°C = 829
Dynamic viscosity (cP) = 4 @ 25° C
API Gravity = 37.6</td><td>Appendix A</td></tr>
</table>

Parameter	Description	Further Information
Weathering Potential	**Reindeer condensate** has been modelled using an analogue hydrocarbon (Grader C). Evaporation is the primary weathering mechanisms for highly volatile condensates such as Grader C. Under low wind speeds, 90% of the surface slick is predicted to evaporate within 3 days. **MDO** is a mixture of volatile and persistent hydrocarbons with low viscosity. It will spread quickly and thin out to low thickness levels, thereby increasing the rate of evaporation. Up to 60% will generally evaporate over the first two days. Approximately 5% is considered "persistent hydrocarbons", which are unlikely to evaporate and will decay over time.	**Appendix A**
Protection Priorities	Dampier Archipelago, Montebello Islands, Lowendal Islands, Barrow Island, Muiron Islands.	**Section 6.5**

2 First Strike Response Actions

The initial response actions to an oil spill incident will be undertaken by the relevant Vessel Master or the Offshore Installation Manager (OIM) depending on the nature of the incident (vessel or MODU based).

If the spill is related to the MODU, the rig OIM (hereafter referred to as the On-Scene Commander) will be notified or in the case of a support vessel, the Vessel Master will be notified first.

Following those initial actions undertaken by the On-Scene Commander or Vessel Master to ensure the safety of personnel on the vessel or MODU, and to control the source of the spill, the Santos Company Site Representative will make an assessment of the situation based upon:

+ What has caused the spill?
+ Is the source under control?
+ What type of hydrocarbon has been spilt?
+ How much has been spilt?

For spills requiring, or potentially requiring external assistance (i.e. Level 2/3 spills), the Santos Company Site Representative notifies Santos' Offshore Duty Manager, who will be responsible for subsequent activations and notifications, which will depend on the circumstances of the spill.

Initial response information contained within this OPEP is concerned primarily with a large scale (Level 2/3) hydrocarbon spill where the Perth-based Incident Management Team (IMT) and Crisis Management Team (CMT) are engaged for support.

While Level 1 spills are defined as those not requiring external assistance to respond to the incident, external reporting requirements to relevant Regulatory authorities may still be relevant (refer to **Section 8**)

Table 2-1: Initial Notifications Following a Level 2/3 Spill

Position	Type of communication	Timeframe	To Whom
Santos Company Site Representative	Verbal	Within 30 minutes of incident having been identified or as soon as additional resources are required	Incident Commander via Santos Offshore Duty Manager

First strike activations required for the credible oil spill incidents identified in this plan are outlined in **Section 2.1** below.

2.1 Level 1 Spills (Hydrocarbon Storage, Handling and Transfers)

Level 1 activations are based on spills which will not have an adverse effect on the public or the environment and can be controlled by the use of resources available onsite, without the need to mobilise additional resources for combatting the spill. It is considered that onsite response equipment and personnel are sufficient to respond to the spill. Spills that require this level of response may arise from blown hydraulic hoses, dropped or leaking drums of fuel or lubricant or minor refuelling accidents.

For spills from support vessels, initial response actions to major incidents are under the direction of the Vessel Master and in accordance with vessel-specific procedures (e.g. Shipboard Oil Pollution Plans (SOPEPS)).

Response information contained within this OPEP is concerned primarily with a large scale (Level 2/3) hydrocarbon spill where the Perth-based IMT and CMTs are engaged for support. Level 1 spills do not typically require the stand-up of the IMT/CMT for support, however on-site response actions to monitor the spill and regulatory requirements for reporting these spills still apply. Therefore, the immediate response actions listed in **Table 2-2** are relevant for any spill. Once sufficient information is known about the spill, the Incident Commander will classify the level of the spill. If the spill is classified as a Level 1 spill, then the actions related to Level 2/3 spills do not apply, unless specified by the Incident Commander.

Table 2-2: First strike activations

When (indicative)	Activations		Who
	Objective	Action	
All spills			
Immediate	Manage the safety of personnel	Implement site incident response procedures (Noble Tom Prosser Offshore Emergency Response Manual [Noble document number SF-EME-NTP-001] and Noble Tom Prosser – Emergency Response Bridging Plan [Santos document number SO-91-BF-20011] or vessel-specific procedures, as applicable)	On-Scene Commander/ Vessel Master
Immediate	Control the source using site resources, where possible	Control the source using available onsite resources (MODU/vessel) Refer to the source control plan in **Section 9**	On-Scene Commander/ Vessel Master
30 minutes of incident being identified	Notify Santos On-call Incident Commander	Report incidents where spill has reached marine environment to on-call Incident Commander	On-Scene Commander via CSR
As soon as practicable	Obtain as much information about the spill as possible	Provide as much information to the IMT (Incident Commander or delegate) as soon as possible	On-Scene Commander via CSR
60 minutes	Gain situational awareness and begin onsite spill surveillance	If spill has reached marine waters gain further situational awareness by undertaking surveillance of the spill from vessel or MODU (refer to **Section 9**)	On-Scene Commander via CSR Incident Commander
Refer timeframes Go to **Section 7**	Make regulatory notifications within regulatory timeframes	Activate the External Notifications and Reporting Procedures Go to **Section 7**	As per **Table 7-1**
Level 2/3 spills (in addition to actions above)			

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When (indicative)	Activations		Who
	Objective	**Action**	
Immediately once notified of spill (to Incident Commander)	Activate IMT, if required	Notify IMT	Duty Manager Incident Commander
IMT Actions (0-48 hours)			
Within 90 minutes from IMT callout	Set-up IMT room	Refer to IMT tools and checklists for room and incident log set-up	Incident Commander IMT Data Manager
	Gain situational awareness and set incident objectives, strategies and tasks	Begin reactive IAP process Go to **Section 8** Review First Strike Activations (this table)	Incident Commander Planning Team Leader
Refer timeframes **Section 7**	Make regulatory notifications as required Notify and mobilise external Oil Spill Response Organisations (OSROs) and/or Support Organisations, as required	Go to **Section 7**	Initial notifications by Environment/ Safety Team Leads OSRO (Australian Marine Oil Spill Centre (AMOSC) and Oil Spill Response Limited (OSRL)) activation by designated call-out authorities (Incident Commanders/ Duty Managers)
Refer timeframes **Section 10**	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	Vessel Surveillance (**Section 10.1**) Aerial Surveillance (**Section 10.2**) Tracking Buoys (**Section 10.3**) Oil Spill Trajectory Modelling (OSTM) (**Section 10.4**) Satellite Imagery (**Section 10.5**) Initial Oil Characterisation (**Section 10.5**) Operational Water Quality Monitoring **(Section 10.7)**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders IMT Environment Team Leaders

When (indicative)	Activations		Who
	Objective	**Action**	
		Shoreline and Coastal Habitat Assessment (**Section 10.8**)	
Activate on Day 1 for applicable scenarios	Source control support to stop the release of hydrocarbons into the marine environment. **Degree of IMT support will be scenario dependent**	Go to **Section 9**	IMT Operations Team Leader (Drilling Team Leader as appropriate to scenario) IMT Logistics/ Supply Team Leaders
Activate on Day 1 for applicable scenarios Refer **Section 11**	Reduce exposure of shorelines and wildlife to floating oil through mechanical/ chemical dispersion	Activate the Mechanical Dispersion Plan. Go to **Section 11**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
Day 1	Identify environmental sensitivities at risk and conduct Net Environmental Benefit Analysis (NEBA)	Review situational awareness and spill trajectory modelling Review strategic NEBA and begin operational NEBA (**Section 6.7**)	IMT Environmental Team Leader
Day 1	Develop forward operational base/s to support forward operations	Begin planning for forward operations base as per Forward Operations Plan. **Appendix Q**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
Day 1	Ensure the health and safety of spill responders.	Identify relevant hazards controls and develop hazard register Begin preparation Site Health and Safety Management requirements Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	IMT Safety Team Leader
If/when initiated Refer **Section 12**	Protect identified shoreline protection priorities	Activate Shoreline Protection and Deflection Plan. Go to **Section 12**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders IMT Environment Team Leader
If/when initiated Refer **Section 14**	Prevent or reduce impacts to wildlife	Activate the Oiled Wildlife Response Plan. Go to **Section 14**	IMT Environment Team Leader IMT Operations Team Leader

When (indicative)	Activations		Who
	Objective	Action	
			IMT Logistics/ Supply Team Leaders
If/when initiated Refer **Section 16**	Assess and monitor impacts from spill and response	Activate the Scientific Monitoring Plan (SMP) – Go to **Section 16**	IMT Environment Team Leader IMT Logistics/ Supply Team Leaders IMT Operations Team Leader
If/when initiated	Clean-up oiled shorelines	Activate Shoreline Clean Up resources. Go to **Section 13**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
If/when initiated	Safely transfer, transport and dispose of waste collected from response activities.	Activate the Waste Management Plan. Go to **Section 15**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
IMT Actions (48+ hours)			
Ongoing	• For ongoing incident management – indicatively 48 + hours – a formal Incident Action Plan (IAP) process is to be adopted to continue with spill response strategies identified above. An IAP is to be developed for each successive operational period. • Santos will maintain control for those activities for which it is the designated Control Agency/ Lead IMT. • Depending on the specifics of the spill Australian Maritime Safety Authority (AMSA) and/or Department of Transport (DoT) may be relevant Control Agencies (refer **Section 4.2**). • Where another Control Agency has taken control of aspects of the response, Santos will provide support to that Control Agency. Santos' support to DoT for a State waters response is detailed in **Section 5.2.3**.		Control Agency IMT Santos to provide the following roles to DoT Maritime Environmental Emergency Coordination Centre (MEECC)/IMT for State waters response: IMT Liaison Officer Intelligence Support Officer Deputy Planning Officer Environmental Support Officer Public Information Support & Media Liaison Officer Deputy Logistics Officer Facilities Support Officer Deputy Finance Officer Deputy On Scene Commander (Forward Operating Base (FOB))

3 Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Dancer-1 Exploration Drilling Environment Plan (EP) (SO-00-BI-20002) required by Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations).

3.1 Description of Activity

Santos WA Northwest Pty Ltd (Santos) proposes to undertake a single-well exploration drilling campaign in permit area WA-1-P, targeting a gas reservoir in the Legendre formation (**Figure 3-1**)

The permit area is wholly within offshore Commonwealth waters, approximately 60 km north-north-west of the Dampier Archipelago, Western Australia (WA), in water depths of approximately 63 m. The Operational Area is defined as a 2 km x 2 km area centered on the planned well location. The final well location may be anywhere within the Operational Area.

The drilling activity will be carried out using a jack-up mobile offshore drilling unit (MODU) with support vessels and helicopters. The EP covers the drilling activities and all MODU, vessel and helicopter operations within the Operational Area (the activity). A 500 m Petroleum Safety Zone will be established around the final well location.

A sidetrack or re-spud is not planned as part of the activity but is included as a contingency. A re-spud location would be anywhere within the Operational Area, although is likely to be within 50 m of the initial Dancer-1 well location. If the MODU is required to move, the 500 m PSZ will relocate simultaneously to be maintained around the MODU location.

Refer to **Section 2** of the Dancer-1 Exploration Drilling EP (SO-00-BI-20002) for detail on the activity.

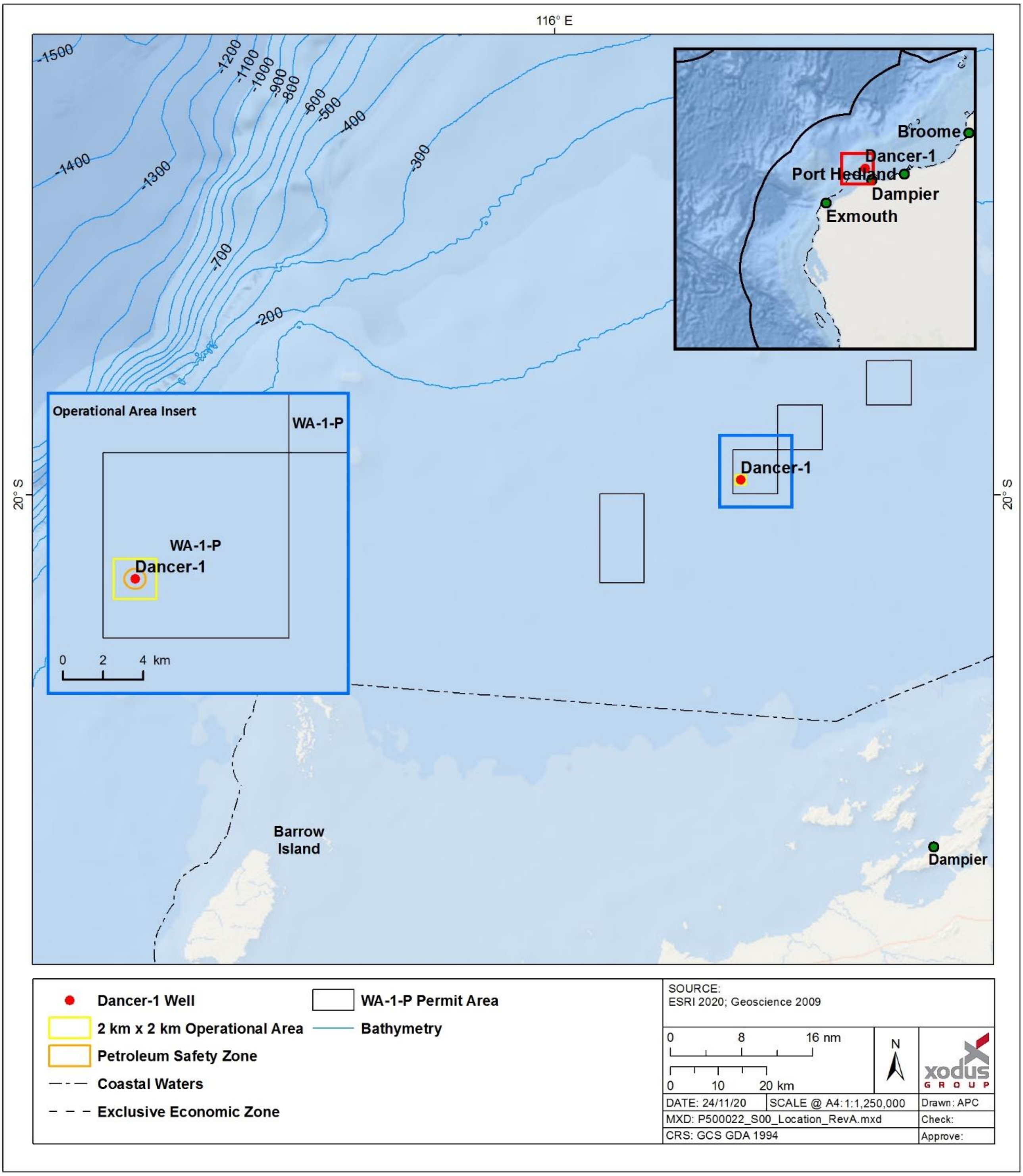

Figure 3-1: Location of Dancer-1 Operational Area

3.2 Purpose and Scope of this OPEP

The purpose of this OPEP is to describe Santos' response to a hydrocarbon spill in Commonwealth waters associated with the petroleum activity.

The OPEP covers exploration drilling and associated activities (as described in **Section 2.4** of the EP) for a single exploration well (Dancer-1) in Commonwealth permit area WA-1-P.

This OPEP has been developed to meet all relevant requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations). It is consistent with the national and State (WA) systems for oil pollution preparedness and response, being the National Plan for Maritime Environmental Emergencies (NatPlan) managed by AMSA and the WA State Hazard Plan for Maritime Environmental Emergencies (SHP - MEE).

This OPEP is to be read in conjunction with the Dancer-1 Exploration Drilling EP (SO-00-BI-20002) when considering the existing environment, environmental impacts, risk management, performance standards and the reporting compliance requirements.

This OPEP will apply from acceptance of the Santos Dancer-1 Exploration Drilling EP (SO-00-BI-20002) and will remain valid for the duration of life of the EP.

The response strategies outlined in this OPEP have been developed by Santos utilising risk assessments to identify credible worst case hydrocarbon spill scenarios, expected/calculated release rates, known information of hydrocarbon types and behaviour, and expected partitioning of the hydrocarbon within the marine environment with an estimate of the volume of persistent oil. This information has been modelled to give a theoretical zone of dispersion that is used to identify potential sensitive receptors and response strategies required to reduce the consequences of a spill to 'As Low As Reasonably Practicable' (ALARP). The response strategies are identified under a NEBA process so the most effective response strategies with the lowest environmental consequences can be identified, documented and prepared for.

3.3 Objectives

The aim of this OPEP is to provide detailed guidance to Santos' IMT, so that it will direct its response effort with the aim of preventing long term significant environmental impacts by safely limiting the adverse environmental effects from an unplanned release of hydrocarbons to the marine environment to a level that is ALARP. This will be achieved through the implementation of the various strategies and spill response mechanisms presented throughout this OPEP. Through their implementation, Santos will:

+ Initiate spill response immediately following a spill;
+ Establish source control as soon as reasonably practicable to minimise the amount of oil being spilt into the environment;
+ Assess the spill characteristics and understand its fate in order to be able to make informed and clear response decisions;
+ Monitor the spill to identify the primary marine and coastal resources requiring protection;
+ Remove as much oil as possible from the marine environment while keeping environmental impacts from the removal methods to ALARP;
+ Reduce the impacts of the remaining floating and stranded oil to ALARP;
+ Respond to the spill using efficient response strategies that do not damage the environment themselves;
+ Comply with all relevant environmental legislation when implementing this OPEP;
+ Conduct all responses safely without causing harm to participants;
+ Monitor the impacts from a spill until impacted habitats have returned to baseline conditions;
+ Remain in a state of 'Readiness' at all times for implementation of this OPEP by keeping resources ready for deployment, staff fully trained and completing response exercises as scheduled; and
+ Keep stakeholders informed of the status of the hydrocarbon spill response to aid in the reduction of social and economic impacts.

3.4 Area of Operation

The Dancer-1 well is located within permit area WA-1-P in Commonwealth waters in approximately 63 m water depth. The well is located approximately 60 km north-northwest of the Dampier Archipelago in Western Australia and 85 km north-northwest of the Dampier township. The relative distances of key features from the Operational Area are provided in **Table 3-1**

Section 3 of the Dancer-1 Exploration Drilling EP (SO-00-BI-20002) includes a comprehensive description of the existing environment.

Table 3-1: Distances from Dancer-1 well to key regional features

Islands/Mainland	Relative Distance
Dampier Archipelago	60 km SSE
Montebello Islands	93 km SW
Dampier	85 km SSE
Cape Preston	97 km SSW
Lowendal Islands	110 km SW
Barrow Island	121 km SW

3.5 Interface with Internal Documents

In addition to this OPEP, a number of other Santos documents provide guidance and instruction relevant to spill response, including:

+ Incident Command & Management Manual (SO-00-ZF-00025);
+ Dancer-1 Exploration Drilling Environment Plan (SO-00-BI-20002);
+ Noble Tom Prosser Offshore Emergency Response Manual (Noble document number SF-EME-NTP-001);
+ Noble Tom Prosser – Emergency Response Bridging Plan (SO-91-BF-20011);
+ Incident Response Telephone Directory (SO-00-ZF-00025.020);
+ Refuelling and Chemical Management Standard (QE-91-IQ-00098);
+ Santos Source Control Planning and Response Guideline (DR-00-OZ-20001);
+ Dancer-1 Source Control Plan (DR-00-BW-20007);
+ Oil Pollution Waste Management Plan (QE-91-IF-10053);
+ Oil Spill Response HSE Management Manual (SO-91-RF-10016);
+ Oil Spill Scientific Monitoring Plan (EA-00-RI-10099);
+ Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162);
+ Oil Spill Scientific Monitoring Baseline Data Review (QE-00-BI-20001); and
+ Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).

4 Oil Spill Response Framework

4.1 Spill Response Levels

Santos uses a tiered system of incident response levels consistent with State and National incident response plans including the SHP - MEE and the NatPlan. Spill Response Levels help to identify the severity of an oil spill incident and the level of response required to manage the incident and mitigate environmental impacts. Incident response levels are outlined within the Santos Incident Command and Management Manual (SO-00-ZF-00025) and further detailed in **Table 4-1** below for hydrocarbon spills.

Table 4-1: Santos Oil Spill Response Levels

Level 1	
An incident which will not have an adverse effect on the public or the environment which can be controlled by the use of resources normally available onsite without the need to mobilise the Santos IMT or other external assistance.	
+ Oil is contained within the incident site. + Spill occurs within immediate site proximity. + Discharge in excess of permitted oil in water (OIW) content (15 ppm). + Incident can be managed by the Incident Response Team (IRT) and its resources.	+ Source of spill has been contained. + Oil is evaporating quickly and no danger of explosive vapours. + Spill likely to naturally dissipate. + No media interest/not have an adverse effect on the public.
Level 2	
An incident that cannot be controlled by the use of onsite resources alone and requires external support and resources to combat the situation; or **An incident that can be controlled onsite but which may have an adverse effect on the public or the environment.**	
+ Danger of fire or explosion. + Possible continuous release. + Concentrated oil accumulating in close proximity to the site or vessel. + Potential to impact other installations.	+ Level 1 resources overwhelmed, requiring additional regional resources. + Potential impact to sensitive areas and/or local communities. + Local/national media attention/may adversely affect the public or the environment.
Level 3	
An incident which has a wide ranging impact on Santos and may require the mobilisation of external state, national or international resources to bring the situation under control.	
+ Loss of well integrity. + Actual or potentially serious threat to life, property, industry. + Major spill beyond site vicinity. + Significant shoreline environmental impact.	+ Level 2 resources overwhelmed, requiring international assistance. + Level 3 resources to be mobilised. + Significant impact on local communities. + International media attention.

4.2 Jurisdictional Authorities and Controlling Agencies

During a spill response there will be both a Jurisdictional Authority and a Control Agency assigned to the oil spill incident for all spill response levels.

Definitions of Jurisdictional Authority and Control Agency are as follows:

+ Control Agency: the organisation assigned by legislation, administrative arrangements or within the relevant contingency plan, to control response activities to a maritime environmental emergency. Control Agencies have the operational responsibility of response activities, but may have arrangements in place with other parties to provide response assistance under their direction; and
+ Jurisdictional Authority: the agency which has responsibility to verify that an adequate spill response plan is prepared and, in the event of an incident, that a satisfactory response is implemented. The Jurisdictional Authority is also responsible for initiating prosecutions and the recovery of clean-up costs on behalf of all participating agencies.

With respect to a hydrocarbon spill from Dancer-1 drilling activities, the relevant Jurisdictional Authority and Control Agency varies dependent upon the location of the oil pollution (Commonwealth or State waters), the nature of the incident (vessel based or petroleum activity) and the spill response level (refer **Table 4-2**).

To aid in the determination of a vessel vs a facility spill the following guidance is adopted:

+ A vessel is a ship at sea to which the *Navigation Act 2012* applies; and
+ A facility is a petroleum facility as defined under the OPGGS Act, Volume 3, Schedule 3, Part 1, Clause 4 & Volume 2, Part 6.8, Section 640.

Table 4-2: Jurisdictional Authorities and Control Agencies for oil spill response

Role	Spill Level	State waters/shoreline oil pollution		Commonwealth waters oil pollution	
		Petroleum Activity[1]	Vessel[2]	Petroleum Activity	Vessel
Control Agency	1	Petroleum Titleholder (Santos)	DoT	Petroleum Titleholder (Santos)	AMSA
	2/3	DoT	DoT	Petroleum Titleholder (Santos)	AMSA
Jurisdictional Authority	1/2/3	DoT	DoT	NOPSEMA	AMSA

4.3 Petroleum Activity Spill in Commonwealth Waters

For an offshore petroleum activity spill in Commonwealth waters the Jurisdictional Authority is National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). NOPSEMA is responsible for the oversight of response actions to pollution events from offshore

[1] Includes a 'Facility', such as a fixed platform, FPSO/FSO, MODU, subsea infrastructure, or a construction, decommissioning and pipelaying vessel. As defined by Schedule 3, Part 1, Clause 4 of the OPGGSA 2006.

[2] Vessels are defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA, 2017) as a seismic vessel, supply or support vessel.

Petroleum Activities, in areas of Commonwealth jurisdiction. During a spill incident, NOPSEMA's role will be to implement regulatory processes to monitor and secure compliance with the *OPGGS Act 2006* and *OPGGS (E) Regulations*, including the issuing of directions as required, and investigate accidents, occurrences and circumstances involving deficiencies in environment management.

Under the *OPGGS (E) Regulations* and the *OPGGS Act 2006*, the Petroleum Titleholder (i.e. Santos) is responsible for responding to an oil spill incident as the Control Agency in Commonwealth waters, in accordance with its OPEP.

Santos is responsible as Control Agency unless NOPSEMA identifies a requirement to delegate control. In this situation, Control Agency responsibility may be delegated to AMSA who will assume control of the incident and respond in accordance with AMSA's NatPlan. In such an occurrence, Santos would assume a Support Agency role and make available all necessary resources to support AMSA in AMSA's performance of their Control Agency responsibilities.

The arrangements between DoT and Santos for sharing resources and coordinating a response across both Commonwealth and State waters are further detailed in **Section 5.2.3.**

4.4 Vessel Spills in Commonwealth Waters

For a vessel incident originating in Commonwealth waters, the Jurisdictional Authority and Control Agency is AMSA. AMSA is the national shipping and maritime industry regulator and was established under the Australian Maritime Safety Authority Act 1990. AMSA manages the NatPlan on behalf of the Australian Government, working with State and the Northern Territory governments, emergency services and private industry to maximise Australia's marine pollution response capability.

Santos will be responsible for coordinating a first-strike response to a vessel based spill in Commonwealth waters until such time as AMSA takes over the role as Controlling Agency, at which time Santos would provide all available resources as a Supporting Agency.

4.5 Cross-jurisdictional Vessel Spills

For a large vessel spill (Level 2/3) that crosses Jurisdictions between Commonwealth and State waters, two Jurisdictional Authorities exist (AMSA for Commonwealth waters and DoT for State waters). Control Agency responsibilities will be determined by DoT and AMSA, with Santos providing all necessary resources (including personnel and equipment) as a Supporting Agency.

5 Santos Incident Management

The Santos IMT (Perth) and Crisis Management Team (CMT) will be activated in the event of a Level 2/3 hydrocarbon spill regardless of the type of spill or jurisdiction. As outlined above, control of the response may be taken over by the relevant Controlling Agency as the incident progresses. The Santos response structure to a major emergency incident is detailed in the Incident Command and Management Manual (ICMM) (SO-00-ZF-00025). The ICMM describes response planning and incident management that would operate under emergency conditions – describing how the Santos IMT operates and interfaces with the CMT and external parties.

The first priority of an escalating oil spill response to a Level 2/3 spill is the formation of an IMT and establishment of an Incident Command Centre (ICC). The ongoing involvement of the IMT and CMT will be dependent on the severity and type of spill and the obligations of Santos and other agencies/authorities in the coordinated spill response.

Santos' incident response structure relevant to an incident within the Dancer-1 operational area includes:

+ Facility-based IRT;
+ Santos Incident Management Team (IMT)– Perth based to coordinate and execute responses to an oil spill incident;
+ Santos Crisis Management Team (CMT) - to coordinate and manage threats to the company's reputation and to handle Santos's corporate requirements as an operator in conjunction with the Perth Based Santos- Executive Vice President Offshore Oil and Gas (EVP Offshore); and
+ Other field-based command, response and monitoring teams for implementing strategies outlined within the OPEP.

The first priority of an escalating oil spill response is the formation of an IMT to establish an Incident Operations Centre. The establishment and involvement of the CMT will be dependent on the severity of the spill.

The Santos incident response organisational structure is defined in the Incident Command and Management Manual (SO-00-ZF-00025), and in **Figure 5-1** for reference.

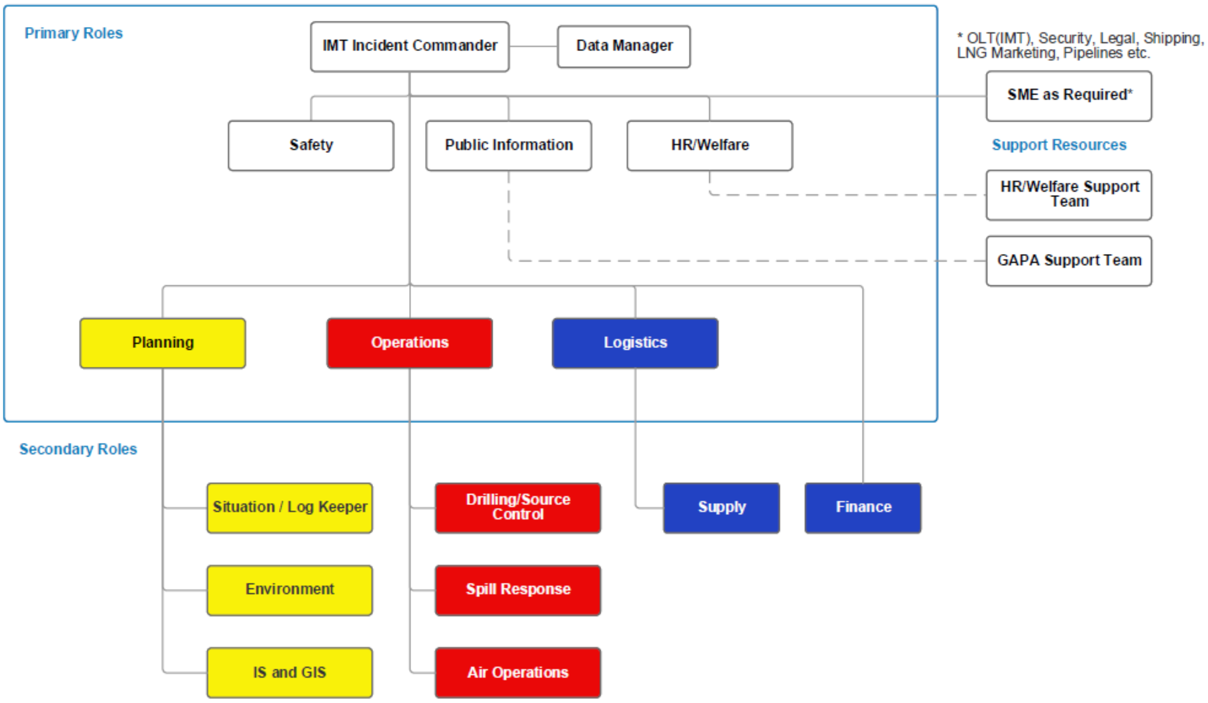

Figure 5-1: Santos Incident Management Team Organisational Structure

Note: For a Level 2/3 Petroleum Activity spills whereby DoT is involved as a Controlling Agency, either within a single jurisdiction (State water only spills) or cross-jurisdictional (spills from Commonwealth to State waters), Santos will work in coordination with the DoT in providing spill response capability. Santos' expanded organisational structure for these situations is detailed in ***Section 5.2.3****.*

5.1 Roles and Responsibilities

The tables below provide an overview of the responsibilities of the Santos CMT (**Table 5-1**), IMT (**Table 5-2**), and field-based response team members in responding to an incident (**Table 5-3**).

Also provided are the roles and responsibilities of Santos personnel required to work within DoT's organisational structure (**Table 5-5**), where DoT has responsibilities for spill response as a Control Agency, as per DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements..

DoT will provide a Liaison officer / Duty Incident Commander to the Santos IMT in a coordinated response, as outlined for reference in **Table 5-4**.

Table 5-1: Roles and Responsibilities in the Crisis Management Team (CMT)

Santos CMT Role	Main Responsibilities
CMT Leader	+ Maintains contact with IMT or Issue Notification stakeholder until the CMT is fully functional + Articulate the overall response priorities and required actions using the PEARL (People Environment Assets Reputation Liability) approach + Consider response options to achieve priorities, including mitigating the potential worst-case scenario + Determine Key Messages and Stakeholders, assigning Santos points of contact for each stakeholder + Ensure Chief Executive Officer (CEO) or delegate is engaged for all internal (staff) and external communications + Confirm frequency of CMT reports and meetings and coordination with CEO, IMT and other stakeholders + Consider how a change in the situation over time may alter the most likely and worst-case scenarios originally identified, and how this impacts response options and priorities + Consider CMT requirements for the next phase of activity, allocating actions as appropriate
Administrator-EHS & Governance	+ Provide location, time and meeting medium details (i.e. telecon etc) to CMT members + Work with the CMT Log Keeper to maintain an accurate CM Log with key situation details, meeting decisions/actions and next meeting time/location details + Disseminate approved briefing material to personnel following CMT Leader's direction + Liaise with Public Affairs/Safety & Security/Facilities on any reception, premises security or media/advisor briefing requirements + Ensure role discipline of CMT representatives, monitoring action progress and any coordination + At each CMT meeting summarise and record any change/handover in CMT representatives i. the situation reviews and actions since last CMT meeting ii. any issues raised between meetings requiring escalation to, or coordination with, the CMT

Santos CMT Role	Main Responsibilities
Duty Manager	+ With CEO agreement and appointment of a CMT Leader, assist with/oversee activation of the CMT + Ensure that the core CMT and specialist members are given details for the initial CMT meeting including location, time and meeting medium (i.e. telecon etc) + Where applicable contact IMT Leader or Issue Notification stakeholder and gain latest update for team + Articulate the overall response priorities and required actions using the PEARL approach. Ensure ongoing monitoring for hidden or emerging risks + Determine Key Messages and Stakeholders, assigning Santos points of contact for each stakeholder + Ensure appropriate Legal Protocols are established on advice from CMT Legal + Ensure CEO or delegate is engaged for all internal (staff) and external communications + Consider how a change in the situation over time may alter the most likely and worst-case scenarios originally identified, and how this impacts response options and priorities
Government & Public Affairs	+ Without delaying CMT attendance, gain advice from Government and Public Affairs teams on main and social media situation, government stakeholder requests and requirements, and immediate strategy + Gain requirements from the CEO or delegate on strategy, timings, and media representation + Follow the Crisis Management Process using the nominated support tools + At initial CMT meeting take the lead role setting out and updating the stakeholder communications plan + Identify current and immediate messaging needs (i.e. Holding Statements, internal communications, industry advices, government notifications, media releases) and ongoing issues management + Advise on Government and Public Affairs recommendations and other considerations to support company sustainability and resilience + Advise on and coordinate the stakeholder management approach across all levels of Santos, including media monitoring and media inquiry + Engage and oversee any specific asset or sub teams required for stakeholder management

Santos CMT Role	Main Responsibilities
Risk & Audit	+ Advise on current and potential company risk issues + Determine if additional specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated + Advise on Santos risk options and recommendations, other mitigation controls to company sustainability, and resilience requirements + Monitor and assess cumulative risk consequences and potential exposures to Santos. + Engage and oversee any specific sub teams or specialists required for Risk and Audit support + Between meetings liaise with sub teams and specialist advisors to ensure an effective response. Ensure confidentiality and authorised comment is continually observed
Safety and Security	+ Identify current and potential safety and security response, support or regulatory issues. + Determine if additional safety or security specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated + Advise on safety and security recommendations and other considerations to support company sustainability and resilience + Advise on notifications to any safety or security related stakeholders, including mandatory regulatory advice or reports + Monitor and assess safety and security consequences, advise on strategies and potential penalties and financial exposures to Santos + Engage and oversee any specific sub teams or specialists required for Safety and Security support + Between meetings liaise with sub teams and specialist advisors to ensure an effective response. Ensure confidentiality and authorised comment is continually observed.

Santos CMT Role	Main Responsibilities
Human Resource Team Leader	+ Identify current and potential Human Resources (HR), People Support (PS) and Industrial Relations (IR) response, support (including incident site deployment) or regulatory issues + Determine if additional HR, PS or IR specialists are needed. If so, coordinate and monitor their implementation (via the IMT where active with the respective IMT Leader) and keep the CMT updated + Advise on and coordinate the personnel and next of kin communication approach across all levels of Santos with support from the Government and Public Affairs representative + Advise on HR, PS and IR recommendations and other considerations to support company sustainability and resilience + Monitor and report on any casualty condition, movement and health tracking to support injured parties (staff, contractors, and community as applicable) + Advise and coordinate management of HR, PS and IR stakeholders (via the IMT Leader where an IMT is active), including emergency services, union representation + Monitor any HR or IR consequences, advise on strategies and potential penalties and financial exposures to Santos + Engage and oversee any specific asset or sub teams used for HR, PS and IR stakeholder management + Between meetings liaise with asset and sub teams and specialist advisors to ensure an effective response. Ensure confidentiality and authorised comment is continually observed.
Legal & Company Secretariat	+ Identify current and potential legal and company secretary issues + Determine if additional legal specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated + Advise on Legal Professional Privilege matters for the CMT and coordinate with other groups (including IMT representation) to ensure company information and personnel are appropriately advised + Advise the CMT, asset and sub teams about contractual obligations, including Joint Venture and supply agreements, as required + Advise on legal and company secretariat recommendations and other considerations to support company sustainability and resilience + Advise on notifications to regulatory or legal related stakeholders, including mandatory advice or reports + Monitor and assess legal consequences, advise on strategies and potential penalties and financial exposures to Santos

Santos CMT Role	Main Responsibilities
Additional CMT support available as required – + Environment and Land Access + Assets and Operations + Engineering and Technical + Exploration + Finance + Information Systems + Insurance + Marketing and Trading + Treasury + Commercial and Procurement	

Table 5-2: Roles and Responsibilities in the Santos Management and Incident Management Team (IMT)

Santos Management / IMT Role	Main Responsibilities
Executive Vice President - Offshore Oil and Gas (EVPO)	+ Depending on the level of the incident, the EVPO (and/or their delegate) will act as the primary liaison to the CMT Duty Manager + On the activation of the IMT, the EVPO is advised by the Incident Commander
Incident Commander	+ Coordinate all onshore support in accordance with the Incident Response Plan (IRP) and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan + Set the response objectives and strategic direction + Oversee the development and implementation of Incident Action Plans + Oversee implementation of Memorandum of Understanding (MoUs) and contracted support for 'mutual aid' + Ensure co-ordination with external organisations/police, etc. + Prepare and review strategic and tactical objectives with the EVPO + Liaise with the EVP Offshore and provide factual information + Set response termination criteria in consultation with regulatory authorities + Coordinate authorities for search and rescue
Planning Team Leader	+ Collect and document situational awareness information of the incident + Develop, document, communicate and implement Incident Action Plans to achieve incident objectives + Determine the status of action/s or planned activities under the Incident Action Plans and assess and document performance against the objectives + Manage the Geographic Information System (GIS) Team in a response

Santos Management / IMT Role	Main Responsibilities
Operations Team Leader/Drilling Team Leader	+ Coordinate operational aspects of Incident Response + Provide the key contact for On-Scene Commanders + Liaise with contractors or third parties + Mobilise additional Santos staff and external experts to form Technical Support Team + Assist Planning Team Leader with overall general plan preparation and preparation of Incident Action Plans + Implement Incident Action Plans + Manage field response teams and activities
Public Information	+ Manage all communication with media & government + Prepare media releases for CMT approval + Ensure timely approve by CMT & release of communications briefs to the Crisis Call Centre
Logistics Team Leader	+ Mobilise response equipment, helicopters, vessels, supplies and personnel + Provide transport and accommodation for evacuated personnel + Oversee the implementation of the Waste Management Plan throughout a Tier 2 or Tier 3 oil spill response. + Liaise with the Supply Team to activate supply contracts and arrange procurements
Supply Team Leader	+ Arrange fast track procurement + Activate supply contracts as required + Implement and maintain Cost Tracking System to enable the tracking of all costs associated to the response of the incident
Environmental Team Leader	+ Manage notification to Designated Environmental Authorities and liaise as required + Assist in the development of Incident Action Plans + Advise on the Net Environmental Benefit Analysis of oil spill response strategies and tactics + Oversee the implementation of scientific monitoring programs in an oil spill response + Provide liaison for implementation of the WA Oiled Wildlife Response Plan in an oil spill response

Santos Management / IMT Role	Main Responsibilities
HR / Welfare Team Leader	+ Obtain personnel status involved in the incident + Review Persons on Board (POB) lists and clarify accuracy through Safety Team Leader + Obtain list of Contactor Companies involved in the incident and obtain 3rd-Party Contractor contact to advise of situation and safety of personnel when appropriate + Obtain employee's emergency contact list (NOK) to advise of situation and safety of personnel when appropriate + Liaise with the CMT HR Team Leader + Work with Logistics Team Leader to arrange transport for affected families to hospitals etc + Assist with arrangements through Employee Assistance Program (EAP) to support families/employees + Validate media and holding statements information with regards to personnel matters + Work with Public Information on content of internal statements to staff and approved by CMT + Put EAP on alert if appropriate + Work with Police welfare person or doctors as required + Be prepared to accompany police to provide initial company support + Arrange NOK notifications for affected personnel (excluding Police managed fatalities); + Determine NOK assistance required i.e. family travel to hospital, child support, etc; + Arrange for dedicated management support for families and next-of-kin, if appropriate; and + Arrange EAP counselling at airports and homes where required – HR personnel to attend where possible.
Safety Team Leader	+ Manage notification to Designated Safety Authorities and liaise as required + Assist in the development of IAPs + Oversee the development and implementation of incident Safety Management Plans as required + Work with the HR / Welfare Team Leader to support personnel safety
IMT Data Manager	+ Ensure IMT resources are in place and functional in the ICC + Oversee the setting up of communications systems + Establish the incident/exercise specific electronic folder system for records/information management + Distribute manuals, contact lists and supporting information to IMT personnel + Record and collect all information associated with the response to the incident + Maintain filing system for Incident Response

Santos Management / IMT Role	Main Responsibilities
GIS	+ Manage and keep up-to-date facility and asset drawings, data sets, and photos in the 'GIS in IMT Database' + Manage and keep up-to-date environmental features and sensitivity data sets in the 'GIS in IMT Database' + Manage and keep up-to-date marine maps in the 'GIS in IMT Database' + Provide IMT with quick access to up-to-date drawings and data sets in the ICC + Provide software system to IMT that allows tactical response mapping overlays on facility drawings and area maps
Finance	+ Handle accounting services and financial record-keeping, track and report on incident costs + Facilitate all procurement requirements and ensure that expenditures are properly audited + May be tasked with handling the receipt and processing of IMT third party claims.
Drilling/Source Control	+ Provide specific advice and support to the IMT on source control matters. + Activates and supervises drilling/source control elements in accordance with the Incident Action Plan (IAP) and directs its execution. + Directs dedicated source control equipment, requests or releases resources, approves group operational plans, and approves source control changes to the IAP as necessary.
Spill Response	+ Provide specific advice and support to the IMT on spill response matters, excluding source control. + Activates and supervises spill response elements in accordance with the Incident Action Plan (IAP) and directs its execution. + Directs dedicated spill response equipment, requests or releases resources, approves group operational plans, and approves spill response changes to the IAP as necessary.
Air Operations	+ Provide specific advice and support to the IMT on air operation matters. + Activates and supervises air operation elements in accordance with the Incident Action Plan (IAP) and directs its execution. + Directs dedicated air operations equipment, requests or releases resources, approves group operational plans, and approves air operations changes to the IAP as necessary.
Situation /Log Keeper	+ Maintain the IMT main event log. + Collate inputs from other IMT members into the main event log. + Assist with updating status boards, and other visual displays. + Collate IMT information on stand down.
Information Systems (IS)	+ Provide specific advice and support to the IMT on IS matters. + Activate and lead IS support resources as required.

Santos Management / IMT Role	Main Responsibilities
Subject Matter Expert	+ Provide specific advice to the IMT on your area of expertise. + Develop assessments and strategies to address the incident. + Activate and lead an SME support team as required.

Table 5-3: Roles and Responsibilities in the Field-Based Response Team

Field-Based Position	Main Responsibilities
On-Scene Commander (MODU)	+ Assess facility-based situations + Single point of communications between facility/site and IMT + Communicates the incident response actions and delegates actions to the Incident Coordinator + Manage the incidents in accordance with MODU IRP + Coordinates medical evacuations as required + Refer to the MODU IRP for detailed descriptions of roles and responsibilities
Company Site Representative (CSR)	+ Notifies the Perth based Incident Commander of oil spills + Coordinates onsite monitoring of oil spill and ongoing communication with Incident Commander
Off-Asset On Scene Commander	+ Coordinates the field response as outlined in the Incident Action Plan developed by the IMT + Commands a FOB for the coordination of resources mobilised to site
Off-Asset Oil Spill Response Teams	+ Respond to oil spills at sea to minimise the impacts to as low as reasonably practical + Refer to activity specific Oil Spill Contingency Plans (OSCP) and Oil Pollution Emergency Plans (OPEP) for detailed descriptions of roles and responsibilities within the Off-Asset Oil Spill Response Team
Source Control Team	+ Respond to incidents involving well loss of containment to stop the flow of oil to sea + Refer to the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) for detailed descriptions of roles and responsibilities within the Source Control Team
Oiled Wildlife Response Team	+ Respond to oiled wildlife incidents to minimise the impacts to wildlife + Refer to the Western Australia Oiled Wildlife Response Plan for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team
Scientific Monitoring Teams	+ Monitor the impacts and recovery to sensitive receptors from an oil spill and associated response actions + Refer to the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) for detail on Scientific Monitoring Team roles and responsibilities

Table 5-4: Department of Transport (DoT) roles embedded within Santos' IMT

DoT roles embedded within Santos IMT	Main Responsibilities
DoT Liaison Officer (prior to DoT assuming role of Control Agency) Deputy Incident Controller – State waters (after DoT assumes Controlling Agency)	+ Provide a direct liaison between the Santos IMT and the MEECC + Facilitate effective communications between DoT's State Maritime Environmental Emergency Coordinator (SMEEC) / Incident Controller and Santos IMT + Provide enhanced situational awareness to DoT of the incident and the potential impact on State waters + Assist in the provision of support from DoT to Santos + Facilitate the provision of technical advice from DoT to Santos Incident Commander as required
Media Liaison Officer	+ Provide a direct liaison between the Santos Media team and DoT IMT Media team + Facilitate effective communications and coordination between the Santos and DoT media teams + Assist in the release of joint media statements and conduct of joint media briefings + Assist in the release of joint information and warnings through the DoT Information & Warnings team + Offer advice to the Santos Media Coordinator on matters pertaining to DoT and wider Government media policies and procedures

Table 5-5: Santos Personnel Roles Embedded within the State Maritime Environmental Emergency Coordination Centre (MEECC)/ Department of Transport (DOT) IMT

Santos roles embedded within the State MECC/ DoT IMT	Main Responsibilities
IMT Liaison Officer	+ Provide a direct liaison between the Santos IMT and the State MEECC + Facilitate effective communications and coordination between the Santos IMT Leader and the SMEEC + Offer advice to SMEEC on matters pertaining to Santos crisis management policies and procedures
Deputy Incident Controller	+ Provide a direct liaison between the DoT IMT and the Santos IMT + Facilitate effective communications and coordination between the Santos Incident Commander and the DoT Incident Controller + Offer advice to the DoT Incident Controller on matters pertaining to the Santos incident response policies and procedures + Offer advice to the Safety Coordinator on matters pertaining to Santos safety policies and procedures particularly as they relate to Santos employees or contractors operating under the control of the DoT IMT
Deputy Intelligence Officer	+ As part of the Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situation and awareness + Facilitate the provision of relevant modelling and predications from the Santos IMT

Santos roles embedded within the State MECC/ DoT IMT	Main Responsibilities
	+ Assist in the interpretation of modelling and predictions originating from the Santos IMT + Facilitate the provision of relevant situation and awareness information originating from the DoT IMT to the Santos IMT + Facilitate the provision of relevant mapping from the Santos IMT + Assist in the interpretation of mapping originating from the Santos IMT + Facilitate the provision of relevant mapping originating from the Santos IMT
Deputy Planning Officer	+ As part of the Planning Team, assist the DoT Planning Officer in the performance of their duties in relation to the interpretation of existing response plans and the development of incident action plans and related sub plans + Facilitate the provision of relevant IAP and sub plans from the Santos IMT + Assist in the interpretation of the Santos OPEP from Santos IMT + Assist in the interpretation of the Santos WA IAP and sub plans from the Santos IMT + Facilitate the provision of relevant IAP and sub plans originating from the DoT IMT to the Santos IMT + Assist in the interpretation of Santos' existing resource plans + Facilitate the provision of relevant components of the resource sub plan originating from the DoT IMT to the Santos IMT (Note this individual must have intimate knowledge of the relevant Santos OPEP and planning processes)
Environment Support Officer	+ As part of the Intelligence Team, assist the Environment Coordinator in the performance of their duties in relation to the provision of environmental support into the planning process + Assist in the interpretation of the Santos OPEP and relevant Tactical Response Plans (TRPs) + Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the Santos IMT + Facilitate the provision of relevant environmental information and advice originating from the DoT IMT to the Santos IMT
Deputy Public Information Officer	+ As part of the Public Information Team, provide a direct liaison between the Santos team and DoT IMT Media team + Facilitate effective communications and coordination between Santos and DoT media teams + Assist in the release of joint media statements and conduct of joint media briefings + Assist in the release of joint information and warnings through the DoT Information & Warnings team + Offer advice to the DoT Media Coordinator on matters pertaining to Santos media policies and procedures

Santos roles embedded within the State MECC/ DoT IMT	Main Responsibilities
	+ Facilitate effective communications and coordination between Santos and DoT Community Liaison teams + Assist in the conduct of joint community briefings and events + Offer advice to the DoT Community Liaison Coordinator on matters pertaining to Santos community liaison policies and procedures + Facilitate the effective transfer of relevant information obtained from through the Contact Centre to the Santos IMT
Deputy Logistics Officer	+ As part of the Logistics Team, assist the Logistics Officer Supply in the performance of their duties in relation to the provision of the management and disposal of waste collected in State-waters. + Facilitate the acquisition of appropriate supplies through Santos's existing OSRL, AMOSC and private contract arrangements + Collects Request Forms from DoT to action via the Santos IMT (Note this individual must have intimate knowledge of the relevant Santos logistics processes and contracts)
Deputy Waste Management Co-ordinator	+ As part of the Logistics Team, assist the Logistics Officer Supply in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters; + Facilitate the acquisition of appropriate services and supplies through Santos' existing private contract arrangements related to waste management; and + Collects Waste Collection Request Forms from DoT to action via the Santos IMT.
Deputy Finance Officer	+ As part of the Finance Team, assist the Finance Officer in the performance of their duties in relation to the setting up and payment of accounts for those services acquired through Santos' existing OSRL, AMOSC and private contract arrangements + Facilitate the communication of financial monitoring information to the Santos to allow them to track the overall cost of the response + Assist the Finance Officer in the tracking of financial commitments through the response, including the supply contracts commissioned directly by DoT and to be charged back to Santos
Deputy Operations Officer	+ As part of the Operations Team, assist the Operations Officer in the performance of their duties in relation to the implementation and management of operational activities undertaken to resolve an incident; + Facilitate effective communications and coordination between the Santos Operations Section and the DoT Operations Section; + Offer advice to the DoT Operations Officer on matters pertaining to Santos incident response procedures and requirements; and + Identify efficiencies and assist to resolve potential conflicts around resource allocation and simultaneous operations of Santos and DoT response efforts.

Santos roles embedded within the State MECC/ DoT IMT	Main Responsibilities
Deputy Division Commander (FOB)	+ As part of the Field Operations Team, assist the Division Commander in the performance of their duties in relation to the oversight and coordination of field operational activities undertaken in line with the IMT Operations Section's direction; + Provide a direct liaison between Santos' FOB/s and the DoT FOB; + Facilitate effective communications and coordination between Santos FOB Operations Commander and the DoT FOB Operations Commander + Offer advice to the DoT FOB Operations Commander on matters pertaining to Santos incident response policies and procedures + Assist the Safety Coordinator deployed in the FOB in the performance of their duties, particularly as they relate to Santos employees or contractors + Offer advice to the Senior Safety Officer deployed in the FOB on matters pertaining to Santos safety policies and procedures

5.2 Regulatory Arrangements and External Support

5.2.1 Australian Marine Oil Spill Centre (AMOSC)

Santos is a Participating Company of AMOSC and as such has access to AMOSC's Level 2/3 equipment and personnel as outlined in the AMOSPlan.

AMOSC has contracts with all its member companies to enable the immediate release of Core Group personnel to be made available for any Santos WA requirements, as outlined in Santos' *Master Service Contract* and *Principle and Agency Agreement* with AMOSC.

Oil spill response resources of individual companies are made available to other companies under AMOSPlan mutual aid agreement administered by AMOSC. To further enhance the mutual aid arrangements, Santos, BHPB and Woodside have signed a MOU that defines the group's mutual aid arrangements. Under this MoU, Santos, BHPB and Woodside have agreed to use their reasonable endeavours to assist in the provision of emergency response services, personnel, consumables and equipment.

5.2.2 Australian Maritime Safety Authority (AMSA)

AMSA is the designated Control Agency for oil spills from vessels within Commonwealth jurisdiction.

Upon notification of an incident involving a ship, AMSA will assume control of the incident and response in accordance with AMSA's Marine Pollution Response Plan. AMSA's Marine Pollution Response Plan is the operational response plan for the management of ship-source incidents. AMSA is to be notified immediately of all ship-source incidents through Rescue Coordination Centre (RCC) Australia using the Incident Response Telephone Directory (SO-00-ZF-00025.020).

A MOU has been established between Santos and AMSA, outlining respective roles and responsibilities when responding to vessel-sourced marine pollution incidents and petroleum activity related marine pollution incidents.

AMSA manages the NatPlan, Australia's key maritime emergency contingency and response plan. All resources under the NatPlan are available to Santos through request to AMSA under the arrangements of the MoU.

For any oil pollution event, Santos agrees to notify AMSA immediately in the interests of facilitating the most efficient and effective response to the incident.

5.2.3 WA Department of Transport (DoT)

In the event that a Level 2/3 Marine Oil Pollution Incident enters, or has potential to enter, State waters, the Hazard Management Agency (HMA) (DoT Marine Safety General Manager or proxy) will take on the role as the SMEEC and DoT will take on the role as a Control Agency.

Santos will notify the DoT Maritime Environmental Emergency Response (MEER) unit as soon as reasonably practicable (within 2 hours of spill occurring) of such an incident. On notification, the HMA will activate their MEECC and the DoT IMT.

For oil spills entering State waters (i.e. across jurisdictions) both Santos and DoT will be Control Agencies. Santos will work in partnership with DoT during such instances, as outlined within the DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements Available online: DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements.

Santos will conduct initial response actions in State waters as necessary in accordance with its OPEP and continue to manage those operations until formal handover of incident control is completed. Appendix 1 within DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements provides a checklist for formal handover.

For a cross-jurisdictional response, there will be a Lead IMT (DoT or Santos) for each spill response activity, with DoT's control resting primarily for State waters activities.

Appendix 2 within DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements provides guidance on the allocation of a Lead IMT to response activities for a cross jurisdictional spill.

To facilitate coordination between DoT and Santos during a cross jurisdictional response, a Joint Strategic Coordination Committee (JSCC) will be established. The JSCC will be jointly chaired between the SMEEC and a nominated senior representative of Santos and will ensure alignment of objectives and provide a mechanism for de-conflicting priorities and resourcing requests.

For a cross jurisdictional response Santos will be responsible for ensuring adequate resources are provided to DoT as Control Agency, initially 11x personnel to fill roles in the DoT IMT or FOB (refer **Section 5.1**) and operational personnel to assist with those response strategies where DoT is the Lead IMT. Santos CMT Liaison Officer and the Deputy Incident Controller are to attend the DoT Fremantle ICC as soon as possible after the formal request has been made by the SMEEC. It is an expectation that the remaining initial cohort will attend the DoT Fremantle ICC no later than 8am on the day following the request being formally made to Santos by the SMEEC.

Figure 5-2 shows the organisational structure of Santos incident management personnel within Santos IMT and embedded within DoT's MEECC/IMT.

Figure 5-3 shows the overall cross jurisdictional organisational structure referenced from the SHP-MEE.

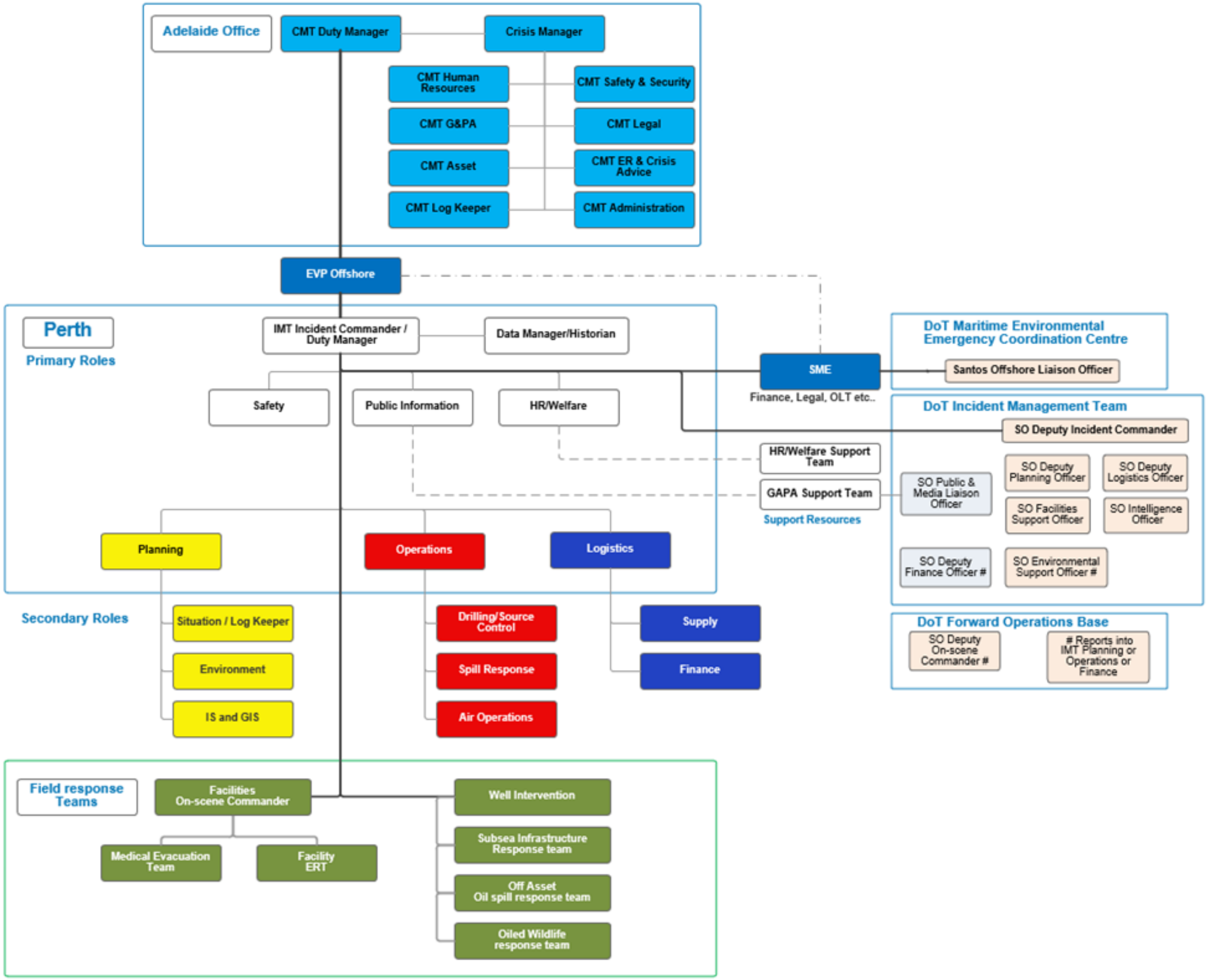

Figure 5-2: Cross jurisdictional incident management structure for Commonwealth waters Level 2/3 facility oil pollution incident entering State waters

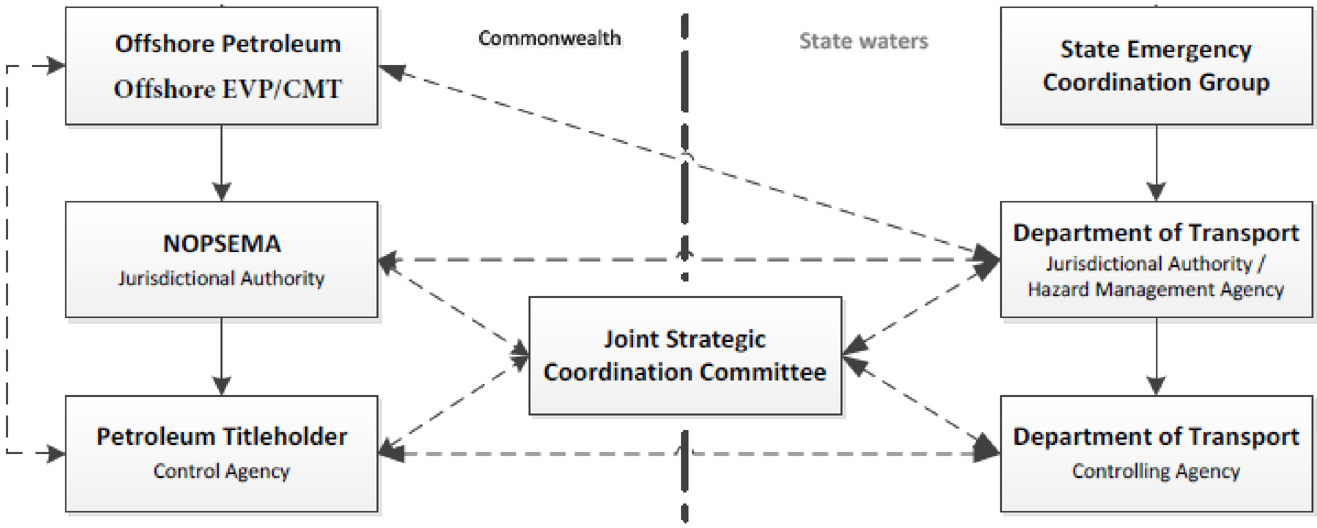

Figure 5-3: Overall Control and Coordination Structure Offshore Petroleum Cross Jurisdiction Incident

5.2.4 WA Department of Biodiversity, Conservation and Attractions (DBCA)

The Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) has responsibilities associated with wildlife and activities in national parks, reserves and State marine parks. The *Biodiversity Conservation Act 2016* (WA) is the legislation that provides DBCA with the responsibility and Statutory Authority to treat, protect and destroy wildlife. In State waters, DBCA is the Jurisdictional Authority for Oiled Wildlife Response (OWR), providing advice to the Control Agency (DoT). The role of DBCA in an OWR is outlined in the Western Australian Oiled Wildlife Response Plan (WAOWRP) and regional sub-plans.

For a Level 2/3 petroleum spill that originates within or moves into State waters, DoT will be the Control Agency responsible for overall command of an oiled wildlife response. Santos will provide all necessary resources (equipment and personnel primarily through AMOSC membership) to DoT to facilitate this response.

For matters relating to environmental sensitivities and scientific advice in State waters DBCA may provide an Environmental Scientific Coordinator (ESC) to support the State Maritime Environmental Emergency Coordinator and/or DoT Incident Controller.

This may include advice on priorities for environmental protection, appropriateness of proposed response strategies and the planning and coordination of scientific monitoring for impact and recovery assessment.

5.2.5 Oil Spill Response Limited (OSRL)

Through an associate membership, Santos has access to spill response services from OSRL with offices in Perth, Singapore, UK and at other various locations around the world. In the event of a Level 2/3 response, Santos WA could access OSRL's international personnel, equipment and dispersants, primarily through OSRL's Singapore stockpile, to supplement resources available within Australia. Santos may also call on OSRL for technical services to support its IMT.

Response equipment and personnel are allocated on a 50% of inventory basis under OSRL's Service Level Agreement (SLA).

5.2.6 Department of Industry, Science, Energy and Resources (DISER)

The Department of Industry, Science, Energy and Resources (DISER) will be the lead Commonwealth Agency for the provision of strategic oversight and Commonwealth government support to a significant offshore petroleum incident (including oil spill incidents). DISER will be notified by NOPSEMA of a significant oil pollution` incident and under the Offshore Petroleum Incident Coordination Framework will stand up the Offshore Petroleum Coordination Committee as the mechanism to provide Commonwealth strategic advice and support to the incident. To facilitate information between the Petroleum Titleholder IMT and Oil Pollution Incident Command Centre (OPICC), Liaison Officer/s will be deployed from DISER to the Petroleum Titleholders IMT.

For incidents that are classified at a greater level that Significant (i.e. Crisis level) a whole of government crisis committee will be formed under the Australian Government Crisis Management Framework to provide strategic advice and support and the OPICC will not be convened, although DISER will remain as the lead agency.

5.3 External Plans

Information from the following external documents have been used or referred to within this Plan:

+ AMOSPlan – Australian Industry Cooperative Spill Response Arrangements
  - Details the cooperative arrangements for response to oil spills by Australian oil and associated industries.
+ Offshore Petroleum Incident Coordination Framework - provides overarching guidance on the Commonwealth Government’s role and responsibilities in the event of an offshore petroleum incident in Commonwealth waters
+ NatPlan - National Plan for Maritime Environmental Emergencies and National Marine Oil Spill Contingency Plan
  - Sets out national arrangements, policies and principles for the management of maritime environmental emergencies. The Plan provides for a comprehensive response to maritime environmental emergencies regardless of how costs might be attributed or ultimately recovered.
+ SHP - MEE – Western Australia State Hazard Plan for Maritime Environmental Emergencies
  - Details the management arrangements for preparation and response to a marine pollution incident occurring in State waters.
+ DoT Oil Spill Contingency Plan
  - Defines the steps required for the management of marine oil pollution responses that are the responsibility of the DoT.
  - DoT’s Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (available online: DoT’s Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements.).
+ Shipboard Oil Pollution Emergency Plans (SOPEP)
  - Under International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I requirements, all vessels of over 400 gross tonnage are required to have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill including steps taken to contain the source with equipment available onboard the vessel.
+ Western Australia Oiled Wildlife Response Plan (WAOWRP)

- Defines the steps, personnel, equipment and infrastructure required for the management of wildlife in an oil pollution response. Each region has a Regional Oiled Wildlife Response Plan that gives further details on sensitivities and available resources. The Pilbara Region Oiled Wildlife Response Plan is the relevant regional plan for OWR associated with the Activity.

+ Oil Spill Response Limited (OSRL) Associate Agreement
  - Defines the activation and mobilisation methods of OSRL spill response personnel and equipment allocated under contract.
+ Australian Government Coordination Arrangements for Maritime Environmental Emergencies
  - Provides a framework for the coordination of Australian Government departments and agencies in response to maritime environmental emergencies.

5.4 Cost Recovery

As required under Section 571(2) of the *OPGGS Act 2006*, Santos has financial assurances in place to cover any costs, expenses and liabilities arising from carrying out its Petroleum Activities, including major oil spills. This includes costs incurred by relevant Controlling Agencies (e.g. DoT) and third party spill response service providers.

5.5 Training and Exercises

5.5.1 Incident Management Team Training and Exercises

Santos provides training to its personnel to fill all required positions within the IMT.

Competency is maintained through participation in regular response exercises and workshops. Exercise and training requirements for Santos IMT members are summarised in **Table 5-6**.

Table 5-6: Training and Exercise Requirements for IMT Positions

IMT Role	Exercise	Training
Incident Commander Operations/ Drilling Team Leader	1 x Level 2 exercise annually or 2 x Level 2 desktop exercises annually.	+ PMAOMIR320; + PMAOMIR418; and + AMOSC – IMO3 Oil Spill Command & Control;
Planning Team Leader Logistics Team Leader Environmental Team Leader		+ PMAOMIR320; and + AMOSC – IMO2 Oil Spill Management Course
Safety Team Leader Supply Team Leader GIS Team Leader Data Manager HR/ Welfare Team Leader		+ PMAOMIR320; and + AMOSC – Oil Spill Response Familiarisation Training

5.5.2 Oil Spill Responder Training

Santos has an internal capability of trained oil spill responders who can be deployed in the field in a spill response and has access to external, trained spill responder resources (**Table 5-7)**.

Table 5-7: Spill Responder Personnel Resources

Responder	Role	Training	Available Number
Santos AMOSC Core Group Responders	Santos personnel trained and competency assessed by AMOSC as the AMOSC Core Group. Deployed by IMT for spill response operations	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 Oil Spill Operators Course	12
Santos Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircrafts.	AMOSC – Aerial Surveillance Course (refresher training undertaken tri-annually).	7
AMOSC Core Group Oil Spill Responders	Industry personnel as the AMOSC Core Group, available to Santos under the AMOSPlan. For providing incident management (IMT) and operations (field response) assistance.	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 Oil Spill Operators Course and/or IMO2 Oil Spill Management Course.	As defined in Core Group Member Reports Min. 84 Max. 140 (incl. Santos).
OSRL Oil Spill Response Personnel	Oil Spill Response Ltd professionals, providing technical, incident management and operational advice and assistance available under Santos OSRL contract.	As per OSRL training and competency matrix.	18
AMOSC Oil Spill Response Specialists	Professionals providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract.	As per AMOSC training and competency matrix.	8
Oiled Wildlife Response Roles (Level 5)	Refer OPEP **Section 15** and **Appendix M**.		
Monitoring Service Provider: Monitoring Coordination Team (MCT) and SMP Teams	MCT SMP Teams: Technical Advisers Field Team Leader Field Team Member	As defined in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Capability defined in Monthly Capability Reports. MCT – 5 personnel SMP Teams 12+ per team
Level 1 Oiled Wildlife	Provide oiled wildlife support activities under supervision.	No previous training required; on the job training provided.	Nominally over 1,000.

Responder	Role	Training	Available Number
Responders (Workforce Hire)			
Shoreline clean-up personnel (Workforce Hire)	Manual clean-up activities under supervision.		

In addition to the resources listed in **Table 5-7**, the following resources are available for spill response and may be activated by the relevant Controlling Agency:

- National Plan: National Response Team (NRT) – Trained oil spill response specialists, including aerial observers and shoreline clean-up personnel, deployed under the direction of AMSA and the IMT in a response. The NRT is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA, 2013b); and
- State Hazard Plan for Maritime Environmental Emergencies (SHP – MEE): State Response Team (SRT)– Oil pollution response team available to assist under the jurisdiction of the DoT. SRT members remain trained and accredited in line with the SHP - MEE requirements.

In the event of a spill, the trained spill responders listed in **Table 5-7** would be required to undertake various roles in key spill response operations, including operational monitoring, shoreline protection, shoreline clean-up, oiled wildlife response and scientific monitoring.

In the event of a spill, Team Leader roles for protection and deflection and shoreline clean-up would be filled through Santos AMOSC Core Group Responders and then industry Core Group Responders.

5.5.3 Response Testing

Following acceptance of an OPEP, notification arrangements of the plan are tested through a communications test to all external agencies and companies with roles defined within the plan. The communications tests are repeated annually for activities that extend longer than 1 year.

Oil spill response arrangements are tested annually as outlined within the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001). Exercises and workshops clarify and familiarise incident and crisis management roles with their responsibilities within OPEPs and other Emergency Plans. Santos conducts oil spill scenario-based exercises and workshops involving Santos' main operating facilities or drilling activities. These exercise and workshops test the chain of command of the Santos response system, communications and notification with external parties, communication processes between office and facility, and field response tactics.

Testing of key response provider arrangements is done as part of larger exercises or as standalone tests where the capability and availability of resources through the response provider are assessed against the performance requirement.

Field deployment tests are undertaken by Santos as a sole responder and through Santos' involvement in multi-operator response deployment exercises.

5.5.4 Testing Schedule

Oil spill specific training, exercises, workshops and tests are detailed in the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001). Once completed, records of exercises and workshops are entered into the Santos EHS Toolbox. Key actions arising from exercises are recorded and tracked through the Santos EHS Toolbox. Progress of training, exercise and workshop completion against the schedule is tracked and reported against on a monthly basis.

The Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001) is reviewed and revised annually.

5.5.5 Oil Spill Response Audits

Oil spill response audits will follow the Santos Assurance Management Standard (SMS-MS15.1) and are scheduled as per the Santos Assurance Schedule (QE-910HA-20002). Audits will assist in identifying and addressing any deficiencies in systems and procedures. At the conclusion of the audit, any opportunities for improvement and/or corrective actions required (non-conformances) will be formally noted and discussed, with corrective actions developed and accepted. In some instances, audits may conclude with potential amendments to the OPEP.

The deployment readiness and capability of AMOSC's oil spill response equipment and resources in Geelong and Fremantle are audited every two years under the direction of AMOSC's participating members. The intent of this audit is to provide assurances to Santos and associated members about AMOSC's ability to respond to an oil spill incident as per the methods and responsibilities defined in Oil Pollution Emergency Plans and AMOSC's Service Level Statement.

The deployment readiness and capability of OSRL's oil spill response equipment and personnel in Singapore are audited every two years by the Emergency & Oil Spill Coordinator. The intent of this audit is to provide assurances to Santos of OSRL's ability to respond to an oil spill incident as per the methods and responsibilities defined in Santos' Oil Pollution Emergency Plans and OSRL's SLA.

The objectives and frequency of oil spill response testing and auditing relevant to the Activity oil spill response are summarised in **Table 5-8.**

Table 5-8: Oil Spill Response Testing Arrangements

Exercise	Objective	Frequency	Recording and review
Communication Test	To test all communication and notification processes to service providers and regulatory agencies defined within the OPEP.	Required for every approved OPEP. When response arrangements have changed. At least annually.	Any results of the test are recorded in a Test Report. Corrections are updated within the Incident Response Telephone Directory (SO-00-ZF-00025.020)
IMT Workshops	To refresh IMT roles and responsibilities and provide familiarisation with OPEP processes and arrangements.	As per Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)	All workshops undertaken are recorded in Santos' EHS Toolbox.
OPEP Desktop and Activation Exercise	To familiarise IMT with functions and process in response to a simulated oil spill scenario	As per Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)	All exercises undertaken are recorded in Santos' EHS Toolbox. Key recommendations are recorded are tracked in Santos EHS Toolbox

Exercise	Objective	Frequency	Recording and review
Response arrangement tests	Tests of response arrangements outlined within the OPEP either as part of desktop/ activation exercises or as standalone desktop tests.	Annually as per Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)	Test reports are recorded
Equipment deployment exercises/ tests	To focus on Santos' deployment capability. To inspect and maintain the condition of the Santos oil spill response equipment. To maintain training of field response personnel.	When new response equipment is added. Annually as per Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001) The following Santos-owned equipment is inspected and/or tested + Tracker buoys + Offshore boom/ nearshore boom + Power packs	Reports are generated for deployment exercises and recorded in Santos' EHS Toolbox. Key recommendations are recorded are tracked in Santos EHS Toolbox Tracker Buoy tests are recorded.
AMOSC audit	To test deployment readiness and capability of AMOSC.	Every 2 years.	Undertaken by two of AMOSC's participating members and the audit report made available to members.
OSRL Audit	To test deployment readiness and capability of OSRL in Singapore.	Every 2 years.	Undertaken by Santos or in coordination/ consultation with other member company. Recommendations provided to OSRL for action and close-out.

6 Response Strategy Selection

6.1 Spill Scenarios

This OPEP outlines strategies, actions and supporting arrangements applicable for all credible oil spill events associated with Dancer-1 drilling activities. Of the credible spill scenarios identified in the Dancer-1 Exploration Drilling EP (SO-00-BI-20002), a sub-set have been selected to represent worst case spills from a response perspective taking into account the following characteristics:

+ They represent all hydrocarbon types that could be spilt during the activity;
+ They represent maximum credible release volumes;
+ Those scenarios that represent the greatest spatial extent from a response perspective based on surface oil and shoreline accumulation as these are the key factors contributing to response; and
+ Proximity to sensitive receptors, shorelines, State/Commonwealth boundaries etc.

The worst case credible spill risks selected to inform this OPEP are presented in **Table 6-1**. Detail on the derivation of these maximum credible spills is provided within the Dancer-1 Exploration Drilling EP (SO-00-BI-20002).

For a description of the characteristics and behaviour associated with hydrocarbons that may unintentionally be released refer to **Appendix A**.

Table 6-1: Maximum credible spill scenarios for Dancer-1 Activity

Maximum Credible Spill Scenario	Hydrocarbon Type	Maximum Credible Volume	Release duration
Surface release of MDO from refuelling of the MODU or from the MODU or vessel as a result of an external impact (vessel collision) which ruptures an MDO tank.	MDO	329 m^3 of MDO as a result of a vessel collision	0.5 hours
Subsea release of gas-condensate from a loss of well control	Reindeer condensate	273,130 STB (43,423 m^3) liquid condensate and 54,618 MMscf (1,547 million sm^3) gas at the seabed	77 days
Surface release of gas-condensate from a loss of well control		271,436 STB (43,153 m^3) liquid condensate and 54,289 MMscf (1,537 million sm^3) gas at the sea surface	77 days

6.2 Response Planning Thresholds

Environmental impact assessment thresholds are addressed in **Section 7.1.5** of the EP. In addition to the environmental impact assessment thresholds, response thresholds have been developed for response planning to determine the conditions that response strategies would be effective. These are shown in **Table 6-2**.

Table 6-2: Surface Hydrocarbon Thresholds for Response Planning

Hydrocarbon concentration (g/m^2)	Description
>1	+ Estimated minimum threshold for commencing some scientific monitoring components (refer to **Appendix O**)
>50	+ Estimated minimum floating hydrocarbon threshold for containment and recovery and surface dispersant application + *Note: Containment and recovery and surface dispersant application are not applicable spill response strategies under this OPEP.*
>100	+ Estimated floating hydrocarbon threshold for effective containment and recovery and surface dispersant application + Estimated minimum shoreline accumulation threshold for shoreline clean-up + *Note: Containment and recovery and surface dispersant application are not applicable spill response strategies under this OPEP.*

Containment and recovery effectiveness drops significantly with reduced oil thickness (McKinney and Caplis, 2017; NOAA, 2013). McKinney and Caplis (2017) tested the effectiveness of various oil skimmers at different oil thicknesses. Their results showed that the oil recovery rate of skimmers dropped significantly when oil thickness was less than 50 g/m^2.

Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50-100 g/m^2 on the sea surface. EMSA (2010) recommends thin layers of spilled hydrocarbons should not be treated with dispersant. This includes Bonn Agreement Oil Appearance Codes (BAOAC) 1-3 (EMSA, 2010).

6.3 Stochastic Spill Modelling Results

Table 6-3 presents the spill modelling results at Protection Priority locations for selected worst-case scenarios. All scenarios were modelled using a stochastic approach running multiple simulations (150 simulations) across all seasons using a number of unique environmental conditions sampled from historical metocean data.

As detailed in **Section 7.1.3.2** of the EP, Grader C was selected as the modelling analogue for Reindeer Condensate. The most recent assay information for Reindeer (June 2019) was primarily used to make the selection, however the properties of the February and April 2012 assays were also considered.

Marine Diesel (IKU) within the SINTEF Oil Library is the appropriate analogue for modelling MDO spills.

For the purpose of spill response preparedness, outputs relating to floating oil and oil accumulated on the shoreline are most relevant (i.e. oil that can be diverted, contained, collected or dispersed through the use of spill response strategies) for the allocation and mobilisation of spill response resources. Therefore, these are the results presented in this OPEP for primary consideration.

Modelling results for dissolved and entrained oil for the worst case scenarios have not been included given there are limited response strategies that will reduce subsurface impacts.

Refer to **Section 7.1.5** of the EP for further description on selection of oil exposure values presented in **Table 6-3**.

Table 6-3: Worst-case Spill Modelling Results for Dancer-1 Exploration Drilling activities

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation> 10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Loss of well control (LOWC) – Surface Release Scenario								
Clerke Reef MP	N/A	N/A	15.3	32.1	NC	NC	NC	NC
Imperieuse Reef MP	N/A	N/A	28.0	31.0	NC	NC	NC	NC
Dampier Archipelago	N/A	N/A	25.3	12.9	2.0	32.3	1.1	3.5
Northern Islands Coast	N/A	N/A	5.3	43.0	NC	NC	NC	NC
Montebello Islands	6.0	2.1	75.3	2.2	27.3	2.2	338.7	28.4
Lowendal Islands	2.0	12.9	18.7	12.9	4.7	12.9	34.3	3.5
Barrow Island	3.3	13.5	76.0	5.4	37.3	9.8	6.1	14.2
Middle Islands Coast	N/A	N/A	0.7	34.3	NC	NC	NC	NC
Barrow-Montebello Surrounds	6.0	1.8	N/A	N/A	N/A	N/A	N/A	N/A

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation> 10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Thevenard Islands	N/A	N/A	28.7	14.7	1.3	38.9	0.8	3.5
Southern Islands Coast	N/A	N/A	48.7	7.4	24.7	7.4	4.1	10.6
Muiron Islands	N/A	N/A	57.3	8.5	15.3	8.5	3.7	10.6
Exmouth Gulf Coast	N/A	N/A	0.7	59.9	NC	NC	NC	NC
Ningaloo Coast North	N/A	N/A	58.7	16.4	NC	NC	NC	NC
Ningaloo Coast South	N/A	N/A	16.0	38.3	NC	NC	NC	NC
Outer Shark Bay Coast	N/A	N/A	4.7	59.2	NC	NC	NC	NC
Abrolhos Islands Pelsaert Group	N/A	N/A	0.7	74.8	NC	NC	NC	NC
Bedout Island	N/A	N/A	1.3	31.2	NC	NC	NC	NC
Montebello AMP	30.7	1.1	N/A	N/A	N/A	N/A	N/A	N/A
Loss of well control (LOWC) – Subsea Release Scenario								
Clerke Reef MP	N/A	N/A	11.3	28.8	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation> 10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Imperieuse Reef MP	N/A	N/A	20.7	24.1	NC	NC	NC	NC
Dampier Archipelago	N/A	N/A	24.7	15.5	2.7	26.5	1.2	3.5
Northern Islands Coast	N/A	N/A	2.7	31.2	NC	NC	NC	NC
Montebello Islands	N/A	N/A	73.3	2.2	30.0	2.2	77.1	31.9
Lowendal Islands	N/A	N/A	20.0	9.1	8.0	12.9	8.8	3.5
Barrow Island	N/A	N/A	77.3	6.1	30.0	8.9	7.6	14.2
Middle Islands Coast	N/A	N/A	0.7	33.7	NC	NC	NC	NC
Thevenard Islands	N/A	N/A	20.7	12.5	0.7	29.5	0.7	3.5
South Islands Coast	N/A	N/A	50.0	7.9	20.0	9.4	4.6	7.1
Muiron Islands	N/A	N/A	54.7	8.5	10.0	8.5	2.7	10.6
Exmouth Gulf Coast	N/A	N/A	3.3	33.3	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation> 10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Ningaloo Coast North	N/A	N/A	52.0	14.6	NC	NC	NC	NC
Ningaloo Coast South	N/A	N/A	14.7	36.3	NC	NC	NC	NC
Outer Shark Bay Coast	N/A	N/A	3.3	49.0	NC	NC	NC	NC
Bedout Island	N/A	N/A	0.7	73.6	NC	NC	NC	NC
Marine Diesel Oil (MDO)								
Dampier Archipelago	N/A	N/A	1.3	2.5	0.7	2.5	0.6	1.4
Northern Islands Coast	N/A	N/A	0.7	5.5	NC	NC	NC	NC
Montebello Islands	1.3	1.8	2.0	6.6	0.7	6.6	152.9	25.5
Barrow Island	N/A	N/A	2.7	4.8	NC	NC	NC	NC
Southern Islands Coast	N/A	N/A	1.3	5.5	NC	NC	NC	NC
Glomar Shoals	6.7	2.3	N/A	N/A	N/A	N/A	N/A	N/A
Rankin Bank	0.7	3.3	N/A	N/A	N/A	N/A	N/A	N/A

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation> 10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Barrow-Montebello Surrounds	2.0	1.8	N/A	N/A	N/A	N/A	N/A	N/A
Montebello AMP	22.7	0.7	N/A	N/A	N/A	N/A	N/A	N/A
Offshore Ningaloo	7.3	3.2	N/A	N/A	N/A	N/A	N/A	N/A

6.4 Evaluation of Applicable Response Strategies

Based on the nature and scale of the credible spill scenarios outlined in **Section 6.1** and spill modelling results (**Sections 6.3**) the following spill response strategies have been assessed as potentially applicable for combatting a spill (**Table 6-4**).

Note: The information contained in **Table 6-4** has been developed by Santos for preparedness purposes. Santos may not be the Control Agency or Lead IMT for implementing a spill response. For example, for Level 2/3 spills within or entering State waters, DoT will ultimately determine the strategies and controls implemented for most State water activities with Santos providing resources and planning assistance.

Table 6-4: Evaluation of Applicable Response Strategies

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Reindeer Condensate	MDO	
Source Control	Spill kits	✔ 1	✔ 1	Relevant for containing spills that may arise on board a vessel or MODU.
	Secondary containment	✔ 1	✔ 1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel or MODU. Bunded areas will contain hydrocarbons reducing the potential for a spill escaping to marine waters. Where applicable open deck drainage will be closed to prevent hydrocarbon draining into marine environment.
	Shipboard Oil Pollution Emergency Plan (SOPEP)	✔ 1	✔ 1	MARPOL requirement for applicable vessels. In the event a vessel hydrocarbon storage tank is ruptured, applicable strategies for reducing the volume of hydrocarbon releases will be contained within the vessel SOPEP. This may include securing cargo via transfer to another storage area on-board the vessel, transfer to another vessel, or through pumping in water to affected tank to create a water cushion (tank water bottom). Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will aim to minimise the volume of fuel spilt.
	Surface well kill	✔ 1	X	Considered during relief well planning but may not be possible depending upon technical and safety constraints. Surface well kill is only considered when the estimated leak rate is small enough not to generate an explosive gas cloud and access to the MODU is still preserved. This methodology would not be considered should safe access to the MODU or ability to operate a vessel alongside the MODU not be achievable.
	Capping Stack	X	X	A subsea Capping Stack response strategy is not applicable given the petroleum activity will take place from a jack-up MODU. Under a credible loss of well control event subsea there is no connection points for Capping Stack installation.
	Relief well drilling	✔ 1	X	Relevant to loss of well control. Relief well drilling is the primary method for killing the well if access to the MODU is not preserved. To be conducted as per the Santos Source

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Reindeer Condensate	MDO	
				Control Emergency Planning and Response Plan Guideline (DR-00-OZF-20001) and Dancer-1 Source Control Plan (DR-00-BW-20007).
In-Situ Burning	Controlled burning of oil spill	X	X	Not applicable to gas wells due to safety hazards. Not applicable to diesel spills due to inability to contain marine diesel making it very difficult to maintain necessary slick thickness for ignition and sustained burning.
Monitor and Evaluate Plan (Operational Monitoring)	Vessel Surveillance	✓ 1	✓ 1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). Informs implementation of other response strategies. Vessel personnel may not be trained observers. Vessel observers on leaking vessel may not have capacity to observe oil during emergency response procedure implementation. Constrained to daylight. Limited to visual range from the vessel. Limited capacity to evaluate possible interactions with sensitive receptors.
	Aerial Surveillance			Provides real-time information on spill trajectory and behaviour (e.g. weathering). May identify environmental sensitivities impacted or at risk of impact (e.g. seabird aggregations, other users such as fishers). Informs implementation of other response strategies.
	Tracking buoys			Can be implemented rapidly. Can provide indication of near-surface entrained / dissolved hydrocarbons (most other monitor and evaluate techniques rely on the hydrocarbon being on the surface or shoreline).
	Trajectory Modelling			Can be implemented rapidly.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Reindeer Condensate	MDO	
				Predictive - provides estimate of where the oil may go, which can be used to prepare and implement other responses. No additional field personnel required. Not constrained by weather conditions. Can predict floating, entrained, dissolved and stranded hydrocarbon fractions. May not be accurate. Requires in-field calibration.
	Satellite Imagery			Can work under large range of weather conditions (e.g. night-time, cloud cover etc) Mobilisation likely to be >24 hours Requires processing May return false-positives
	Operational Water Quality Monitoring			Fluorometry surveys are used to determine the location and distribution of the entrained oil and dissolved aromatic hydrocarbon components of a continuous subsea spill and validate the spill fate modelling predictions.
	Shoreline and Coastal Habitat Assessment			Provides information on shoreline oiling (state of the oil, extent of pollution etc.). Can provide information on amenability of shoreline response options (e.g. clean-up, protect and deflect). Provides information on status of impacts to sensitive receptors. Considerable health & safety considerations. Requires trained observers. Constrained to daylight. Delayed response time.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Reindeer Condensate	**MDO**	
Chemical dispersion	Vessel Application	X	X	*Reindeer Condensate* Reindeer condensate is not considered a persistent hydrocarbon and has a very high natural evaporation and dispersion rates in the marine environment reducing the volume of hydrocarbon remaining at the sea surface. Spill modelling of subsea and surface Loss of Well Control (LOWC) scenarios did not predict the formation of a surface slick at concentrations exceeding 50 g/m^2, which is typically considered the lowest threshold for effective surface dispersant application. The gas component of the reservoir hydrocarbon means that applying subsea dispersant through an SFRT is not considered feasible due to access and safety constraints. *MDO* Marine diesel is not considered a persistent hydrocarbon and has high natural dispersion rates in the marine environment. Chemical dispersant application is not recommended as a beneficial option for diesel as it has a low additional benefit of increasing the dispersal rate of the spill while introducing the potential for more chemicals into the marine environment. On the basis of the above, chemical dispersant application is not recommended as an applicable strategy the credible spill scenarios covered under this OPEP.
	Aerial Application	X	X	
	Subsea dispersant injection (SSDI)	X	X	
Offshore Containment and Recovery	Use of offshore booms/ skimmers or other collection techniques deployed from vessel/s to contain and collect oil.	X	X	Given the fast spreading nature of diesel and Reindeer condensate causing the slick to break up and disperse, this response is not considered to be effective in reducing the impacts of a diesel spill. The ability to contain and recover spreading diesel and Reindeer condensate on the ocean water surface is extremely limited due the very low viscosity of the fuels.
Mechanical Dispersion	Vessel prop-washing	✔ 2	✔ 2	Safety is a key factor and slicks with potential for high Volatile Organic Compound (VOC) emissions are not suitable.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Reindeer Condensate	MDO	
				Mechanical dispersion may be applicable for the localised entrainment of surface oil but is not considered to have a significant effect on removing oil from the surface. Mechanical dispersion will entrain surface oil into the top layer of the water column. The aim of mechanical dispersion is to reduce the concentration of oil floating at the surface which could potentially contact receptors at the sea surface (e.g. sea birds) or shoreline receptors (e.g. mangroves). Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. Marine diesel and Reindeer condensate are very light oils that can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the propellers to break up the slick. Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. Given the condensate is predicted to have a high rate of natural volatility and a spill would originate in offshore waters, dispersing fresh condensate underwater would not be recommended. Dispersing weathered condensate away from the spill site (that has lost lighter products) may be beneficial if there was a potential for this hydrocarbon to impact on receptors at the sea surface or along shorelines. The potential disadvantage of mechanical dispersion is that it could temporarily increase the concentration of entrained and dissolved oil in the vicinity of submerged shallow water receptors (e.g. corals, seagrass ad macroalgae). This is most likely in shallow water of a few metres deep. The suitability of mechanical dispersion as a response measure would consider the prevailing environmental conditions (it mimics the action of wave induced entrained so is most beneficial in calm conditions) and the type, proximity and depth (as applicable) of sensitivities in the area. Mechanical dispersion will be considered for petroleum activity sourced spills at the discretion of the On-Scene Commander/IMT or by the relevant Control Agency.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Reindeer Condensate	MDO	
Protection and Deflection	Booming in nearshore waters and at shorelines	✔ 1	✔ 2	Considered if operational monitoring shows or predicts contact with sensitive shorelines. *Reindeer Condensate* Modelling shows a 93.3% probability of shoreline oiling at low environmental values (10 g/m2) from a surface release LOWC, and moderate environmental values (100 g/m2) at Montebello Islands (27.3%), Barrow Island (37.3%), Muiron Islands (15.3%) and Southern Islands Coast (24.7%), among others. *MDO* Modelling shows low probability (0.7%) of contact with shorelines. Shoreline protection and deflection activities can result in physical disturbance to intertidal and shoreline habitats. However, given the potential volumes predicted to come ashore at sensitive locations, exclusion or deflection booming may be a suitable response strategy. Containment booming is likely to be more difficult to the low thickness levels of oil, however, will be considered.
Shoreline clean-up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	✔ 1	✔ 2	Considered if operational monitoring shows or predicts contact with sensitive shorelines. Shoreline clean-up has the ability to reduce stranded oil on shorelines and/or reduce remobilisation of oil. However, this response has potential to cause more impacts than benefits, especially if oiling is light. Shoreline assessments as part of operational monitoring provide site-specific guidance on the applicability and likely benefits of different clean-up techniques. Intrusive activities such as physical removal of waste using manual labour or mechanical aids requires careful site-specific planning to reduce secondary impacts of habitat disturbance, erosion and spreading oil beyond shorelines. Secondary impacts can be minimised through the use of trained personnel to lead operations. Logistically, clean-up operations will require site access, decontamination, waste storage, Personal Protective Equipment (PPE), catering and transport services to support personnel working on shorelines.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Reindeer Condensate	MDO	
				Flushing may be considered if the oil enters high priority/slow recovery habitats such as mangroves. Natural dispersion will occur as the hydrocarbon is remobilised from rock shelves and hard substrates, while residual hydrocarbons will biodegrade.
Oiled wildlife response	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation.	✔ 1	✔ 2	Can be used to deter and protect wildlife from contact with oil. Mainly applicable for marine and coastal fauna (e.g. birds) where oil is present at the sea surface or accumulated at coastlines. Surveillance can be carried out as a part of the fauna specific operational monitoring. Wildlife may become desensitised to hazing method. Hazing may impact upon animals (e.g. stress, disturb important behaviours such as nesting or foraging) Permitting requirements for hazing and pre-emptive capture.
Scientific Monitoring	The monitoring of environmental receptors to determine the level of impact and recovery form the oil spill and associated response activities.	✔ 1	✔ 1	Monitoring activities include: + Water and sediment quality + Biota of shorelines (sandy beaches, rocky shores and intertidal mudflats) + Mangrove monitoring + Benthic habitat monitoring (seagrass, algae, corals, non-coral benthic filter feeders) + Seabirds and shorebirds + Marine megafauna (incl. whale sharks and mammals) + Marine reptiles (incl. turtles) + Seafood quality + Fish, fisheries and aquaculture

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Reindeer Condensate	MDO	
				The type and extent of scientific monitoring will depend upon the nature and scale of oil contact to sensitive receptor locations as determined through operational monitoring. Pre-defined initiation criteria exist for SMPs associated with marine and coastal sensitivities.

6.5 Identify Priority Protection Areas and Initial Response Priorities

Spill modelling results for a worst-case scenario (LOWC) were used to predict the Environment that May Be Affected (EMBA) for Dancer-1 drilling activities (refer **Section 3.1** of the EP). The EMBA is the largest area within which effects from hydrocarbons spills associated with this activity, could extend. Within the EMBA, Santos has determined Hot Spots (key areas of high ecological value that have the greatest potential to be impacted by a Dancer-1 drilling activity spill) for which detailed oil spill risk assessment has been conducted (refer **Section 7.1.6.3** of the EP. From these Hot Spot areas, priority protection areas for spill response have been identified (as per **Section 7.1.6.4** of the EP). Protection priority areas are emergent features (i.e. coastal areas and islands) that would be targeted by nearshore spill response operations such as protection and deflection and shoreline clean-up.

Table 6-8 to Table 6-6 list the key sensitivities and associated locations within the protection priority areas identified for the worst-case spill scenarios. The ranking of these sensitivities (also referred to as receptors) are listed, which is consistent with the rankings in *Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara* (DoT, 2017). Using a combination of sensitivities, and their associated rankings; together with the modelled maximum total volumes ashore and minimum time to shoreline contact, an initial response priority is provided in **Table 6-5** and **Table 6-6**. This information is designed to aid decision making in the preliminary stages of the response operation, so that initial resources are used for best effect.

Table 6-5: Initial Response Priorities during a LOWC

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m²	Minimum arrival time accumulated oil ashore >100 g/m² (days)	Initial response priority
Dampier Archipelago	Mangroves	3	3	Widespread and present in lagoons. Important stands west Intercourse and Enderby	N/A	Subsea release - 1.2 Surface release – 1.1	Subsea release - 26.5 Surface release – 32.3	Medium
	Turtles –hawksbill (Vulnerable) and flatback (Vulnerable) turtles	4	3	Hawksbill turtle nesting north-west of Rosemary Island and Delambre. Flatback turtle nesting at Legendre, Huay and Delambre	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			Medium
	<u>Marine mammals</u> Humpback whale (Vulnerable) migration area	3	2	N/A	Humpback whale migration: Jun-Jul			Low
	<u>Birds</u> Migratory and threatened seabirds – at least 14 species Significant nesting, foraging, breeding and resting areas	3	2	Breeding on Goodwyn, Keast Islands and Nelson Rocks.				Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	<u>Socio-economic</u> Recreational fishing/ charter boats, tourism related to water-based activities and nature National Heritage Aboriginal sites Camping beaches Shipping fairway	2	2	Widespread	Year-round			Low
Montebello Islands	Mangroves	3	3	Widespread and present in lagoons. Important stands in Stephenson Channel	N/A	Subsea release – 3,673.5 Surface release - 15,605.8	Subsea release – 2.2 days Surface release – 2.2 days	Medium
	Turtles – loggerhead (Endangered) and green (Vulnerable) (significant rookeries); hawksbill (Vulnerable), flatback (Vulnerable) turtles	4	3	Northwest and Eastern Trimouille Islands (hawksbill) Western Reef and Southern Bay at Northwest Island (green)	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			Medium
	<u>Marine mammals</u>	3	2	N/A	Pygmy blue whale			Low

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	Pygmy blue whale (Vulnerable) and humpback whale (Vulnerable) migration area				migration: Apr-Aug Humpback whale migration: Jun-Jul			
	<u>Birds</u> Migratory and threatened seabirds – at least 14 species Significant nesting, foraging and resting areas	3	2	Widespread	Nesting: Sept-Feb			Medium
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	<u>Socio-economic</u> Pearling (inactive/pearling zones) Very significant for recreational fishing and charter boat tourism (Marine Management Area) Social amenities and other tourism	2	2	Widespread	Year-round			Low

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	Nominated place (national heritage)							
Lowendal Islands	Mangroves	3	3	Offshore	N/A	Subsea release – 8.8 Surface release – 34.3	Subsea release – 12.9 days Surface release – 12.9 days	Medium
	Coral and other subsea benthic primary producers	3	4	Deep-water benthic (soft-sediment) habitats Dugong Reef and Batman Reef (eastern side Island),	Coral spawning: Mar & Oct			Low
	Turtles Important hawksbill, loggerhead and green turtle nesting	4	3	Beacon, Parakeelya, Kaia and Pipeline Varanus pipeline, Harriet and Andersons Beaches	Nesting all year, peak Oct - Jan Significant flatback rookery, nesting season for flatback turtles peaks Dec - Jan			Medium
	Birds Approximately 89 species of avifauna, 12 to 14 species of migratory and threatened seabirds	2	1		Year round			Medium
	Marine mammals	3	2	Seagrass beds	N/A			Low

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	Dugong foraging							
	Socio-economic and heritage values Social amenities and other tourism, very significant for recreational fishing and charter boat tourism	2	2	Widespread	Year-round			Low
Barrow Island	Mangroves	3	3	Bandicoot Bay	N/A	Subsea release – 7.6 Surface release – 6.18	Subsea release – 8.9 days Surface release –8.9 days	Medium
	Regionally and nationally significant green (western side) and flatback turtle (eastern side) nesting beaches, Turtle Bay north beach, North and west coasts- John Wayne Beach, loggerheads and hawksbill	4	3	Green turtles on the western side of Barrow Island and flatback turtle nesting on the eastern side. Turtle Bay north beach, North and west coasts and John Wayne Beach have loggerhead and hawksbill turtle nesting	Year-round, peaking Oct - Jan			Medium
	Birds Migratory birds (important habitat); 10th of top 147 bird sites, Highest	2	1	Double Islands, migratory birds at Bandicoot Bay and widespread on Barrow Island	Nesting: Sept-Feb			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	population of migratory birds in Barrow Island Nature reserve (south-south east island), Double Island has important bird nesting (shearwaters, sea eagles)							
	Coral and other subsea benthic primary producers	3	4	Eastern side – Biggada Reef	Coral spawning: Mar & Oct			Low
	Socio-economic Significant for recreational fishing and charter boat tourism, Nominated place (National heritage), Industry – Reverse Osmosis Plant and port operations Petroleum Activities such as BWI petroleum production	5	5	Reverse Osmosis plant and port on eastern side of Island (Port of Barrow Island)	N/A			Medium
Muiron Islands	Turtle nesting – major loggerhead (Endangered) site,	4	3	Loggerhead – south island	Turtle nesting and breeding Nov-Mar with	Subsea release – 2.7		High

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m²	Minimum arrival time accumulated oil ashore >100 g/m² (days)	Initial response priority
	significant Green turtle (Vulnerable) nesting site, low density Hawksbill nesting (Vulnerable), occasional Flatback (Vulnerable) presence				peak in late Dec/early Jan	Surface release – 3.7	Subsea release – 8.5 days Surface release – 8.5 days	
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning: Mar & Oct			Medium
	Seabird nesting	2	1	Widespread	Nesting: Sept-Feb			Low
	Humpback whale (Vulnerable) migration	3	2	N/A	Jun-Jul			Medium
	Exmouth gulf prawn fishery (Muiron is western boundary); significant for recreational fishing and charter boat tourism	1	2		Prawn fishery – April to November Tourism and recreation: year-round			Low

Source of DoT Ranking Floating and Dissolved oil: Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara (DoT, 2017)

Table 6-6: Initial Response Priorities during a surface MDO release (surface spill)

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum time-averaged oil ashore (g/m^2) >100g/m²	Minimum arrival time (days) >100g/m²	Initial response priority
Dampier Archipelago	Mangroves	3	3	Widespread and present in lagoons. Important stands west Intercourse and Enderby	N/A	223.2	2.5	Medium
	Turtles –hawksbill (Vulnerable) and flatback (Vulnerable) turtles	4	3	Hawksbill turtle nesting north-west of Rosemary Island and Delambre. Flatback turtle nesting at Legendre, Huay and Delambre	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			Medium
	<u>Marine mammals</u> Humpback whale (Vulnerable) migration area	3	2	N/A	Humpback whale migration: Jun-Jul			Low
	<u>Birds</u> Migratory and threatened seabirds – at least 14 species Significant nesting, foraging, breeding and resting areas	3	2	Breeding on Goodwyn, Keast Islands and Nelson Rocks.				Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum time-averaged oil ashore (g/m^2) $>100g/m^2$	Minimum arrival time (days) $>100g/m^2$	Initial response priority
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	Socio-economic Recreational fishing/ charter boats, tourism related to water-based activities and nature National Heritage Aboriginal sites Camping beaches Shipping fairway and proximity to major port	2	2	Widespread	Year-round			Low
Montebello Islands	Mangroves	3	3	Widespread and present in lagoons. Important stands in Stephenson Channel	N/A	11,531.3	6.6	High
	Turtles – loggerhead (Endangered) and green (Vulnerable) (significant rookeries); hawksbill (Vulnerable), flatback (Vulnerable) turtles	4	3	Northwest and Eastern Trimouille Islands (hawksbill) Western Reef and Southern Bay at Northwest Island (green)	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			High

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum time-averaged oil ashore (g/m^2) >100g/m^2	Minimum arrival time (days) >100g/m^2	Initial response priority
	Marine mammals Pygmy blue whale (Vulnerable) and humpback whale (Vulnerable) migration area	3	2	N/A	Pygmy blue whale migration: Apr-Aug Humpback whale migration: Jun-Jul			High
	Birds Migratory and threatened seabirds – at least 14 species Significant nesting, foraging and resting areas	3	2	Widespread	Nesting: Sept-Feb			Medium
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Medium
	Socio-economic Pearling (inactive/pearling zones) Very significant for recreational fishing and charter boat tourism (Marine Management Area) Social amenities and other tourism	2	2	Widespread	Year-round			High

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Maximum time-averaged oil ashore (g/m^2) >$100g/m^2$	Minimum arrival time (days) >$100g/m^2$	Initial response priority
	Nominated place (national heritage)							

Source of DoT Ranking Floating and Dissolved oil: Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara (DoT, 2017)

6.6 Net Environmental Benefit Analysis (NEBA)

The IMT use a NEBA, also referred to as a spill impact mitigation assessment (SIMA),to inform the IAP process (**Section 8**), so the most effective response strategies with the least detrimental environmental impacts can be identified, documented and executed.

The Environmental Team Lead will use the information in **Section 6.5** to identify and prioritise initial response priorities and apply the NEBA to identify which response strategies are preferred for the situation, oil type and behaviour, environmental conditions, direction of plume and priorities for protection.

As a component of the IAP process, NEBA is conducted by the Control Agency with responsibility for the spill response activity. Where there are different activities controlled by different IMTs, as in a cross-jurisdictional response between Santos and DoT, consultation will be required during the NEBA process such that there is consistency in the sensitivities prioritised for response across the Controlling Agencies.

A strategic NEBA has been developed for all response strategies identified as applicable to credible spills identified in this OPEP, with the benefit or potential impact to each sensitivity identified. While not all spill response activities included in the strategic NEBA would be under the control of Santos during a spill incident, they have been included to assist the planning conducted by DoT.

In the event of a spill, NEBA is applied with supporting information collected as part of the Operational Monitoring Plan (**Section 10**) to achieve the following:

+ Identify sensitivities within the area potentially affected by a spill at that time of the year (noting that the sensitivity of some key receptors, such as birdlife and turtles, varies seasonally);
+ Assist in prioritising and allocating resources to sensitivities with a higher protection and response priority (**Table 6-4 and Table 6-6**)**;** and
+ Assist in determining appropriate response strategies with support of real time metocean conditions, oil spill tracking and fate modelling.
+ When a spill occurs, NEBA is applied to the current situation, or operationalised. Operational NEBA Templates are filed within the Environment Team Leader folder on the Santos ER Intranet site. To complete the Operational NEBA:
+ All ecological and socioeconomic sensitivities identified within the spill trajectory area are recorded; and
+ Potential effects of response strategies on each sensitivity are assessed in terms of their benefit or otherwise to the socio-economic sensitivities.

All persons involved and data inputs that have been considered for the analysis are recorded throughout the Operational NEBA process.

The Operational NEBA Form documents the decisions behind the recommendation to the Incident Commander on which resources at risk to prioritise, and the positives and negatives of response strategies to deploy. The Operational NEBA provides guidance to the IAPs and is revisited each Operational Period. It is likely that the NEBA will evolve as new information and expertise comes to light throughout the response.

Table 6-7: Strategic NEBA Matrix Table – Reindeer Condensate

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersant	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Dampier Archipelago										
Mangroves				N/A		N/A				
Turtles –hawksbill (Vulnerable) and flatback (Vulnerable) turtles				N/A		N/A				
<u>Marine mammals</u> Humpback whale (Vulnerable) migration area				N/A		N/A				
Seabird breeding				N/A		N/A				
Coral and other subsea benthic primary producers				N/A		N/A				
<u>Socio-economic</u> Recreational fishing/ charter boats, tourism related to water-based activities and nature National Heritage Aboriginal sites Camping beaches Shipping fairway				N/A		N/A				
Montebello Islands										
Turtle nesting – North West and Eastern Trimouille Islands (hawksbill); Western Reef, Southern Bay and North West Island (green)				N/A		N/A				

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersant	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Mangroves – particularly Stephenson Channel				N/A		N/A			N/A	
Coral and other subsea benthic primary producers				N/A		N/A	N/A	N/A	N/A	
Seabird nesting				N/A		N/A				
Migratory shorebirds				N/A		N/A				
Humpback/pygmy blue whale migration				N/A		N/A	N/A	N/A		
Fishing/charter boat tourism				N/A		N/A				
Lowendal Islands										
Turtle nesting – particularly flatback and green turtles				N/A		N/A				
Mangroves and mudflats (shorebird foraging)				N/A		N/A			N/A	
Coral and other subsea benthic primary producers				N/A		N/A	N/A	N/A	N/A	
Seabird nesting				N/A		N/A				
Migratory shorebirds				N/A		N/A				
Aboriginal listed sites incl. pearling camps				N/A		N/A			N/A	N/A
Muiron Islands										
Turtle nesting – major loggerhead site, significant Green turtle nesting site				N/A		N/A				
Coral and other subsea benthic primary producers				N/A		N/A				
Seabird nesting				N/A		N/A				

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersant	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Humpback whale migration				N/A		N/A				
Tourism - significant fishing/charter boat tourism				N/A		N/A				
Barrow Island										
Turtle nesting –particularly flatback (western side) and green turtles (eastern side)				N/A		N/A				
Mangroves and mudflats (shorebird foraging) – Bandicoot Bay				N/A		N/A				
Coral and other subsea benthic primary producers – incl. Biggada Reef				N/A		N/A				
Seabird nesting - incl. Double Island				N/A		N/A				
Migratory shorebirds - particularly Bandicoot Bay				N/A		N/A				
Aboriginal listed sites incl. pearling camps				N/A		N/A				

Legend	
	Beneficial impact.
	Possible beneficial impact depending on the situation (e.g., time frames and metocean conditions to dilute entrained oil).
	Negative impact.
N/A	Not applicable for the environmental value.

Table 6-8: Strategic NEBA Matrix Table - Marine Diesel Oil spills

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Dampier Archipelago										
Mangroves				N/A		N/A				
Turtles –hawksbill (Vulnerable) and flatback (Vulnerable) turtles				N/A		N/A				
Marine mammals Humpback whale (Vulnerable) migration area				N/A		N/A				
Seabird breeding				N/A		N/A				
Coral and other subsea benthic primary producers				N/A		N/A				
Socio-economic Recreational fishing/ charter boats, tourism related to water-based activities and nature National Heritage Aboriginal sites Camping beaches Shipping fairway				N/A		N/A				
Montebello islands										
Turtle nesting – North West and Eastern Trimouille Islands (hawksbill); Western Reef, Southern Bay and North West Island (green)				N/A		N/A				
Mangroves – particularly Stephenson Channel				N/A		N/A				

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Coral and other subsea benthic primary producers				N/A		N/A				
Seabird nesting				N/A		N/A				
Migratory shorebirds				N/A		N/A				
Humpback/pygmy blue whale migration				N/A		N/A				
Fishing/charter boat tourism				N/A		N/A				
Legend										
	Beneficial impact.									
	Possible beneficial impact depending on the situation (e.g., time frames and metocean conditions to dilute entrained oil).									
	Negative impact.									
N/A	Not applicable for the environmental value or not applicable for hydrocarbon type.									

6.7 Oil Spill Response ALARP Assessment

For each response strategy included within this OPEP an environmental performance outcome has been determined and key control measures and performance standards have been identified such that the response can meet the required performance outcome. For each response strategy, an ALARP assessment has been conducted to demonstrate that the control measures mitigate the risk of an oil spill to ALARP.

Appendix B details the ALARP assessment framework and the results of the ALARP assessment conducted to inform the control measures and performance standards contained within this OPEP.

7 External Notifications and Reporting Procedures

For oil spill incidents the On-scene Commander (of the MODU or Company Site Representative) will notify the Perth-based IMT for delegation of further notifications to relevant Regulatory Authorities and for further spill response assistance for Level 2/3 spills.

7.1 Regulatory Notification and Reporting

The Incident Commander (IC) is to delegate the following regulatory reporting requirements. Typical delegated parties will be the Safety Team Leader and the Environmental Team Leader.

Contact details for the Regulatory agencies outlined in **Table 7-1** are provided within the Incident Response Telephone Directory (SO-00-ZF-00025.020)

Table 7-1 outlines the external regulatory reporting requirements specifically for oil spill incidents outlined within this OPEP in Commonwealth and State jurisdictions, noting that regulatory reporting may apply to smaller Level 1 spills that can be responded to using onsite resources as well as larger Level 2/3 spills.

State water notifications to WA DoT will apply to spills in State waters or spills originating in Commonwealth waters that move or may move into State waters.

Table 7-1 outlines Santos oil spill reporting requirements associated with carrying out a Petroleum Activity in State and Commonwealth waters. There are also additional requirements for Vessel Masters to report oil spills from their vessels under relevant marine oil pollution legislation (e.g. MARPOL). This includes, where relevant, reporting oil spills to AMSA (Rescue Coordination Centre) and WA DoT (MEER unit).

The Incident Response Telephone Directory (SO-00-ZF-00025.020) contains a more detailed list and contact details for incident response support and is updated every 6 months with up-to-date revisions available within the IMT room and online (intranet procedures and emergency response pages).

7.2 Activation of External Oil Spill Response Organisations and Support Agencies

Table 7-2 outlines notifications that should be made to supporting agencies to assist with spill response activities outlined within this plan. This list contains key Oil Spill Response Organisations (OSROs) that have pre-established roles in assisting Santos in an oil spill response. It is not an exhaustive list of all providers that Santos may use for assisting an oil spill response.

The Incident Response Telephone Directory (SO-00-ZF-00025.020) contains a more detailed list and contact details for incident response support and is updated every 6 months with up-to-date revisions available within the IMT room and online (intranet procedures and emergency response pages).

7.3 Environment Performance

Table 7-3 lists the Environmental Performance Standards and Measurement Criteria for external notifications and reporting.

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Table 7-1: External Notification and Reporting Requirements (Commonwealth and State Water)

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
NOPSEMA Reporting Requirements for Commonwealth water spills					
NOPSEMA (Incident Notification Office)	Verbal notification within 2 hours Written report as soon as practicable, but no later than 3 days	*Petroleum and Greenhouse Gas Storage Act 2006* Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009 (as amended 2014)	A spill in Commonwealth waters that has the potential to cause moderate to significant environmental damage[1]	Notification by IMT Environmental Team Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
NOPTA (National Offshore Petroleum Titles Administrator) & Department of Mines, Industry Regulation and Safety (DMIRS) (WA Department of Mines, Industry Regulation and Safety)	Written report to NOPTA and DMIRS within 7 days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by IMT Environmental Team Leader (or delegate)	Provide same written report as provided to NOPSEMA
DMIRS Reporting Requirements for State water spills					
WA DMIRS	• Verbal phone call within 2 hours of incident being identified • Follow up written notification within 3 days	Guidance Note on Environmental Non-compliance and Incident Reporting	A spill in State waters that has the potential to cause an environmental impact that is categorised as moderate or more serious than moderate[1]	Notification by IMT Environmental Team Leader (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Documents/Environment/ENV-PEB-189.docx

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
AMSA and DoT spill reporting requirements					
AMSA Rescue Coordination Centre (RCC)[2]	Verbal notification within 2 hours of incident	Under the MoU between Santos and AMSA	Santos to notify AMSA of any marine pollution incident[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
WA Department of Transport (WA DoT)[2] (Maritime Environmental Emergency Response (MEER) Duty Officer)	• Verbal notification within 2 hours • Follow up with POLREP as soon as practicable after verbal notification (**Appendix C**) • If requested, submit Marine Pollution Situation Report (SITREP) within 24 hours of request (**Appendix D**)	Emergency Management Regulations 2006 State Hazard Plan: Maritime Environmental Emergencies Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements	Santos to notify of actual or impending Marine Pollution Incidents (MOP) <u>that are in, or may impact, State waters.</u> Emergency Management Regulations 2006 define MOP as an actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment[1].	Notification by IMT Environmental Team Leader (or delegate)	DoT POLREP and SITREP: https://www.transport.wa.gov.au/imarine/reporting-marine-oil-pollution.asp
Protected areas, fauna and fisheries reporting requirements					
Commonwealth Department of Agriculture, Water and the Environment (DAWE) (Director of monitoring and audit section)	Email notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	If MNES are considered at risk from a spill or response strategy, or where there is death or injury to a protected species	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Department of Biodiversity	Verbal notification within 2 hours	Western Australian Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
Conservation and Attractions (State Duty Officer and Pilbara Regional Office)			in State waters (to activate the Oiled Wildlife Advisor)		
Parks Australia (Director of National Parks)	Verbal notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	An oil spill which occurs within a marine park or are likely to impact on an Australian Marine Park	Notification by IMT Environmental Team Leader (or delegate)	Not applicable, but the following information should be provided: Titleholder's details Time and location of the incident (including name of marine park likely to be affected) Proposed response arrangements as per the OPEP Details of the relevant contact person in the IMT
Department of Primary Industry and Regional Development (DPIRD) - Fisheries	Verbal phone call notification within 24 of incident	As per consultation with DPIRD Fisheries	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Australian Fisheries Management Authority	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

1- For clarity and consistency across Santos regulatory reporting requirements, Santos will meet the requirement of reporting a marine oil pollution incident to AMSA by reporting oil spills assessed to have an environmental consequence of moderate or higher in accordance with Santos' environmental impact and risk assessment process outlined in **Section 5** of the EP (SO-00-BI-20002).

2- Santos reporting requirements only listed. For oil spills from vessels, Vessel Masters also have obligations to report spills from their vessels to AMSA RCC and, in State waters, WA DoT MEER.

Table 7-2: List of spill response support notifications

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
AMOSC, AMOSC Duty Manager	As soon as possible	Verbal Service Contract	Santos is a Participating Company in AMOSC and can call upon AMOSC personnel and equipment (including oiled wildlife). Under the AMOSPlan, Santos can also call upon mutual aid from other trained industry company personnel and response equipment AMOSC's stockpiles of equipment include cleaning, absorbent, oiled wildlife and communications equipment. Equipment is located in Geelong, Fremantle, Exmouth and Broome	**Step 1.** Obtain approval from Incident Commander to mobilise AMOSC **Step 2.** Notify AMOSC that a spill has occurred. Put on standby as required – activate if spill response escalates in order to mobilise spill response resources consistent with the AMOSPlan **Step 3.** E-mail confirmation and a telephone call to AMOSC will be required for mobilisation of response personnel and equipment, and callout authorities will be required to supply their credentials to AMOSC. A signed service contract must also be completed by a call out authority and returned to AMOSC prior to mobilisation	IMT Environment Team Leader (or delegate) will notify AMOSC (upon approval from Incident Commander)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
Babcock Helicopters	Within 2 hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place.	Phone call	IMT Logistics Team Leader (or delegate))
Duty Officers/ Incident Commanders **(Woodside, BHP, Chevron)**	Within 2 hours of incident having been identified	Verbal	Mutual aid resources (through AMOSC mutual Aid Arrangement)	Phone call	Incident Commander (or delegate)
Exmouth Freight & Logistics	Within 2 hours of incident having been identified	Verbal	Assistance with mobilising equipment and loading vessels	Phone call	IMT Logistics Team Leader (or delegate)
North West Alliance – Waste	When Shoreline Clean-up is activated (**Section 13**)	Verbal	Santos has contract arrangements in place with North West Alliance to take overall responsibility to transport and dispose of waste material generated through clean-up activities.	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	IMT Logistics Team Leader (or delegate)
Astron	SMP initiation criteria are met (**Section 16**)	Verbal and written	Astron has been contracted by Santos to provide Standby Services for SMPs 1-11. This includes provision of personnel and equipment. Astron annually reviews the SMPs for continual improvement.	**Step 1.** Obtain approval from Incident Commander to activate Astron for Scientific Monitoring **Step 2.** Verbally notify Astron followed by the submission of an Activation Form (Environment Team Leader Folder) via email **Step 3.** Provide additional details as requested by the Astron Monitoring Coordinator on call-back **Step 4.** Astron initiates Scientific Monitoring Activation and Response Process	IMT Environment Team Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When characterisation of oil is activated (**Section 10.5**)	Verbal	Oil analysis including GC/MS fingerprinting	**Phone call**	IMT Environment Team Leader (or delegate)
Oil Spill Response Limited (OSRL), OSRL Duty Manager	Within 2 hours of incident having been identified	Verbal OSRL Mobilisation Authorisation Form OSRL Notification Form	Santos has a SLA with OSRL, which includes the provision of support functions, equipment and personnel to meet a wide range of scenarios At minimum OSRL will provide technical support to the IMT and place resources on standby Further details available on the OSRL webpage.	**Step 1.** Contact OSRL Duty Manager in Singapore and request assistance from OSRL **Step 2.** Send notification to OSRL as soon as possible after verbal notification **Step 4.** Upon completion of the OSRL incident notification form, OSRL will plan and place resources on standby.	Designated call-out authorities (including Incident Commanders)
RPS Group	As soon as possible but within 2 hours of incident having been identified	Verbal and written	Santos has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, which will be undertaken for any spill greater than Level 1. AMOSC can also run	Contact RPS Group Duty Officer	IMT Environment Team Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
			modelling on behalf of Santos, if required, as part of contracting arrangements with RPS Group		
Wild Well Control (WWC)	Within four hours of a loss of well control incident having been identified	Loss of well control only Verbal	Well intervention services. Under contract.	**Step 1**. Following Santos management confirmation of a loss of well control, the Incident Command Team (IMT) Drilling Team Leader is to call the Wild Well Control 24 hour emergency hotline number to notify WWC of the incident **Step 2**. As soon as practical after initial notification and once the scale of the loss of well control is confirmed, an emergency mobilisation authorisation form (saved in ECM) must be filled out, signed off by the authorised Santos Manager and sent through to WWC. The form is located on the Santos Intranet Procedures Index under Emergency Procedures (http://ausintranet.enerylimited.com/dept_data/ Procedure_data/index.htm). Email as directed by WWC point of contract provided by the emergency hotline attendant.	Drilling Team Leader

Table 7-3: Environmental Performance – External Notification and Reporting

Environmental Performance Outcome	Make notifications and reports within regulatory and defined timeframes		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
External notifications and reporting plan	**Response Preparedness**		
	Incident Response Telephone Directory (SO-00-ZF-00025.020)	Incident Response Telephone Directory is revised every 6 months	Document revision history
	OPEP Communications Test	OPEP contact details for regulatory and service provider notifications are checked annually	Test records
	Response Implementation		
	External notifications and reporting tables	External notification and reporting undertaken as per **Table 7-1** and **Table 7-2**	Incident Log

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8 Incident Action Planning

Santos incident response personnel use the IAP process to guide the incident response and to develop IAPs. All stakeholders involved in the incident achieve unity of effort through application of the disciplined planning process.

The IAP process is built on the following phases:

1. Understand the situation;
2. Establish incident priorities, objectives and tasks;
3. Develop a plan (IAP);
4. Prepare and disseminate the plan; and
5. Execute, evaluate and revise the plan for the next operational period.

The Santos IMT will use the IAP process to determine and document the appropriate response priorities, objectives, strategies and tasks to guide the incident response which are reviewed and updated as more information becomes available.

The Santos IAP process is built on the phases described in **Figure 8-1.**

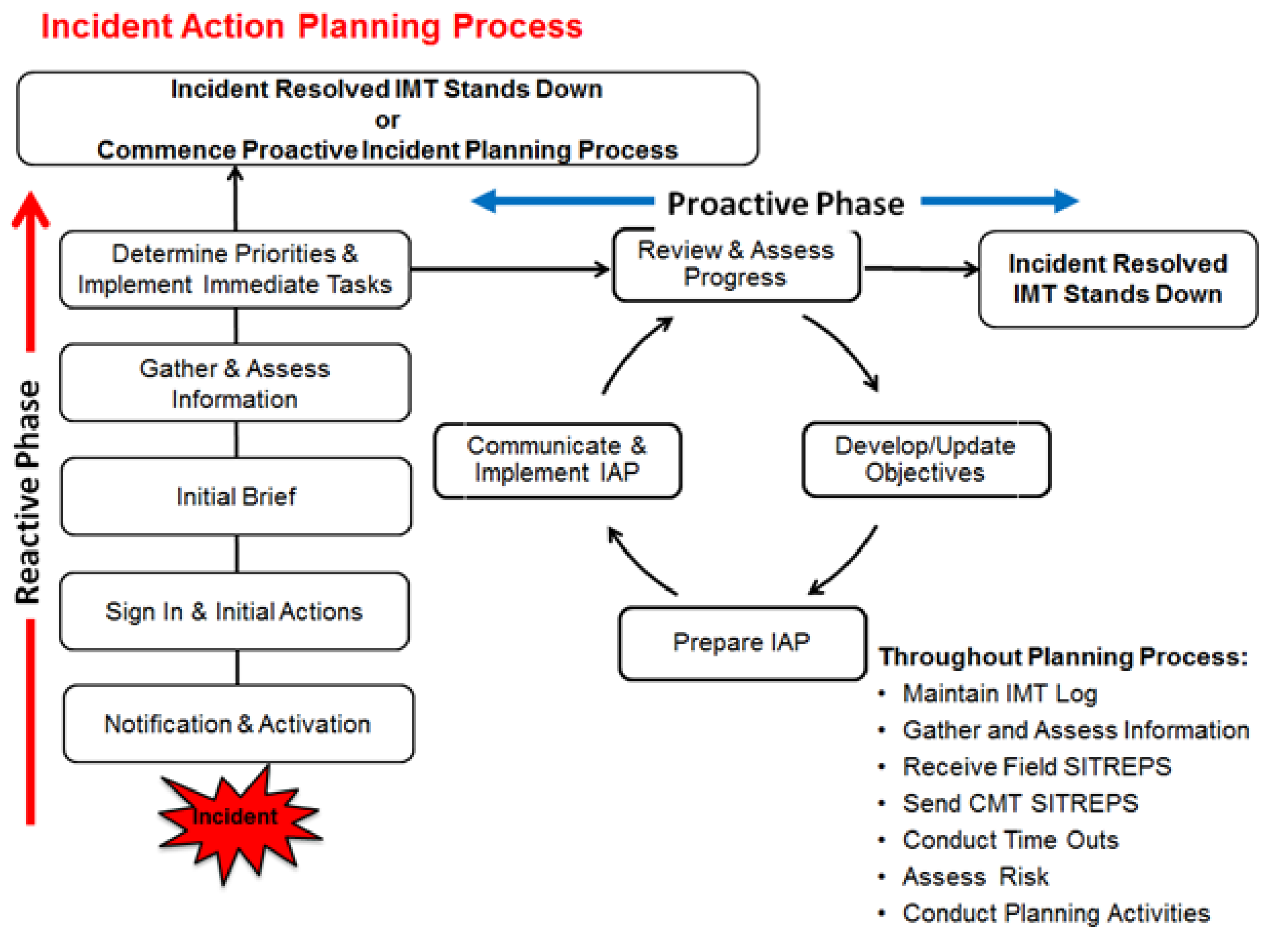

Figure 8-1: Incident Action Plan process

8.1 Reactive Phase Planning

The initial phase of the IAP process can be considered a reactive phase (indicatively lasting up to 48 hours) where information on the incident is being progressively established through reports coming in from the field. During this phase there is no formal IAP to follow (given the incident has just begun and details are still being established) however the OPEP (this document) has been prepared to contain all first strike oil spill response actions required to be followed during this phase in lieu of a formal IAP.

First strike response actions are summarised in **Section 2** and provide links to relevant oil spill strategy sections within the OPEP which contain a more detailed list of implementation actions and considerations as well as statements of performance (performances standards) that must be followed to ensure the initial response meets regulatory requirements and environmental performance outcomes.

For each credible oil spill scenario covered by this OPEP the first strikes response actions, have been informed by a pre-assessment of applicable oil spill response strategies, priority response locations and a strategic NEBA also referred to as a SIMA. This pre-planning is included in **Section 6**. During the reactive phase the strategic NEBA is to be reviewed and, using the specific information gathered from the spill, operationalised into an operational NEBA (**Section 6.6**). This assessment helps verify that the response strategies pre-selected for each spill scenario are providing the best environmental outcome for the incident response.

8.2 Developing an Incident Action Plan (IAP)

At the end of the reactive phase where the incident specifics have been determined, a more formal phase of spill response is entered whereby a documented IAP is developed to guide the incident response activities for the next operational period. An operational period is defined as the period scheduled for execution of actions specified in the IAP. The next operational period is nominally a daily period but for long running incidents may be extended further where the pace of the incident response has settled and the level of new information has decreased.

As IAPs and response strategies are implemented their performance is monitored. The performance measurement results are fed back into the IMT to provide the IMT with greater situational awareness to enable the effective formulation of following IAPs. Those response strategies that are effective are continued or increased, while those strategies that are ineffective are scaled back or ceased.

The performance against the objectives of the IAP must be documented in the Incident Log by the IMT. This provides the IMT with information required to assist in formulating the following IAP and provides evidence of Santos' response to the incident for regulatory and legal investigations that will follow the termination of the incident.

IAP performance is monitored through IMT communication with in-field response personnel both verbally and through logs/reports/photos sent throughout the response (e.g. surveillance personnel, team leaders, laboratory chemists, etc.) who report on the effectiveness of the response strategies.

IAP forms and processes are documented in the *Incident Command and Management Manual* (SO-00-ZF-00025) and in the 'Emergency Response' folder sets at *L:\Resource\Emergency Response\Incident-Exercise Number-Name*. Begin the response by copying and saving *Incident-Exercise Number-Name* folder set with a unique incident name and Id number on the lead folder; this is the Incident Log. Access subfolders to display all forms required to conduct IAP. Each functional position within the IMT and CMT has subfolders carrying forms and processes unique to the functional position.

8.3 Environmental Performance

Table 8-1 lists the Environmental Performance Standards and Measurement Criteria for IAP.

Table 8-1: Environmental Performance – Incident Action Planning (IAP)

Environmental Performance Outcome	Manage incident via a systematic planning process		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Incident Action Planning (IAP)	**Response Preparedness**		
	IMT Exercise and Training Plan	IAP and NEBA is practiced by the IMT during exercises	Exercise records
	Response Implementation		
	IAP	IAP is completed for each operational period and approved by the Incident Commander	Incident Log IAP/s
		Monitor effectiveness of response strategies being implemented and use information in the development of IAPs	Incident Log IAP/s
	NEBA	An operational NEBA will be undertaken for each operational period of the incident	NEBA IAP

9 Source Control Plan

The initial and highest priority response to an oil spill incident following the health and safety of onsite personnel is to prevent or limit further loss of hydrocarbons to the environment.

For major hydrocarbon release incidents during the activity, the Noble Tom Prosser Offshore Emergency Response Manual (Noble document number SF-EME-NTP-001) and the Noble Tom Prosser – Emergency Response Bridging Plan (SO-91-BF-20011) outline the initial actions to be taken by onsite personnel to control the source of a hydrocarbon spill and limit the volume released to the environment.

For vessels with a SOPEP, the SOPEP will provide the relevant initial actions to control the source of the spill.

For the ongoing response to a loss of well control, the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) is to be consulted as the overarching source of information for implementing a relief well response.

The sections below provide an outline of source control activities noting that the Noble Tom Prosser Offshore Emergency Response Manual (Noble document number SF-EME-NTP-001), Vessel SOPEP and Santos Source Control Planning and Response Guideline (DR-00-OZ-20001), where applicable, will provide a higher level of detail for specific incidents.

9.1 Fuel Tank Rupture

Table 9-1 provides the environmental performance outcome, initiation criteria and termination criteria for source control response of a fuel tank rupture. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 9-1: Fuel Tank Rupture – Source Control Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment	
Initiation criteria	Level 2/3 incident (to be determined by On-Scene Commander)	
Applicable hydrocarbons	**Diesel**	**Reindeer Condensate**
	✔	X
Termination criteria	The cargo in the ruptured fuel tank is secured and release to the marine environment stopped	

9.1.1 Implementation Guidance

Implementation guidance is summarised in **Table 9-2.** In the event MDO is released from a vessel due to a ruptured fuel tank, the relevant vessel specific procedures will be applied.

Section 9.3 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 9-2: Implementation Guidance – Fuel Tank Rupture

Action		Consideration	Responsibility	Complete
Initial Actions	The vessel's SOPEP, as applicable under MARPOL, or procedure for responding to a ruptured tank will be followed as applicable	Notwithstanding vessel specific procedures for source control, the following activities would be immediately evaluated for implementation providing safe to do so: + Consider pumping water into the leaking tank to create a water cushion to prevent further cargo loss; + If the affected tank is not easily identified, reduce the level of the cargo in the tanks in the vicinity of the suspected area if stability of the vessel will not be compromised; + Evaluate the transfer of cargo to other vessels; + Trimming or lightening the vessel to avoid further damage to intact tanks; and/or + Attempt repair and plugging of hole or rupture.	Vessel Master	❑

9.2 Loss of Well Control

Table 9-3 provides the environmental performance outcome, initiation criteria and termination criteria for controlling the source of an exploration loss of well control.

Table 9-3: Loss of Well Control - Source Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment	
Initiation criteria	Loss of Well Control	
Applicable hydrocarbons	**Diesel**	**Reindeer condensate**
	X	✔
Termination criteria	The primary well is contained and killed to prevent any further release of hydrocarbon to the environment.	

Santos identified the following worst-case credible oil spill scenarios for assessment:

- A LOWC with the release of 273,130 STB (43,423 m^3) liquid condensate and 54,618 MMscf (1,547 million sm^3) gas at the seabed (~63 m depth).
- A LOWC with the release of 271,436 STB (43,153 m^3) liquid condensate and 54,289 MMscf (1,537 million sm^3) gas at the sea surface.

9.2.1 Relief Well Implementation Guidance

Relief well drilling is the primary source control strategy to control a LOWC at Dancer-1. For a LOWC event, the installation of a subsea Capping Stack is not considered applicable (refer **Table 6-4**).

The Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for the purpose of drilling a relief well.

A high-level summary of relief well Implementation actions is provided in **Table 9-4.**

Table 9-4: Implementation Guidance – Loss of Well Control

Action		Responsibility	Complete
Initial Actions	Implement the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001)	Drilling Team Leader	❑
	Notify Santos Drilling and Completions Team to assemble a Source Control Team and immediately begin preparations	Drilling Team Leader	❑
	Notify well control service provider personnel for mobilisation	Drilling Team Leader and Drilling & Completions Source Control Team	❑
	Source MODU through nearby drilling operations if available or procure from nearest operator through mutual aid agreement MOU.	Drilling & Completions Source Control Team	❑
	Design Relief Well, using relief well pre-planning work, as applicable, and have prepared in time to procure equipment and personnel prior to MODU arrival on location	Drilling & Completions Source Control Team	❑
	Assess relief well equipment and personnel requirements. Procure and make ready	Logistics Team Leader	❑
	Deploy equipment and personnel to site to begin spud and drill	Drilling Team Leader	❑
Ongoing actions	Design Relief Well, using relief well pre-planning work, as applicable, and have prepared in time to procure equipment and personnel prior to MODU arrival on location	Drilling & Completions Source Control Team	❑
	Assess relief well equipment and personnel requirements. Procure and make ready	Logistics Team Leader	❑
	Deploy equipment and personnel to site to begin spud and drill	Drilling Team Leader	❑
	Monitor progress of relief well drilling and communicate to IMT	Drilling Team Leader	❑

9.2.2 Relief Well Planning

Relief well planning is embedded into the Santos Drilling & Completions Management Process. The following industry accepted guidelines have been adopted to assist relief well planning requirements:

+ SPE Calculation of Worst-Case Discharge (WCD) Rev 1, 2016; this is used as part of the prospect screening review to generate a credible rate for oil spill modelling, as well as providing an input for the dynamic kill modelling as part of the Dancer-1 Source Control Plan (DR-00-BW-20007); and
+ UKOG Relief Well Guidelines, Issue 2, 2013; this methodology is used to confirm a well complexity analysis and tailor required content for the Dancer-1 Source Control Plan (DR-00-BW-20007) to the appropriate level of detail.

The following well specific source control plans have been developed for the Dancer-1 well:

+ Dancer-1 Source Control Plan (DR-00-BW-20007).

This plan contain the following relief well planning information:

+ MODU positioning assessment for relief well drilling locations
+ MODU / key equipment requirements and availability
+ Relief well trajectory analysis and casing design
+ Dynamic kill simulation results

These reports are static reports developed prior to higher-risk campaign-specific activities (drilling activities). While they contain planning that would be relevant to drilling a relief well for a exploration well release (e.g. MODU positioning locations), time-variable information, such as MODU availability is only assessed for the duration of the campaign.

To ensure Santos has current MODU availability Santos maintains a register of MODU activity within the region and updates this on a monthly basis. The relief well rig capability register includes the following information;

+ Rig name;
+ Rig contract status (Operator and contract duration);
+ Current location;
+ Maximum water depth capability;
+ Rig type (Floating vs jack-up; mooring type; Rig Design/Class);
+ Available drilling envelope;
+ BOP specifications;
+ BOP/LMRP connector specifications;
+ Mud pumps specifications/capability;
+ Choke and Kill line IDs;
+ Storage capability (i.e. diesel, base-oil, brine, drill-water, potable water, bulks); and
+ NOPSEMA safety case (yes/no).

In order to facilitate and expedite the use of regional MODU for relief well drilling an APPEA Memorandum of Understanding: Mutual Assistance is in place. This agreement provides the mechanism to facilitate the transfer of drilling units and well-site services between operators in Australian and Timor Leste administered waters in order to respond urgently to emergency source control events.

A Safety Case Revision will be required for the relief well rig to undertake the activity; this cannot be submitted before the event. The Safety Case Revision will be based on existing documents, specifically the Safety Case Revision approved for the drilling of the original well and the Safety Case in force for the relief well rig. A Safety Case Revision would be submitted within 14 days from the exploration well release, however the critical path time allowed for the actual writing of the document is 3 days. The remaining estimated time would be used for gathering post-event data, mobilising the workforce and conducting a HAZID. It is not practicable to reduce the critical path days with additional pre-planning as document revision, final review and approval will still be required after completing the HAZID.

9.2.3 Relief Well Schedule

An indicative relief well drilling schedule is provided in **Table 9-5.** This is based on control of the well by 11 weeks (77 days). This period is used as a base case well control timeframe by Santos across its wells and is based on indicative mobilisation durations and relief well planning. It could take up to 34 days to have a MODU onsite ready to spud.

This time-line has been assessed as ALARP based on the current controls/measures in place, however Santos is actively working with industry to evaluate measures to improve on the ALARP response time model through the APPEA Drilling Industry Steering Committee (DISC) Source Control Response Industry (SCRI) Working Group. The SCRI working group is an APPEA DISC initiative which has been established to drive collaboration and continuous improvement in source control emergency response planning. The Working Group will explore and act on opportunities to align and strengthen the Titleholders' source control emergency response capability though "mutual aid" initiatives and drive continuous improvement by implementing fit-for-purpose and effective source control emergency response strategies.

Table 9-5: Schedule for MODU arriving onsite

Exploration well release		
Task	**Duration (in days)**	**Controls**
Event reported – begin sourcing of rig for relief well drilling	1	+ On-site communications + Active IMT on call including Drilling Team Lead
Relief well MODU confirmed. Relief well MODU suspends drilling and prepares to mobilise to relief well location.	10	+ Active IMT + Santos Source Control Emergency Planning and Response Plan Guideline (DR-00-OZ-20001) + Regional MODU tracking + APPEA MOU: Mutual Assistance
Continue preparations for relief well and rig mobilisation	21	+ Stood-up Relief Well Team (as per SCERP) + Pre-complete campaign specific source control plan complete with relief well study (Dancer-1 Source Control Plan (DR-00-BW-20007)). + Relief Well Drilling specialists services contract (Wild Well Control) + Drilling services contracted + Pre-verified access to relief well equipment (e.g. casing and wellhead) + APPEA MOU: Mutual Assistance

Rig mobilisation to well offset location (dependent on current and prevailing weather)	2	+ Vessel and rig move services contracted
Total days prior to arrival, ready to spud/commence relief well operations	34	
Total days from LOWC to well kill	77	

9.3 Environmental Performance

Table 9-6 indicates the Environmental performance outcomes, controls and performance standards for the Source Control response strategy.

Table 9-6: Environmental Performance – Source Control

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Response Preparedness			
Source control – relief well drilling	Source Control Planning and Response Guideline (DR-00-OZ-20001)	The Source Control Planning and Response Guideline (DR-00-OZ-20001) is in place and up to date during the activity	Source Control Planning and Response Guideline (DR-00-OZ-20001)
	MODU Capability Register	A MODU Capability Register is maintained during the activity	Rig Capability Register
	Arrangements for source control emergency response personnel	Arrangements for access to source control personnel are maintained during the activity	Contract/MoUs for source control personnel
Source control - vessel collision	Vessel Spill Response Plan (SOPEP/SMPEP)	Support vessels have a shipboard oil pollution emergency plan (SOPEP) or shipboard marine pollution emergency plan (SMPEP) that outlines steps taken to combat spills	Audit records. Inspection records
		Spill exercises on support vessels are conducted as per the vessels SOPEP or SMPEP	Spill exercise close out reports
Response Implementation			
Source control – relief well drilling	Drilling and Completions Source Control Team	Drilling and Completions Source Control Team mobilised within 24 hours of exploration well release	Incident Log
	Equipment/Services for Relief Well drilling	Equipment/Services for Relief Well drilling sourced within 5	Incident Log

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		days of exploration well release	
	Well Control Specialists	Well control specialists mobilised within 72 hours of exploration well release	Incident Log
	Relief Well MODU	MODU for relief well drilling to be onsite by Day 34 from the start of a well release.	Incident Log
	Relief Well	Relief well completed within 77 days of well leak incident	Incident Log
	Source Control Planning and Response Guideline (DR-00-OZ-20001)	Relief well drilling implemented in accordance to the Source Control Planning and Response Guideline (DR-00-OZ-20001) during a exploration well release	Incident Log
Source control - vessel collision	As per the vessel SOPEP	Actions to control spill associated with a vessel incident followed in accordance with SOPEP	Vessel logs

10 Monitor and Evaluate Plan

Understanding the behaviour and likely trajectory of an oil spill is critical to evaluate the appropriate response strategy. There are a number of methods that can be used to monitor and evaluate, including:

+ Vessel Surveillance;
+ Aerial Surveillance;
+ Tracking buoys;
+ OSTM;
+ Satellite Imagery;
+ Initial Oil Characterisation;
+ Operational Water Quality Monitoring; and
+ Shoreline Assessments.

10.1 Vessel Surveillance

Table 10-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-1: Vessel Surveillance – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Initiation criteria	Notification of a Level 2/3 spill - may be deployed in a Level-1 incident (to be determined by On-Scene Commander)	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Vessel-based surveillance is undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable; OR + NEBA is no longer being achieved; OR + Agreement is reached with Jurisdictional Authorities to terminate the response	

Direct observations from field support or other vessels can be used to assess the location and visible extent of the hydrocarbon incidents, and to verify modelling predictions and trajectories. Due to the proximity of observers to the water's surface, vessel surveillance is limited in its coverage in comparison to aerial surveillance and may also be compromised in rough sea state conditions or where fresh hydrocarbons at surface poses safety risks.

10.1.1 Implementation Guidance

Table 10-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-3** provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial vessel surveillance operations are listed in **Table 10-4.**. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-2: Implementation Guidance – Vessel Surveillance

Action		Consideration	Responsibility	Complete
Initial Actions	Notify nearest available Support Vessel to commence surveillance	Current Santos on hire vessels or Vessels of Opportunity (VOO) can be used. AIS vessel tracking is available through ER intranet page	On-Scene Commander Operations Lead	❑
	Source additional contracted vessels if possible, need for assistance		Logistics Team Leader	❑
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms, located in **Appendix E** and provide to On-Scene Commander (Level 1 spills) or IMT (Level 2-3 spills)	Photographic images are to be taken where possible and included with surveillance forms Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by IMT	Vessel Observers	❑
	Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick to the IMT within 60 minutes of completing vessel surveillance	Initial reports to the IMT may be verbal (followed by written transmission) if the vessel is out of range or has no facilities for transmitting forms	Vessel Master and/or On-Scene Commander	❑
Ongoing Actions	Review surveillance information to validate spill fate and trajectory		Planning Team Leader/ GIS	❑
	Use available data to conduct operational NEBA and confirm that pre-identified response options are appropriate		Environment Unit Lead	❑
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required	Surveillance data is useful in updating the Common Operating Picture	Planning Section Chief	❑

Table 10-3: Vessel Surveillance Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Contracted vessels and vessels of opportunity	Santos Contracted Vessel Providers. Vessels of opportunity identified through AIS Vessel Tracking	Availability dependent upon Santos and Vessel Contractor activities.	Vessels mobilised from Exmouth, Dampier, Varanus Island or offshore location. Locations verified through AIS Vessel Tracking Software	Pending availability and location. Expected within 12 hours.

Table 10-4: Vessel Surveillance – First Strike Response Timeline

Task	Time from IMT call-out
IMT begins sourcing Santos contracted vessel or VOO for on-water surveillance	<90 minutes
VOO onsite for surveillance	<12 hours (daylight dependent)
Minimum Resource Requirements	
1x vessel. No specific vessel or crew requirements.	

10.2 Aerial Surveillance

Table 10-5 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-5: Aerial Surveillance – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Initiation criteria	Notification of a Level 2/3 spill	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Aerial surveillance undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable; OR + As directed by the relevant Control Agency	

Aerial surveillance is used to record the presence and size of the hydrocarbon spill at the surface as well as other environmental observations including weather conditions, marine fauna and sensitive receptors in the area. Aerial surveillance provides superior coverage over vessel surveillance for estimating the spatial extent of a spill but is generally required only for larger Level 2/3 spills.

10.2.1 Implementation Guidance

Table 10-6 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-7** provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial aerial surveillance operations are listed in **Table 10-8**. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-6: Implementation Guidance – Aerial Surveillance

Action		Consideration	Responsibility	Complete
Initial Actions	Contact contracted aviation provider- provide details of incident and request mobilisation to spill site for initial surveillance	If aviation asset is available near spill location, utilise where possible to gather as much information about the spill. If aviation asset not available at spill location IMT is to seek available resources through existing contractual arrangements. It is possible that the initial surveillance flight will not include a trained aerial surveillance observer. Initial flights can be conducted using a standard crew and initial surveillance should not be delayed waiting for trained personnel. Ensure all safety requirements are met prior to deployment. There should be an attempt to obtain the following data during initial surveillance: + name of observer, date, time, aircraft type, speed and altitude of aircraft + location of slick or plume (Global Positioning System (GPS) positions, if possible) + spill source + size of the spill, including approximate length and width of the slick or plume + visual appearance of the slick (e.g. colour) + edge description (clear or blurred) + general description (windrows, patches etc.) + wildlife, habitat or other sensitive receptors observed + basic metocean conditions (e.g. sea state, wind, current) + photographic/video images	Operations Team Leader Logistics Team Leader	❑

Action		Consideration	Responsibility	Complete
	Source available Santos Aerial Observers, arrange accommodation/logistics and deploy to Forward Operations/ Air base location.	Santos Aerial Observer list available from First Strike Resources on Santos ER Intranet page	Operations Team Leader Logistics Team Leader	❑
	Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation ops. Expected that 2 overpasses per day of the spill area are completed.	Flying time to the Dancer-1 well location is 15 - 25 minutes each way from Karratha. Flights are only to occur during daylight and in weather conditions that do not pose significant safety risks	Operations Team Leader Aviation Superintendent	❑
	Pre-flight briefing		Aerial Observers Contracted aircraft provider/ pilots	❑
	Aerial Observers to commence surveillance	Consider procedure for interacting with marine fauna	Operations Team Leader	❑
	Determine the spill extent by completing Aerial Surveillance Log (**Appendix F**) and Aerial Surveillance Surface Slick Monitoring Template. Calculate volume of oil (**Appendix G**). Take still and/or video images of the slick	Thickness estimates are to be based on the Bonn Agreement Code (Santos Procedure Index)	Aerial Observer	❑
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix H**)		Aerial Observer	❑
	Record shoreline habitat type and degree of oiling by completing the Shoreline Aerial Reconnaissance Log (**Appendix I**)	Thickness estimates are to be based on the Bonn Agreement Code (Santos Procedure Index)	Aerial Observer	❑
	Relay all surveillance records: logs, forms, photographic images, video footage to the IMT	Where possible, a verbal report via radio/telephone en-route providing relevant information should be considered if the aircraft has long transits from the spill location to base	Aerial Observer Planning Team Leader Operations Team Leader	❑

Action		Consideration	Responsibility	Complete
Ongoing Actions	Update flight schedule for ongoing aerial surveillance as part of broader Aviation Subplan of IAP	Frequency of flights should consider information needs of IMT to help maintain the Common Operating Picture and determine ongoing response operations	Operations Team Leader / Aviation Superintendent Planning Team Leader	❑
	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities		Logistic Team Leader	❑
	Update common operating picture with surveillance information and provide updates to spill trajectory modelling provider		Planning Team Leader GIS Team Leader	❑

Table 10-7: Aerial Surveillance Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Rotary Wing Aircraft & flight Crew	Santos contracted provider/s (primary provider currently Babcock)	2 contracted (1 primary + 1 back-up) + additional as required	Karratha (primary base) Learmonth Onslow	Wheels up within 1 hour for Emergency Response. Spill surveillance <6 hours (daylight dependent)
Aerial Surveillance Crew	Santos aerial observers AMOSC Industry Mutual aid	7 x Santos 7 AMOSC staff 5 AMOSC Core Group 54 Additional trained industry personnel	Perth & VI (Santos aerial observers) Australia wide	Santos trained personnel - next day mobilisation to airbase <24 hours
Drones and pilots ** secondary response to assist shoreline and vessel-based surveillance	AMOSC OSRL- 3rd Party UAV provider Local WA hire companies	2 2 x Qualified remote pilots, however response is on best endeavour 10+	Geelong Perth Perth and regional WA	<48 hours OSRL - depending on the port of departure, 1-2 days if within Australia

Table 10-8: Aerial Surveillance – First Strike Response Timeline

Task	Time from IMT call-out
Santos helicopter activated for aerial surveillance	<3 hours
Helicopter onsite for aerial surveillance	<6 hours (daylight dependent)
Trained Aerial Observers mobilised to airbase	<24 hours
Minimum Resource Requirements	
• Santos contracted helicopter and pilots • Santos trained Aerial Observers	

10.3 Tracking Buoys

Table 10-9 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-9: Tracking buoys – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Initiation criteria	Notification of a Level 2 or 3 spill May be deployed for a Level 1 spill if deemed beneficial by the On-Scene Commander	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Tracking buoy deployment will continue for 24 hours after the source is under control and a surface sheen is no longer observable; OR + As directed by the relevant Control Agency	

10.3.1 Implementation Guidance

Table 10-10 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-11** provides a list of resources that may be used to implement this strategy. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-10: Implementation Guidance – Tracking Buoys

Action		Consideration	Responsibility	Complete
Initial Actions	Organise vessel to deploy 2x tracking buoys from Dampier.	Personnel and vessel safety is priority Current Santos on hire vessels or VOO can be used. AIS vessel tracking is available through ER intranet page.	On-Scene Commander/ Operations Team Leader	❑
	Deploy 2x tracking buoys at leading edge of slick.	Note deployment details and weather conditions in incident log	Vessel Master	❑
	Inform IMT that tracking buoys have been deployed and provide deployment details. Monitor movement of tracking buoys	Refer login details of tracking buoy monitoring website on Santos ER intranet site	On-Scene Commander Planning Team Leader/ GIS	❑
	Use tracking buoy data to maintain Common Operating Picture	Data tracked online	IMT Planning Team Leader/ GIS	❑
	Relay information to spill fate modelling supplier for calibration of trajectory modelling		IMT Planning Team Leader/ GIS	❑
Ongoing Actions	Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations.	IAP to provide guidance regarding any additional deployments of tracking buoys	Planning Team Leader	❑
	Mobilise additional tracking buoys if required from other Santos operations (Santos presently has 12 tracker buoys located on the NWS) or from AMOSC stockpiles		Logistics Team Leader	❑
	Direct the deployment of the tracker buoys – for continuous releases over multiple days use a rolling deployment/collection of buoys to provide better coverage of plume direction		Operations Team Leader	❑
	Deploy tracking buoys		Vessel Master	❑
	Monitor movement of tracking buoys		Planning Team Leader/ GIS	❑

Action		Consideration	Responsibility	Complete
	Relay information to spill trajectory modelling supplier for calibration of trajectory modelling		Planning Team Leader/ GIS	❑

Table 10-11: Tracking Buoys Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Tracking buoys x 12	Santos	2 2 4 6	Support Vessels Exmouth Varanus Island Dampier	Support Vessel buoys - <4 hours for incident Exmouth buoys - <12 hours pending vessel availability VI/ Dampier buoys - 24-48 h pending vessel availability
AMOSC tracking buoys	AMOSC	12 AMOSC	Broome x 2 Fremantle x 6 Geelong x 4	Response via duty officer within 15 minutes of first call- AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location.

Table 10-12: AMOSC Equipment Mobilisation Timeframes

	Perth	Darwin	Exmouth	Dampier	Broome
Geelong	40 hrs 3395 km	44 hr 3730 km	64 hrs 4520 km	70 hrs 4840 km	68 hrs 4970 km
Perth	NA	48 hrs 4040 km	15 hrs 1250 km	19 hrs 1530 km	27 hrs 2240 km
Exmouth	15 hrs 1250 km	38 hrs 3170 km	NA	7 hrs 555 km	16 hrs 1370 km
Broome	27 hrs 2240 km	22 hrs 1870 km	16 hrs 1370 km	11 hrs 855 km	NA

Table 10-13: Tracking Buoy – First Strike Response Timeline

Task	Time from IMT call-out
Tracking buoys deployed from Support Vessels	<4 hours
OR	
Tracking buoys deployed from Dampier using vessel of opportunity	<12 hours
Minimum Resource Requirements	
• 2x tracking buoys for initial deployment	

10.4 Oil Spill Trajectory Modelling

Table 10-14 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-14: Oil Spill Trajectory Modelling – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Spill fate modelling will continue for 24 hours after the source is under control and a surface sheen is no longer observable, or until no longer beneficial to predict spill trajectory and concentrations; OR + As directed by the relevant Control Agency	

OSTM uses computer modelling (e.g. OILMAP, SIMAP) to estimate the movement, fate and weathering potential of spills. Santos has engaged RPS Group to provide forecast spill fate modelling. RPS Group use SIMAP and OILMAP modelling systems that comply with Australian Standards (ASTM Standard F2067 “Standard Practice for Development and Use of Oil Spill Models”). RPS Group also provide the capacity for forecast air quality monitoring to enable an assessment of potential health and safety risks associated with VOCs released from a surface slick.

An advantage of spill trajectory modelling is that the transport and weathering of spilled hydrocarbons can be forecast, at all times of the day and night, at any location, and under any type of metocean conditions. By contrast, aerial surveillance and vessel-based monitoring will be constrained to day-time use, and have limits imposed by the operating environment. Aerial surveillance and vessel-based monitoring are, however, essential for model validation, verification and calibration of any modelling or first principal predictions.'

10.4.1 Implementation Guidance

Table 10-15 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 10-16 provides a list of resources that may be used to implement this strategy. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-15: Implementation Guidance – Oil Spill Trajectory Modelling

Action		Consideration	Responsibility	Complete
	Initiate OSTM by submission of an OSTM request form (Santos Procedure Index). Request for 3-day forecast trajectory modelling.		Environment Team Leader	❑
	Determine requirement for gas/VOC modelling and request initiation	hydrocarbon releases have human health and safety considerations for responders (volatile gases and organic compounds). This to be considered for any tactics that monitor/recover oil – especially at close proximity to release site.	Safety Team Leader Environmental Team Leader	❑
	Operational surveillance data (aerial, vessel, tracker buoys) to be provided to modelling provider to verify and adjust fate predictions of the spill and improve predictive accuracy		Planning Team Leader/ GIS	❑
	Login to the RPS Group data sharing website and maintain connection. Download modelling results.	Data should be stored digitally and backed up on to independent digital storage media. All datasets should be accompanied by a metadata summary and documented QA/QC procedures	Planning Team Leader/ GIS	❑
	Place RPS Group modelling data into GIS/ Common Operating Picture	RPS Group is to provide at least daily updates to the IMT of trajectory model outputs to inform response planning. More frequent updates can be provided if weather conditions are highly variable or change suddenly	Planning Team Leader/ GIS	❑
	Identify location and sensitivities at risk based on the trajectory modelling and inform IMT. Conduct NEBA on proposed response strategies.		Environment Team Leader	❑
Ongoing Actions	Request spill trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture		Planning Team Leader/ GIS	❑
Ongoing Actions	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon		Planning Team Leader/ GIS	❑

Action		Consideration	Responsibility	Complete
	assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input data (if or when available) to improve model accuracy			

Table 10-16: Oil Spill Trajectory Modelling Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
RPS Oil Spill Trajectory (OST) modellers and software	RPS under direct contract to Santos. Also available through AMOSC.	Daily OSTM reports	Perth- digital	2-4 hrs from activation

Table 10-17: Oil Spill Trajectory Modelling (OSTM) – First Strike Response Timeline

Task	Time from IMT call-out
RPS OSTM activated by IMT	<2 hours
OSTM provided to IMT	<4 hours
Minimum Resource Requirements	
• Contracted OST modellers and software • OSTM Activation Form	

10.5 Satellite Imagery

Table 10-18 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-18: Satellite Imagery – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Satellite monitoring will continue until no further benefit is achieved from continuing; or as advised by relevant Control Agency.	

Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT.

Suitable imagery may be available via satellite imagery suppliers. This can be done through existing AMOSC and OSRL contracts. The most appropriate images for purchase will be based on the extent and location of the oil spill. Synthetic Aperture Radar (SAR) and visible imagery may both be of value.

10.5.1 Implementation Guidance

Table 10-19 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-20** provides a list of resources that may be used to implement this strategy. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-19: Satellite Imagery Implementation Guide

Action		Consideration	Responsibility	Complete
Initial Actions	Assess requirement for satellite imagery		Planning Team Leader	❑
	Notify AMOSC and OSRL Duty Officer to initiate request for available satellite imagery	Formal written activation of resources from AMOSC and OSRL by designated call-out authorities (Santos Duty Managers/ Incident Commanders) is required	Planning Team Leader	❑
	Assess suitability and order imagery		Planning Team Leader	❑
	Integrate satellite imagery into common operating picture and provide to trajectory modelling provider for model validation		GIS Team Leader Planning Team Leader	❑
Ongoing Actions	Review surveillance information to validate spill fate and trajectory		Planning Team Leader	❑
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required	Use surveillance data when updating the Common Operating Picture	Planning Team Leader	❑

Table 10-20: Satellite Imagery Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Satellite Imagery	Kongsberg Satellite Services (KSAT)- Activated through AMOSC GDS- Activated through OSRL	Dependent upon overpass frequency (TBC on activation)	Digital	KSAT: 1 hour- if satellite images available

10.6 Initial Oil Characterisation

Table 10-21 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-21: Initial Oil Characterisation - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Oil sample and analysis to terminate once enough data has been collected to profile the oil characteristics; OR + As directed by the relevant Control Agency.	

10.6.1 Overview

Given diesel is a common fuel type with known properties and Reindeer condensate is a production hydrocarbon that has been previously assayed, the general physical and chemical characteristics of these hydrocarbons are known and have been presented in **Appendix A.** Nevertheless, sampling and analysis of the released hydrocarbon will provide the most accurate information on the hydrocarbon properties at the time of release.

The composition and physical properties of the hydrocarbon will also evolve over time through weathering processes that change its composition and properties, such as the viscosity, density, water content and pour point. The rate of change of the hydrocarbon properties will affect the likely time-window of opportunities for particular responses and the associated logistical requirements of these responses.

10.6.2 Implementation Guidance

Table 10-22 provides guidance to the IMT on the actions and responsibilities for this strategy. **Table 10-23** provides a list of resources that may be used to implement this tactic. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

10.6.3 Oil Sampling and Analysis

Laboratory analysis

Using onsite vessels of opportunity, oil samples (2L per sample) are to be taken daily where possible from fresh oil, and from the weathered oil locations and dispatched to a laboratory for analysis. Samples are to be collected for 14 days post release where oil is available for sampling.

Laboratory analysis of the chemical and physical properties of the recovered oil, including Gas Chromatography/ Mass Spectrometry (GC/ MS) for the purpose of fingerprinting the oil constituents, is to be undertaken. Fingerprinting of the released hydrocarbon potentially allows contamination to be traced back to the source where this is otherwise unclear or in dispute.

Ecotoxicology assessment of the oil is to be conducted at an ecotoxicology laboratory following the revised Australian and New Zealand Water Quality Guidelines. The quantity of oil required for analysis will be confirmed by the laboratory but is expected to be in the order of 6-10 L of oil. Testing results will provide the concentrations at which toxicity endpoints consistent with revised Australian and New Zealand Water Quality Guidelines are met for each test. Overall species protection concentrations, including 90%, 95% and 99% species protection trigger levels are then to be generated using a Species Sensitivity Distribution (SSD) fitted to the data (e.g. by using the Burrlioz software program).

Table 10-22: Implementation Guidance – Initial Oil Characterisation

Action		Consideration	Responsibility	Complete
Initial Actions	Source available vessels (on hire or VOO) for oil sampling.	Can be multi-tasked – e.g. for vessel surveillance or tracking buoy deployment	Operations Team Leader Logistics Team Leader	❑
	Source sampling equipment. Confirm sampling methodology Confirm laboratory for sample analysis Develop H&S requirements/ controls	Refer **Table 10-23** for resource availability. Appendix A and D of CSIRO oil spill monitoring handbook provide suitable procedure	Environment Team Leader Safety Team Leader	❑
	Vessel directed to sampling location	Sampling of oil at thickest part of slick – typically leading edge	Operations Team Leader	❑
	Vessel crew to undertake sampling and delivery of samples to Exmouth or Dampier for dispatch to laboratory. Environmental Team Leader to confirm analysis of oil with lab	Exmouth and/or Dampier Logistics personnel to assist with logistics of sending oil samples to laboratory for analysis	Operations Team Leader Environmental Team Leader Logistics Team Leader	❑
Ongoing Actions	Continue sample collection for 14 days post release where oil is available	Initial monitoring by crew of available vessels – Once mobilised to site Santos scientific monitoring provider to continue sampling of oil in conjunction with operational water quality monitoring once mobilised to site.	Operations Team Leader Environment Team Leader Logistics Team Leader	❑

Table 10-23: Initial Oil Characterisation - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Oil fingerprinting kits	AMOSC/Santos	3	Exmouth, Varanus Island, Dampier*	Within 12 hours
Bulk oil sampling bottles	Intertek/Santos	As required	Perth Exmouth, Varanus Island, Dampier*	Within 12 hours

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Santos contracted vessel providers. Vessels of Opportunity identified through AIS vessel tracking system	Availability dependent upon Santos and Vessel Contractor activities.	Vessels mobilised from Exmouth, Dampier, Varanus Island or offshore location. Locations verified through AIS vessel tracking system	Pending availability and location. Expected within 12 hours.	Santos Contracted Vessel Providers. Vessels of Opportunity identified through AIS Vessel Tracking
National Association of Testing Authorities (NATA) accredited Laboratory/ personnel for analysis	Intertek	NA	Perth	24+ hrs
*oil sampling kits are currently being procured with the intent to store at Varanus Island and logistics yards at Exmouth and Dampier.				

Table 10-24: Initial Oil Characterisation – First Strike Response Timeline

Task	Time from IMT call-out
Oil sample collection	<12 hours (daylight dependent)
Oil samples arrive at lab for analysis	<36 hours
Minimum Resource Requirements	
• 1x vessel. No special requirements. Oil sampling can be done concurrently with other tasks. • 1x oil fingerprinting kit[1]. • Sampling jars for bulk oil collection[1].	

[1] oil fingerprinting kits and sample bottles for laboratory analyses are currently being procured with the intent to store at Varanus Island and logistics yards at Exmouth and Dampier.

10.7 Operational Water Quality Monitoring

10.7.1 Operational Water Sampling and Analysis

Table 10-25 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-25: Operational Water Quality Sampling and Analysis - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Operational water sampling and analysis will continue for 24 hours following control of the source provided oil is no longer detectable; or + As directed by the relevant Control Agency; or + Vessel Surveillance will terminate if there are unacceptable safety risks associated with volatile hydrocarbons at the sea surface.	

Operational sampling of oil and oil in water will be undertaken at discrete locations, providing visual observations, real time fluorometry/ dissolved oxygen readings and providing oil and water samples for laboratory analysis. The intent of this sampling is to confirm the distribution and concentration of oil, validating spill trajectory modelling and providing and informing the selection and implementation of other response strategies, including scientific monitoring.

Table 10-26 presents the water quality sampling and analysis plan considerations.

This monitoring is complimentary to scientific water quality monitoring plan (SMP1) delivered through the Oil Spill Scientific Monitoring Plan (EA-00-RI-10099) in terms of methodology and required skillset and can be provided through Santos' Scientific Monitoring Provider (**Section 16**).

10.7.1.1 Implementation Guidance

Refer to **Table 10-27** for the Operational Water Quality Sampling and Analysis implementation guide. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-26*: Operational Water Quality Sampling and Analysis Plan considerations*

Considerations for Operational Water Quality Sampling and Analysis	
Scope of Work	The work scope for operational water quality monitoring will be driven by the IMT, confirming objectives for each operational period.
Survey design	The operational water sampling activities will be conducted by experienced environmental scientists and managed through the IMT IAP process. The exact nature of the sampling activities will depend upon the objectives for each operational period; however, the sampling design and methodology will consider the following points: + Sampling locations will be moved with the slick and/or plume based on the observed or predicted location and movement of oil on water and subsea plumes. This will be informed by vessel/aerial surveillance, satellite tracking buoys and spill fate modelling; + At each discrete location, sampling will be conducted along a depth profile which captures the three-dimensional distribution of the oil. For a subsea release or where surface oil is present in shallow water (<5 m) this should involve a depth profile from the seabed to surface waters. Profiles should ensure that the full gradient of oil in water concentration can be determined; + Oil and oil in water samples are to be collected using suitable pumping or sampling apparatus. For samples at depth a Niskin bottle(s) or similar device that allows remote closing and discrete sampling at depth is to be used. Alternatively, water samples can be pumped from defined depths using a hose suspended vertically using a suitable pump for water sampling (e.g. a peristaltic pump); + Samples are to be collected in clean, fully labelled glass jars, filled to the top and refrigerated/ kept cool and in darkness during storage and transport. Handling, storage and documentation requirements to be confirmed with laboratory but holding time <7 days is expected requirement; + Oil and oil in water samples will be replicated at each site to allow intra-site variability to be assessed and appropriate QA/QC samples incorporated into replicates; + Concurrent with collection of water samples a Conductivity-Temperature-Depth (CTD) meter shall be deployed at each site along the same depth profile from which water samples are collected. The CTD will require fluorometry and Dissolved Oxygen (DO) sensors as part of the sensor package to record the presence of oil (fluorometry) and the activity of hydrocarbon degrading bacteria (DO); and + Water samples also to be provided to an independent NATA-accredited laboratory in Perth for hydrocarbon suite analysis including polycyclic aromatic hydrocarbons (PAHs).
Analysis and reporting	+ All data collected on oil properties provided in spreadsheets (including GPS location, depth of sampling, timing, on water observations, in-situ readings and water sample label details) to IMT on an ongoing basis during spill response operations; + Daily field reports of results provided to the IMT; + Analytical analysis of oil properties following laboratory evaluation; and + Final report detailing all data collected on oil properties throughout the monitoring program including relevant interpretation.

Table 10-27: Implementation Guidance - Operational Water Quality Sampling and Analysis

Action		Consideration	Responsibility	Complete
Initial Actions	Activate Santos Monitoring Service Provider for Operational Water Quality Monitoring		Environment Team Leader	❑
	Obtain spill trajectory modelling and provide to Monitoring Service Provider		Environment Team Leader Planning Team Leader GIS Support	❑
	Develop Monitoring Action Plan (Including Sampling and Analysis Plan) for operational water quality monitoring. Plan to also consider oil characterisation sampling (**Section 10.5**)– Monitoring Service Provider to take over this sampling once mobilised.	Sites to be selected using OSTM and distribution of oil from surveillance tactics. Refer **Table 10-26** for considerations for Sampling and Analysis Plan	Monitoring Service Provider Environment Team Leader	❑
	Develop health and safety plan including potential exposure to volatile gases/VOCs	Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	Monitoring Service Provider Safety Team Leader	❑
	Monitoring Service Provider to assemble team/s and water quality monitoring equipment		Monitoring Service Provider	❑
	Organise Vessels, accommodation and transport requirements to mobilise monitoring team/s to site	Monitoring Service provider to outline requirements in resource request form	Logistics Team Leader	❑
	Sampling and analysis undertaken. Daily communication and confirmation of sampling plan with On-Scene commander and IMT. Daily activity/data reports provided to IMT. Oil/water samples dispatched to nominated laboratories for analysis.		Monitoring Service Provider On-Scene Commander Operations Team Leader Environment Team Leader Logistics Team Leader	❑

Action		Consideration	Responsibility	Complete
Ongoing Actions	Monitoring results to be conveyed to IMT through Common Operating Picture and provided to spill trajectory modeller to validate predictions.		Planning Team Leader GIS Support Environment Team Leader	❑

Table 10-28: Operational Water Quality Sampling and Analysis - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Water quality monitoring personnel	Monitoring Service Provider (currently Astron/BMT)	Approx. 15 (based on capability reports)	Perth based	Personnel and equipment within 72 hour from approval of work scope - pending vessel availability.
Water quality sampling equipment and water quality meters	Third party suppliers via Monitoring Service Provider (currently Astron/BMT)	Multiple providers	Australia based	
Contracted water quality monitoring vessels	Santos Contracted Vessel Providers.	Availability dependent upon Santos and Vessel Contractor activities.	Vessels mobilised from Exmouth, Dampier, Varanus Island or offshore location. Locations verified through AIS Vessel Tracking Software	<72 hours

Table 10-29: Operational Water Quality Sampling and Analysis – First Strike Response Timeline

Task	Time from IMT call-out
IMT activates monitoring service provider	<4 hours
Operational water quality monitoring personnel, equipment and vessel deployed to spill site	<72 hours
Minimum Resource Requirements	
• Water quality monitoring vessel/s – refer Santos ER Intranet for vessel specification • Water quality monitoring team (through monitoring service provider) • Water quality monitoring equipment (through monitoring service provider)	

10.7.2 Continuous Fluorometry Surveys

Table 10-30 provides the Environmental Performance Outcome, initiation criteria, termination criteria and other key aspects for this strategy

Table 10-30: Continuous Fluorometry Surveys - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Initiation criteria	Level 2/3 spill	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Continuous fluorometry surveys will continue for 24 hours following control of the source provided oil is no longer detectable; or + As directed by the relevant Control Agency.	

In addition to operational water sampling and sensor deployment at discrete locations, a continuous fluorometry survey(s) may be run across the expected slick/plume extent, as well as vertically through the water column. This allows a far greater area of coverage than discrete sampling, aiding in the mapping of entrained and dissolved oil movement.

Sub surface gliders containing fluorometers built into the body of the glider may be used for this monitoring and would be preferential for monitoring a continuous subsea release (well leak scenario). This will allow continuous monitoring of entrained oil covering a large area and will provide near real-time three-dimensional data on the distribution of entrained oil to enable decision making within the IMT. Similarly, other sources of monitoring data (e.g. spill fate modelling) can be used in near real-time to inform the path of the sub surface glider. Sub surface gliders are particularly suited to subsea releases where oil may be distributed below surface layers.

Towed fluorometers towed behind vessels will be used as an alternative or complementary approach for a subsea release and would be preferred for surface spills.

10.7.3 Implementation Guidance

Table 10-31 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-32** provides a summary of resources that may be used to implement this strategy. **Table 10-33** details the minimum first strike requirements to be mobilised on activation. The Incident Commander is ultimately responsible for the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-31: Continuous Fluorometry Surveys – Implementation Guidance

Action		Consideration	Responsibility	Complete
Initial Actions	Activate Monitoring Service Provider and engage to provide towed fluorometry services (personnel and equipment) as part of Operational Water Sampling and Analysis – refer **Table 10-27** for actions.		Monitoring Service Provider Environment Team Leader	❑
	Activate OSRL monitoring and determine availability of subsea gliders and towed fluorometry equipment.	OSRL can provide specialist technical advice on operation of towed fluorometers. Consider: Engaging OSRL for review and input into monitoring Action plan for towed fluorometry	Incident Commander Environment Team Leader	❑
	Determined suitability of subsea gliders for monitoring	Sub surface gliders containing fluorometers built into the body of the glider may be used for this monitoring and would be preferential for monitoring a continuous subsea release (well leak scenario)	Environment Team Leader	❑
	If gliders and pilot/s available and suitable for incident, engage provider to develop Monitoring Action Plan.	Arrange joint meeting with spill modelling provider and OSRL/ glider operator to develop monitoring design and ongoing data transfer protocols to meet objective of model validation.	Environment Team Leader	❑
	Source vessels and other logistics to support monitoring		Logistics Team Leader Operations Team Leader	❑
	Conduct monitoring as per monitoring action plan with deployment area guided by other operational monitoring studies	The scope of monitoring will be dictated by the response strategies being employed.	Operations Team Leader Planning Team Leader Environment Team Leader	❑
Ongoing Actions	Provide daily data reports and spatial outputs IMT		Monitoring Provider	❑
	Monitoring results to be incorporated into Common Operating Picture		Planning Team Leader GIS Support	❑

Table 10-32: Continuous Fluorometry Surveys - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Towed fluorometers	OSRL	Towed Fluorometers: 7 x Turner C3 fluorometers globally	4 in Southampton, 2 in Singapore and 1 in Fort Lauderdale	<72 hours
Glider mounted fluorometers	OSRL	Subsea glider: Qty subjected to availability from OSRL contractor - 1 engineer from OSRL contractor to deploy and operate the Glider.	Gliders based in Perth OSRL towed fluorometers out of Singapore, Southampton and Fort Lauderdale	<72 hours dependent upon availability
Water quality monitoring personnel to operate towed fluorometers	Monitoring Service Provider (currently Astron/BMT)	approx. 15 (based on capability reports)	Perth based	<72 hours
Glider (remote) pilot/s and deployment crew	Third-party provider via OSRL	Subsea glider: Qty subjected to availability from OSRL contractor - 1 engineer from OSRL contractor to deploy and operate the Glider.	Perth based pilot and deployment crew	<72 hours dependent upon availability

Table 10-33: Operational Water Quality Sampling and Analysis – First Strike Response Timeline

Task	Time from IMT call-out
IMT activates OSRL and Monitoring Service Provider	<4 hours
Monitoring Service Provider water quality monitoring personnel deployed to site	<72 hours
Towed fluorometers deployed to site	<72 hours
Glider and pilot/s and deployment crew deployed (if gliders available and appropriate)	<72 hours (if gliders available and appropriate)
Minimum Resource Requirements	
• Water quality monitoring vessel/s – refer Santos ER Intranet for vessel specification • Water quality monitoring team (through monitoring service provider) • OSRL Towed fluorometer (Turner C3)	

10.8 Shoreline and Coastal Habitat Assessment

Table 10-34 provides the Environmental Performance Outcome, initiation criteria, termination criteria and other key aspects for this strategy.

Table 10-34: Shoreline and Coastal Habitat Assessment - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Initiation criteria	Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by On-Scene Commander)	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	As directed by the relevant Control Agency	

To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character (topography, complexity, exposure etc.), degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts. This detailed information can be collected from on-ground assessments.

DoT are the designated Control Agency for shoreline response for all spills identified in this OPEP and will direct resources provided through Santos for the purposes of on-ground shoreline assessments and shoreline response activities. Santos will provide additional information on shoreline character and oiling collected as part of aerial surveillance activities carried out under its control (refer **Section 10.2**).

Existing information on shoreline character, distribution of habitats/fauna and access/safety constraints can be obtained from:

+ Santos Energy GIS, including habitat/fauna distribution layers and aerial imagery
+ Oil Spill Response Atlas (OSRA) Web Map Application (WMA)
+ Pilbara Region Oiled Wildlife Response Plan

+ WA Marine Oil Pollution Risk Assessment Web Map Application (WMOPRAWMP) (rankings and general information on protection priorities).

10.8.1 Implementation Guidance

The information provided below is included for planning purposes and represents how Santos would approach shoreline assessments. In the event of a spill with the potential for shoreline contact, DoT, will control shoreline assessments and ultimately personnel supplied through Santos will follow the direction of DoT; this may differ from that included below.

DoT provides guidance on shoreline assessments within their Oil Spill Contingency Plan.

Table 10-35 presents considerations for planning and conducting the assessments.

The implementation guide for Shoreline and Coastal Habitat and Assessment is found in **Table 10-36**.

Table 10-37 provides a list of resources that may be used to implement this strategy and **Table 10-38** details the minimum first strike mobilisation requirements for Santos on activation.

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-35*: Shoreline and Coastal Habitat Assessment Considerations*

Considerations for Shoreline and Coastal Habitat Assessment	
Survey design	A shoreline assessment may include the following tasks: 1. Assessment of shoreline character, habitats and fauna including: + Shoreline structured biotic habitats; + Distribution of fauna; + Shoreline and processes (e.g. Wave, tidal flows; + Shoreline substrate (e.g. Mud, sand, pebble, rock); + Shoreline form (e.g. Width, shape and gradient); and + Access/ safety constraints. 2. Assessment of shoreline oiling: + Surface distribution and cover; + Subsurface distribution; + Oil type, thickness, concentration and physical character; and + Sampling of oil for laboratory analysis. 3. Recommendations for response; + Applicable strategies based on oil type and habitat; + Potential access, safety and environmental constraints; and + Likely resourcing (personnel and equipment) requirements. Ground surveys undertaken on foot, by vehicles or by small vessel will occur at prioritised areas to provide a close range assessment of shoreline physical characteristics, coastal habitats/fauna, scale and character of oiling and safety/ access constraints. Ground surveys should be undertaken by trained shoreline clean-up specialists and other trained oil spill responders as per those required for managing shoreline clean-up operations.

Considerations for Shoreline and Coastal Habitat Assessment	
	This includes the use of AMOSC Core Group personnel across industry and State and National Response Teams as provided for under MEE and NatPlan. The deployment of ground survey teams will be directed by DoT as the HMA and Control Agency for coastal/ shoreline pollution in WA. The deployments will be informed by the observed and predicted contact of oil and from existing baseline information on shoreline character. Shoreline surveys will be undertaken within segments that are recorded and/or mapped that share common traits based on coast geomorphology, habitat type, fauna presence, level of oiling or access. Information on shoreline character and habitat/fauna distribution for each segment should be recorded through the use of the following techniques: + Still or video imagery collected with simultaneous GPS acquisition; + Field notes together with simultaneous GPS acquisition; + Mud maps outlining key natural features, oil distribution, imagery locations of quantitative data (transects, oil samples); + Transects (cross-shore, longshore) and vertical sediment profiles; and + Samples of oil and/or oiled sediments. The following parameters should be assessed: + Physical characteristics: rocky, sandy beach, flat, dune, other wetland; + Major habitat types: mangrove, salt marsh, saltpan flats, fringing reef, rubble shore, seagrass verge; + Coastal fauna and key habitats (e.g. Nests) including quantification/ distribution of oiled fauna; + State of erosion and deposition: deposition, erosion, stable; + Human modified coastline (access tracks, facilities etc); and + Oil character, if present, including appearance, surface thickness, depth (into sediments), distribution, area and percentage cover.
Analysis and reporting	Shoreline survey reports to be submitted to the Control Agency IMT at completion of assessments. All raw data collected will be included as appendices to the report and provided in a geospatial format for subsequent use in GIS mapping software.

Table 10-36: Shoreline and Coastal Habitat Assessment – Implementation Guidance

Action		Consideration	Responsibility	Complete
Initial Actions	Ensure initial notifications to WA DoT have been made	Refer to **Section 7** for reporting requirements	Environment Team Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for assistance in identification of priority protection areas and NEBA.	Existing shoreline sensitivity mapping information for the potential oil contacted locations is available on the Santos ER intranet site.	Environment Team Leader Planning Team Leader	❑
	Actions below are indicative only and are at the final determination of DoT as the Control Agency			
	Mobilise the AMOSC core group responders as required for industry support to DoT	Refer to **Table 10-37**	Incident Commander Operations Team Leader Logistics Team Leader	❑
	Assessment of shoreline character, habitats and fauna.	Refer to **Table 10-35**	AMOSC Core group and DoT	❑
	Assessment of shoreline oiling.	Refer to **Table 10-35**	AMOSC Core group and DoT	❑
	Recommendations for response strategies.	Refer to **Table 10-35**	AMOSC Core group and DoT	❑

Table 10-37: Shoreline and Coastal Habitat Assessment - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Santos and WA industry AMOSC core group staff and responders	Santos Core Group Industry Core Group, AMOSC staff	12 (Santos core group) 60+ (industry core group ops)	Perth, Dampier, Varanus Island and other NW locations	<24 hours from time of shoreline contact prediction

Table 10-38: Shoreline Assessment – First Strike Response Timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction and begins sourcing personnel for shoreline assessment team	<4 hours
AMOSC core group (shoreline assessment personnel) mobilised to site	<24 hours
Minimum Resource Requirements	
• Minimum 2x AMOSC core group personnel	

10.9 Environmental Performance

Table 10-39: Environmental Performance- Monitor and Evaluate

Environmental Performance Outcome	Implementation monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Response Preparedness			
Monitor and Evaluate – vessel and aerial surveillance	Maintenance of Master Services Agreement (MSAs) with multiple vessel providers	Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	MSA with aircraft supplier	MSA in place with helicopter provider throughout activity	MSA with aircraft suppliers
	Santos trained Aerial Observers	Santos maintains a pool of trained aerial observers	Exercise Records Training Records
	AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	AMOSC Participating Member Contract
	Access to certified Unmanned Aerial Vehicles (UAV) providers	Maintenance of contract for access to UAV providers	Maintenance of contract with service provider
	Aircraft charter companies for fauna observations	Maintain a list of aircraft charter companies that could potentially provide fauna observation services	List of providers
Response Implementation			
Monitor and Evaluate – vessel and aerial surveillance	Vessel Surveillance	Minimum first strike resource requirements mobilised in accordance with **Table 10-4**	Incident log

Environmental Performance Outcome	Implementation monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		Daily observation reports submitted to IMT until termination criteria is met	Incident log
	Vessels and aircraft compliant with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	Vessels comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising the risk of collision with marine fauna	Completed vessel statement of conformance
		Aircraft comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising interaction with marine fauna	Aircraft contractor procedures align with Santos's Protected Marine Fauna Interaction and Sighting Procedure
	Aerial surveillance	Minimum first strike resource requirements mobilised in accordance with **Table 10-8**	Incident log
		Following initiation two passes per day of spill area by observation aircraft provided	Incident log
		Trained Aerial Observers supplied from Day 2 of response	Incident log

Environmental Performance Outcome	Implementation monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		Flight schedules are maintained throughout response	Incident Action Plan (IAP)
		Observers completed aerial surveillance observer log following completion of flight	Aerial Observer Logs
Response Preparedness			
Monitor and Evaluate – tracking buoys	Tracking buoys available	Maintenance of 12 tracker buoys throughout the activity	Computer tracking software Tracker buoy tests
Response Implementation			
Monitor and Evaluate – tracking buoys	Tracking buoy mobilisation	Minimum requirements mobilised in accordance with **Table 10-11**	Incident log
Response Preparedness			
Monitor and Evaluate – oil spill modelling	Maintenance of contract for emergency response modelling	Maintenance of contract for forecast spill trajectory modelling services throughout activity	Modelling services contract
Response Implementation			
Monitor and Evaluate – oil spill modelling	Oil spill modelling	Oil Spill Modelling provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill	Incident Log
		Modelling delivered to IMT within 2 hours of request to service provider	Incident Log
Response Preparedness			
Monitor and Evaluate – satellite imagery	Satellite imagery	Contract in place with third party provider to enable access and analysis of satellite imagery	Contract with service provider
Response Implementation			
Monitor and Evaluate – satellite imagery	Satellite imagery	Data incorporated into common operating picture and provided to spill modelling provider	Incident Log and IAP

Environmental Performance Outcome	Implementation monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Response Preparedness			
Monitor and Evaluate – oil and oil in water monitoring	Maintenance of Monitoring Service Provider contract for water quality monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Entrained oil monitoring equipment and services	Maintenance of arrangements to enable access to fluorometry services throughout activity	Arrangement with provider of fluorometry equipment
	Water quality monitoring vessels	Maintenance of vessel specification for Water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil and water quality monitoring kits pre-positioned at Exmouth, Dampier and Varanus Island	Evidence of deployment to site
Response Implementation			
Monitor and Evaluate – oil and oil in water monitoring	Initial Oil Characterisation	Minimum requirements mobilised in accordance with **Table 10-20**	Incident Log
		Oil samples sent to laboratory for initial fingerprinting	Incident Log
		Oil samples to be sent immediately for laboratory ecotoxicity testing of oil	Incident Log
		90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results (minimum 5 species’	Incident Log

Environmental Performance Outcome	Implementation monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		tests) within 24 hours of receiving all results	
	Operational Oil and Oil in Water Monitoring	IMT activates monitoring service provider within 4 hours	Incident Log
		Operational water sampling and analysis surveys mobilised within 72 hours of approval	Incident Log
		Fluorometry surveys mobilised within 5 days of initiation	Incident Log
		Daily report including fluorometry results provided to IMT	Incident Log
Response Preparedness			
Monitor and Evaluate – shoreline assessments	AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders	AMOSC Participating Member Contract
Response Implementation			
Monitor and Evaluate – shoreline assessments	Shoreline assessment	Minimum shoreline assessment requirements mobilised as per **Table 10-38**	Incident Log
		Shoreline Assessment strategies will be implemented under the direction of DoT as the HMA	Incident Log
		Santos will make available AMOSC Core Group Responders for shoreline and coastal habitat assessment positions to the Control Agency	Incident Log
		Shoreline assessment reports provided to the IMT daily detailing the assessed areas to maximise effective utilisation of resources	Incident Log

Environmental Performance Outcome	Implementation monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Use of shallow draft vessels for shoreline and nearshore operations	Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency (i.e. DoT).	Vessel specification documentation contained in IAP.
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Conduct shoreline/nearshore habitat/bathymetry assessment	Unless directed otherwise by the designated Control Agency (i.e. DoT) a shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities.	IAP records assessment records
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat.	Unless directed otherwise by the designated Control Agency (i.e. DoT) demarcation zones are mapped out in sensitive habitat areas.	IAP demonstrates requirement is met
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	Unless directed otherwise by the designated Control Agency (i.e. DoT) action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met

11 Mechanical Dispersion Plan

Table 11-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 11-1: Mechanical Dispersion - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	To create mixing for oil and water to enhance natural dispersion	
Initiation criteria	Operational monitoring identifies thin oil patches at sea surface that are not naturally dissipating in sea surface and is posing risks to wildlife and shorelines by remaining on the surface.	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔ (applicable for targeted small breakaway patches)
Termination criteria	+ There is no longer a noticeable reduction of surface oil resulting from the activity; or + NEBA is no longer being achieved; + Unacceptable safety risks associated with gas and VOCs at the sea surface; and + Agreement is reached with Jurisdictional Authorities to terminate the response.	

11.1 Overview

This response strategy assists with the natural dispersion process; creating mixing through physical agitation, which encourages the oil to break into smaller particle sizes that are more easily biodegraded. The two common activities associated with mechanical dispersion are:

Manoeuvring a vessel through the slick, using propeller wash to create mixing in the water body; and

Spraying water from the fire hose of a vessel and moving the vessel through the water body to create additional mixing and breakup of the slick.

11.2 Implementation Guidance

Table 11-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 11-3** provides a list of resources that may be used to implement this strategy. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 11-2: Implementation Guidance – Mechanical Dispersion

Action		Consideration	Responsibility	Complete
Initial Actions	The Operational NEBA will confirm the suitability and environmental benefit of conducting mechanical dispersion at appropriate locations.	Water depth, sea state, possible impacts to sensitive shorelines and/or wildlife before spill naturally disperses. This activity is to be conducted during daylight hours only and once the safety plan has been developed	Operations Team Leader Environment Team Lead Planning Team Leader	❑
	Safety team lead to develop a safety plan for the activity with respect to potentially dangerous gasses and VOC's (including applicable controls).		Operations Team Leader Safety Team Leader	❑
	Notify vessel based responders to trial mechanical dispersion		Operations Team Leader	❑
	Response personnel on vessels to evaluate the effectiveness of the use of mechanical dispersion operations to reduce the volume of oil on the water surface. Communicate the information to the IMT Operations Team Leader for inclusion in Operational NEBA		Vessel Master/s Santos AMOSC Core Group Responders	❑

Table 11-3: Mechanical Dispersion Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Vessels undertaking other activities	Santos contracted vessel providers	Varies – check through vessel contractors/ Santos vessel tracking system	Exmouth, Dampier, NW locations	Varies subject to location/ availability

11.3 Environmental Performance

Table 11-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 11-4: Environmental Performance – Mechanical Dispersion

Environmental Performance Outcome	To create mixing for oil and water to enhance natural dispersion		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Response implementation			
Mechanical Dispersion	Mechanical Dispersion Plan Safety Plan Operational NEBA	Mechanical dispersion is to be conducted during daylight only, once the safety plan has been developed and Operational NEBA confirms suitability and environmental benefit	Incident Log IAP

12 Shoreline Protection and Deflection Plan

Table 12-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 12-1: Shoreline Protection and Deflection - Objectives, Initiation Criteria and Termination Criteria

<table>
<tr><td>Environmental Performance Outcome</td><td colspan="2">Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities</td></tr>
<tr><td>Initiation criteria</td><td colspan="2">+ Level 2 or Level 3 spills where shorelines with identified or potential protection priorities will potentially be contacted; and
+ Approval has been obtained from DoT IC or delegate (as the Control Agency) to initiate response strategy</td></tr>
<tr><td rowspan="2">Applicable hydrocarbons</td><td>Diesel</td><td>Gas condensate</td></tr>
<tr><td>✔</td><td>✔</td></tr>
<tr><td>Termination criteria</td><td colspan="2">+ NEBA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s; and
+ Agreement is reached with Jurisdictional Authorities to terminate the response strategy</td></tr>
</table>

12.1 Overview

Protection and deflection tactics are utilised to divert hydrocarbons away from sensitive shoreline receptors and are more effective if they are deployed ahead of spill contact. They are typically used to protect smaller, high priority sections of shoreline.

The effectiveness of this response will be dependent on spill characteristics, hydrocarbon type, and the operating environment. Deployment is subject to safety constraints such as the potential grounding of vessels.

Protection and deflection is part of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Control Agency. Santos will undertake first-strike protection and deflection activities as required. Upon assumption of Control Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline protection. Santos will provide all relevant information on shoreline character and oiling collected as part of surveillance activities carried out under its control (refer **Section 10**).

The information provided below is included for planning purposes and represents Santos' first-strike response for protection and deflection activities. In the event of a spill with the potential for shoreline contact, the ongoing response objectives, methodology, deployment locations and resource allocation will be controlled by DoT, as the Control Agency and therefore may differ from that included below.

Information gathered during operational monitoring including shoreline assessments and assessed through an Operational NEBA will guide the selection of protection and deflection locations and techniques.

Shoreline protection and deflection techniques include:

+ Nearshore booming, which can involve different booming arrangements including:
    i. Exclusion booming: boom acts as a barrier to exclude the spill from areas requiring protection

ii. Diversion booming: booms divert the spill to a specific location where it may be removed (e.g. sandy beach)
iii. Deflection booming: booms deflect the spill away from an area requiring protection

+ Berms, dams and dikes – uses sandbags or embankments to exclude oil from sensitive areas;
+ Shoreside recovery – uses nearshore skimmers to collect oil corralled by nearshore booms (also used during shoreline clean-up);
+ Passive recovery -uses sorbent booms or pads to collect oil and remove it from the environment. This can be used as a pre-impact tactic where sorbents are laid ahead of the spill making contact with the shoreline; and
+ Non-oiled debris removal – removes debris from the shoreline before it is impacted to reduce overall waste volumes from shoreline clean-up.

The effectiveness of these techniques will be dependent on local bathymetry, sea state, currents/tides and wind conditions and the available resources.

12.2 Implementation Guidance

Table 12-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 12-3** provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial protection and deflection operations, unless directed otherwise by DoT, are listed in **Table 12-4**. The Incident Commander of the DoT's IMT (once the DoT assumes control) is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 12-2: Implementation Guidance – Shoreline Protection and Deflection

Action		Consideration	Responsibility	Complete
Initial Actions	Ensure initial notifications to WA DoT have been made	Refer to **Table 7-1** for reporting requirements	Environment Team Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for confirmation of priority protection areas and NEBA		Environment Team Leader Planning Team Leader	❑
	Where DoT have assumed roles as Control Agency actions undertaken by DoT may differ to those below.			
	Conduct Operational NEBA to determine if protection and deflection is likely to result in a net environmental benefit using information from shoreline assessments (**Section 10.8**) and any tactical response plans for the area.	Pre-existing TRPs exist for various locations including Montebello Islands and Muiron Islands and are available on the Santos ER Intranet page. Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, Pilbara Region Oiled Wildlife Response Plan and WAMOPRA.	Environment Team Leader	❑
	If NEBA indicates that there is an overall environmental benefit, develop a Shoreline Protection Plan (IAP Sub-Plan) for each deployment area	Shoreline Protection Plan may include (but not be limited to) and should reference any existing TRPs: + Priority nearshore and shoreline areas for protection (liaise with Control Agency for direction on locations) + Locations to deploy protection and deflection equipment + Permits required (if applicable) + Protection and deflection tactics to be employed for each location	Operations Team Leader Planning Team Leader Environment Team Leader	❑

Action		Consideration	Responsibility	Complete
		+ List of resources (personnel and equipment) required + Logistical arrangements (e.g. staging areas, accommodation, transport of personnel) + Timeframes to undertake deployment + Access locations from land or sea + Frequency of equipment inspections and maintenance (noting tidal cycles) + Waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes + No access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (utilise existing roads and tracks first)		
	If required identify vessels with relevant capabilities (e.g. shallow draft) for equipment deployment in consultation with Control Agency	Ensure vessels have shallow draft and/or a suitable tender (with adequate towing capacity and tie-points) if they are required to access shorelines	Operations Team Leader Logistics Team Leader	❑
	Deploy shoreline protection response teams to each shoreline location selected and implement response	If passive recovery and/or non-oiled debris removal has been selected as a tactic, ensure deployment activities prioritise their implementation prior to hydrocarbon contact	Operations Team Leader On-Scene Commander	❑
Ongoing Actions	Conduct daily re-evaluation of NEBA to assess varying net benefits and impacts of continuing to conduct shoreline protection and deflection activities		Environment Team Leader	❑

Action		Consideration	Responsibility	Complete
	Report to the Operations Team Leader on the effectiveness of the tactics employed		Shoreline Response Team Leader – AMOSC core group responder	❑
	Response teams to conduct daily inspections and maintenance of equipment	Shoreline protection efforts will be maintained through the forward operation(s) facilities setup at mainland locations under direction of DoT Response crews will be rotated on a roster basis, with new personnel procured on an as needs basis from existing human resource suppliers	Shoreline Response Team Leader	❑

Table 12-3: Shoreline Protection and Deflection- Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
AMOSC nearshore boom and skimming equipment'	AMOSC	Beach Guardian (98x 25m lengths) Zoom Boom (199 x 25m lengths) HDB Boom (2x 200 m lengths) Curtain Boom (58 x 30 m lengths) Skimmers: Passive Weir GT 185 Desmi 250 Weir Ro-skim Weir boom	Broome x 4; Exmouth x 20; Fremantle x 23; Geelong x 51 Broome x 8; Exmouth x 20; Fremantle x 30; Geelong x 141 Broome x 2; Fremantle x 18; Geelong x 40 Exmouth x 1; Fremantle x 1; Geelong x 1 Exmouth x 1; Geelong x 1 Geelong x 1 Geelong x 2	Response via duty officer within 15 minutes of first call- AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location. For mobilisation timeframes refer **Table 10-12**
AMSA nearshore boom/skimmer equipment	AMSA	Canadyne inflatable Structureflex inflatable	Karratha x 5; Karratha x 10; Fremantle x 15	Access to National Plan equipment through AMOSC.

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
		Versatech zoom inflatable Slickbar - solid buoyancy Structureflex - solid buoyancy Structureflex - land sea Skimmers: None for inshore HFO or heavy crude	Karratha x 5; Fremantle x 13 Karratha x 2 Karratha x 3; Fremantle x 10 Karratha x 30; Fremantle x 30 other locations around Aust	For mobilisation timeframes refer **Table 10-12**
Santos owned nearshore boom/ skimming equipment	Santos	Beach Guardian (8x 25m lengths) Zoom Boom (16 x 25m lengths) 2x Desmi DBD16 brush skimmer	Varanus Island Varanus Island 1 ea Dampier and VI	Within 12 h for deployment by vessel from VI
Personnel (field responders) for OSR strategies	AMOSC Staff	8	Fremantle x 2 Geelong x 6	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site.
	AMOSC Core Group (Santos)	12	Perth/ NW Aus facilities x 10 Port Bonython (SA) x 2	12+ hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation.

Table 12-4: Shoreline Protection and Deflection – First Strike Response Timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirm if protection of shoreline sensitivity/s is required and begins sourcing resources	<4 hours
Santos Offshore Core Group mobilised to protection site or deployment port location	<12 hours
Protection booming equipment mobilised to protection site or deployment port location	<12 hours
Waste storage equipment mobilised to protection site or deployment port location	<12 hours
Boom deployment vessel / remote island transfer vessel mobilised to protection site or deployment port location	<12 hours
AMOSC Staff and Industry Core Group mobilised to protection site or deployment port location	<24 hours
Protection/deflection operation deployed to protection location	<24 hours (weather/daylight dependent)
Minimum Resource Requirements	
NB: Resource requirements for protection and deflection will be situation/receptor specific. TRPs if developed for the area/receptor will outline suggested resource requirements. TRPs are held by Santos and DoT and have been developed for Montebello Islands and Muiron Islands amongst other locations. Indicative first strike resources for a single site protection area are: • 1x Small vessel suitable for boom deployment; • Shoreline (e.g. Beach Guardian) and nearshore booms (e.g. Zoom Boom) plus ancillary equipment (e.g. anchors, stakes) sufficient for protection of shoreline resource (refer TRP if applicable); • 1x skimmer appropriate for oil type; • Waste storage equipment; • 1x Protection and Deflection Team (6x AMOSC Core Group members); and • PPE.	

12.3 Environmental Performance

Table 12-5 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 12-5: Environmental Performance – Shoreline Protection and Deflection

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Protection and Deflection	**Response Preparedness**		
	Access to protection and deflection equipment and personnel through AMOSC,	Maintenance of access to protection and deflection equipment and personnel	MoU for access to National Plan resources through AMSA

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	AMSA National Plan and OSRL	through AMOSC, AMSA National Plan and OSRL throughout activity	AMOSC Participating Member Contract
			OSRL Associate Member Contract
	Small vessel providers for nearshore booming operations	Maintenance of a list of small vessel providers for Dampier region	List of small vessel providers
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 12-4** unless directed otherwise by DoT	Incident log
	Shoreline Protection and Deflection Plan	Santos IMT to confirm protection priorities in consultation with DoT	IAP/Incident Log
		Prepare operational NEBA to determine if shoreline protection and deflection activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to shoreline protection and deflection activities commencing
		IAP Shoreline Protection and Deflection Sub-plan developed to provide oversight and management of shoreline protection and deflection operation	Records indicate IAP Shoreline Protection and Deflection Sub-plan prepared prior to shoreline protection and deflection operations commencing
		NEBA undertaken each operational period by the relevant Control Agency to determine if response strategy is continuing to have a net environmental benefit. NEBA included in development of following period IAP	IAP/Incident Log
		Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation	Incident Log IAP

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		which may include secondary contamination	
	Spill response activities selected on basis of a Net Environmental Benefit Analysis (NEBA)	A NEBA is undertaken for every operational period	Incident Log contains NEBA
	Use of shallow draft vessels for shoreline and nearshore operations	Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency (i.e. DoT).	Vessel specification documentation contained in IAP.
	Conduct shoreline/nearshore habitat/bathymetry assessment	Unless directed otherwise by the designated Control Agency (i.e. DoT) a shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities.	IAP records assessment records

13 Shoreline Clean-up Plan

Table 13-1: Shoreline Clean-up – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery	
Initiation criteria	+ Level 2 or Level 3 spills where shorelines with identified or potential protection priorities that will be, or have been, contacted; + NEBA indicates shoreline clean-up will benefit receptors; and + Approval has been obtained from DoT IC or delegate (as the Control Agency) to initiate response strategy	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	X	✔
Termination criteria	+ As directed by DoT	

13.1 Overview

Shoreline clean-up aims to remove hydrocarbons from shorelines and intertidal habitat to achieve a net environmental benefit. Removal of these hydrocarbons helps reduce remobilisation of hydrocarbons and contamination of wildlife, habitat and other sensitive receptors. Shoreline clean-up is often a lengthy and cyclical process, requiring regular surveys to monitor the effectiveness of clean-up activities and assess if they are resulting in any adverse impacts.

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Control Agency. Santos will undertake first-strike activations as triggered, until such time as DoT assume control. Upon assumption of Control Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline clean-up. The information obtained from Operational Monitoring (refer **Section 10**), will be used by the IMT in the development of the operational NEBA to inform the most effective clean-up tactics (if any) to apply to individual sites. Intrusive shoreline clean-up techniques have the potential to damage sensitive shorelines. The appropriateness of clean-up tactics will be assessed against natural attenuation for sensitive sites. Selection of shoreline clean-up methods and controls to prevent further damage from the clean-up activities are to be undertaken in consultation with the Control Agency and selected based on NEBA.

Spill modelling indicates if a worst-case spill were to occur as a result of Dancer-1 drilling activities, shoreline contact would occur and therefore clean-up of shorelines is likely to be required.

Both types of hydrocarbon are light and volatile with a very low proportion of residue following weathering. These hydrocarbons are difficult to handle for removal given their light nature but are readily washed from sediments by wave and tidal flushing; contaminated sand and debris the likely waste products from a shoreline response.

Shoreline clean-up techniques include:

+ Shoreline and Coastal Habitat Assessment – uses assessment processes (refer to **Section 10.8**) to assess shoreline character, assess shoreline oiling and develop recommendations for response. Typically, this should be the first step in any shoreline clean-up response;
+ Natural Recovery – oiled shorelines are left untreated and the oil naturally degrades over time;
+ Manual and Mechanical Removal – removes oil and contaminated materials using machinery, hand tools, or a combination of both;

- Washing, Flooding, and Flushing – uses water, steam, or sand to flush oil from impacted shoreline areas; and
- Sediment reworking and Surf washing – uses various methods to accelerate natural degradation of oil by manipulating the sediment.

13.2 Implementation Guidance

Table 13-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy. **Table 13-2** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 13-3** provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial shoreline clean-up operations, unless directed otherwise by DoT, are listed in **Table 13-4**. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 13-2: Implementation Guidance – Shoreline Clean-up

Action		Consideration	Responsibility	Complete
Initial Actions	**Actions below are indicative only and are at the final determination of DoT as the Control Agency**			
	Initiate Shoreline and Coastal Habitat Assessment (if not already activated)	Refer to **Section 10.8** for additional information	Environment Team Leader	❑
	Using results from Shoreline and Coastal Habitat Assessment, conduct Operational NEBA to assess shoreline-clean up suitability and recommended tactics for each shoreline location	Shoreline and Coastal Habitat Assessment Teams are responsible for preparing field maps and forms detailing the area surveyed and make specific clean-up recommendations The condition of affected shorelines will be constantly changing. Results of shoreline surveys should be reported as quickly as possible to the IMT to help inform real-time decision making Engage a Heritage Advisor if spill response activities overlap with potential areas of cultural significance	Environmental Team Leader	❑
	If operational NEBA supports shoreline clean-up, prepare a Shoreline Clean-up Plan for inclusion in the IAP	Shoreline Clean-up Plan may include (but not be limited to): + Clean-up objectives; + Clean-up end points (may be derived from Shoreline and Coastal Habitat Assessment); + Clean-up priorities (may be derived from Shoreline and Coastal Habitat Assessment); + Assessment and location of staging areas and worksites (including health and safety constraints, zoning); + Utility resource assessment and support (to be conducted if activity is of significant size in comparison to the size of the coastal community); + Permits required (if applicable);	Environmental Team Leader Planning Team Leader Operations Team Leader	❑

Action		Consideration	Responsibility	Complete
		+ Chain of command for onsite personnel; + List of resources (personnel, equipment, PPE) required for selected clean-up tactics at each site; + Details of accommodation and transport management; + Security management; + Waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes; and + Establish no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (utilise existing roads and tracks first). Refer to IPEICA-IOGP (2015) for additional guidance on shoreline clean-up planning and implementation		
	In consultation with the Control Agency procure and mobilise resources to a designated port location for deployment, or directly to location via road transport		Logistics Team Leader Supply Team Leader Deputy Logistics Officer (DoT IMT)	❑
	Deploy shoreline clean-up response teams to each shoreline location to begin operations under direction of the Control Agency	Each clean-up team to be led by a Shoreline Response Team Lead, who could be an AMOSC Core Group Member or trained member of the AMSA administered National Response Team (as per the MoU agreement between Santos and AMSA) Clean-up teams and equipment will be deployed and positioned as per those observations by the	Operations Team Leader Logistics Team Leader Deputy Logistics Officer (DoT IMT)	❑

Action		Consideration	Responsibility	Complete
		Shoreline and Coastal Habitat Assessment Teams in consultation with the DoT. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change		
Ongoing Actions	Shoreline Response Team Lead shall communicate daily reports to the IMT Operations Team Leader to inform of effectiveness of existing tactics and any proposed tactics and required resources	Where possible, maintain some consistency in personnel within Shoreline Response Teams. If the same personnel are involved in Shoreline and Coastal Habitat Assessment and Clean-up they will be better placed to adapt their recommendations as the clean-up progresses and judge when the agreed end-points have been met	Shoreline Response Team Leader Operations Team Leader	❑
	The IMT Operations Team Leader shall work with the Planning Team Leader to incorporate recommendations into the IAPs for the following operational period, and ensure all required resources are released and activated through the Supply and Logistics Team Leaders		Operations Team Leader Planning Team Leader	❑
	Monitor progress of clean-up efforts and report to the Control Agency		Operations Team Leader On-Scene Commander Deputy On-Scene Commander (DoT FOB)	❑

Table 13-3: Shoreline Clean-up - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Manual clean-up tools (shovels, rakes, wheel barrows, bags etc)	AMOSC shoreline kits	shoreline support kits first strike	Fremantle x 1 Geelong x 1	Response via duty officer within 15 minutes of first call- AMOSC personnel available within 1 hour of initial activation call. Equipment

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
				logistics varies according to stockpile location.
	Santos	1x shoreline clean-up Container	Varanus Island	Within 12 hour for deployment from VI
	Hardware suppliers	As available	Exmouth, Karratha, Perth	
Shoreline flushing (pumps/hoses)	AMOSC	Shoreline flushing kit Shoreline Impact lance kit	Fremantle x 1, Geelong x 1 Geelong x 1	Response via duty officer within 15 mins of first call - AMOSC personnel available within 1 hour of initial activation call. For mobilisation timeframes see Table 13-4.
Nearshore skimmers/hoses	AMOSC AMSA	See Protection and Deflection (**Table 12-3)**		
Decontamination/ staging site equipment	AMOSC	Decontamination station x 3	Fremantle x 1; Exmouth x 1; Geelong x 1	Response via duty officer within 15 mins of first call - AMOSC personnel available within 1 hour of initial activation call. For mobilisation timeframes see Table 13-4.
	AMSA	Decontamination station x 4	Karratha x 2; Fremantle x 2	Access to National Plan equipment through AMOSC
	Oil spill equipment provider (e.g. Global Spill., PPS)	As available	Perth	Subject to availability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Waste storage (including temporary storage and waste skips and tanks for transport)	AMOSC temporary storage	Fast tanks x 8 Vikotank (13000L)	Geelong x 4; Fremantle x 2; Exmouth x 2 Broome x 1	15 mins of first call - AMOSC personnel available within 1 hour of initial activation call. For mobilisation timeframes see Table 13-4.
	AMSA temporary storage	Fast tanks	Karratha x 4; Fremantle x 4	Access to national Plan equipment through AMOSC
	via North West Alliance contract	Refer **Table 15-3**	Perth, Karratha	24+ hours
Personnel (field responders) for OSR strategies	AMOSC Staff	8	Fremantle x 2 Geelong x 6	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site.
	AMOSC Core Group (Santos)	12	Perth/ NW Aus facilities x 10 Port Bonython (SA) x 2	12+ hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation.
	Santos contracted Work Force Hire company (e.g. Dare)	As per availability (up to 2,000)	Australia wide	Subject to availability (indicatively 72+ hours)

Table 13-4: Shoreline Clean-up – First Strike Response Timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirms applicability of strategy and begins sourcing resources	<4 hours
Santos Offshore Core Group mobilised to site/ deployment port location	<24 hours
Clean-up equipment mobilised to site/ deployment port location	<24 hours
Waste storage equipment mobilised to site/ deployment port location	<24 hours
Remote island transfer vessel (if required) mobilised to deployment port location	<24 hours
AMOSC Staff, Industry Core Group and Labour Hire mobilised to site/ deployment port location	<48 hours
Clean-up operation deployed to clean-up area under advice from Shoreline Assessment Team	<48 hours
Minimum Resource Requirements	
NB: Resource requirements for shoreline clean-up will be situation/receptor specific. TRPs if developed for the area/receptor will outline suggested resource requirements and shoreline assessments (as part of operational monitoring strategy) will be conducted prior to clean-up to confirm techniques. TRPs are held by Santos and DoT and have been developed for Montebello Islands and Muiron Islands amongst other locations. Indicative minimum requirements for 1x Santos activated shoreline clean-up team are: • Manual clean-up / shoreline flushing equipment kit • Waste storage (bags, temporary storage tanks, skips as appropriate) • Decontamination/ staging equipment kit • PPE • 1x clean-up team includes: i. 1x Team Leader (AMOSC staff, Industry Core Group or Santos Core Group) ii. 10-30 Shoreline Clean-up Responders (AMOSC Crore Group, Santos contracted labour hire personnel)	

13.3 Shoreline Clean-up Resources

Shoreline clean-up equipment available for use by Santos is a combination of Santos owned, AMOSC, AMSA, DoT and OSRL equipment as well as other industry resources available through the AMOSPlan mutual aid arrangements (refer to **Appendix J**). Shoreline consumables are available through hardware, PPE and specialist oil/chemical spill suppliers and mobile plant equipment is available through hire outlets in Perth, Karratha and other regional centres. Where vessel deployments are required, Santos will leverage from existing contracted vessel providers.

Shoreline clean-up personnel available to Santos is a combination of AMOSC Staff, AMOSC Core Group Responders (comprising AMOSC trained Santos and Industry personnel), OSRL responders, State Response Team members and National Response Team members. Personnel for manual clean-up and mobile plant operation can be accessed through Santos' labour hire arrangements.

The level of deployment of equipment and personnel for clean-up will be commensurate to the spatial extent of shoreline contact, the volume of oil arriving and the sensitivity and access constraints of the shoreline in question. Once activated as Control Agency, deployment will be under the direction of DoT and the advice of shoreline clean-up specialists from AMOSC Core Group and National/State response teams. Shoreline Assessments (**Section 10.8**) will provide information to guide the clean-up strategy and deployment of resources.

Across all credible spill scenarios, modelling has indicated that the worst-case surface release LOWC scenario would result in the highest potential shoreline loading of oil. All potentially released oils are relatively light; physical removal may not be possible or recommended due to the degree of infiltration into sediments that could occur.

Spill modelling indicates shoreline loading of up to a maximum of 338.7 tonnes at Montebello Islands (refer **Section 6.3**).

Shoreline clean-up can be effective technique for reducing the potential for it to remobilise to other locations. However, prolonged shoreline clean-up operations or large-scale operations involving large numbers of personnel may cause adverse environmental impacts, as the constant removal of oil through mechanical or manual techniques can result in a removal of substrate (e.g. sand, pebbles). If this process is conducted over a long period of time, this may result in geomorphological changes to the shoreline profile.

Many of the shorelines predicted to be contacted are important nesting/breeding sites with high conservation values, therefore intensive clean-up operations will potentially do more damage than the oil alone. For this reason, shoreline clean-up operations at sensitive locations will involve smaller teams for a longer period and may involve techniques such as passive recovery booms (sorbents) and flooding or flushing (depending on the degree or oiling and hydrocarbon type). Although this may take longer to undertake the clean-up, it is considered that the benefits outweigh the impacts as smaller teams are more targeted, recovering more oil and less sand and debris, reducing trampling of oil into the shoreline profile and will minimise physical impacts on the coastlines and their sensitive species.

To approximate the likely waste produced and time required to conduct a manual shoreline clean-up, a conservative bulking factor of 10x has been applied to the worst-case scenario. Using the 338.7 tonnes loading, a bulking factor of 10x would result in up to 3387 tonnes of oily waste. An estimate of required resources for clean-up can be made by applying a removal rate of 1 m^3 (1 tonne) per person per day for manual removal. For example, 30 small teams consisting of 6 personnel (including one trained responder per team) could theoretically remove a loading of 338.7 tonnes (3387 tonnes oily waste) in roughly 19 days. This calculation assumes oil is accessible for removal (i.e. on accessible sections of coastline) and there would be a net benefit in removing all oil. Dependent on the nature of the oiling, habitat type, access constraints and environmental sensitivities nearby, larger teams of responders and mechanical aids can be employed to remove oil at a greater rate.

13.4 Shoreline Clean-up Decision Guides

A number of shoreline types are found within the EMBA associated with Dancer-1 drilling, including:

+ Mangroves;
+ Rocky shores including cliffs, intertidal platforms and loose rocks;
+ Sandy beaches; and
+ Intertidal mudflats and sandflats.

The shoreline types are amenable in varying degrees to clean-up methods depending upon the type of hydrocarbon spilt. To assist with planning purposes, guidance for the selection of appropriate shoreline response strategies based on shoreline sensitivities is provided within **Appendix K**

Operational guidelines for shoreline response activities including worksite preparation, manual and mechanical oil removal and vessel access for remote shorelines are included in **Appendix L**.

The DoT Oil Spill Contingency Plan (OSCP) (2015) also provides guidance on shoreline clean-up techniques.

13.5 Environmental Performance

Table 13-5 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 13-5: Environmental Performance – Shoreline Clean-up

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Clean-Up	**Response Preparedness**		
	Access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL	Maintenance of access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Maintenance of MSAs with multiple vessel providers	Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	Vessels for offshore island response	Maintenance of vessel specification for resource transfer for offshore island response	Vessel specification
	Labour hire contract	Maintenance of contract with labour hire provider	Contract
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 13-4** unless directed otherwise by DoT	Incident log
	Shoreline Clean-Up Plan	Santos IMT to confirm protection priorities in consultation with DoT	IAP Incident Log
		Prepare operational NEBA to determine if shoreline clean-up activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to shoreline clean-up activities commencing
		Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation which may	Incident Log IAP

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		include secondary contamination	
		IAP Shoreline Clean-up Sub-plan developed to provide oversight and management of shoreline clean-up operation	Records indicate IAP Shoreline Clean-up Sub-plan prepared prior to shoreline clean-up operations commencing
		Clean-up strategies will be implemented under the direction of DoT as the HMA	Incident Log
		Santos will make available AMOSC Core Group Responders for shoreline clean-up team positions to the Control Agency	Incident Log
		Santos will make available to the Control Agency equipment from Santos WA, AMOSC and OSRL stockpiles	Incident Log
		NEBA undertaken every operational period by the relevant Control Agency to determine if response strategy is having a net environmental benefit. NEBA included in development of following period IAP	IAP/Incident Log
	Prioritise use of existing roads and tracts	Unless directed otherwise by the designated Control Agency (i.e. DoT) access plans for shoreline operations will prioritise use of existing roads and tracks	IAP demonstrates requirement is met.
	Soil profile assessment prior to earthworks	Unless directed otherwise by the designated Control Agency (i.e. DoT) a soil profile assessment is conducted prior to earthworks	Documented in IAP and Incident Log.
	Pre-cleaning and inspection of equipment (quarantine)	Vehicles and equipment provided by Santos are verified as clean and invasive species free prior to deployment to offshore islands	Documented in IAP and Incident Log.

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance	Unless directed otherwise by the designated Control Agency (i.e. DoT) a Heritage Advisor is consulted if shoreline operations overlap with areas of cultural significance	Documented in IAP and Incident Log.
	Select temporary base camps in consultation with DoT and DBCA	Any establishment of forward staging areas at shoreline areas done under direction or in consultation with DoT and DBCA	Documented in IAP and Incident Log.
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat.	Unless directed otherwise by the designated Control Agency (i.e. DoT) demarcation zones are mapped out in sensitive habitat areas.	IAP demonstrates requirement is met.
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	Unless directed otherwise by the designated Control Agency (i.e. DoT) action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met.
	Stakeholder consultation	Consultation is undertaken with relevant stakeholders prior to deployment of resources to townships and marine/coastal areas	Consultation records

14 Oiled Wildlife Response Plan

Note: DoT is the Control Agency and DBCA is the Jurisdictional Authority for oiled wildlife response within State waters. Santos is the Control Agency for oiled wildlife response within Commonwealth waters.

Table 14-1: Oiled Wildlife Response - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement tactics in accordance with the WAOWRP to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife	
Initiation criteria	Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ Oiling of wildlife have not been observed over a 48-hour period; + Oiled wildlife have been successfully rehabilitated; and + Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response.	

14.1 Overview

Santos will provide all necessary resources to assist DoT in an oiled wildlife response in State waters, mainly, and initially, through its access to AMOSC oiled wildlife resources. Timely provision of equipment and personnel will be provided by AMOSC to DoT as the Control Agency/ Lead IMT through a combination of owned and operated equipment, call-off contracts with suppliers, and the management of industry OWR response personnel through an Industry Oiled Wildlife Advisor (OWA). This team will work in conjunction with DBCA OWR capability under the direction of the DoT Incident Controller. Where Santos is the Control Agency for OWR in Commonwealth waters, AMOSC will also provide the above-mentioned resources and be supported by DCBA but would instead work under the direction of the Santos IC.

The key plan for oiled wildlife response (OWR) in WA is the WAOWRP. The WAOWRP has been developed by DBCA and AMOSC, on behalf of the petroleum industry, and DBCA to define the minimum standards for OWR in WA as a sub-plan to the SHP - MEE. The WA OWRP can also be used for guidance to OWR in Commonwealth waters adjacent to State waters, noting that OWR requirements in State waters are expected to be greater. The Pilbara Region Oiled Wildlife Response Plan (OWRP), which sits under the WA OWRP provides operational guidance to respond to injured and oiled wildlife in the Pilbara region and covers the areas potentially contacted by a spill from drilling activities.

The sections below provide guidance to the Santos IMT on OWR stages of response and implementation. In some cases, the implementation guidance (**Table 14-5**) includes detail which is additional to what is provided in the WAOWRP. The information below should be used in conjunction with the WAOWRP.

14.2 OWR Stages of Response

The WAOWRP includes eight stages to an OWR, which are described in **Table 14-2**. If an OWR is initiated, implementation will follow these stages, as appropriate to the nature and scale of the incident.

Table 14-2: Oiled Wildlife Response Stages (adapted from WAOWRP)

Stage	Description
Stage 1: Initial wildlife assessment and notifications	Gather situational awareness on whether an OWR impact has occurred or is imminent and complete notifications to Jurisdictional Authorities and external support agencies
Stage 2: Mobilisation of wildlife resources	Mobilise initial preventative measures and/or mobilisation of resources to deal with incident in early stages of development.
Stage 3: Wildlife reconnaissance	Wildlife Reconnaissance for the OWR should occur as part of the implementation of surveys for the fauna related Operational Monitoring Plans (OMPs) undertaken to aid planning and decision making for executing spill response or clean-up operations. Wildlife Reconnaissance will be required for the duration of the wildlife response operations
Stage 4: IAP wildlife sub-plan development	The Wildlife Response Sub-plan should include the following operational components (relevant to the scale of the OWR): + Wildlife impact assessment; + Reconnaissance and monitoring; + Search and collection; + Carcass collection and necropsy storage; + Field stabilisation; + Wildlife transport; + Wildlife processing/admission; + Wildlife intake and triage; + Wildlife cleaning; + Rehabilitation/conditioning; + Release; + Post-release monitoring; and + OWR termination and demobilisation. (It should be noted that separate strategies and protocols may be required for different species groups).
Stage 5: Wildlife rescue and staging	This includes commencing actions such as hazing, pre-emptive capture, administering first-aid and holding and/or transportation of wildlife to oiled wildlife facilities. If oiled birds or non–avian wildlife were to be observed at sea, on-water collection should be considered for the effective capture of oiled animals before they become so debilitated that their chance of survival is severely affected (IPIECA, 2017)
Stage 6: Establishment of an oiled wildlife facility	Treatment facilities would be required for the cleaning and rehabilitation of affected animals. A vessel-based 'on-water' facility would likely need to be established to enable stabilisation of oiled wildlife before transport to a suitable treatment facility
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping, release and post-release monitoring
Stage 8: Oiled wildlife response termination	Demobilisation of the OWR should be undertaken in accordance with parameters or endpoints established in the IAP and supplementary Wildlife

Stage	Description
	Response Sub-plan. This decision will be made in consultation with the relevant jurisdictional authorities and support agencies

14.3 OWR Levels and Resourcing

An impact assessment threshold of 10 g/m^2 for impacts on fauna from floating hydrocarbons is provided in the EP. This conservative threshold is broadly accepted as being the minimal thickness of surface hydrocarbons that may result in adverse impacts to seabirds through ingestion from preening of contaminated feathers (French-McCay, 2016) and is also considered appropriate for turtles, sea snakes and marine mammals (NRDAMCME, 1997).

Review of the worst-case spill modelling for a surface release of a loss of well control incident (GHD, 2020) indicates that condensate concentrations above 10 g/m^2 may extend up to 1,050 km from the spill location. At the moderate threshold 100 g/m^2 the maximum shoreline loading of 339 tonnes (loss of well control surface release scenario), at the Montebello Islands and affecting 28 km of shoreline. Surveys at the Montebello Islands have recorded 70 bird species, including 12 species of seabird and 14 species of migratory shorebirds. These islands also include both major and minor nesting areas for green, hawksbill, and flatback turtles (Commonwealth of Australia, 2017), with hundreds of turtles nesting annually. Offshore of the Montello Islands, dugong and migrating pygmy blue whales are known to occur.

Conservative estimates for OWR planning predict a worst-case OWR for this activity will be an OWR Level 5, as defined in the WAOWRP (2014). For a Level 6 response, it is expected that up to 116 personnel will be required, with a range of skill levels (**Table 14-4** – OWR 1 = basic training to OWR 4 = OWR Advisor; Information drawn from WAOWRP). Personnel at skill levels OWR 2 - 4 and those with specialised skills (e.g. vets) are expected to be sourced through AMOSC, OSRL, DBCA, Universities and contractors.

Roles could be filled by the organisations listed above and through labour hire agencies that can provide field workers that undergo an induction and basic training. Basic training (over 1 day) for OWR personnel can be delivered as just-in-time training through an arrangement with DBCA.

Table 14-3: Indicative Oiled Wildlife Response Level (adapted from WA OWRP, 2014)

OWR Level	Indicative personnel numbers	Indicative duration	Indicative number of birds (non-threatened species)	Indicative number of birds (threatened species)	Turtles (hatchlings, juveniles, adults)	Cetaceans	Pinnipeds	Dugongs
Level 1	6	< 3 days	1–2/day < 5 total	None	None	None	None	None
Level 2	26	> 4–14 days	1–5/day < 20 total	None	< 20 hatchlings No juv/adults	None	None	None
Level 3	59	> 4–14 days	5–10/day	1–5/day < 10 total	< 5 juv/adults	None	< 5	None

OWR Level	Indicative personnel numbers	Indicative duration	Indicative number of birds (non-threatened species)	Indicative number of birds (threatened species)	Turtles (hatchlings, juveniles, adults)	Cetaceans	Pinnipeds	Dugongs
					< 50 hatchlings			
Level 4	77	> 4–14 days	5–10/day < 200 total	5–10/day	< 20 juv/adults < 500 hatchlings	< 5, or known habitats affected	5–50	Habitat affected only
Level 5	116	> 4–14 days	10–100/day > 200 total	10–50/day	> 20 juv/adults > 500 hatchlings	< 5 dolphins	> 50	Dugongs oiled
Level 6	122	> 4–14 days	> 100/day	10–50/day	> 20 juv/adults > 500 hatchlings	> 5 dolphins	> 50	Dugongs oiled

Table 14-4: Oiled Wildlife Response Level and Personnel Numbers

Skill Level	OWR Response Level and Personnel Numbers					
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
OWR 4	1	1	3	2	2	2
OWR 3	2	0	4	4	4	4
OWR 2	4	9	15	17	18	18
OWR 1	0	14	33	47	84	90
Technicians (i.e. vets)	0	1	2	4	4	4
Other specified skills	0	0	2	3	4	4
Total	**7**	**25**	**59**	**77**	**116**	**122**

14.4 Implementation Guidance

Oiled wildlife response activities can be resource intensive and require additional personnel to be positioned within the IMT. The oiled wildlife response team will be managed according to the Wildlife Division outlined in the WAOWRP. The wildlife operations unit will contain all the field staff and activities, including oiled wildlife reconnaissance, who will work in close consultation with personnel undertaking relevant monitor and evaluate activities. The IAP Wildlife Response Sub-plan as outlined in **Table 14-2** will form the key management system which will provide control and oversight over the response.

Table 14-5 provides guidance to the IMT on the actions and responsibilities that should be considered when implementing OWR. These actions are provided as a guide and should be read in conjunction with the WAOWRP. In some cases, the Implementation Guidance (**Table 14-5**) will provide additional detail to the WAOWRP and has greater linkages to other aspects of the response operation and this OPEP (e.g. NEBA and aerial surveillance). Mobilisation times for the minimum resources that are required to commence initial oiled wildlife operations are listed in **Table 14-6**.

The IC of the Control Agency is ultimately responsible for the implementation of the response and therefore, depending on the circumstances of the spill, may determine that some tasks be varied, should not be undertaken or should be reassigned.

Information on resource capability for this strategy is shown in **Appendix M**.

Table 14-5: Implementation Guidance – Oiled Wildlife Response

Action		Consideration	Responsibility	Complete
Stage 1: Initial wildlife assessment and notifications				
Initial Actions	Personnel conducting monitor and evaluate activities shall report wildlife sightings in or near the spill trajectory (including those contacted with hydrocarbons or at risk of contact) and report them to the IMT within 2 hours of detection	Record all reports of wildlife potentially impacted and impacted by spill. Record reports on: + Location; + Access; + Number; + Species; and + Condition of impacted animals (if available).	Surveillance personnel	❑
	If wildlife are sighted and are at risk of contact (or have been contacted), initiate oiled wildlife response by contacting AMOSC Duty Manager and DCBA State Duty Officer (who will then activate their respective Oiled Wildlife Advisors)	Obtain approval from IC prior to activating AMOSC Oiled Wildlife Advisor and/or DCBA Oiled Wildlife Advisor DoT will be the Control Agency for OWR in State waters	Environmental Team Leader	❑
	Notify DAWE if there is a risk of death or injury to a protected species (including Matters of National Environmental Significance (MNES))	Refer to **Table 7-1** for reporting requirements. A list of MNES is provided in the Existing Environment **Section 3.2.3** of the EP	Environmental Team Leader	❑
	Review all wildlife reports from surveillance or opportunistic activities and contact personnel who made the reports (if possible) to confirm information collected		Environmental Team Leader Wildlife Division Coordinator	❑
	Use information from initial assessments to prepare an Operational SIMA. Use this information to help determine: Initial OWR Response Level (1-6), as defined in the WAOWRP (**Table 14-3**) If OWR activities are likely to result in a net environmental benefit.	Oiled wildlife response activities can cause additional stress and mortality on individuals than oil pollution alone. The Environmental Team Leader and Wildlife Division Coordinator will determine via an Operational NEBA whether capture and cleaning of oiled wildlife will result in a net environmental benefit. This may be done in consultation with the DCBA and AMOSC Oiled Wildlife Advisors and any SME's as relevant (if	Environmental Team Leader Wildlife Division Coordinator	❑

Action	Consideration	Responsibility	Complete
	available, but an Operational NEBA should not be delayed if they are not immediately available)		
Stage 2: Mobilisation of wildlife resources			
Determine resources required to undertake Stage 3: Wildlife Reconnaissance and provide list to Logistics Section	Confirm best reconnaissance platform (e.g. vessel, aerial, shoreline). Consider ability to share resources (e.g. Shoreline Clean-up Assessment Teams, Monitor and Evaluate activities)	Wildlife Division Coordinator Wildlife Reconnaissance Officer AMOSC OWA	❑
Determine number of Oiled Wildlife Responders and IMT Wildlife related positions required based on the likely number of oiled wildlife and arrange access to resources via AMOSC and DCBA	Refer to **Table 14-4** Consider need for veterinary care	Wildlife Division Coordinator Logistics Team Leader AMOSC OWA DBCA OWA	❑
Commence mobilisation of equipment (including adequate PPE) and personnel to required location/s		Wildlife Logistics Officer	❑
Contact OSRL to activate Sea Alarm if additional support is likely to be required to sustain an ongoing OWR		Environmental Team Leader	❑
Stage 3: Wildlife reconnaissance			
Determine reconnaissance plan including survey locations, techniques and priority species	Consult local experts, if available	Wildlife Division Coordinator Wildlife Reconnaissance Officer AMOSC OWA DBCA OWA Planning Team Leader	❑
Conduct reconnaissance activities and upon completion, submit report detailing: + Area/s surveyed + Estimated number of animals oiled or at risk of being affected + Any deaths		Wildlife Division Coordinator Wildlife Operations Officer Wildlife Reconnaissance Officer OWR field personnel	❑

Action	Consideration	Responsibility	Complete
+ Species affected		Operations Team Leader	
Stage 4: IAP wildlife sub-plan development			
Develop Wildlife Response Sub-plan for inclusion in the IAP IAP should include options for wildlife rescue and rehabilitation, including: + Wildlife priorities for protection from hydrocarbons + Any deterrence/hazing measures + Anticipate number of oiled wildlife requiring rescue + Reassess Oiled Wildlife Level + Actions required for the collection, recovery, transport and treatment of oiled wildlife; including resourcing of equipment and personnel anticipated	Consider need for any permits to conduct activities	Wildlife Division Coordinator Wildlife Operations Officer AMOSC OWA DBCA OWA Environmental Team Leader	❑
Stage 5: Wildlife rescue and staging			
Implement Wildlife Response Sub-plan for deterrence/hazing, pre-emptive capture, relocation	Trained personnel required to handle wildlife	Wildlife Division Coordinator Wildlife Operations Officer Wildlife Rescue Officer AMOSC OWA DBCA OWA OWR field personnel Operations Team Leader	❑
Establish staging site/s	Wildlife first aid/stabilisation may be required at staging site if OWR treatment facility is more than 2 hours away	Wildlife Operations Officer Wildlife Staging/Holding Officer OWR field personnel Operations Team Leader	❑
Stage 6: Establishment of an oiled wildlife facility			
Implement Wildlife Response Sub-plan for oiled wildlife facility	Utilise OWR containers where possible. One container/kit can treat up to 150 OWR units, so will be adequate to treat oiled wildlife from the worst-	Wildlife Division Coordinator Wildlife Operations Officer	❑

Action	Consideration	Responsibility	Complete
	case spill. If insufficient, additional OWR containers can be requested via the IAP to AMSA Should oiled wildlife treatment be set up on vessels rather than onshore, the vessel needs to have adequate deck space to house the oiled wildlife equipment and be able to provide continuous hot water at constant pressure and temperature. The vessel must have the ability to properly contain and dispose of contaminated wastewater. Most Support Vessels are likely to be appropriate as they have mud and other tanks for water storage and oil-water systems for treating water	Wildlife Facilities Officer AMOSC OWA DBCA OWA OWR field personnel Operations Team Leader	
Stage 7: Wildlife rehabilitation			
Implement Wildlife Response Sub-plan for rehabilitation	Animals need to be stable to withstand stress of washing. Oiled animals, particularly birds, cannot thermoregulate and need to be kept indoors in a temperature-controlled room. The room needs to be well ventilated to disperse the hydrocarbon fumes	Wildlife Division Coordinator Wildlife Veterinarian Wildlife Rehabilitation Officer AMOSC OWA DBCA OWA OWR field personnel Operations Team Leader	❑
Stage 8: Oiled wildlife response termination			
Liaise with Jurisdictional Authorities regarding OWR termination, using endpoints established in the IAP and supplementary Wildlife Response Sub-plan (Termination and Demobilisation section)		Wildlife Division Coordinator AMOSC OWA DBCA OWA Incident Commander	❑

Table 14-6: Oiled Wildlife Response – First Strike Response Timeline

Task	Time from oiled wildlife contact (predicted or observed)
IMT notifies regulatory authorities and AMOSC of oiled wildlife / potential for contact	<2 hours
Mobilise Santos personnel for oiled wildlife reconnaissance **this will be already occurring through Aerial Observer mobilisation and Shoreline Assessment Team mobilisation**	<24 hours
Mobilisation of AMOSC oiled wildlife equipment and industry OWR team to forward staging area	<48 hours
Minimum Resource Requirements	
The requirements for oiled wildlife response will be situation specific and dependent upon reconnaissance reports. Indicative minimum resource requirements below align with personnel requirements for a Level 1 response as per the WAOWRP: • 6x trained industry oiled wildlife response team personnel (AMOSC staff & contractors/ AMOSC Industry OWR group) • 1x AMOSC OWR treatment container • 1x AMOSC Oiled Wildlife Deterrence Kit	

14.5 Environmental Performance

Table 14-7 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 14-7: Environmental Performance – Oiled Wildlife Response

Environmental Performance Outcome	Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Oiled Wildlife Response	**Response preparedness**		
	Maintenance of access to oiled wildlife response equipment and personnel	Maintenance of access to oiled wildlife response equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Labour hire contract	Maintenance of contract with labour hire provider	Contract
	Santos Oiled Wildlife Response Framework	Development of a Santos Oiled Wildlife Response Framework (to be in place prior to the commencement of the Activity)	Santos Oiled Wildlife Response Framework
	Santos personnel trained on OWR	Additional Santos personnel trained in OWR in 2020	Training records
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 14-6** unless directed otherwise by DoT/ DBCA.	Incident log
	OWR managed in accordance with the WAOWRP	Prepare operational NEBA to help classify OWR level and determine if OWR activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to OWR operations commencing
		IAP Wildlife Response Sub-plan developed to provide oversight and management of OWR operation	Records indicate IAP Wildlife Response Sub-plan prepared prior to OWR operations commencing

15 Waste Management Plan

Table 15-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 15-1: Waste Management – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible	
Initiation criteria	Response activities that will be generating waste have been initiated	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	+ All waste generated from the oil spill response has been stored, transported and disposed as per the regulatory requirements; and + Agreement is reached with Jurisdictional Authorities to terminate the response	

15.1 Overview

The implementation of some spill response strategies will generate waste solid and liquid waste that will require rapid management, storage, transport and disposal. It is important that waste is collected and removed quickly to ensure waste management does not create a bottleneck in response operations.

The type and amount of waste generated during a spill response will vary depending on the spill type/characteristics, volume released, and response strategies implemented. To account for this potential variability, waste management (including handling and capacity) needs to be scalable to allow a continuous response to be maintained.

Where Santos is the Control Agency, or at the request of the designated Control Agency, Santos will engage its contracted Waste Service Provider (WSP) to provide sufficient waste receptacles to store collected waste and manage oily waste collection, transport and disposal associated with spill response activities. The WSP will arrange for all personnel, equipment and vehicles to carry out these activities from nominated collection points to the final disposal points. Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053) provides detailed guidance to the WSP in the event of a spill.

Where DoT is the Control Agency, Santos will provide a Facilities Support Officer to the DoT IMT Logistics Unit to support the DoT IMT in coordinating waste management services.

15.2 Implementation Guidance

Table 15-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 15-3** provides a list of resources that may be used to implement this strategy The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 15-2: Implementation Guidance – Waste Management

Action		Consideration	Responsibility	Complete
Initial Actions	Contact WSP (Primary or Secondary Contact Person) and activate Waste Project Manager.	Refer to Incident Response Telephone Directory (SO-00-ZF-00025.020) for contact details	Logistics Team Leader	❑
	Based on operational modelling and applicable response strategies communicate the type and quantity of empty liquid and solid waste receptacles required to support planned operations	It is better to overestimate volumes and scale back resources then to underestimate waste volumes	Logistics Team Leader Planning Team Leader	❑
	Using most recent monitor and evaluate data and any existing and future response activities, determine most suitable locations for waste receptacles to be positioned and for temporary storage locations to be established	Consideration would be given to positioning receptacles and locating temporary storage sites to ensure secondary contamination of sensitive receptors is avoided or minimised. The approval of temporary storage sites would be given through Department of Water and Environmental Regulation (DWER)	Logistics Team Leader Planning Team Leader Environmental Team Leader	❑
	For each receival location indicate the anticipated: + Material types; + Material generation rates; + Material generation quantities; + Commencement date/time; + Anticipated clean-up duration; + Receptacle types required; + Logistical support requirements; and + Any approvals required from Ports, Local Governments, Landowners, State Government Agencies (Refer to Oil Pollution Waste Management Plan (QE-91-IF-10053)).	Consider facilities for waste segregation at source	Logistics Team Leader Planning Team Leader	❑

Action		Consideration	Responsibility	Complete
	Once the above information is obtained, ensure all necessary waste management information is included in the IAP	Waste management should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan	Logistics Team Leader (or delegate) Facilities Support Officer (DoT IMT) WSP Location Responsible Person or Operations Supervisor	❑
	Mobilise waste management resources and services to agreed priority locations		WSP Location Responsible Person or Operations Supervisor Logistics Team Leader (or delegate) Facilities Support Officer (DoT IMT)	❑
Ongoing Actions	Provide ongoing point of contact between IMT and WSP	If DoT is the Control Agency, the Facilities Support Officer shall be the point of contact between DoT and the WSP	Facilities Support Officer (DoT IMT) Logistics Team Leader	❑
Ongoing Actions	Ensure all waste handling, transport and disposal practices comply with legislative requirements	Alert Logistics Team Leader (or delegate)/ Deputy Logistics Officer (if DoT is the Control Agency) if any non-compliance is anticipated or detected Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan	WSP Location Responsible Person or Operations Supervisor	❑
Ongoing Actions	Ensure records are maintained for all waste management activities, including but not limited to:		WSP Location Responsible Person or Operations Supervisor	❑

Action		Consideration	Responsibility	Complete
	+ Waste movements (including types of receptacles, receival points, temporary storage points, final disposal locations); + Volumes generated at each site (including total volume and generation rates); + Types of waste generated at each site; and + Approvals obtained (as required).			

15.3 Waste Approvals

Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan. In addition, regulatory approval may be required for the temporary storage, transport, disposal and treatment of waste, through DWER. DWER administers the *Environmental Protection Act* 1986 (WA) and is the relevant Regulatory Authority for waste management approvals. If required, DoT may establish an Operational Area Support Group (OASG), as defined in the SHP - MEE, to request support from relevant WA Government Agencies, including DWER, during a State waters spill response. The Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053) provides detail on the regulatory requirements for each port/location likely to be used for waste management during any spill response operation associated with Santos' activities.

15.4 Waste Service Provider Capability

Detailed guidance on Santos' Waste Service Provider responsibilities for spill response waste management is provided in the Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053).

Key responsibilities of the waste service provider include:

+ Maintaining emergency response standby preparedness arrangements, including:
    - Access to personnel, equipment and vehicles required for a first strike and ongoing response commensurate to Santos worse case spill and waste requirements;
    - Provide primary and secondary contact details for activation of spill response waste management services;
    - Have suitably trained personnel for completing critical tasks in spill response waste management; and
    - Participation in exercising undertaken by Santos.
+ Ability to assist in the Control Agency's IAP and Waste Management Sub-plan process as required;
+ Mobilise resources to waste collection points identified by the Control Agency;
+ Ensure waste handling, transport and disposal practices meet legislative requirements;
+ Keep auditable records of waste streams from collection points to final disposal points;
+ Provide regular progress reporting to the Control Agency IMT and a final report relating to quantities and destinations of collected waste;
+ Provide a project manager responsible for the rollout of spill response resources to meet spill response waste management objectives; and
+ Provide location specific Operations Supervisor/s to handle on-site operational aspects (management of personnel and equipment, reporting, liaison with relevant field-based spill responders).

15.5 Waste Management Resources

Santos has access to capacity to deliver storage receptacles, remove, transport and dispose of all waste material from oil spill response activities to predetermined disposal points.

Table 15-3 provides waste service provider capability for waste removal and storage, which is in excess of the waste management requirements for spill response activities associated with this OPEP.

Table 15-3 : North West Alliance (NWA) Vehicle and Equipment Availability

Plant and Equipment	No.	Capacity	Functionality	Uses per week	Indicative waste stored/shifted per week (m3)	NWA mobilisation schedule to meet estimated capacity			
						No. Sourced locally	No. Sourced State-wide and Nationally		
Waste removal						**48 hours**	**1 week**	**2 weeks**	**1 month**
Skip Lift Truck	12	Lift up to 15 Tonnes	Servicing of skip bins	7	1260	4	3	3	2
Front Lift Trucks	10	28 m³ Body	Servicing of front lift bins	7	1960	4	3	2	1
Side Loading Truck	10	18 m³ Body	Servicing of MGB's	7	1260	1	2	4	3
Hook Lift Truck	5	70 Tonne rated	Servicing of hook lift bins	7	2450	3	2	2	N/A
Flat Bed Truck	16	15 pallet spaces	Servicing of bins	7	840	3	6	4	N/A
Waste storage						**48 hours**	**1 week**	**2 weeks**	**1 month**
MGB's	500	240 litres	Mobile bins	2	240	200	300	N/A	N/A
Offshore 8 pack Lifting Cradle (MGB's)	2	16 x 240 litre MGB'S	Able to remove 16 x 240L MGB'S simultaneously	continuous		0	2	N/A	N/A
Waste storage						**48 hours**	**1 week**	**2 weeks**	**1 month**
Lidded Bins	6	1,100 litres	contain various waste streams	2	13	6	N/A	N/A	N/A
Front Lift Bins	50	3 m³	various waste streams	2	300	20	30	N/A	N/A

Plant and Equipment	No.	Capacity	Functionality	Uses per week	Indicative waste stored/shifted per week (m3)	NWA mobilisation schedule to meet estimated capacity			
						No. Sourced locally	No. Sourced State-wide and Nationally		
Front Lift Bins	25	4.5 m^3	various waste streams	2	225	10	15	N/A	N/A
Offshore Rated Front Load Bins	100	3 m^3	various waste streams	2	600	40	60	N/A	N/A
Offshore Rated Bins	45	7 m^3	various waste streams	2	630	20	25	N/A	N/A
Marrell Skip Bins	60	6-9 m^3	various waste streams	2	960	20	40	N/A	N/A
Hook Lift Bins	12	15-30 m^3	various waste streams	25	6900	12	N/A	N/A	N/A
Forklift	4	4 tonne Forklift	All areas	continuous	N/A	4	N/A	N/A	N/A

15.6 Waste Management Environmental Performance

Table 15-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 15-4: Environmental Performance – Waste Management

Environmental Performance Outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Waste Management	**Response preparedness**		
	Maintain access to waste management equipment, personnel, transport and disposal facilities	Maintain access to waste management equipment, personnel, transport and disposal facilities throughout activity	Contract with Waste Service Provider for emergency response services
	Response Implementation		
	Implement Oil Pollution Waste Management Plan (QE-91-IF-10053)	Waste Service Provider to appoint a Project Manager within 24 hours of activation	Incident Log
		Provision of waste bins for oil and oily waste for shoreline clean-up operations to clean-up site or deployment port, if requested, within 24 hours	Incident Log
		Waste Service Provider shall track all wastes from point of generation to final destination	Waste tracking records
		Waste Service Provider to provide monthly waste management reports and more regular situation reports during the response until termination criteria are met	Waste reports

16 Scientific Monitoring Plan

Table 16-1: Scientific Monitoring - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response	
Initiation criteria	Refer to individual Receptor SMPs –**Appendix O**: SMP Activation Process	
Applicable hydrocarbons	**Diesel**	**Gas condensate**
	✔	✔
Termination criteria	Refer to individual SMPs - **Appendix O**: SMP Activation Process	

Oil spill scientific monitoring is the principle tool for detecting and quantifying environmental impact and recovery to sensitive receptors from an oil spill. Santos is required to have an oil spill SMP in place for Petroleum activities in State and Commonwealth waters.

Santos will activate and implement scientific monitoring in State and Commonwealth waters for hydrocarbon spills in line with its SMPs unless directed otherwise by the relevant Control Agency/s.

16.1 Objectives

The overarching objective of Santos' SMPs is to provide guidance to staff, consultants and contractors in developing monitoring a monitoring program for detecting impacts and recovery to environmentally sensitive receptors contacted by a spill.

Receptor-specific SMPs have different objectives as outlined in **Appendix O**: SMP Activation Process**.**

16.2 Scope

Santos will implement its SMPs, as applicable, for Dancer-1 drilling activity oil spills across both State and Commonwealth waters. In the event that control of scientific monitoring in State waters is taken over by DoT under advice from the State ESC, Santos will follow the direction of DoT and provide all necessary resources (monitoring personnel, equipment and planning) to assist as a Supporting Agency.

16.3 Relationship to Operational Monitoring

Operational monitoring (**Section 10**) is monitoring undertaken to obtain information which will provide situational awareness and assist in the planning and execution of the oil spill response.

Scientific monitoring activities have different objectives to Operational Monitoring**,** which influences the monitoring methods likely to be used, the degree of scientific rigour required to meet the monitoring objectives, and the scope of studies. Scientific monitoring may occur in parallel to operational monitoring and is typically conducted over a wider study area, extending beyond the spill footprint. It is also typically conducted over a longer time period, extending beyond the spill response.

Scientific monitoring is designed to provide data for short term and longer-term environmental effects assessment. This is typically required to be quantitative in nature and appropriate for statistical analyses. However, these two types of monitoring are related, and Operational Monitoring outputs typically inform the final design of the related SMP.

16.4 Scientific Monitoring Plans

Owing to the diverse nature of sensitive receptors that could be contacted by an oil spill and the different techniques and skillsets required to monitor impact and recovery to these receptors, there are a number of Oil Spill SMPs relevant to Dancer-1 Drilling activities **(Table 16-2).** These are detailed further in **Appendix O**: SMP Activation Process; each SMP has corresponding objectives, initiation/termination criteria, methodologies, baseline data sources and analysis and reporting requirements, noting that in a response controlled by DoT methodology, termination criteria and analysis/reporting requirements may differ.

Table 16-2: Oil Spill Scientific Monitoring Plans relevant to activity

Study	Title
SMP1	Marine Water Quality
SMP2	Marine Sediment Quality
SMP3	Shorelines and Coastal Habitats – Sandy Beaches and Rocky Shores
SMP4	Shorelines and Coastal Habitats – Mangroves
SMP5	Shorelines and Coastal Habitats – Intertidal Mudflats
SMP6	Benthic Habitats
SMP7	Seabirds and Shorebirds
SMP8	Marine Megafauna (incl. whale sharks and mammals)
SMP9	Marine Reptiles
SMP10	Seafood Quality
SMP11	Fish, Fisheries and Aquaculture
SMP12	Whale Sharks

16.5 Baseline Monitoring

Baseline monitoring provides information on the condition of ecological receptors prior to, or spatially independent of (e.g. if used in control chart analyses), a spill event and is used for comparison with the post-impact scientific monitoring where required. This is particularly important for scientific monitoring where the ability to detect changes between pre-impact and post-impact conditions is necessary.

In the event of a spill to marine or coastal waters, reactive pre-impact monitoring should, where practicable, be implemented to gather additional data on the current state of the environment.

Santos periodically review the status, availability and suitability of existing baseline data sources related to key environmental sensitivities in its areas of operations. **Appendix P** provides further information on Santos baseline data reviews and outlines a baseline date assessment conducted on high priority areas for scientific monitoring in the event of a Dancer-1 drilling well oil spill.

16.6 Monitoring Service Providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos by a contracted Monitoring Service Providers (MSPs) and applies to the implementation of SMPs 1-11 (**Table 16-2**). These services are provided by Astron Environmental Services (Astron) and primary sub-contractor (BMT).

For whale sharks, in addition to the monitoring that will be undertaken as part of SMP8 Marine Megafauna, additional scientific monitoring of whale sharks along the Ningaloo Coast will be undertaken (SMP12) if applicable. Santos has historically and currently supports research on the behaviour, demography and migration patterns of whale sharks at Ningaloo Reef conducted by AIMS. In the event of a spill that could impact whale sharks, Santos will leverage off this long-term research program to assess potential impacts to whale sharks at, and migrating to-and-from, Ningaloo Reef. SMP12 is regarded as complementary to SMP8 which will detect potential impacts to whale sharks from visual surveys of whale sharks wherever they may occur in relation to a spill.

As per the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162), Santos' MSP provides the following scientific monitoring services to Santos:

+ 24/7 monitoring support accessed through 24 hr call out number;
+ Provision of a suitably trained Monitoring Coordination Team including a Monitoring Coordinator, Monitoring Operations Officer, Planning and Logistics Officer and Safety Officer;
+ Provision of Technical Advisors and Field Teams (staff and contractors) for first strike deployments;
+ Maintenance of standby monitoring equipment;
+ Monthly personnel capability reports;
+ Provision and review of Scientific Monitoring Sub-plans;
+ Provision and review of the Monitoring Standby and Response Manual (EA-00-RI-10162) and associated response activation forms; and
+ Participation in audits, workshops, drills and exercise to facilitate readiness.

Appendix P provides an overview of Santos' processes in place to provide assurance that its oil spill scientific monitoring arrangements for SMPs 1-11 are fit for purpose to meet the worst case first-strike monitoring requirements associated with the Dancer-1 drilling activities.

16.7 Activation

The SMP Activation Process is outlined in **Appendix O**: SMP Activation Process. SMPs are activated as per the initiation criteria for each as outlined in **Appendix N**. The SMP Activation Form is available on the Santos Procedures Index and IMT Environment Team Leader folder.

The Santos IMT Environment Team Leader (ETL) with support from IMT Environment Team members is responsible for activating the primary MSP. The Santos Environment Team will assist the MSP Monitoring Coordination personnel and relevant Technical Advisors in defining the monitoring study design, monitoring locations and field methodologies based on Operational Monitoring information (e.g. spill modelling and aerial surveillance information), relative location of sensitive receptors to the spill and the timing of the spill with respect to seasonality of sensitive receptors.

This process will identify monitoring operational objectives and resourcing/mobilisation requirements which the Environment Team Leader will feed back to the IMT for approval. Mobilisation times for the minimum resources that are required to commence initial scientific monitoring operations are listed in **Table 16-3**.

In the event that a designated Control Agency takes command of scientific monitoring, Santos will follow the direction of the Control Agency providing planning and resourcing support through its MSPs as required.

Table 16-3: Scientific Monitoring – First Strike Response Timeline

Task	Time from activation of SMP
Santos IMT approve initial monitoring plan	<24 hours
Santos to mobilise sampling platforms to deployment location	<96 hours (72 hours from monitoring plan approval)
SMP teams and monitoring equipment mobilised to deployment locations	<96 hours (72 hours from monitoring plan approval)
Minimum Resource Requirements	
Initial resourcing requirements will be dependent upon the number of SMPs activated and the requirement for post spill baseline data to be collected. First strike personnel requirements for scientific monitoring field teams at Protection Priority areas are presented in **Appendix P.** • Suitable vessels for on-water monitoring or transfer of personnel to remotes areas/islands; • Vehicle/s as required; • Helicopter for aerial surveys as required; • Scientific monitoring personnel for first strike teams (refer **Appendix P**); and • Scientific monitoring equipment as detailed in the relevant SMP.	

16.8 Scientific Monitoring Environmental Performance

Table 16-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 16-4: Environmental Performance – Scientific Monitoring

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement criteria**
Scientific Monitoring	**Response preparedness**		
	Maintenance of Monitoring Service Provider contract for scientific monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Conduct periodical review of existing baseline data sources across the Santos combined EMBA	Regular review of baseline data	Baseline data review report
	Water quality monitoring vessels	Maintenance of vessel specification for water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil and water quality monitoring kits pre-	Evidence of deployment to site

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement criteria**
		positioned at Exmouth, Dampier and Varanus Island	
	Response implementation		
	Activate SMPs	Initiation criteria of SMPs will be reviewed during the preparation of the initial IAPs and subsequent IAPs; and if any criteria are met, relevant SMPs will be activated	IAP and Incident Log
		If any SMPs are activated, the subsequent activation of Monitoring Service Provider is to follow the process outlined in Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Incident Log
		Monitoring Service Provider shall commence activation process within 30 mins of initial notification form being received from Santos	Monitoring Service Provider records
		Santos personnel to support Monitoring Service Provider through the provision of operational monitoring information and relative location of sensitive receptors to the spill	Incident Log and Monitoring Service Provider records
	Mobilisation of minimum requirements for initial scientific monitoring operations	Minimum requirements mobilised in accordance with **Table 16-3**	Incident log

17 Spill Response Termination

The decision to terminate the spill response is made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other Statutory Authorities that play an advisory role (e.g. DBCA). This decision will be made with consideration of the following factors:

+ The efficacy and benefit of current response options;
+ Any potential for additional pollution;
+ Any potential for additional environmental damage caused by further clean-up efforts; and
+ An assessment of prevailing weather conditions that can increase risk to response teams or increase the efficacy in weathering hydrocarbon.
+ A NEBA will be conducted to inform the decision making process. Termination criteria are defined within each section of contingency response activities defined within the OPEP.
+ Upon conclusion of the spill response activity, Santos will complete the following tasks:
+ Prepare detailed reports and collate all documents;
+ Report on the performance objectives of each individual spill response that was mobilised;
+ Undertake an inventory of consumables and prepare accounts;
+ Arrange for the return of equipment;
+ Arrange for the refurbishment of consumed equipment;
+ Conduct an investigation into the cause of the incident and report to relevant authorities; and
+ Assess long-term environmental monitoring requirements.

18 OPEP Administration

18.1 Document Review and Revision

In line with regulatory requirements, this document shall be reviewed, updated and submitted to NOPSEMA every 5 years from date of acceptance, until the activity is complete.

The document may be reviewed and revised more frequently, if required, in accordance with the Santos Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to one or more of the following:

+ When major changes have occurred, which affect Oil Spill Response coordination or capabilities;
+ Changes to the Environment Plan that affect Oil Spill Response coordination or capabilities (e.g. a significant increase in spill risk);
+ Following routine testing of the OPEP if improvements or corrections are identified;
+ After a Level 2/3 spill incident; or
+ The extent of changes made to the OPEP and resultant requirements for regulatory resubmission will be informed by the relevant Commonwealth regulations, i.e. the OPGGS (E) Regulations.

18.2 OPEP Custodian

The custodian of the OPEP is Santos Senior Oil Spill Response Coordinator based in Santos Perth Office.

19 References

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Appendix A: Hydrocarbon Characteristics and Behaviour

Hydrocarbon Characteristics and Behaviour:

Marine diesel

In the marine environment diesel will behave as follows:

- Diesel will spread rapidly in the direction of the prevailing wind and waves;
- In calm conditions evaporation is the dominant process contributing to the fate of spilled diesel from the sea surface and will account for 60 to 80% reduction of the net hydrocarbon balance;
- As wind increases, and breaking waves form, entrainment of diesel below the surface increases;
- The evaporation rate of diesel will increase in warmer air and sea temperatures; and
- Diesel residues usually consist of heavy compounds that may persist longer and will tend to disperse as oil droplets into the upper layers of the water column.

ITOPF (2011) and Australian Maritime Oil Spill Centre-AMOSC (2011) categorises diesel as a light group II hydrocarbon. In the marine environment, a 5% residual of the total quantity of diesel spilt will remain after the volatilisation and solubilisation processes associated with weathering.

For full details on the properties of marine diesel, refer to **Section 7.1.4** of the EP

Table A1: Characteristics of diesel

Hydrocarbon	Initial density (kg/m^3)	Viscosity (cP) @ 25^{o}C	Component	Volatiles (%)	Semi-volatiles (%)	Low volatility (%)	Residual (%)
			Boiling Points (^{o}C)	<180	180–265	265–380	>380
Diesel	836.8	4.0	% of total	6	34.6	54.4	<5

Source: APASA (2013a)

Hydraulic oils

These are medium oils of light to moderate viscosity and behave similarly to marine diesel when spilt to the marine environment. They have a relatively rapid spreading rate and dissipate quickly in ocean conditions. Similar to diesel, hydraulic oil residue will have a tendency to sit on the surface during calm conditions and will entrain during variable winds between 4-19 knots; returning to the surface when conditions become calm. After several days up to 40% could be expected to evaporate and 15% decay (APASA 2013a).

Lubricating fluid

Lubricating oils vary widely but in general are comprised primarily of long-carbon chain, persistent, hydrocarbons (APASA 2013b). These are reasonably viscous and so the spreading rate of a slick of these oils would be slow. These will not readily move into the water column, therefore are likely to remain on the water's surface during calm to windy conditions. In the marine environment, approximately 90% residual of the total quantity of lubricating oil spilt is likely to remain after weathering (i.e. < 6% due to evaporation and < 8% due decay after several days). Lubricating oils also readily combine with sea-water to form a water-in-oil emulsion, taking up as much as 70% by volume as water (APASA 2013b).

Oily water

Oily water can be mixture of any hydrocarbon used or stored on the vessel mixed with stormwater, ocean water, or process water. The concentrations of oil in the water are usually quite low; thereby the volumes of hydrocarbons released in a spill event are quite low and tend to dissipate quickly.

Gas condensate

Table A2 details the properties of Reindeer Condensate taken from a 2012 Assay Report, as used to inform oil spill modelling presented in the EP, and the current Assay Report from 2019. Properties from these reports show similar density, viscosity and make up of volatile, semi-volatile, low volatile and residual components. On this basis predictions of weathering behaviour and spill trajectory made using 2012 assay information are considered representative of the current oil properties. The whole-oil aromatic composition from the 2012 assay is higher than that derived from the 2019 assay and therefore modelled predictions of dissolved aromatic concentration may be slightly overestimated and therefore conservative with respect to current properties.

Reindeer condensate assay results show the condensate to be highly volatile with low viscosity (Table A-2). The weathering curve for Reindeer condensate indicates that a large proportion of the condensate will evaporate rapidly. Evaporation rates will increase with temperature, but in general about 65.4% if the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 17.4% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 14.8% should evaporate over several days (265 °C < BP < 380 °C).

The whole condensate has a low asphaltene content (<0.5%), indicating a low tendency for the hydrocarbons to take up water to form water-in-oil emulsions over the weathering cycle.

However, because the oil would be injected into the water column under the spill scenarios, there will be variable periods of time required for the droplets to surface before atmospheric weathering can commence. This factor will extend the effective weathering time for the oil and will result in variable compartmentalisation of the oil between the water surface and the water column over time.

Table A2: Characteristics of gas condensate

Hydrocarbon	Initial density (kg/m^3)	Viscosity (cP) @ 25°C	Component	Volatiles (%)	Semi-volatiles (%)	Low volatility (%)	Residual (%)
			Boiling Points (°C)	**<180**	**180–265**	**265–380**	**>380**
Reindeer condensate	786	0.841	% of total	72	17.0	10.0	1.0

Source: Intertek (2019)

Further hydrocarbon characteristics for the Reindeer condensate include:

+ Water Cut 2.8 stb/MMscf (0.016 kL/m3) (Average as at November 2019)
+ Asphaltene content (% mass) = <0.50 resulting in low tendency for the hydrocarbons to take up water to form water-in-oil emulsions.
+ Wax Content (% mass) = <5
+ Pour Point (oC) = -21oC ensuring the hydrocarbon will remain in a liquid state over the annual temperature range observed on the North West Shelf.
+ Condensate to Gas ratio= 3.96 STB/MMscf

Appendix B: Oil Spill Response ALARP Framework & Assessment

Oil Spill Response ALARP Framework & Assessment:

ALARP Assessment Framework

Rationale

As part regulatory approval requirements for petroleum activities, the Environment Plan (EP) and/or Oil Pollution Emergency Plan (OPEP) must demonstrate that through the implementation of all reasonable control measures, environmental risks have been reduced to a level that is As Low As Reasonably Practicable (ALARP).

With respect to hydrocarbon spill risk and response planning, this includes an assessment to demonstrate that the oil spill response control measures are reducing risk to a level that is ALARP.

This ALARP Assessment Framework provides a process to facilitate the identification of all existing and potential spill response control measures, the selection or rejection of which are supported by reasoned arguments.

1. Guidance Documents

Guidance documents used in the preparation of this framework include:

+ Oil Spill Risk Assessment and Response Planning Procedure QE-91-II-20003;
+ NOPSEMA Guidance Note ALARP N-04300-GN0166 Revision 6 June 2015;
+ NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 Last Reviewed 2020;
+ NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721 Revision 6 – November 2019;
+ NOPSEMA Guidance Note Risk Assessment GN0165 Revision 5 May 2017; and
+ NOPSEMA Oil Pollution Risk Management GN1488 Rev 2 February 2018

2. Overview

The ALARP Assessment Framework uses activity specific information to systematically assess existing and potential control measures and ensure that all practicable control measures are identified and documented.

When selecting controls to reduce risk is it good practice to apply a preferential order; elimination, substitution, prevention, reduction and mitigation. In the context of this ALARP Assessment Framework for oil spill response, all control measures are response strategies to reduce the impacts of an unplanned event that has already occurred. All source control response measures may be classed as ‘reduction’ in the hierarchy of controls with all other response measures classed as ‘mitigation’.

The ALARP Assessment Framework is shown in **Figure B1**.

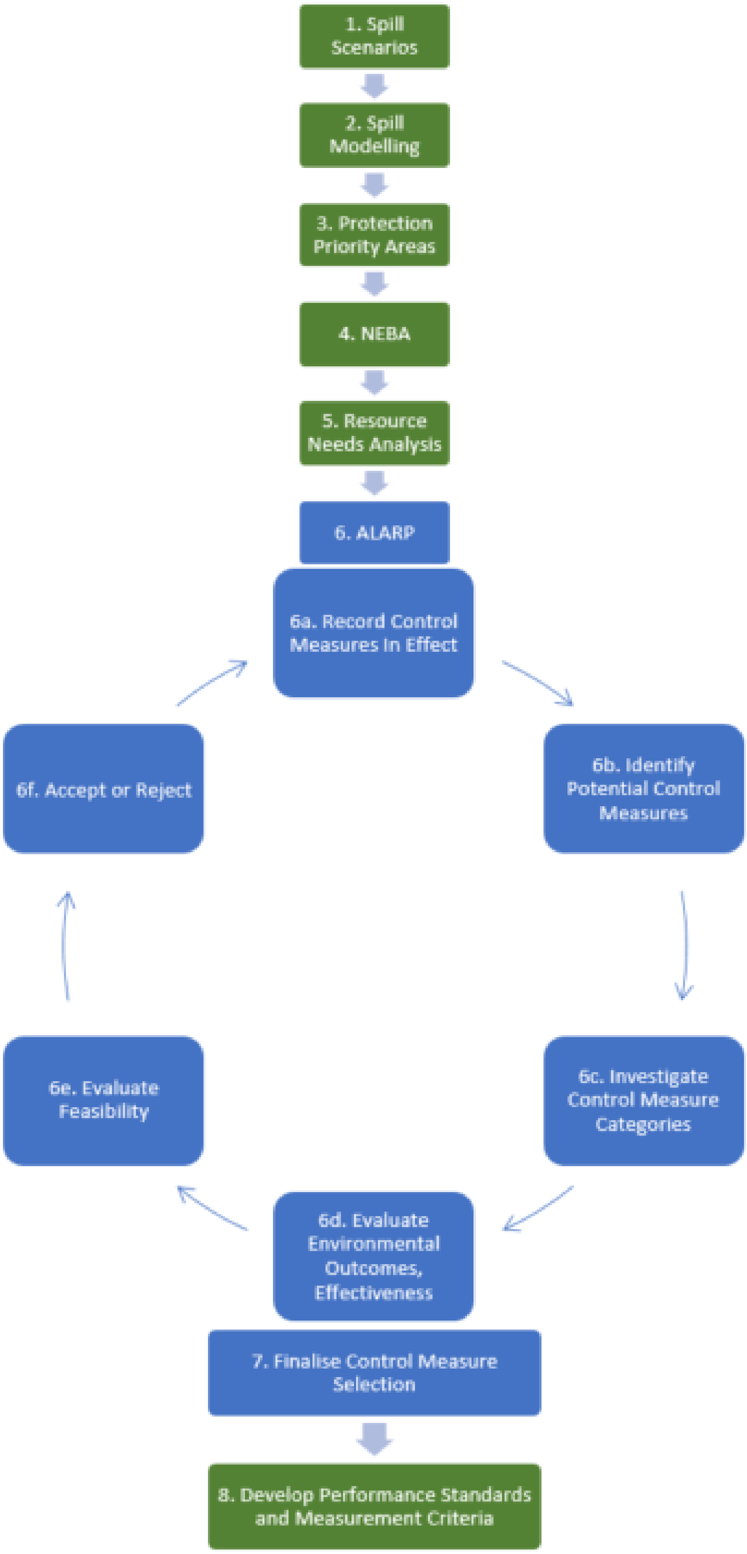

Figure B1: ALARP Assessment Framework

In **Figure B1**, Steps 1 to 5 (in GREEN) denote input information into the ALARP Assessment Framework. This information comprises:

<u>Spill Scenarios</u>: this step will involve assessing all possible spill scenarios from the activity and identifying the worst-case credible scenarios as a basis for pollution response planning.

Spill Modelling: a quantitative spill modelling assessment is conducted for the worst-case credible scenarios identified in Step 1.

Protection Priority Areas: the Environment that may be Affected (EMBA) is the largest area within which impacts from hydrocarbon spills associated with the activity could extend. The EMBA is predicted using spill modelling results from Step 2. Protection Priority Areas are locations of high ecological value within the EMBA that would be targeted in response. Selection of Protection Priority Areas is detailed in the Oil Spill Risk Assessment and Response Planning Procedure QE-91-II-20003

NEBA: Net Environmental Benefit Analysis (NEBA) is used to select the most effective response strategies to protect the Protection Priority Areas identified in Step 3.

Resource Needs Analysis: For the response strategies identified through NEBA, the worst-case resource, timing, and location requirements are determined, using quantitative spill modelling information where applicable. An Implementation Guidance is then developed to detail what arrangements and actions are required to be initiated by the Incident Management Team (IMT) to meet the incident requirements up to a worst-case incident.

Through the development of the Implementation Guidance, it may be possible to identify resource, timing and location requirements that could be improved. These areas of improvement should be noted in the ALARP so that additional, alternative or improved control measures can be considered in this context.

A detailed ALARP Assessment Framework for the evaluation of control measures is shown in **Figure 1**, Step 6 (in BLUE). Criteria and definitions used to evaluate control measures are shown in **Table B1**.

Record Control Measures In Effect: the spill response control measures currently in place for Santos Offshore are listed here. The environmental outcomes and effectiveness of the in-effect control measures are noted, using the Resource Needs Analysis to assess whether there are any areas of improvement. Environmental outcomes include potential harmful effects of control measures.

Identify Potential Additional Control Measures: potential control measures are identified, with a focus on any control measures that address areas of improvement identified in Step 6a.

Investigate Control Measure Categories: in-effect and potential control measures from Steps 6a and 6b are classified as either additional, alternative or improved, and as either people, system, equipment or procedures. This step serves as a prompt to ensure that potential control measures from all categories are explored.

Evaluate Environmental Outcomes, Effectiveness: the environmental outcomes and effectiveness are assessed for all control measures identified and described through Steps 6a, b and c.

Evaluate Feasibility: time, cost and effort required for implementation are assessed for all control measures identified and described through Steps 6a, b and c.

Accept or Reject: The potential control measure will be accepted or rejected on the basis of environmental outcomes and effectiveness described in Step 6d and whether cost is grossly disproportionate, as described in Step 6e.

When evaluating potential control measures, implementation plans of in-effect control measures are carefully considered to ensure that any accepted control measures will equal or improve Santos capacity to meet resource needs. Potential control measures are also considered within the context of current Santos response arrangements to determine if synergies or resource conflicts might occur.

As control measures are evaluated for selection or rejection, they can be compared with industry good practise to ensure that all practicable control measures were implemented. Where unique circumstances exist and further analysis is required, a different evaluation technique may be used, such as technical analysis, detailed cost benefit analysis or combination of approaches.

New information on risks, impacts and response strategies obtained through analysis of operations, exercises and scheduled documentation reviews can be incorporated into the ALARP Assessment Framework cycle in a process of continual improvement.

In **Figure B1**, Steps 7 and 8 show the conclusion of the ALARP Assessment Framework:

Finalised Control Measure Selection: outputs from the ALARP Assessment shown in Step 6 comprise finalised control measures (in BLUE).

Develop Performance Standards and Measurement Criteria: for each control measure finalised in Step 7, performance standards and measurement criteria are then developed and documented in the OPEP (in GREEN).

Performance standards for all accepted control measures should be written to enable the operator to measure, monitor and test effectiveness. Only the key aspects of any given control will require performance standards and these may include the various measures of effectiveness; functionality, availability, reliability, survivability, dependency and compatibility. Parameters set in the performance standard should be 'SMART'; specific, measurable, appropriate, realistic and timely.

Corrective action based on deviations or trends in performance should be taken by amending either the performance standard or the control measure, as appropriate.

3. Criteria and Definitions

Standardised criteria and definitions are used to bring consistency to the ALARP assessment across diverse activities and response strategies. Criteria and definitions are shown in Table B1.

Table B1: Criteria and Definitions of ALARP Assessment Framework

Column	Description
Strategy	Response Strategy
Control Measure	Aspect of Response Strategy being evaluated Description of the control measure that is In Effect or description of the potential control measure
In Effect, Alternative, Additional, Improved	In Effect control measures are already in place. Alternative control measures are evaluated as replacements for the control already in effect. Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures. Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures. Adapted from NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721 Revision 6 – November 2019

Column	Description
Control Measure Category	A range of different types of controls generally provide effective protection as they provide independence and multiple layers of protection. The OPGGS(S) regulations refer to technical and 'other' controls where technical control measures involve hardware like shutdown valves and alarms. 'Other' control measures include administrative and procedural control measures such as inductions, a drug and alcohol policy or an inspection regime. Industry practice has further developed this concept of a range of different types of controls based on a POiSTED framework to assess organisational capability: People – personnel System – organisation, information/communications, support facilities, training/ competency Equipment – equipment Procedures – doctrine Santos aims to implement a range of different types of controls where possible.
Environmental Outcomes	Assessment of environmental benefits, particularly those over and above those environmental benefits documented in the Control Measure that is in effect. Environmental impacts of the Control Measure are also considered here.
Effectiveness	The effectiveness of a Control Measure in reducing the risk to ALARP is evaluated using the following six criteria. <u>Functionality</u> The functional performance of a control measure is what it is required to do. How does the control perform in order to achieve the required risk reduction? <u>Availability</u> Probability that the control measure will be available when required and has not failed or is undergoing a maintenance or repair. <u>Reliability</u> The reliability of a control measure is the probability that at any point in time it will operate correctly for a further specified length of time. Reliability is all to do with the probability that the system will function correctly and is usually measured by the mean time between failure. <u>Survivability</u> Whether or not a control measure is able to survive a potentially damaging event such as fire or explosion is relevant for all control measures that are required to function after an incident has occurred. To achieve their purpose, oil spill response control measures should have high survivability. <u>Dependency</u> The dependency of the control measure is its degree of reliance on other systems in order for it to be able to perform its intended function. If several control measures can be disabled by one failure mechanism (common mode failure), or the failure of one control measure is likely to cause the failure of others, then the control measures are not independent and it may not be appropriate to count such measures as separate. <u>Several control measures are reliant on equipment, people and vessels, hence have high dependence.</u> <u>Compatibility</u> Whether or not a control measure is compatible takes into account how alternative control measures may interact with other controls and the rest of the

Column	Description
	facility, if introduced. Consideration should be given to whether new control measures are compatible with the facility and any other control measures already in use. Adapted from NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 Last Reviewed 2020
Feasibility	Feasibility describes the time, cost and/or effort required to implement the Control Measure.
Accept/ Reject	Outcome of assessment and key reasons for the decision

Dancer-1 Exploration Drilling Oil Spill Response ALARP Assessment

ALARP Assessment Summary - Source Control (refer worksheet for further detail)
The Control Measures in place for relief well drilling represent industry best practice and are considered to reduce the timeframe for drilling a relief well to as low as reasonably practicable in the context of the risk of an uncontrolled well leak from an exploration well. Potential Control Measures were identified and assessed by the Santos Drilling & Completions Department representatives. The drilling of a relief well is considered to be an effective control and relief well planning conducted in the area has demonstrated that relief well drilling within 77 days can be implemented using MODUs, equipment and specialist personnel that Santos has arrangements to gain access to. Five potential Control Measures were identified and assessed. Two Control Measures were accepted as reasonably practicable: + pre-purchase of relief well drilling supplies + direct surface intervention via well control experts Three Control Measures were rejected as grossly disproportionate. Rejected response strategies were: + Contract source control personnel through an alternative provider + Contract source control personnel through a provider in addition to existing arrangements + MODU on standby at activity location Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in the OPEP. The key performance requirements for relief well drilling are the maintenance tracking, access and relief well planning arrangements (during times of maintaining preparedness) and the timely mobilisation of resources (during a response). These key areas of effectiveness are reflected in the Performance Standards.
ALARP Assessment Summary - Monitor and Evaluate (refer worksheet for further detail)
Various, independent inputs from multiple service providers are used to build a detailed Common Operating Picture in the incident. Areas of improvement for monitor and evaluate activities were the availability of aerial observers and SCAT trained personnel in initial 24 hours of incident and availability of vessels for water quality monitoring. One potential Control Measure sought to make trained aerial observers available from Day 1 of a response, rather than Day 2, however an assessment of the Control Measure found that the cost was grossly disproportionate to the benefit. No potential Control Measures were identified to improve availability of SCAT trained personnel in the initial 24 hours of incident. A potential control measure to improve the availability of vessels for water quality monitoring by implementing more detailed vessel tracking parameters was evaluated and accepted. Six other potential Control Measures were also identified and assessed. Four were rejected as cost was grossly disproportionate to the reduction in risk , whilst two Control Measures around the provision of strategically located water quality monitoring kits and improved record keeping of service providers that could assist with fauna aerial observations were accepted as reasonably practicable. Eight potential Control Measures were identified and assessed. Three Control Measures were accepted as reasonably practicable. The accepted response strategies were: + Determine required vessel specifications and improve accuracy of Vessel Tracking System + Purchase of First Strike Oil/Water quality monitoring kits to be positioned at Exmouth, VI and Dampier. Development of technical procedure for sample collection by untrained personnel + Maintain a list of providers that could assist with fauna aerial observations, eg whale shark spotting planes Five Control Measures were rejected as grossly disproportionate. Rejected response strategies were:

- Purchase of oil spill modelling system and internal personnel trained to use system
- Additional satellite tracking buoys
- Ensure trained aerial observers based at strategic locations
- Trained monitoring specialists on site
- Ensure trained marine mammal/fauna observers based at strategic locations

Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, focus on maintaining access to equipment and personnel through contractual arrangements with vessel providers, aircraft providers, aerial observers, UAV providers, tracking buoys, oil spill trajectory modelling providers, satellite imagery providers water quality monitoring providers and spill responders. Additional key areas for effectiveness during preparedness are following relevant procedures such as the Protected Marine Fauna Interaction and Sighting Procedure and limiting environmental impacts from response activity through personnel and vehicle management. During response, a key area for ensuring effectiveness is the mobilisation of requirements in order to commence monitor and evaluate operations. These key areas of effectiveness have been represented in Performance Standards for monitor and evaluate operations.

ALARP Assessment Summary - Mechanical Dispersion (refer worksheet for further detail)

Mechanical dispersion is a secondary strategy that could be undertaken by vessels undertaking primary response strategies without the requirement for additional equipment, and no areas of improvement were identified. The use of mechanical dispersion in a response would be assessed as part of an operational NEBA.

No potential additional Control Measures were identified and assessed.

Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures during a response are around the development of an operational NEBA to confirm suitability and environmental benefit, and the mobilisation of vessels. These key areas of effectiveness are reflected in the Performance Standards.

ALARP Assessment Summary - Protect and Deflect (refer worksheet for further detail)

Large quantities of various types of nearshore booms and skimmers from Dampier, Exmouth and Fremantle ensures that equipment is in place to implement this response strategy within 24 hrs in a wide range of metocean conditions. Trained regional Santos personnel can be quickly mobilised to appropriate locations using helo services, followed by AMOSC staff and AMOSC Core Group from Perth. These regional and state resources ensure that equipment and personnel are not a limiting factor in this response strategy. An area of improvement is availability of shallow draft vessel. A review of Control Measures associated with vessels identified that improvement could be made by adding a provision for shallow draft boom tow vessels in existing Master Service Agreements with vessel providers.

Five potential Control Measures were identified and assessed.

One Control Measure was accepted as reasonably practicable. The accepted response strategy was:

- Provision for shallow draft boom tow vessels added to Master Service Agreement

Four Control Measures were rejected as grossly disproportionate. Rejected response strategies were:

- Santos to purchase additional shoreline and nearshore booms and ancillary equipment
- Access to additional shallow draft boom tow vessels owned by Santos
- Ensure trained personnel based at strategic locations such as Exmouth
- Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations

Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified

Control Measures, during times of preparedness, are around maintaining access to equipment and personnel through contractual arrangements. During response, a key area for ensuring effectiveness is the mobilisation of requirements in order to commence protection and deflection operations and the preparation of an operational NEBA for each operational period that takes into account protection priorities and the ongoing effectiveness of the response strategy. These key areas of effectiveness have been represented in Performance Standards for protection and deflection operations.
ALARP Assessment Summary - Shoreline Clean-up (refer worksheet for further detail)
Regional and Fremantle stockpiles and locally available supplies provide a range of shoreline clean-up equipment can be accessed to suit most beach types / required clean-up operations. Trained regional Santos personnel can be quickly mobilised to appropriate locations using helo services, followed by AMOSC staff and AMOSC Core Group from Perth. Equipment and trained personnel are not expected to be limiting factors for this response strategy. The availability of labour hire personnel for initial stages of a response was identified as an area of improvement. Control Measures that were evaluated to improve the availability of labour hire was either not feasible or the cost was grossly disproportionate to the reduction in risk. The availability of shallow draft vessels in initial stages of a response was also identified as an area or improvement. A review of control measures associated with vessels identified that improvements could be made by adding a provision for shallow draft boom tow vessels in existing Master Service Agreements with vessel providers. Waste management may be a limiting factor for ongoing shoreline clean-up operations and further information is shown in the ALARP assessment for Waste. Ten potential Control Measures were identified and assessed. One Control Measure was accepted as reasonably practicable. The accepted response strategy was: + Provision for shallow draft vessels added to Master Service Agreement Nine Control Measures were rejected as grossly disproportionate. Rejected response strategies were: + Mechanical mobile plant equipment for clean-up pre purchased and positioned at strategic locations + Prepurchase and storage of equipment (decontamination/ staging equipment, clean-up and flushing, PPE) at strategic locations + Access to additional shallow draft vessels owned by Santos to transport personnel to key sensitive areas on offshore islands such as Murion Islands + Access to additional team leaders that are locally based at strategic locations or can be mobilised within short time frames + Faster access to clean-up personnel via Perth based labour hire contractor + Faster access to clean-up personnel via locally based labour hire companies or emergency response organisations + Faster access to clean-up personnel via Santos employment of local personnel + Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to suitable equipment and personnel through contractual arrangements. During response, a key area of effectiveness is the rapid mobilisation of equipment and personnel and preparation of a Shoreline Clean-up Subplan and NEBA to ensure that impacts from response activities are minimised and operations are conducted in accordance with protection priorities as confirmed by the Control Agency.
ALARP Assessment Summary - Oiled Wildlife (refer worksheet for further detail)
Oiled wildlife equipment including first strike kits and containers can be mobilised from regional locations and Perth. Further equipment is available through national or international resources to implement a timely and sustained response adequate for the scale of worst-case oiled wildlife operations identified in the OPEP. The availability of trained personnel in the initial stages of an incident is a limiting factor for this response strategy. Control Measures around the provision of

trained personnel were reviewed to identify that trained Santos personnel could be based not just in the Perth Office but also at VI and DC facilities. Potential Control Measures around additional responders through pre-hiring or contracts with additional service providers were investigated but were found to be not beneficial and/or the cost was grossly disproportionate to risk reduction. An additional area of improvement is clarity for how Santos will integrate with Control Agencies OWR. It has been identified that additional planning captured in a Santos Oiled Wildlife Response Framework is a practicable control measure to ensure that resources are deployed in a coordinated approach. Four potential Control Measures were identified and assessed. Two Control Measures were accepted as reasonably practicable. The accepted response strategies were: + Development of a Santos Oiled Wildlife Response Framework which will set the corporate guidance for OWR preparedness and response and define how Santos will integrate with Control Agencies to provide a coordinated response + Additional Santos OWR trained personnel positioned at VI and Perth Two Control Measures were rejected as grossly disproportionate. Rejected response strategies were: + Pre-hire and/or prepositioning of staging areas and responders + Direct contracts with service providers Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to equipment and personnel through contractual arrangements. During response, the mobilisation of requirements for initial oiled wildlife response operations and the management of the oiled wildlife response in accordance with the WA Oiled Wildlife Response Plan are both key elements for achieving this strategy and they are represented as a Performance Standards.
ALARP Assessment Summary – Waste (refer worksheet for further detail)
The Santos contract with the waste service provider has provisions for waste management operations of the scale estimated to be required in worst case scenarios detailed in the OPEP. Further detail is captured in the *Waste Management Plan - Oil Spill Response Support (QE-91-IF-10053).* The waste service provider can mobilise waste receptacles from Karratha. Given the waste service provider arrangements and preplanning already undertaken, waste storage facilities, road transport and logistics are not expected to be limiting factors in the response. For these components, potential Control Measures were identified and evaluated but were found to either make no improvement in capability or cost was grossly disproportionate. An area of improvement is the availability of vessels required for waste transport at sea. One potential Control Measure to address this area of improvement was identified and assessed but cost was grossly disproportionate to risk. No other potential control measures were identified. Three potential Control Measures were identified and assessed. No Control Measure were accepted as reasonably practicable. Three Control Measures were rejected as grossly disproportionate. Rejected response strategies were: + Maintain contracts with multiple service providers + Procure temporary waste storage for Santos stockpile + Contract additional vessels on standby for waste transport Performance Standards and Measurement Criteria that have been developed for the in effect Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to waste management equipment and services through contractual arrangements. During response, a key area for increasing effectiveness is the timely mobilisation of requirements for initial response operations and defining critical management and reporting services to be provided by the waste service provider. These key areas of effectiveness are captured in the Performance Standards.

ALARP Assessment Summary - Scientific Monitoring (refer worksheet for further detail)
Oil spill scientific monitoring will be conducted on behalf of Santos by a contracted monitoring service provider as detailed in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and the relevant Scientific Monitoring Programs. An area of improvement is the availability of vessels in the initial stages of response. To address this area of improvement, a potential Control Measure around more detailed vessel tracking was assessed and accepted. Additionally, three potential Control Measures were identified and assessed. A potential Control Measure on the purchase and standby of scientific monitoring resources was found to be grossly disproportionate in cost in comparison to the reduction in risk. Two potential Control Measures on improved record keeping for scientific monitoring consumable requirements and suppliers and the provision of water quality sampling kits to be located at strategic regional locations were both found to be reasonable practicable. Four potential Control Measures were identified and assessed. Three Control Measure were accepted as reasonably practicable. The accepted response strategies were: + Maintain equipment list and list of suppliers for implementation of Scientific Monitoring Plans + Purchase of oil/water quality sample kits in 2020 for scientific monitoring personnel to be positioned at Varanus Is., Exmouth and Dampier + Determine required vessel specifications required for Scientific Monitoring implementation and improve accuracy of Vessel Tracking System One Control Measure was rejected as grossly disproportionate. Rejected response strategy was: + Scientific monitoring personnel, plant and equipment on standby at the operational location Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to equipment and personnel through contractual arrangements, regular reviews of monitoring service provider capability and reviews of existing baseline data. During response, a key area for effectiveness is the mobilisation of requirements to commence scientific monitoring and ensuring that relevant approved manuals and plans are followed. These key areas of effectiveness are reflected in the Performance Standards.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Relief well drilling	Santos WA Drilling and Completions Source Control Team mobilised within 24 hours. Well Control Specialists mobilised within 72 hours. Contract/ MOUs for source control personnel. APPEA MoU for mutual assistance for relief well drilling.	In effect	People	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.	This control measure provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Cost of contracts/ MOUs	In effect
	Contract source control personnel through an alternative provider	Alternative	People	No environmental benefit if both service providers are adequate to fulfil requirements.	Provides functionality, availability, reliability, survivability, compatibility and independence	Time and cost involved in reviewing and renegotiating contract outside of regular review period	Reject No environmental benefit in moving to alternative service provider
	Contract source control personnel through a provider in addition to existing arrangements	Additional	People	No environmental benefit if additional services are surplus to requirements	Improved availability and reliability	Significant additional cost in maintaining two contracts for the same service	Reject No environmental benefit in having access to personnel surplus to requirements
	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a set process top follow in the planning and mobilisation for relief well drilling by Santos WA Source Control Team thereby reducing the timeframe and increasing the effectiveness of relief well drilling.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort in updating and maintaining document	In effect
	MODU Capability Register is monitored monthly	In effect	Procedure	By monitoring MODU, it will be possible to gain an understanding of which MODU may be rapidly available for relief well operations. This could reduce mobilisation times for MODU thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	In effect
	MODU on standby at activity location	Improved	Equipment	Reduce mobilisation times of MODU to drill relief well thus reducing hydrocarbon released to the environment. Instead of base timeframe for the drilling of a relief well of 77 days, relief well potentially could be drilled in 43 days (77 days less the 34 days required for mobilisation).	Improved availability	The cost of having a MODU on standby is approximately $600,000 per day. If adopted this cost is paid regardless if there is a loss of containment or not.	Reject Likelihood of LOWC is considered rare and the cost of having a second MODU on standby at location is considered grossly disproportionate to the environmental benefit.
	Pre purchase of relief well drilling supplies	Improved	Equipment	Relief well drilling supplies such as casings and well head equipment could potentially reduce relief well drilling times	Increase in availability	Cost of purchase, maintenance and storage of supplies	Adopt Offshore D&C commit to having long lead equipment for a relief well at our disposal as part of our WOMP commitments for each well we drill.
	Direct Surface Intervention Via Well Control Experts	Improved	Procedure	Reduce time taken to control source and reduce environmnetal impacts	1) Effectiveness of intervention of this type needs to be assessed at the time given that personnel safety considerations may preclude this control measure. 2) Mobilisation procedure for personnel as per SCERP 3-4) Contracts and MoUs for well control personnel (WWC)	Ability to implement and effectiveness of this control can only be determined at the time of an incident.	Adopt Santos has a standing agreement with Wild Well Control for call-out of well control experts. Arrangements already in place to access resources (SCERP, Contracts) but this control will be applied opportunitistically and will be dependent upon safety constraints.
Source Control - Vessel Collision	Vessel Spill Response Plan (SOPEP/SMPEP)	In effect	Procedure	Provides a set process to follow in the planning and mobilisation for spill response actions by the Vessel Contractor thereby reducing the timeframe and increasing the effectiveness of spill response.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Effort required in contractor procudure due diligence.	In effect
No alternate, additional or improved control measures identified							

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Vessel surveillance	Level 1: vessels in use by Santos WA could be used for surveillance purposes in the event of a spill. (Vessel surveillance will be activated within 90 minutes for available on-site vessels. Santos has access to on-hire vessels supporting Santos WA's VI and NV facilities. Santos WA Vessel Monitoring System has access to automatic identification system live-vessel tracking portal to establish vessel availability.)	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of existing contracts with vessel providers	In effect
	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Santos WA Vessel Monitoring System.	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	Cost of contracts at the time of requirement.	In effect
No alternate, additional or improved control measures identified							
Aerial surveillance - aircraft and crew	Maintain contract with service provider for dedicated aerial platform operating out of Karratha. (Helicopter services available through Santos WA's primary contracted supplier. Activation of aerial surveillance using helicopter pilots will occur in 3 hours of notification of the spill. Helicopter on site for surveillance within 6 hrs. Surveillance and recording using helicopter pilots is considered adequate for situational awareness.)	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of aerial observers in initial 24 hours of incident	Cost of contract	In effect
No alternate, additional or improved control measures identified							
Aerial surveillance - observers	Level 1: Trained Santos observers will be available from Day 2 of the incident, following activation	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of aerial observers in initial 24 hours of incident	Cost of training and maintaining trained staff	In effect
	Level 2: Access to additional aerial observers through AMOSC Staff and Industry Mutual Aid Core Group Responders	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of AMOSC membership	In effect
	Level 3 : Access to additional aerial observers through OSRL (18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of OSRL membership	In effect
	Ensure trained aerial observers based at strategic locations	Additional	People	Current capability meets need and therefore environmental benefit would be incremental. Having trained observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1 (current arrangements are that the pilot would provide the initial observations and recording on Day 1 with trained aerial observers from Perth and VI mobilised and operational by Day 2).	Improved availability and reliability	Costs associated with staff employment and training	Reject Cost is considered disproportionate to the incremental benefit given surveillance on Day 1 by pilots is considered sufficient

Aerial surveillance - unmanned aerial vehicles	Level 2: Unmanned Aerial Vehicles for aerial surveillance available through AMOSC (UAVs and pilots can be accessed through AMOSC with a mobilisation time of 12+ hours)	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given shorter deployment time and ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Level 3: Unmanned Aerial Vehicles for aerial surveillance available through OSRL	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given shorter deployment time and ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							
Surveillance (vessel and aerial)	Vessels and aircraft compliant with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	In effect	Procedure	Provides the procedure for interaction and sighting of protected marine fauna from vessel or aircraft, to ensure compliance with EPBC Regulations.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of maintaining and implementing procedure.	In effect
	Level 1. Santos WA owns and maintains 12x tracking buoys across its NW facilities.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of equipment	In effect
	Level 2: tracking buoys available from AMOSC and through AMOSC Mutual Aid	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership	In effect
	Level 3: tracking buoys available from OSRL. Transit times (air) Singapore to Karratha = 3–5 days.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership	In effect
	Santos WA purchase additional satellite tracking buoys	Additional	Equipment	There is no expected environmental benefit from having additional tracking buoys, as there are already tracking buoys located on the facility/ vessel ready for deployment 24/7 and any additional needs can be provided by Santos owned stocks. Additional buoys can be accessed from AMSA, AMOSC and OSRL within days with no additional upfront cost.	Increase in availability and reliability	Cost of purchasing additional tracking buoys	Reject Does not provide any additional environmental benefit and the cost associated is therefore not warranted
Oil Spill Trajectory Modelling	Maintain contract with Oil Spill Trajectory Modelling service provider. The service provider will be contacted immediately (within 2 hours) upon notification of a level 2 or 3 spill. Upon activation, the service provider will provide trajectory models within: - 2 hours for OILMAP model for offshore and open ocean; - 4 hours for OILMAP operations for near-shore; and - Detailed modelling service is available for the duration of the incident.	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of contract	In effect
	Access to additional spill modelling capability through OSRL	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	An additional service provider ensures redundancy (independence) if for some reason the other service provider was unable to fulfil the function. There is also the possibility of increased functionality associated with improved certainty of the modelling results if both service providers are activated.	Cost of membership	In effect
	Purchase of oil spill modelling system and internal personnel trained to use system	Alternative	System, people	This could result in the faster generation of the initial model which may result in an environmental benefit as a consequence of the IMT making operational decisions quicker	Potentially increases availability Decrease in functionality- in house service may not be across technical advances to same extent as contracted service providers	Purchase of system, training of personnel, and on-call roster	Reject The cost of purchasing the system, training and having personnel on-call is disproportionate to any potential gains from potentially being able to deliver initial results quicker than the 2 hour turn-around currently guaranteed by the service provider

Satellite Imagery	Maintain membership with AMOSC provider to enable access and analysis of satellite imagery.	In effect	Systems	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Maintain membership with OSRL to enable access to and analysis of satellite imagery	In effect	System	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							
Water Quality Monitoring (operational and scientific)	Maintain of monitoring service provider contract for water quality monitoring services. Water quality monitoring personnel, equipment and vessel deployed to spill site within 72 hrs.	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	Cost of contracts	In effect
	Access to additional water quality monitoring services through OSRL	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	Cost of OSRL membership	In effect
	Determine required vessel specifications and improve accuracy of Vessel Tracking System	Improved	Procedure	Improve mobilisation time	Improved availability and reliability	Cost to determine vessel specifications	Accept
	Purchase of First Strike Oil/Water quality monitoring kits to be positioned at Exmouth, VI and Dampier. Development of technical procedure for sample collection by untrained personnel	Additional	Equipment, procedure	Will enable Oil fingerprinting, and initial measurements of oil concentrations	Improve function, availability, survivability and compatibility	Cost of purchasing equipment and developing procedure	Accept
	Trained monitoring specialists on site	Additional	People	Ensure sampling is conducted correctly	Improves reliability	Costs associated with staff employment	Reject This is not necessary as a good procedure for sample collection is in place
Shoreline Assessment	Level 1: WA-based AMOSC staff and core group operations personnel (Santos WA has arrangements through AMOSC to mobilise WA-based AMOSC staff and Core Group personnel to site 24 hours following initiation)	In effect	People, procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; availability - reduce time to mobilise personnel to strategic locations	Cost of AMOSC membership	In effect
	Level 3: Maintain membership with OSRL to access SCAT trained responders (OSRL, 18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People, procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts	Provides additional functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of OSRL membership	In effect
No alternate, additional or improved control measures identified							
Wildlife Reconnaissance (aerial/ vessel surveillance. Shoreline and coastal habitat assessment)	Maintain contract with scientific monitoring service provider for access to fauna aerial observers and personnel experienced in conducting relevant fauna surveys.	In effect	People, procedures	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Provides functionality, availability and compatibility Area for improvement; availability - reduce time to mobilise personnel to strategic locations	Cost of contract	In effect
	Maintain a list of providers that could assist with fauna aerial observations, eg whale shark spotting planes	Additional	People	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Improves availability and reliability Area of improvement; none identified	Cost of developing and maintaining list	Accept

	Ensure trained marine mammal/fauna observers based at strategic locations	Additional	People	Having trained marine mammal/fauna observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1	Improved availability and reliability	Costs associated with staff employment and training	Reject Maintaining trained fauna observers at location is considered grossly disproportionate as they are required only for the initial stages of the response until observers from scientific monitoring provider can be mobilised.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Mechanical Dispersion	Use of vessel crews, contract vessels and vessels of opportunity to disperse small areas of amenable hydrocarbon types such as marine diesel.	In effect	People, equipment	Enhanced dispersion and biodegradation of released hydrocarbons	Provides availability, reliability, survivability, compatibility and independence. Limited functionality as mechanical dispersion is secondary response strategy limited by weather conditions, hydrocarbon type and hydrocarbon volume.	Cost of vessel time	In effect

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Protection and deflection- booms and ancillary equipment	Level 2: Shoreline and nearshore booms plus ancillary equipment from Varanus Is. (Santos WA, 8*Beach Guardian, 16*25m Zoom Boom, 2*skimmer), Exmouth (AMOSC, 20*25m Beach Guardian, 20*25m Zoom Boom, 2 skimmers), Dampier (Santos WA, 1*skimmer; AMSA, 5* Canadyne Inflatable, 10* Structureflex Inflatable, 5* Versatech Zoom Inflatable, 2 Slickbar Solid Buoyancy, 3*Structureflex Solid Buoyancy, 30* Structureflex Land Sea), Fremantle (AMOSC, 23*35m Beach Guardian, 30*25m Zoom Boom, 18* Curtain Boom, 1*skimmer; AMSA, 15*Structureflex Inflatable, 13*Versatech Zoom Inflatable, 10*Structureflex Solid Buoyancy, 30* Structureflex Land Sea), Broome (AMOSC, various equipment). Vehicles sourced from local hire companies. Transit times (vessel): Varanus Is. to Dampier = 4 hrs, Transit times (road) Fremantle to Karratha= ~24 hrs Exmouth to Dampier/ Karratha = 7 hrs Protection booming equipment mobilised to FOB location within 12 hrs.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs associated with equipment purchase and maintenance Costs of contracts, MOUs with AMOSC and AMSA	In effect
	Level 3: Shoreline and nearshore booms plus ancillary equipment from Geelong (AMOSC), interstate (AMSA) and Singapore (OSRL). Transit times (road/ air) Geelong or Singapore to Exmouth or Karratha = 3–5 days. These resources in place to commence protection and deflection within 3-10 days.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs associated with equipment purchase and maintenance Costs of contracts, MOUs Costs associated with staff training	In effect
	Santos WA to purchase additional shoreline and nearshore booms and ancillary equipment	Additional	Equipment	Enable more protection and deflection operations to occur simultaneously to protect more key areas	Improved availability and reliability	Costs associated with equipment purchase and maintenance	Reject Sufficient quantities of equipment located in the region.
Protection and deflection- vessels	Level 1: Shallow draft vessels in use by Santos WA. Boom deployment vessel / remote island transfer vessel mobilised to FOB location/ port within 12 hrs.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of existing contracts with vessel providers	In effect
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: Shallow draft vessels sourced without existing contracts from any location	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of contracts at the time of requirement.	In effect
	Access to additional shallow draft boom tow vessels owned by Santos WA	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	Costs of vessel purchase and maintenance	Reject High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.

	Provision for shallow draft boom tow vessels added to Master Service Agreement	Improved	Equipment	Reduce time required to source vessels and crew in initial phase of response. Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	Time involved in providing vessel specifications and liaising with existing suppliers	Accept
Protection and deflection-personnel	Level 2: Spill responders from Varanus Is., Devil Creek, Perth (Santos WA, 13 people), Fremantle (AMOSC staff, 2 people), Perth (AMOSC Core Group, up to 60 people). Santos Offshore Core Group mobilised to Dampier within 12 hrs. AMOSC Staff and Industry Core Group mobilised to FOB within 24 hrs.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Availability - Santos WA access to helo services ensures that regional personnel can be quickly mobilised to the appropriate location. Area for improvement; none identified	Costs of contracts, MOUs with AMOSC, AMSA Costs associated with staff training	In effect
Protection and deflection-personnel	Level 3: Spill responders from Geelong (AMOSC staff, 6 people), interstate (AMOSC Core Group, up to 60 people; AMSA, unspecified) and international (OSRL, 18 people). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs of contracts, MOUs with AMOSC, AMSA, OSRL Costs associated with staff training	In effect
	Ensure trained personnel based at strategic locations	Improved	Personnel	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	Costs associated with staff employment and training	Reject No Santos personnel currently based at all spill locations so employment costs would be significant and not justified given that helicopters enable rapid transportation of Santos WA staff within the region.
Protection and deflection-planning	Ningaloo Coast shoreline sensitivity and access data/maps and Tactical Response Plans	In effect	Procedures	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of document preparation and maintenance	In effect
	Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations	Improved, additional	Procedures	Improved level of response planning to streamline resourcing and logistics and effect a better response	Improved functionality	Cost involved in revision of sensitivity mapping and tactical response plans and preparation of additional tactical response plans	Reject Current maps/plans are adequate to initiate an effective response. Plans will have to be reassessed at the time of the incident, to take into account variables such as weather and tides.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Shoreline Clean-up - equipment	Level 1: Manual clean-up equipment from local hardware outlets. Decontamination/staging equipment from Karratha(AMSA, 1*decon station). Mobile plant from local hire companies. PPE from Dampier/Karratha (Santos WA, 1*container). Clean-up equipment mobilised to location within 12 hrs.	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of equipment in initial 48 hours of incident	Cost of equipment purchase and hire at the time of incident Cost of membership with AMOSC	In effect
	Level 2: Manual clean-up and flushing equipment from Varanus Is. (Santos WA, 1*container), Fremantle (AMOSC, 1*shoreline support kit and 1*flushing kit) and state hardware outlets. Decontamination/staging equipment from Karratha (AMSA; 1*decon stations) and Fremantle (AMOSC, 1*decon station; AMSA, 2* decon stations). Mobile plant from state hire companies. PPE from Dampier and Varanus Is (Santos WA, 2*containers) and Fremantle (AMOSC, 1*container, 2*gas detectors). Transit times (vessel): Varanus Is. to Dampier = ~4hrs, Transit times (road) Fremantle to Dampier = ~24 hrs Exmouth to Dampier/ Karratha = 7 hrs Resources in place to commence shoreline clean-up within 1–3 days	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - procurement and mobilisation of equipment	Cost of equipment purchase and hire at the time of incident Cost of equipment purchase and maintenance Cost of contract with AMOSC	In effect
	Level 3: Manual clean-up and flushing equipment from Geelong (AMOSC, 1*shoreline support kit, 1* flushing kit, 1*shoreline impact lance kit), Singapore (OSRL) and national hardware outlets. Decontamination/ staging equipment from Geelong (AMOSC, 1*decon station). Mobile plant sourced from national hire companies. PPE from Geelong (AMOSC, 1*container, 7*gas detectors). Transit time (road/ air) Geelong or Singapore to Exmouth or Karratha = 3–5 days	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - procurement and mobilisation of equipment	Cost of equipment purchase and hire at the time of incident Cost of equipment purchase and maintenance Cost of memberships with AMOSC and OSRL	In effect
	Mechanical mobile plant equipment for clean-up pre purchased and positioned at strategic locations	Additional	Equipment	Environmental benefits and impacts are dependant on hydrocarbon fate and local ecology. Reduced mobilisation times and improved access would assist, should mobile plant be deemed advantageous	Improved availability and reliability	Costs associated with equipment purchase and maintenance	Reject there is a high likelihood that mobile plant equipment is not used due to negative environmental impacts, leaving purchased equipment unutilised and costs disproportionate Locally available hire plant can be used. Additional plant could be purchased and mobilised from Perth if required
	Prepurchase and storage of equipment (decontamination/ staging equipment, clean-up and flushing, PPE) at strategic locations	Additional	Equipment	Improve mobilisation time, potential for more response locations	Improved availability and reliability	Cost in purchase and maintenance of equipment	Reject Equipment for first strike available at Dampier/Karratha Additional equipment can be mobilised to Karratha in less than 24 hours.

Shoreline Clean-up - vessels	Level 1: Shallow draft vessels in use by Santos WA. Remote island transfer vessel mobilised to FOB location/ port within 12 hrs.	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of existing contracts with vessel providers	In effect
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region and tracked by Santos WA Vessel Monitoring System	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: Shallow draft vessels sourced without existing contracts from any location	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of contracts at the time of requirement.	In effect
	Access to additional shallow draft vessels owned by Santos WA to transport personnel to key sensitive areas on offshore islands such as Montebello Islands	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas on offshore islands	Improved availability and reliability	Costs of vessel purchase and maintenance	Reject High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.
	Provision for shallow draft vessels added to Master Service Agreement	Improved	Equipment	Reduce time required to source vessels and crew in initial phase of response. Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability. Improve capacity for Santos WA to source shallow draft vessels within the minimum arrival time (>10g/m2 shoreline accumulation) of 2.2 days for Montebello Islands.	Time involved in providing vessel specifications and liaising with existing suppliers	Accept
Shoreline Clean-up - personnel	Level 2: Clean-up team leaders from Varanus Is., Devil Creek, Perth (Santos WA, 13 people), Fremantle (AMOSC staff, 2 people), Perth (AMOSC Core Group, up to 60 people). Santos Offshore Core Group mobilised to Dampier/Karratha within 12 hrs. AMOSC Staff and Industry Core Group mobilised to FOB within 24 hrs.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Costs associated with staff training Costs of membership, MoUs with AMOSC, AMSA	In effect
	Level 3: Clean-up team leaders from Geelong (AMOSC staff, 6 people), interstate (AMOSC Core Group, up to 60 people; AMSA, unspecified) and international (OSRL, 18 people). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel	Costs associated with staff training Costs of membership, MoUs with AMOSC, AMSA	In effect
	Access to additional team leaders that are locally based at strategic locations or can be mobilised within short time frames	Additional	People	Improve mobilisation time, potential for more response locations	Improved availability and reliability	Cost of employment and training of staff Cost of being locally based or on a rapid mobilisation plan	Reject Santos WA already employs trained oil spill responders in the region that can be mobilised to key areas by helicopter within short time frames.
	Clean-up labour personnel predominantly based in Perth.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Costs of labour hire through existing service provider	In effect
	Faster access to clean-up personnel via Perth based labour hire contractor	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	Not feasible to mobilise labour hire personnel in less than 72 hours	Reject
	Faster access to clean-up personnel via locally based labour hire companies or emergency response organisations	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	No identified regional labour hire companies	Reject

	Faster access to clean-up personnel via Santos employment of local personnel	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	Costs associated with personnel employment and training	Reject Cost of permanently employing personnel is grossly disproportionate to benefits of availability in initial
Shoreline Clean-up - planning	Shoreline sensitivity mapping and Tactical Response Plans	In effect	Procedures	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation in initial 48 hours of incident	Cost associated with development and maintenance of mapping and Tactical Response Plans	In effect
	Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations	Improved, additional	Procedures	Improved level of response planning to streamline resourcing and logistics and effect a better response	Improved functionality	Cost involved in revision of sensitivity mapping and tactical response plans and preparation of additional tactical response plans	Reject Current maps/plans are adequate to initiate an effective response. Plans will have to be reassessed at the time of the incident, to take into account variables such as weather and tides.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Oiled wildlife response - planning	Implementation of the Western Australian Oiled Wildlife Response Plan (WAOWRP) and Pilbara Region Oiled Wildlife Response Plan	In effect	Procedure	Working within the guidelines of the WAOWRP and Pilbara regional plan will ensure a coordinated response and that the expectations of the Control Agency are met with the overall aim to increase the likelihood of success of the OWR (success in terms of wildlife survivorship and rates for release back into the wild).	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement- framework for how Santos will integrate with Control Agencies for OWR	Effort and time involved in developing OWR implementation plan within OPEP based on guidance from WAOWRP and Pilbara Regional Plan	In effect
	Development of a Santos WA Oiled Wildlife Response Framework which will set the corporate guidance for OWR preparedness and response and define how Santos will integrate with Control Agencies to provide a coordinated response	Additional	Procedure	The framework will be complementary to the WAOWRP and Pilbara Regional Plan and will facilitate a rapid coordinated response, and the provision of resources by Santos in order to increase the likelihood of success of the OWR.	Improved functionality and reliability.	Cost of document development and maintenance	Accept
Oiled wildlife response - equipment	Level 2 OWR kits and containers available from AMOSC, AMSA, DBCA or DoT in Exmouth, Darwin, Broome, Karratha, Fremantle, or Kensington. WA equipment (OWR containers) mobilised to Dampier region within 24 hrs.	In effect	Equipment	Timely access to appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Level 3 OWR equipment available from OSRL. Transit times (road/ air) Singapore to Karratha = 3–5 days.	In effect	Equipment	Appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							
Oiled wildlife response - personnel	Level 1/2 Santos WA personnel trained in OWR. OWR trained personnel mobilised to Dampier region within 24 hrs.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; ensure personnel are based not just in the Perth Office but also at VI and DC facilities	Cost of training and maintaining training	In effect
	Level 2 OWR personnel from AMOSC, AMOSC-activated Wildlife Response contractors, and Industry Mutual Aid. Mobilisation of OWR personnel to site will start to occur in 24-48 hours following notification of actual or imminent impact to wildlife.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Cost of membership with AMOSC	In effect
	Level 3 OWR personnel available through OSRL. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
	Maintain labour hire arrangements for access to untrained personnel. Untrained personnel accessed through labour-hire arrangements would receive an induction, on-the-job training and work under the supervision of an experienced supervisor.	In effect	People	During a large scale OWR the ability to access large numbers of personnel through labour hire arrangements is imperative in terms of capability for conducting an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of labour hire at time of incident	In effect
	Additional Santos WA OWR trained personnel positioned at VI and Perth	Additional	People	Additional personnel trained in OWR and whom are located at facilities will enhance the first strike capability of Santos WA and therefore enhance the likelihood of success of the OWR, particularly for those instances where oil is ashore within 48 hours	Improved functionality, availability, reliability and independence.	Cost of training staff	Accept

	Prehire and/or prepositioning of staging areas and responders	Additional	System	This may enhance response times and first strike capability and hence improve the likelihood of success of the OWR. Conversely, prepositioned personnel and staging areas may result in negative impacts to the environment and wildlife.	Improved functionality, availability, reliability and independence.	Additional wildlife resources could total $1500 per operational site per day. This is a guaranteed cost regardless of whether a spill occurs or not.	Reject- the cost of setting up staging areas and having responders on standby is considered disproportionate to the environmental benefit gained. Further, prepositioned personnel and staging sites may have negative impacts on the environment and wildlife. The overall OWR capability Santos WA can access through Santos WA staff, AMOSC, AMOSC mutual aid, Santos WA labour force hire arrangements, DBCA and wildlife carer network are considered adequate, with further advice and international resources available through OSRL.
	Direct contracts with service providers	Alternative	System	This option duplicates the capability accessed through AMOSC and OSRL and would complete for the same resources without providing a significant environmental benefit	Does not improve effectiveness	Cost of contract	Reject- this option is not adopted as the existing capability meets the need.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcome	Effectiveness	Feasibility	Accept/ Reject
Waste Management	Waste management sourced through contract with waste service provider. Contract with waste service provider to be maintained and periodically reviewed. Waste service provider waste receptacles mobilised from Karratha within 12 hrs for containment and recovery, protection and deflection and shoreline clean-up response strategies.	In effect	System	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Cost of contract	In effect
	Maintain contracts with multiple service providers	Additional	System	Contract with additional waste service provider will not provide an additional environmental benefit as there are two major service providers in the region and reciprocal arrangements facilitate access to equipment of both.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Significant additional cost in maintaining two contracts for the same service	Reject
	Temporary waste storage capacity available through waste service provider, AMOSC, AMSA, OSRL stockpiles	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Costs of contracts, MOU with waste service provider, AMOSC, AMSA and OSRL	In effect
	Procure temporary waste storage for Santos stockpile	Additional	Equipment	Additional storage available if required. Tanks may be stored in geographic locations that may reduce mobilisation times and allow faster collection and storage of waste. Additional storage may facilitate continuous collection operations to occur.	Provides functionality, availability, reliability, survivability, compatibility and independence	Additional cost in purchase and maintenance of tanks	Reject Purchasing this equipment for Santos stockpile is surplus to Santos requirements as AMOSC, AMSA, OSRL provides this equipment in strategic locations. Reduced mobilisation time is not an advantage, as waste storage can be mobilised at the same time as collection response strategies, and no waste needs to be stored prior to collection commenced.
	Vessels for waste transport through Santos contracted providers. To minimise vessel decontamination requirements, larger vessel will remain on station whilst smaller vessel will transport waste to Dampier.	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility. Area of improvement; dependence and availability of vessels	Contract with vessel contractors to be maintained and periodically reviewed	In effect
	Contract additional vessels on standby for waste transport	Additional	Equipment	Reduce delays in transportation of waste, particularly greater capacity for containment and recovery in the initial 2-5	Provides functionality, availability, reliability, survivability, compatibility and dependence	Cost in contracting vessels to remain on standby for incident waste requirements	Reject Expense of maintaining vessels on standby that are surplus to day to day
	Vessel to vessel waste transfer plan gives details of waste storage requirements and procedures	In effect	Procedure	Allows effective use of available vessels and minimises vessel decontamination requirements	Provides functionality, availability, reliability, survivability, compatibility and independence.	Cost of documentation development, implementation, maintenance and exercising	In effect
	Decanting oily water, by returning into boomed area, to be undertaken subject to necessary approvals from AMSA or DoT	In effect	System, Procedure	Allows more effective handling, transportation and disposal of concentrated wastes	Provides functionality, availability, reliability, survivability, compatibility and independence.	Effort to obtain and adhere to approvals	In effect

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Scientific Monitoring - monitoring service provider and equipment	Maintenance of Monitoring Service Provider contract for scientific monitoring services and annual review of standby manual. SMP provider and monitoring equipment mobilised to site within 72 hrs.	In effect	System	This is the main tool for determining the extent, severity and persistence of environmental impacts from an oil spill and allows operators to determine whether their environmental protection outcomes have been met (via scientific monitoring activities). It is used to inform areas requiring rehabilitation. This strategy also evaluates the recovery from the spill.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of contract with Scientific Monitoring Service Provider	In effect
	Regular capability reports from Monitoring Service Provider shows personnel availability and annual reviews of standby manual	In effect	System	This ensures the Monitoring Service Provider has the capability to undertake Scientific Monitoring, including, post-spill preimpact surveys within the EMBA of receptors with deficient baseline data	Improves functionality, availability and reliability	Cost of contract with Scientific Monitoring Service Provider	In effect
	Conduct periodical review of existing baseline data sources across the Santos WA combined EMBA	In effect	System	This ensures that receptors within the EMBA with deficient baseline data are identified	Improves functionality and provides compatibility	Cost of contract with Scientific Monitoring Service Provider	In effect
	Scientific monitoring personnel, plant and equipment on standby at the operational location	Additional	People, equipment	Improve mobilisation time	Improved availability and reliability	Cost would be in excess of $1 mil annually	Reject- cost of control measure is disproportionate to the environmental benefit
	Maintain equipment list and list of suppliers for implementation of Scientific Monitoring Plans	Improved	Procedure	Improve response time	Improved functionality, availability and reliability	Cost of contract with Scientific Monitoring Service Provider	Accept
	Purchase of oil/water quality sample kits in 2020 for scientific monitoring personnel to be positioned at Varanus Is., Exmouth and Dampier	Improved	Equipment	Improve response time	Improved availability and reliability	Cost associated with purchase of equipment and maintenance	Accept
Scientific Monitoring - vessels	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Santos WA Vessel Monitoring System. Santos to mobilise monitoring vessels to	In effect	Equipment	Improve response time	Provides availability and reliability	Effort associated with maintaining MSA	In effect
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	Cost of contracts at the time of requirement.	In effect
	Determine required vessel specifications required for Scientific Monitoring implementation and improve accuracy of Vessel Tracking System	Improved	Procedure	Improve mobilisation time	Increase in availability and reliability	Effort to determine vessel specifications and improve tracking	Accept

Appendix C: POLREP

Department of Transport

BEFORE completing this form please contact the MEER duty officer on (08) 9480 9924 (24hrs). Immediate reporting will enable a rapid response.

Marine Pollution Report (POLREP)

Return completed form to:
Maritime Environmental Emergency Response
Department of Transport
Email: marine.pollution@transport.wa.gov.au and rccaus@amsa.gov.au
Phone (08) 9480 9924
Fax: 1300 905 866

INCIDENT DETAILS

Date of Incident: ________________ Time of Incident *(24 hr format)*: _______________

Location name/description: ______________________________

____

Incident Coordinates Latitude of spill ______________________________ **Longitude of spill** ______________________________

Format of coordinates used *(select one)* ☐ *Degrees & decimal degrees* ☐ *Degrees, minutes & decimal minutes* ☐ *Degrees, minutes & seconds*

Description of Incident: ______________________________

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POLLUTION SOURCE

☐ Vessel ☐ Land *(Specify)* ______________________ ☐ Other *(Specify)* ______________________ ☐ Unknown

Vessel type *(if known)* ☐ Tanker ☐ Container ☐ Bulk ☐ Cargo
☐ Fishing ☐ Defence ☐ Recreational ☐ Other *(Specify)* ______________________

Vessel name: ______________________ Flag State / Callsign: ______________________ Australian vessel? ☐ Yes ☐ No

POLLUTANT

☐ **Oil** *(type)* ☐ Bilge ☐ Diesel ☐ HFO bunker ☐ Crude ☐ Unknown ☐ Other *(Specify)* ______________________

☐ **Chemical** Name: ______________________ MARPOL cat / UN Nos: ______________________

☐ **Garbage** Details/description: ______________________________

☐ **Packaged** Details/description: ______________________________

☐ **Sewage** Details/description: ______________________________

☐ **Other** Details/description: ______________________________

EXTENT

Size of spill ***(length & width in metres):*** ______________________________

Amount of pollutant, if known ***(litres):*** ______________________________

Has the discharge stopped? ☐ Yes ☐ No ☐ Unknown

Weather conditions at site: ______________________________

____

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☐ **Photos taken** Details: ______________________ held by: ______________________

☐ **Video taken** Details: ______________________ held by: ______________________

☐ **Samples taken** Description: ______________________ held by: ______________________

☐ **Items retrieved** Description: ______________________ held by: ______________________

ADDITIONAL INFORMATION

Response action undertaken? ☐ Yes ☐ No If yes, provide details below, please include any environmental impact.

Equipment used? ☐ AMSA ☐ State / NT ☐ Industry

Is assistance for an investigation required from DoT ☐ Yes ☐ No

ORIGINAL REPORT SOURCE

Name:____________________ Position: ____________________ Phone: ____________________

Combat agency:____________________ Statutory agency: ____________________

SENDER DETAILS

Name:____________________ Agency: ____________________ Date:____________________

Phone: ____________________ Fax: ____________________ Email:____________________

PRIVACY STATEMENT

The Department of Transport is collecting the information on this form to enable it to carry out its role as Jurisdictional Authority as per WestPlan - Marine Oil Pollution. The Department of Transport and/or AMSA may give some or all of this information to other government bodies, non-government organisations who have responsibilities under the National Plan, and law enforcement agencies.

Once you have completed the form please check that all relevant fields have been filled with accurate data.
To post the form please click on the "POST" button opposite.

POST **Reset Form**

mep_polrep_0815

Appendix D: SITREP

Marine Pollution Situation Report (SITREP)

Send completed form to:
Maritime Environmental Emergency Response
Department of Transport
PO Box 402 Fremantle , 6159
Email: marine.pollution@transport.wa.gov.au
and rccaus@amsa.gov.au
Fax: 1300 905 866

MARINE POLLUTION SITUATION REPORT (SITREP)

This is advice from the Control Agency of the current status of the incident and the response.

This form is transmitted to all relevant agencies including:

- Jurisdictional Authority
- Support Agencies

Incident Name:____________________ **Ref. No.** ____________

Priority ☐ Urgent ☐ Immediate ☐ Standard

Final SITREP? ☐ Yes ☐ No Next SITREP on: ____________

Date:________________ **Time:**____________

POLREP Reference: ____________________

Incident location Latitude____________ Longitude____________

Brief description of incident and impact:

Overall weather conditions:

Summary of response actions to date:

Current Strategies:

Summary of resources available/deployed:

Expected developments:

Other Information:

SITREP **Prepared By**	Name:	
	Agency:	
	Role:	
	Contact	Telephone
		Fax
		Mobile
	No of Pages Attached:	

To post the form please click on the "POST" button below

POST

RESET

MEP_Sitrep_1114

Appendix E: Vessel Surveillance Observer Log

Santos

Vessel Surveillance Observer Log – Oil Spill

Survey Details			
Date	Start time:	End Time:	Observers:
Incident:			Area of Survey:
Vessel:			Master:

Weather Conditions	
Wind speed (knots):	Wind direction:
Time high water and height (LAT):	Current direction:
Time low water and height (LAT):	Current speed (nM):
Tide during observations:	Sea state:
Stage of tide during observations (incoming/falling):	Other weather observations:

Slick Details									
Slick grid parameters by lat/long:					Slick grid parameters (vessel speed)		Slick grid dimensions: N/A		
Length Axis:		Width Axis:			Length Axis: N/A		Width Axis	Length	nm
Start Latitude		Start Latitude			Time (seconds)		Time (seconds)	Width	nm
Start Longitude		Start Longitude						Length	nm
End Latitude		End Latitude			Speed (knots)		Speed (knots)	Width	nm
End Longitude		End Longitude						Grid area	km^2
Code	Colour	%age cover observed	Total grid area		Area per oil code		Factor	Oil volume	
1	Silver			km^2		km^2	40-300 L/ km^2		L
2	Iridescent (rainbow)			km^2		km^2	300-5,000 L/ km^2		L
3	Discontinuous true oil colour (Brown to black)			km^2		km^2	5,000-50,000L/ km^2		L
4	Continuous true oil colour (Brown to black)			km^2		km^2	50,000 – 200,000 L/ km^2		L
5	Brown / orange			km^2		km^2	>200,000 L/ km^2		L

Santos

Timeline of observations:

Time	Description

Appendix F: Aerial Surveillance Observer Log

Santos

Aerial Surveillance Observer Log – Oil Spill

Survey Details			
Date:	Start time:	End Time:	Observer/s:
Incident:		Area of Survey:	
Aircraft type:	Call sign:	Average Altitude:	Remote sensing used:

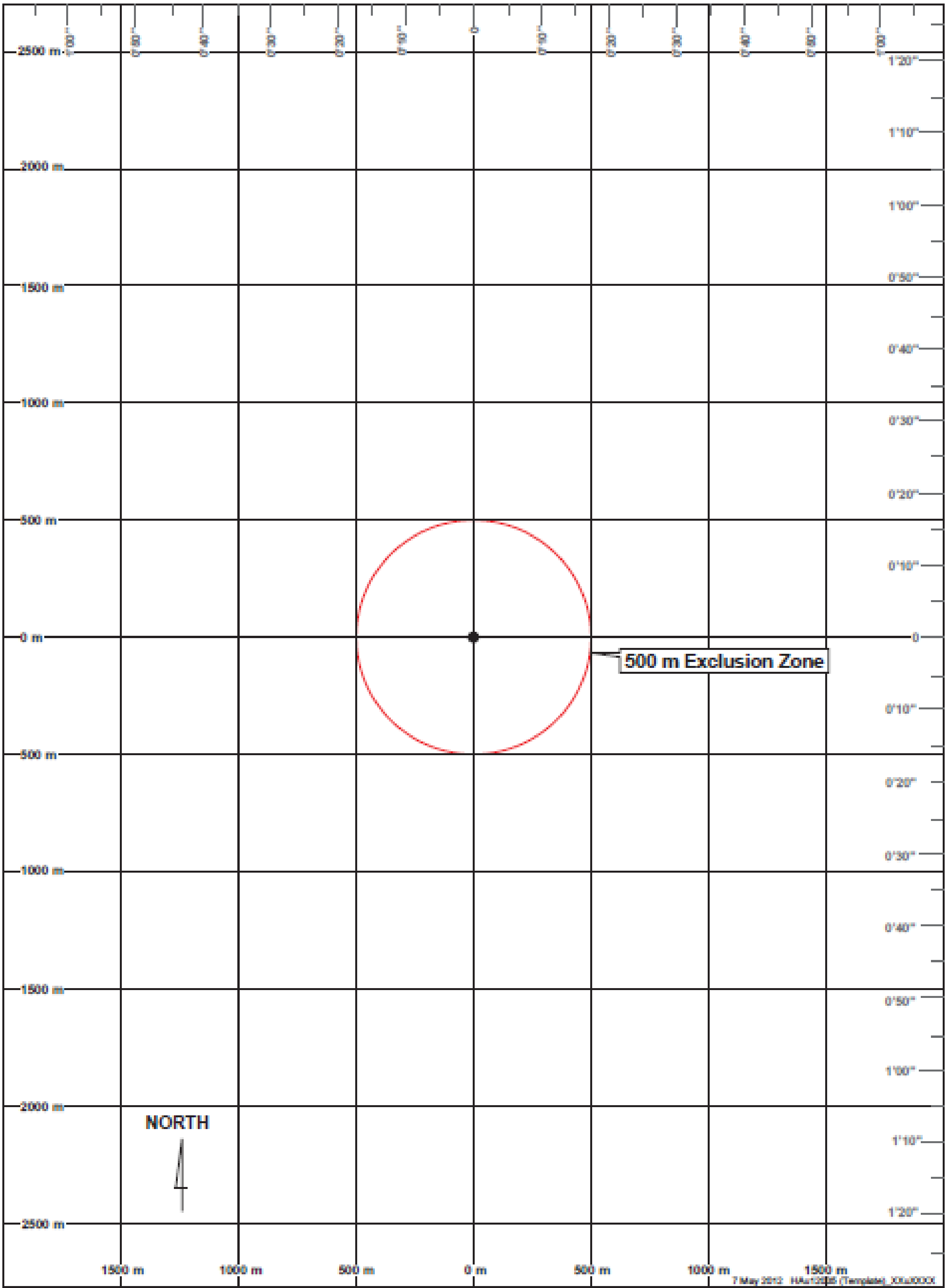
Weather Conditions	
Wind speed (knots)	Wind direction
Cloud base (feet)	Visibility
Time high water	Current direction
Time low water	Current speed (nM)

Slick Details						
Slick grid parameters (lat/long)		Slick grid parameters (air speed)		Slick grid dimensions		
Length Axis	Width Axis	Length Axis		Width Axis	Length	nm
Start Latitude	Start Latitude	Time (seconds)		Time (seconds)	Width	nm
Start Longitude	Start Longitude				Length	nm
End Latitude	End Latitude	Air Speed (knots)		Air Speed (knots)	Width	nm
End Longitude	End Longitude				Grid area	km^2

Code	Colour	% cover observed	Total grid area		Area per oil code		Factor	Oil volume	
1	Silver			km^2		km^2	40-300 L/ km^2		L
2	Iridescent (rainbow)			km^2		km^2	300-5,000 L/ km^2		L
3	Discontinuous true oil colour (Brown to black)			km^2		km^2	5,000-50,000L/ km^2		L
4	Continuous true oil colour (Brown to black)			km^2		km^2	50,000 – 200,000 L/ km^2		L
5	Brown / orange			km^2		km^2	>200,000 L/ km^2		L

Appendix G: Aerial Surveillance Surface Slick Monitoring Template

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



	NAME:	VESSEL / AIRCRAFT:
	DATE / HOUR:	OTHER REFERENCE:

Appendix H: Aerial Surveillance Marine Fauna Sighting Record

Santos

OIL SPILL SURVIELLANCE - MARINE FAUNA SIGHTING RECORD SHEET

Date:		**Time:**	
Latitude:		**Longitude:**	

MARINE FAUNA ID GUIDE

Humpback whale

Blue whale

Minke whale

Sperm whale

Killer whale

Bryde's whale

Whale species unknown

Bottlenose dolphin

Spinner dolphin

Dolphin species unknown

Whale shark

Dugong

Hawksbill turtle

Loggerhead turtle

Green turtle

Flatback turtle

Leatherback turtle

Turtle species unknown

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FAUNA DETAILS					
Category	**Type/species?** **Adult/juvenile?** **ID confidence?**	**Number**	**Date/Time**	**Photo/ video taken?** **Reference No.**	**<u>Behaviour / Comments.</u>** **Proximity to oil? Oiled?** **Milling? Feeding? Transiting?**
Cetaceans (Whales/ Dolphins)					
Turtles					
Birds					
Dugongs					
Sharks					
Other					

Santos

Other details for each observation location		
WEATHER DETAILS		
Sea State ◯ Mirror calm ◯ Small waves ◯ Slight ripples ◯ Large waves some whitecaps ◯ Large waves, many whitecaps **Visibility** ◯ Excellent ◯ Good ◯ Moderate ◯ Poor ◯ Very Poor		
OBSERVER DETAILS		
Observer Name	Observer signature	**Observer** ◯ Inexperienced ◯ Experienced

Appendix I: Aerial Surveillance Shoreline Observation Log

Aerial Surveillance Reconnaissance Log – Oil Spill

Survey Details				
Incident:	Date:	Start time:	End Time:	Observer/s:

Area of Survey	
Start GPS LATITUDE: LONGITUDE:	End GPS LATITUDE: LONGITUDE:

Aircraft type	Call sign	Average Altitude	Remote sensing used (if any)

Weather Conditions		
Sun/Cloud/Rain/Windy	Visibility	Tide Height L/M/H
Time high water	Time low water	Other

Shoreline Type - Select only ONE primary (P) and ANY secondary (S) types present					
	Rocky Cliffs		Boulder and cobble beaches		Sheltered tidal flats
	Exposed artificial structures		Riprap		Mixed sand and gravel beaches
	Inter-tidal platforms		Exposed tidal flats		Fine-Medium sand grained beaches
	Mangroves		Sheltered rocky shores		Other
	Wetlands		Sheltered artificial structures		

Operational Features (tick appropriate box)					
	Direct backshore access		Alongshore access		Suitable backshore staging
Other					

Appendix J: Shoreline Clean-up Equipment

Equipment List for an Initial deployment of a 6 person Manual Clean Up Team

On Shore Clean-up Tools		Quantity
	Disposal Bag Labelled, 140 cm x50cm x 100um	1000
	Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100um	50
	Polyethylene Safety Shovel 247mm z 978mm	2
	Steel Shovel	4
	Steel Rake	2
	Landscapers Rake	2
	Barrier Tape – “Caution Spill Area”	10
	Pool scoop with extendable handle – flat solid	2
	Poly Mop Handle	2
	Safety Retractable Blade Knife	2
	Poly Rope 20m	6
	Star Pickets	24
	Star Picket driver	1
	Hand Cleaner	1
	Cable ties – general use	1000
	Wheel Barrow	2
	Galvanised Bucket	4
	Pruning secateurs	2
	Hedge Shears	1
Personal Protection Equipment (PPE) Team of 6		
	Spill Crew Hazguard water resistant coveralls (assort sizes)	36
	Respirator dust/mist/fume and valve	40
	Disposable box light nitrile gloves (100bx)	2
	Alpha Tec gloves (assort size)	24
	Ear Plugs (200bx)	1
	Safety Glasses	18
	Safety Goggles non vented	6
	Gum Boots (assort size)	18
	Rigger Gloves (assort size)	18
	Day/Night Vest	6
Storage Equipment		
	Collapsible Bund 1.6m x 1.2m	2
	Collapsible bund 4m x 2.4m	1
	Misc sizes of ground sheets/tarps	6
Absorbents		
	Absorbent Roll ‘oil and fuel only’ 40m x 9m	6
	Absorbent Pad “oil and fuel only” 45cm x 45cm	400
	Poly Mops (snags)	150
	Poly Absorbent Wipes	10
Additional Items		
	Folding Deck Chair	6
	Folding Table	1
	Shelter open side	1
	6 Person first aid kit	1
	Wide Brim Hat with cord	6
	Sunburn Cream 1 litre pump bottle	1
	Personal Eyewash bottle 500mls	6
	Personal Drink bottle 750mls	6
	Boxes, Bin and Lid Storage/transport assorted	
Optional Items		

	Inflatable Tent 9 square metres	1

Equipment list for a decontamination unit for Beach Clean Up Team

Shore Clean-up Tools		**Quantity**
	Inflatable Decon Tent	1
	Inflatable Tent 9 square metres – Modesty or Control tent	1
	Misc sizes of ground sheets/tarps	4
	Collapsible Bund 1.6m x 1.2m (two stages)	2
	2 stools in each bund	
	Collapsible Bund 4m x 2.4m (for used PPE and clothing into DB's)	1
	Long Handled Scrub brush	2
	Scrub Brush	2
	Simple Green 20 ltr	2
	Poly Absorbent Wipes	10
	Wet Wipe Canister	6
	Disposal Bag for Clothing, 140cm x 50cm x 100um	100
	Bath towel	6
	Liquid soap in push dispenser (citrus based)	1
	Track mat – Absorbent for Corridor/walkway	1
	Star pickets	16
	Star picket driver	1
	Barrier tape to create corridors	4
	Safety Goggles non vented (used during decon)	6
Optional Items		
	Folding Deck Chair	6
	Folding Table	1
	Shelter open side	1
	6 Person first aid kit	1
	Wide Brim Hat with cord	6
	Sunburn Cream 1 litre pump bottle	1
	Personal Eyewash bottle 500mls	6
	Personal Drink bottle 750mls	6
	Boxes, Bin and Lid Storage/transport assorted	

Equipment list for deployment of a 6-person team for flushing or recovery

Flushing Equipment		**Quantity**
	Diesel self prime semi trash pump, 25-35 psi, 4.8hp	1
	Perforated 2” lay flat hose, 20 mtr sections	2
	Section Hose 2”, 20m sections	5
	Hose End Strainer	1
Recovery Equipment		
	Tidal Boom (shoreline boom) 25m lengths	2 (50m)
	Tidal Boom Accessories pack	1
	Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section	2 (50m)
	Towing Bridle	2
	Danforth Sand Anchor Kit, 30m lines, 15m trip lines	3
	Diesel Powered pump with hose	1
	Manta Ray skimmer	1
Personal Protection Equipment (PPE) Team of 6		
	Spill Crew Hazguard water resistant coveralls (assort sizes)	36
	Respirator dust/mist/fume and valve	40
	Disposable box light nitrile gloves (100bx)	2
	Ear Plugs (200bx)	1
	Safety Glasses	18
	Gum Boots (assort size)	18
	Hyflex Oil Restraint Gloves (assort size)	18
	Day/Night Vest	6
Storage Equipment		
	Collapsible Bund 1.6m x1.2m	1
	Misc sizes of ground sheets/tarps	6
	Collapsible Tank 5000 litres	2
Absorbents		
	Absorbent Boom ‘oil and fuel only’ 3 or 6m x 180mm	200mtrs
	Absorbent Roll ‘oil and fuel only’ 40m x 9m	10
	Absorbent Pad “oil and fuel only” 45cm x 45cm	1000
	Poly Absorbent Wipes	10
Additional Items		
	Folding Deck Chair	6
	Folding Table	1
	Shelter open side	1
	6 Person first aid kit	1
	Wide Brim Hat with cord	6
	Sunburn Cream 1 litre pump bottle	1
	Personal Eyewash bottle 500mls	6
	Personal Drink bottle 750mls	6
	Boxes, Bin and Lid Storage/transport assorted	
	Inflatable Tent 9 square metres	1

Equipment list for a 6 person team for near shore clean up

Absorbents		
	Absorbent Roll 'oil and fuel only' 40m x 9m	20
	Absorbent Pad "oil and fuel only" 45cm x 45cm	2000
	Absorbent Boom "oil and fuel only" 3or6m z 180mm	200mtrs
	Poly Mops (snags)	150
	Poly Absorbent Wipes	20
Recovery Equipment		
	Tidal Boom (shoreline boom) 25m lengths	4 (100m)
	Tidal Boom Accessories pack	2
	Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section	8 (200m)
	Towing Bridle	2
	Danforth Sand Anchor Kit 15kg 30m lines, 15m trip lines	10
	Weir Skimmer 30T hr	1
	Trash Screen for above	1
	Diesel Powered pump with hose	1
	Manta Ray skimmer	1
Shore Clean-up Tools		**Quantity**
	Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100um	200
	Pool scoop with extendable handle – flat solid	2
	Poly Mop Handle	2
	Poly Rope 20m	10
	Star Pickets	24
	Star Picket driver	1
	Intrinsic Safe Torch	6
	Hand Cleaner	1
	Cable ties (to add extra join to absorbent booms)	150
Personal Protection Equipment (PPE) Team of 6		
	Spill Crew Hazguard water resistant coveralls (assort sizes)	36
	Disposable box light nitrile gloves (100bx)	2
	Alpha Tec gloves (assort size)	24
	Ear Plugs (200bx)	1
	Safety Glasses – with head strap	18
	Gum Boots (worn extra large or as advised by skipper)	18
	Steel cap waders	2
	Personal Flotation Device	6
	Rigger Gloves (assort size)	18
Storage Equipment		
	Collapsible Bund 1.6m x 1.2m	2
	Collapsible bund 4m x 2.4m	1
	Collapsible Tank 5000 litres	2
	Alum box, Bin & lid Storage/transport cases	10
	Misc sizes of ground sheets/tarps	6
Optional Items		
	6 Person first aid kit	1
	Wide Brim Hat with cord	6
	Sunburn Cream 1 litre pump bottle	1
	Personal Eyewash bottle 500mls	6
	Personal Drink bottle 750mls	6

Appendix K: Shoreline Response Strategy Guidance

Shoreline Response Strategy Guidelines

Guidance on response methods for sensitive coastal habitats is provided in **Table 1**.

Guidance on applicable shoreline clean-up techniques based on shoreline substrate and degree of oiling are presented in **Figure 1** to **Figure 4**.

Table 1 Strategy Guidance for shoreline response at coastal sensitivities

Sensitive Receptors	Strategy Guidance	
Mangroves	- All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. - However, if oil is expected to move into this area, multiple rows of booms, or earthen booms can be deployed at the entrance of creeks or along the mangrove fringe to prevent/minimise oiling. - Sorbents can be used to wipe heavy oil coating from roots in areas of firm substrate. Close supervision of clean-up is required. - Where thick oil accumulations are not being naturally removed, low-pressure flushing may be attempted at the outer fringe – sorbent pads and sorbent sweeps can be used to recover the sheen. - No attempt should be made to clean interior mangroves, except where access to the oil is possible from terrestrial areas. - Oily debris should be removed; it is extremely important to prevent disturbance of the substrate by foot traffic; thus most activities should be conducted from boats. - Live vegetation should not be cut or otherwise removed.	-
Seabirds, shorebirds and migratory waders	- All efforts should focus on deflecting oil away from this area or dispersing the oil offshore or using booms offshore to divert the oil away from this area. - If oil is expected to move into the coastal colonies and roosting areas, multiple booms can be deployed along the reserve to prevent/minimise oiling.	-

Sensitive Receptors	Strategy Guidance	
Turtle nesting beaches during or near nesting season	- All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. - However, if oil is expected to move into this area, booms can be deployed along the reserve to prevent/minimise oiling.	-
Fringing coral reef communities (Note: submerged coral reef communities are less susceptible to oiling)	- Little can be done to protect coral reef beds along exposed sections of shoreline. - Floating oil would potentially coat living reef communities, which are usually slightly elevated and are consequently exposed at low tide. - Natural recovery with a close monitoring program is the preferred clean-up technique. Clean-up of the reef itself by natural processes is expected to be rapid. - As much as practicable, oil should be removed from adjacent intertidal areas to prevent chronic exposure of the corals to oil leaching from these sites. - Use of sorbents should be limited to those that can be contained and recovered.	-
Macroalgal and seagrass beds	- All efforts should focus on deflecting oil away from this area, dispersing the oil offshore, or using booms to divert the oil away from this area. - Extreme care should be taken not to disturb the sediments during clean-up operations in the vicinity of macroalgal and seagrass beds, which could result in total loss of the macroalgal and seagrass beds. - Removal of oiled parts of the macroalgal and seagrass beds should only be considered when it can be demonstrated that special species are at significant risk of injury from contact or grazing on the macroalgal and seagrass beds. - Otherwise, the best strategy for oiled seaweed is to allow natural recovery.	-

Sensitive Receptors	Strategy Guidance	
Rocky coast	- Where practicable, booms can be deployed parallel to the rocky coasts to prevent/minimise oiling. - Flushing rocky shoreline is considered the most effective method of cleaning. Care must be taken to assess the fate and transport of the flushed oil and sorbent snares can be used to recover if deemed necessary to reduce impacts to ALARP. - For small areas of contamination, rocky structure can be manually wiped with sorbent pads or scraped to remove oil.	-

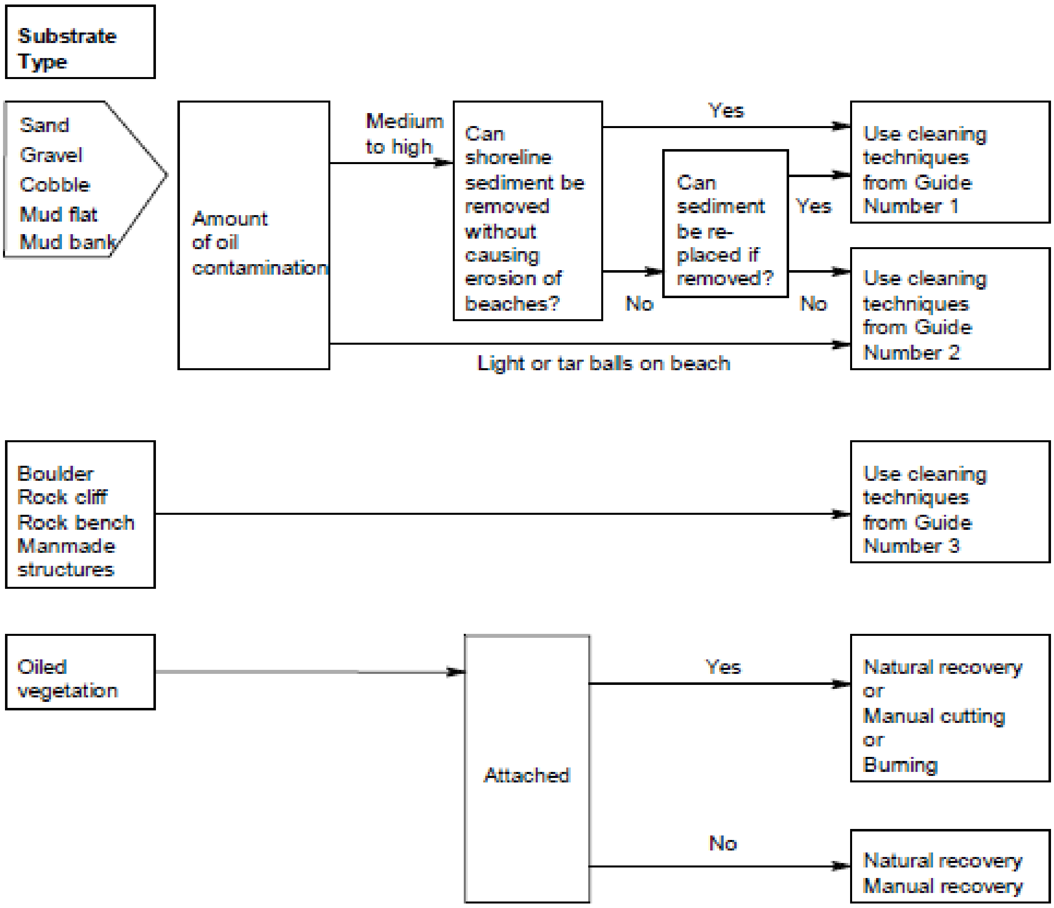

Figure 1: Shoreline Clean-up Master Decision Guide

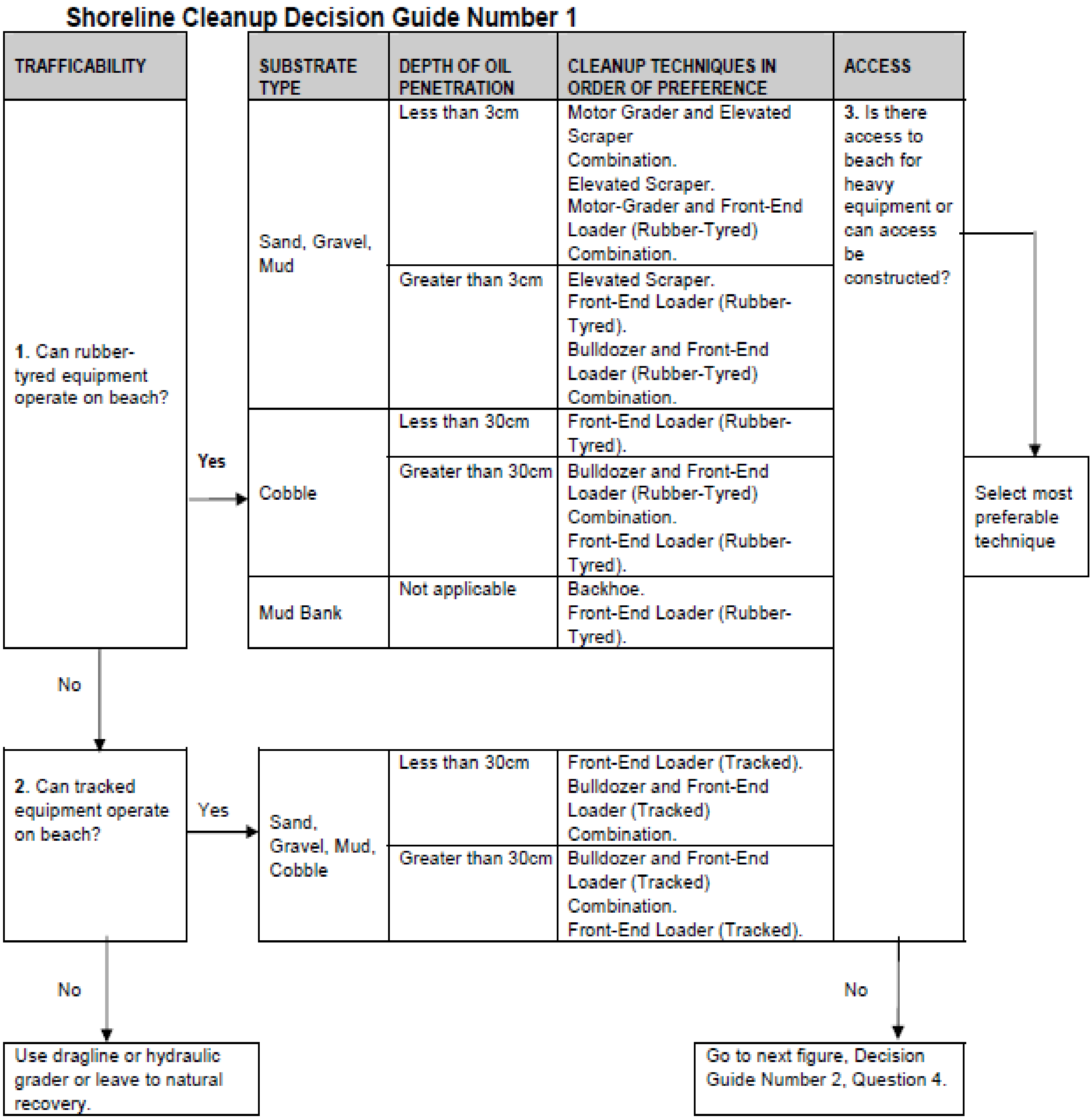

Figure 2: Shoreline Clean-Up Decision Guide 1

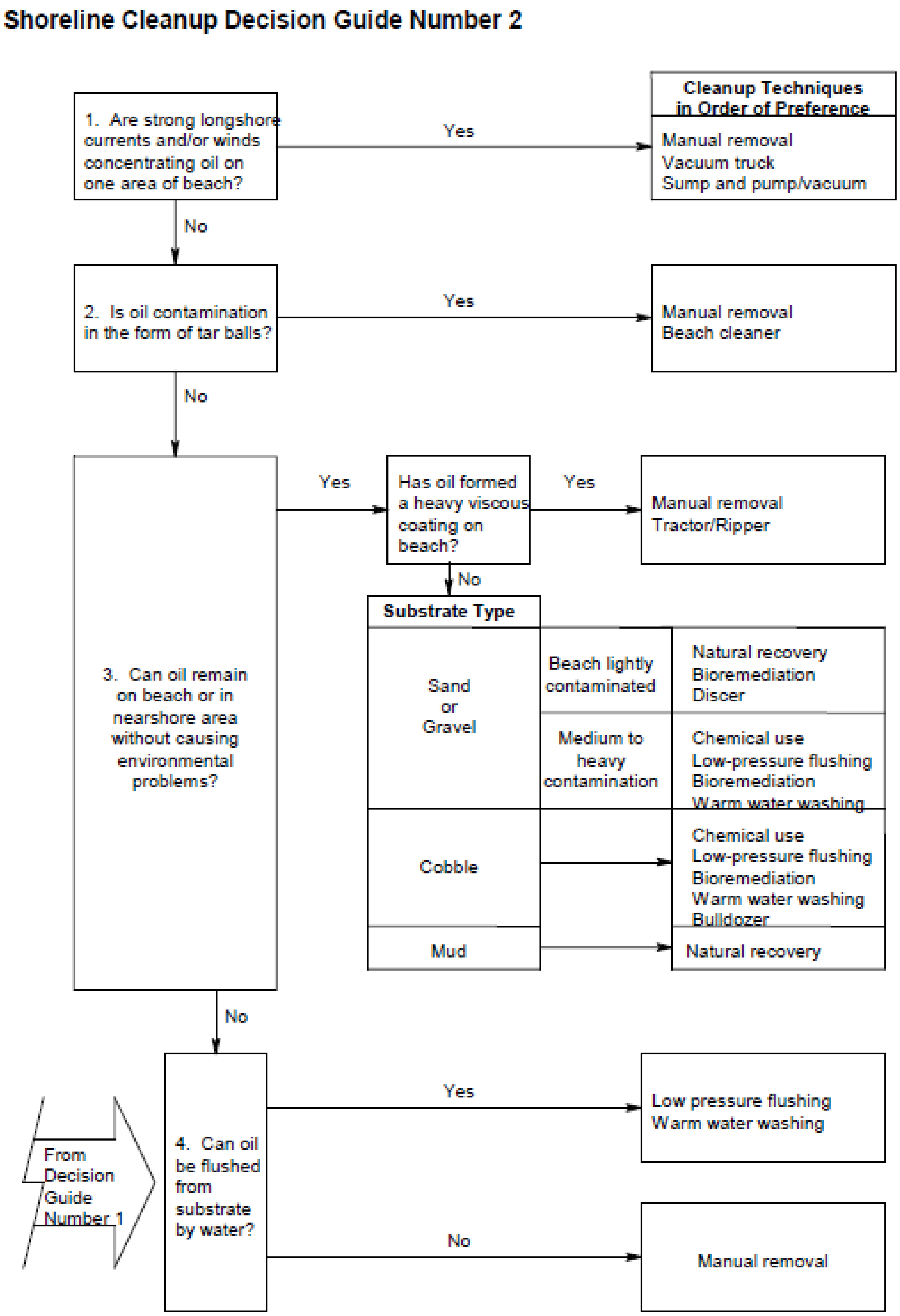

Figure 3: Shoreline Clean-Up Decision Guide 2

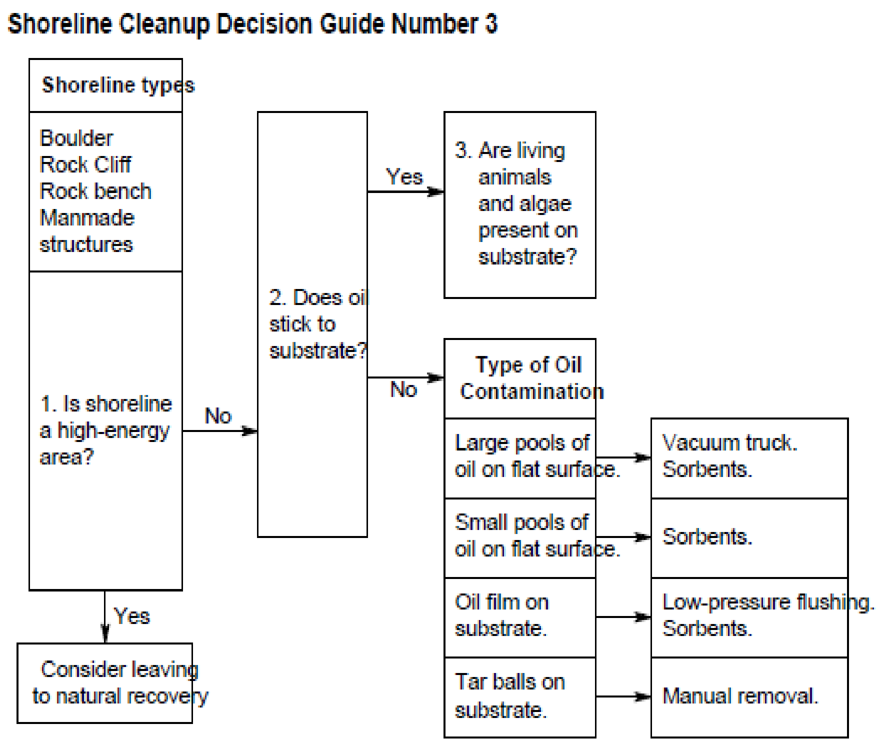

Figure 4: Shoreline Clean-Up decision Guide 3

Appendix L: Operational Guidelines for Shoreline Response

Operational Guidelines for Shoreline Clean-up activities

1.1.1 Worksite preparation guidelines

The following provides guidelines for the preparation of staging areas supporting shoreline clean-up operations.

Organisation and worksite set-up

The worksite does not only include the polluted areas that require cleaning. Several other specific areas must be identified and cordoned off and routes for pedestrians and vehicles should be signposted.

These specific areas are:

- The polluted area;
- The waste storage area, with different types of containers suitable for the different kinds of waste;
- The decontamination area: whatever the size of the spill, a decontamination phase for operational personnel, equipment and tools must be carried out in order to provide some comfort to personnel after each work session, avoiding oiling clean areas, and group together personal clean-up equipment and protective gear, to facilitate the management of the site (cleaning, storage, re-use);
- A rest area, with at least changing rooms, toilets, a first aid kit and cold and hot beverages. Cold or even hot meals can also be organised on the spot provided that a canteen tent or temporary building is available; and
- A storage area for tools and machinery (or equipment warehouse).

Access to the worksite should be restricted and traffic of vehicles should be strictly regulated to avoid accidents.

Preparation

- Prevent the general public from accessing the worksite;
- Delineate accesses for vehicles and machinery (check load-bearing capacity) and routes;
- Channel vehicle and pedestrian traffic;
- Protect the ground (geotextile, roll out mat system…) during operations in sensitive areas (dunes...);
- Prepare and signpost the different areas of activity (on the beach), living areas (locker room, meals, showers, toilets...) and stockpiling areas presenting a risk (fuel, equipment, waste pit....);
- Define a site for fluid storage away from the locker room:
  - Provide an extinguisher for each cabin
  - Set up a recovery system for fuel leaks
- Provide at least minimum lighting for installations and the surrounding area during the winter.

Basic Equipment	Extra Equipment
✓ Plastic liners, geotextiles	✓ Bins, barrels, skips, tanks
✓ Barrier tape and stakes	✓ Hot and cold beverages Welfare)
✓ Signposting equipment	✓ Cooking oil, soap (Welfare)
	✓ Earthmoving equipment

PRIMARY STORAGE OF WASTE

A primary storage site is:

- ✓ An emergency staging area of the immediate deposit of the waste collected before its transfer to either an intermediate long term storage site or if possible directly to a treatment facility; and
- ✓ A key stage in the waste management process for sorting, labelling and quantifying the types and volumes of waste collected and when possible, reducing volumes to be transported by pre-treatment.

The storage site must be closed as soon as clean-up operations are completed.

The return of the site to its original condition implies:

- ✓ A contamination diagnosis made by an organisation specialised in ground pollution, decontamination operations if needed and the approval of the authorities; and
- ✓ In some cases, botanical evaluations to define a plant cover restoration operation.

✓ Segregate the different types of waste
✓ Protect containers from rain water and to contain odours
✓ Protect containers from prolonged exposure to sunlight if necessary
✓ Ensure security to prevent unauthorised dumping

Primary waste storage sites should meet certain criteria:

- ✓ Close proximity to the site of clean-up;
- ✓ Good access to roads for heavy lorries; and
- ✓ A flat area with enough space away from environmentally-sensitive areas (vegetation, groundwater) and out of reach of the sea tides and waves.

- ✓ Depending on the volume of waste, site characteristics and availability of containers, prepare:
  - o Staging areas
  - o Pits if necessary
  - o Platform within earth berms
  - o Platform for bagged solids and liquids in tank.
- ✓ Protect areas using watertight plastic liners
- ✓ Lay fine gravel or sand at the base of the storage area to protect the membranes
- ✓ Prepare rain water or effluent management
- ✓ Ensure correct labelling of the containers to avoid mixing the different types of waste (liquid, solid, non-biodegradable – oiled plastics, contaminated cleanup equipment, biodegradable – oiled seaweed, faunal)
- ✓ Control access to the cleanup sites and protect access routes using lining and/or geotextiles

BASE CAMP/REST AREA

The rest area (base camp) should at least consist of:

- ✓ Changing rooms;
- ✓ Toilets; and
- ✓ A rest area.

At base camp, operators must be provided with:

- ✓ A first aid kit; and
- ✓ Hot and cold beverages, meals.

Selection of the rest area must meet certain criteria:

- ✓ Close proximity to the clean-up site;
- ✓ Easy access; and
- ✓ A flat area with enough space away from environmentally sensitive areas.

Equipment

- ✓ Shelter/rest area (tent, temporary building;
- ✓ Portable toilets (at least one for men and one for women);
- ✓ Locker rooms;
- ✓ First aid kit;
- ✓ Fire extinguisher; and
- ✓ Communication equipment.

STORAGE AREA FOR EQUIPMENT AND MACHINERY

This area consists of and equipped repair and maintenance site.

In order to avoid incidents and clean-up equipment failures, equipment should only be used by trained personnel and all equipment should regularly be checked for conformity with standard operating procedures and safety.

- ✓ Check and adjust daily levels of gasoline, diesel, oil, water and other fluids
- ✓ Regularly maintain the machines (pumps, pressure washers...)
- ✓ Equipment must be checked, counted by the person in charge of logistics and stored daily at the end of the work day
- ✓ Some pieces of equipment must be washed or at least rinsed daily, with proper recovery of cleaning effluent, other kinds of equipment should be washed weekly or at the end of operations
- ✓ Set up a systematic maintenance-cleaning-repair operation at the end of each week
- ✓ Small tools and equipment and even detachable parts of all equipment remaining outside should be securely stored away (eg stainless steel bucket of small sand screeners)
- ✓ In case of interruption of operations, large pieces of equipment should be moved to a supervised site
- ✓ Regularly check equipment for conformity and safety

The storage area for equipment and machinery must meet certain criteria:

- ✓ Close proximity to the site of clean-up;
- ✓ Easy access; and
- ✓ A flat area with enough space away from environmentally-sensitive areas.

Equipment

- ✓ Cabins;
- ✓ Hut;
- ✓ Maintenance equipment and tools; and
- ✓ Cleaning equipment.

1.1.2 Manual clean-up guidelines

Oil, polluted sediment and debris are removed by hand or with the help of manual tools and then stored for disposal.

Conditions of use

- ✓ Pollution : all types ; most often scattered pollution; on large spills, if implementation of other techniques is impossible;
- ✓ Pollutant : all types;
- ✓ Substrate : all types; sufficient load bearing capacity for pedestrians and light equipment; and
- ✓ Site: all types sufficiently accessible and which tolerate intensive traffic.

Equipment

Basic Equipment:

- ✓ Scrapers (paint scrapers, long handle scrapers...), rakes, brushes, forks; and
- ✓ Landing nets, shovels, trowels.

Extra Equipment:

- ✓ Waste containers, big bags, bins, plastic bags; and
- ✓ Front-end loader (for disposal).

PPE: At least protective clothing: overalls, boots, gloves, etc. depending on the nature of the pollutant, expose and responder activity.

- ✓ Divide the response personnel among three functions:
  - o Collection/scraping/gathering
  - o Placing in bags/waste containers
  - o Disposal
- ✓ Rotate the teams among the three functions;
- ✓ The waste can be disposed of manually or with the use of mechanical means if possible;
- ✓ Don't overfill bins, plastic bags; and
- ✓ Don't remove excessive quantities of sediments.

Impact

- ✓ Impact insignificant to heavy, depending on the type of substrate. Risk of destroying the structure of the substrate in marshes. Erosion;
- ✓ Potentially destructive effects on vegetation (dunes, marshland);
- ✓ Deconstruction and destabilisation of the foot of the dune (upper end of beach); erosion, destruction of the dune and the associated vegetation, decrease in biodiversity and fertility by reduction of the low water mark; and
- ✓ Can tend to fragment the oil in certain conditions.

Performance

This is a highly selective technique, but requires a lot of time and personnel. If not done correctly, there is a risk of removal of large quantities of clean sediment.

1.1.3 Mechanical clean-up guidelines

This technique consists of collecting the oil in order to facilitate its removal from the beach. Collection is carried out using a tractor, ATV or earthmoving vehicle or earthmoving equipment.

Conditions of use

- ✓ Pollution : heavy pollution, continuous slick;
- ✓ Pollutant : slightly to very viscous oil;
- ✓ Substrate : vast, flat foreshore with wet fine-grain sand (very damp to saturated) and a good load-bearing capacity, without ripple marks; and
- ✓ Site: accessible and sufficient load bearing capacity for earthmoving equipment, sufficiently large to allow vehicles to manoeuvre.

Equipment

Basic equipment:

- ✓ Backhoe loader;
- ✓ Grader/bulldozer;
- ✓ Tractor or loader with front blade; and
- ✓ Front-end loader or lorry (for removal).

PPE: At least suitable for heavy machinery operation

Impact

- ✓ Normally only removes the oil, but some sediment may also be taken with it (if the operator is poorly supervised or inexperienced), especially if used on light pollution or an unsuitable site;
- ✓ High risk of disturbance due to traffic and mixing of oil with sediment; and
- ✓ May lead to reduction of beach stability and beach erosion/loss of beach area.

Minimum workforce required: 2 people per vehicle (1 drive + 1 assistant)

Waste: oil mixed with a varying quantity of sediment; but can rapidly become unselective if scraping is carried out on moderate pollution (should be avoided)

- ✓ Consists of bringing the oil together in order to facilitate its removal from the beach. Scraping is carried out using a tractor or earthmoving equipment fitted with a front end blade in an oblique position. According to the viscosity of the oil, two options are available:
    - o (case 1) fluid oil: radial or converging scraping towards a collection point on the foreshore; removal by pumping
    - o (case 2) more viscous oil /solids: concentration to form windrows, by successive slightly curing passes parallel to the water line; subsequent removal of windrows
- ✓ Should only be carried out on heavy pollution; do not use on moderate to light pollution
- ✓ Inform and supervise operators; use experienced operators
- ✓ Work methodically
- ✓ Set up traffic lanes on the beach in order to reduce oil and sediment mixing

- ✓ Don’t remove excessive amounts of non-contaminated materials
- ✓ Don’t fill the bucket of loader more than 2/3 capacity
- ✓ Don’t drive on polluted materials

1.1.5 Shoreline vessel access guidelines

There are numerous landing craft vessels available in the North West Shelf area. These vessels are capable of grounding out; therefore the vessels can access a contacted area on high tide, ground out, unload equipment and personnel, reload with waste oil then depart on the next high tide. Landing craft vessels are supplied through Quadrant Energy existing vessel suppliers.

Mechanical equipment and PPE are to be mobilised to the nominated marine operational base for onward movement to the affected locations.

For shoreline clean-up of remote islands the following guidelines will be considered so as to minimise the secondary impacts of high numbers of spill response personnel on shorelines:

Vessels are to be mobilised to the designated deployment Port to mobilise shoreline clean-up teams by water. The shoreline clean-up will be undertaken through on-water deployment to the defined shorelines in 4 stages:

(1) Drop off of 6-person clean-up containers (refer below) to shoreline contact locations defined by IMT through observation data;

(2) Deployment of marine and environmental specialists to demarcate the clean-up zones with barrier posts and tape to prevent secondary impacts to flora and fauna by the clean-up teams;

(3) Deployment of small clean-up teams with a trained/competent shoreline responder as a Team Leader to conduct clean-up methods (flushing, bag and retrieve, etc.) with all waste being bagged and stored in temporary bunding made of HDPE above the high-high tide mark; and

(4) Deployment of the waste pickup barges to retrieve collected wastes from the temporary bunding and to complete the shoreline clean-up and final polishing.

Appendix M: Oiled Wildlife Response Personnel and Equipment

In the event of a spill impacting wildlife, Santos WA will commence arrangements to mobilise personnel and equipment to fill responder positions as identified in the WAOWRP. An overview of sources of personnel is provided in Table 1 and an overview of 'first-strike' equipment for initial deployment is provided in Table 2**.**

In the event of large-scale OWR, further specialised OWR equipment and personnel will be provided by in-country and international organisations, as necessary, accessed through AMOSC (primary) and OSRL (secondary). Equipment and personnel required for the development and operation of staging areas/ treatment facilities can be provided locally (for example veterinary personnel and supplies). The Pilbara Region OWR Plan provide detail of local organisations and suppliers for personnel and equipment.

In addition to OWR providers mobilised through AMOSC and OSRL/Sea Alarm, Santos WA maintains access to the workforce marketplace during an emergency response. Level 1 oiled wildlife responders, of which the WAOWRP indicates 90+ could be required for a Level 6+ event, could be provided through Santos WA's workforce hire arrangements. On the job training requirements for Level 1 responders could be provided by DBCA, AMOSC or Sea Alarm personnel. Skilled but ubiquitous roles required for manning and maintaining facilities and staging areas, such as trades, technicians and vets, could also be filled through workforce hire arrangements. The Pilbara Region OWR Plan provide contact details for local trade personnel, vets and wildlife specialists that could be employed for manning/maintenance of forward response wildlife response facilities.

Table 1: Sources of Oiled Wildlife Response Personnel

AMOSC / INDUSTRY RESPONDERS	Activated through	Capability
AMOSC Technical Advisor – Oiled Wildlife – assistant in IMT (as industry OWA if required)	AMOSC Duty Officer	1*
AMOSC OWR Industry Team– Level 2-4 responders (DBCA training)		18*
WA Petroleum industry personnel – Trained by individual petroleum industry companies – activated via mutual aid		~50*
AUSTRALIAN OWR EXPERTISE	Activated through	Capability
Blue Planet Marine (ACT and WA) – Oiled Wildlife Responders	AMOSC Duty Officer	10-20*
Phillip Island National Parks (VIC) – Oiled Wildlife Responders		~70 staff ~45 volunteers*
NatPlan Mutual Aid		50-100*
Wildlife care and rehabilitation	Personnel potentially available to petroleum industry (currently there is no formal arrangement)	

Perth Zoo – Duty Veterinarian	advice, expertise and management Links to wildlife rehabilitation networks		
OWA		DBCA State Duty Officer –	1 per shift
Personnel			
DBCA staff with wildlife and emergency management skill set who currently operate in fire preparedness and response			
INTERNATIONAL OWR EXPERTISE		Activated through	Capability
DwyerTECH NZ - Facilities Management Personnel Call-off contract)		AMOSC Duty Officer	2*
Wild base, Massey University (NZ) - Oiled Wildlife Responders			4-6*
International Bird Rescue (USA)- Oiled Wildlife Responders			4*
Sea Alarm (Belgium) – Expert assistance with organisational set-up and global OWR resourcing		OSRL Duty Officer	2/3** (Sea Alarm) + additional OWR responders accessed through global network

* As per AMOSC Capacity Statement 25 Jun 2020

** As per Sea Alarm/OSRL Service Level Agreement Statement

Table 2: First Strike Deployment-Ready OWR Equipment

AMOSC OWR Equipment*	Activated through	Location
1 x AMOSC owned OWR container 1 x AMOSC owned box kit 1 x Fauna Hazing and Exclusion kit	AMOSC Duty Officer	Fremantle
1 x AMOSC owned OWR container 1 x AMOSC owned box kit 1 x Fauna Hazing and Exclusion kit		Geelong
1 x AMOSC owned box kit		Exmouth
1 x AMOSC owned box kit		Broome
National Plan (NatPlan) OWR Equipment*	Activated through	ion
1 x NatPlan OWR container 1 x NatPlan/DBCA Box/trailer kit	AMSA RCC	Dampier
1 x NatPlan OWR container		Darwin
1 x NatPlan OWR container		Townsville
1 x NatPlan OWR container		Devonport
WA DBCA OWR Equipment*	Activated through	Location
1 x DoT OWR container	DoT Duty Officer	Fremantle
DBCA OWR trailer kit		Karratha
DBCA OWR trailer kit		Kensington
NSW Maritime OWR Equipment*	Activated through	Location
1 x NSW Maritime OWR container	AMSA RCC	Sydney
OSRL OWR Equipment**	Activated through	Location
1 x Search and rescue response package 1 x Intake and triage response package 2 x Cleaning and rehabilitation response package	OSRL Duty Officer	UK
1 x Search and rescue response package 1 x Cleaning and rehabilitation response package		Singapore
1 x Search and rescue response package 1 x Cleaning and rehabilitation response package		Bahrain

1 x Wildlife Rehabilitation Unit 1 x Cleaning and rehabilitation response package		Fort Lauderdale, USA

* As per AMOSC Capacity Statement 25 June 2020

** As per OSRL SLA Equipment Report 4 May 2020.

Appendix N: Scientific Monitoring Plans

1 Scientific Monitoring Principles

1.1 Monitoring Design

In the event of an oil spill the monitoring design will depend upon the nature of the spill, the availability of baseline data in relation to the spill extent and expert opinion. In order to ensure the application of robust designs and sampling approaches which have the highest likelihood of detecting an environmental impact while allowing suitable flexibility, this plan provides a set of Guiding Principles for monitoring design and sampling (Table 1). A structured decision making framework for allocating monitoring effort in both time and space is described in Figure 1.

Table 1: Guiding principles for oil spill monitoring design and methodologies.

Principle	Explanation	Key guiding references
Match baseline	Designs and methodologies should follow those used in appropriate baseline studies wherever possible.	N/A
Comprehensive sampling	Sampling methods should seek to sample the full range of taxa within each assemblage. This may require the use of several complimentary techniques (the exception is if indicator taxa are employed; see below).	N/A
Reliable indicator taxa	If indicator taxa are targeted then the choice of indicator should be defensible, and a link to the response of the broader assemblage demonstrated. Indicators of ecosystem function should also be considered.	Hilty and Merenlender (2000)
Appropriate sample area or volume	Size of sampling unit should be determined based on the level of clustering of individuals and whether the goal is to quantify this clustering, or establish low inter-sample variability (probably more the latter for oil spill studies).	Kenkel et al. (1989)
Reduce within sample variation over time	Wherever possible repeated measures are carried out on the same sample space in order to reduce within treatment variation.	N/A
Compositing of samples	Appropriate compositing to increase statistical power should be considered.	Carey and Keough (2002)
Account for environmental gradients and partition variations	Sources of variation are considered and compartmentalised to best reduce within treatment variation, and thereby maximise power to detect an impact. This is managed through several means: 1. Environmental covariates are considered in sampling design recorded and incorporated statistically. 2. A hierarchical or stratified sampling design is used to address variation at multiple scales 3. Design is standardized, by sampling equivalent strata (e.g., level of exposure, depth etc.).	English et al. (1997), Snedecor and Cochran (1989)
Assess statistical power	Where null-hypothesis tests are planned, statistical power of the design is assessed prior to execution.	Gerrodette (1987) Legg and Nagy (2006) Toft and Shea (1982)

Principle	Explanation	Key guiding references
Appropriate sampling extent	Sample the range of hydrocarbon concentration (and at least the upper end).	Skalski (1995)
Independence amongst samples	Site selection should aim for independence amongst samples and potential spatial or temporal autocorrelation should be considered.	Hurlbert (1984)
Reduce observation error	Observer bias and amongst observer variation should be considered.	Thompson and Mapstone (1997)
Appropriate spatial replication	Sites are replicated. A limitation is that there is only one spill, but control sites should be replicated and spatially Interspersed. Ideally, the design should be able to detect an impact at several possible scales.	Underwood (Underwood 1991, 1992, 1994)
Appropriate temporal replication	Sampling should account for natural temporal variation.	Underwood (Underwood 1991, 1992, 1994)

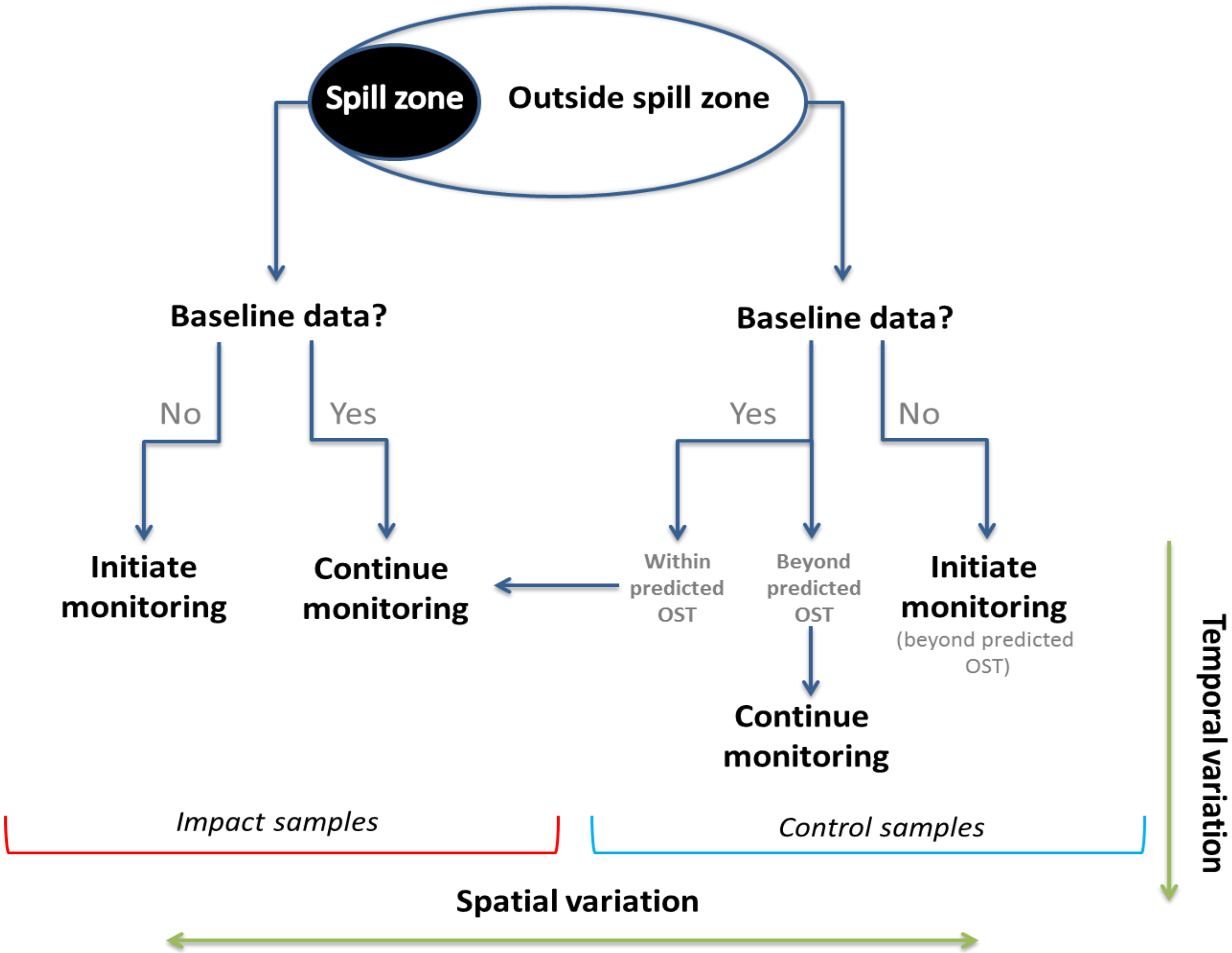

Figure 1: Structured decision making process based on Gregory et al. (2012) in reference to monitoring programs, the availability of baseline data, and oil spill trajectory. In an ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

1.2 Data Analysis

The most important approaches to statistical analysis and related sampling design are summarised in Table 2 (below).

Table 2: Summary of data analysis techniques.

Analysis type		Description	Strengths	Limitations	Addressing limitations
Gradient analysis		Impact is quantified in terms of distance from spill.	Can be established post-spill.	Doesn't account for inherent spatial patterns present prior to spill.	Include spatial covariates in model. Incorporate a temporal component.
Control chart	Univariate	Single variable is monitored and plotted over time, and breaching of control limits tested.	Control sites are not required. Takes account of natural variation in system.	Control limits do not necessarily have biological meaning. Doesn't control for broader spatial scale temporal variation.	Include control charts for control sites which incorporate broad scale temporal variation.
	Multivariate	Multiple variables are combined, monitored and plotted over time, and breaching of control limits tested.	Ability to combine suite of data (e.g. community composition) into one variable. Sites plots not required.	Individual responses are masked. Control limits do not necessarily have biological meaning. Significant control limits challenging to define. Direction of change is undefined.	Compliment with graphical approaches to identify direction of change and individual species responses.
	Reference	Control limits are based on knowledge of biological system (e.g. minimum viable population size, toxicity).	Control limits have recognised biological meaning or consequence.	Control limits may be considered arbitrary.	Use established standards for control limits.
BACI		Quantifies state before and after potential impact, and also at impacted and control sites. Impact is tested by statistical interaction of terms.	Controls for natural variation, by incorporating control sites.	Limited power to detect significant impact. Requires appropriate matching of control (non-impacted) sites. Requires pre-impact data.	Increase power by increasing temporal component. Choose indicators with low natural variability.

2 Scientific Monitoring Plans by Receptor

2.1 SMP1 Marine Water Quality

SMP1 – Marine Water Quality	
Rationale	The release of hydrocarbons at sea will pollute marine waters via floating, entrained or dissolved aromatic hydrocarbons. The water quality SMP may also be used in conjunction with Monitor and Evaluate, to inform the sampling design of other SMPs where objectives are to evaluate impact and recovery of sensitive receptors, in relation to hydrocarbon contamination.
Aim	To monitor changes in water quality following an oil spill and associated response activities for the purpose of detecting a potential impact and recovery and for informing other scientific monitoring studies.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the Industry-Government Environmental Metadatabase (IGEM) (Santos is subscribed to) will be reviewed for applicable marine water quality baseline data. In the absence of baseline data for hydrocarbons, data from appropriate reference sites will be used in place of the baseline values.
Initiation criteria	Upon notification of a Level 2 or 3 incident -(a level 2 or 3 incident includes those which may have an adverse effect on the environment. This may be informed by operational water quality monitoring)
Termination criteria	Concentrations of hydrocarbon contaminants, attributable to the released hydrocarbon, are not significantly higher than baseline data or similar non-impacted sites data. In the absence of baseline or similar non-impact sites data, concentrations of hydrocarbon contaminants, attributable to the released hydrocarbon, are below the relevant hydrocarbon contaminant trigger level within the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Governments 2018), or the relevant regulatory site-specific trigger level (where these exist), if this is lower and values are not significantly different to reference sites. Forensic fingerprinting of the released hydrocarbon and water quality sample analysis by way of gas chromatography/mass spectrometry (GC/MS) may be used to determine the source of contaminants where this is not otherwise clear from operational monitoring.
Receptor impact	Impacts to specific receptors from hydrocarbons within marine waters are described in individual SMPs.

<table>
<tr><th colspan="2">SMP1 – Marine Water Quality</th></tr>
<tr><td>Methodological approach</td><td>Overall sampling design approach will be enacted according to the availability of baseline data guided by the structured decision-making process based on Gregory et al. (2012):
4. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied;
5. If insufficient long-term baseline data is available, where appropriately matched baseline data sites are impacted and non-impacted, a before-after-control-impact (BACI) approach to monitoring will be applied;
6. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied.

See Figure 1 for detailed description of these approaches.

The selection of potentially impacted and non-impacted sites will be informed by Operational Monitoring, including operational water quality monitoring and spill trajectory modelling.

Sampling frequency will be dictated by the spatial extent of the spill, the number and location of sampling sites and the philosophy of the sampling design.

<u>Water profiles</u>

A water quality probe will be used to measure conductivity (to derive salinity), temperature and depth (CTD), dissolved oxygen (% and mg/L), turbidity, total dissolved solids and fluorometry along a depth profile. Sampling methods will be aligned with the recommended standard operating procedures for the use of sensors for oil spill monitoring found in Appendix F of the Oil Spill Monitoring Handbook (Hook et al. 2016).

<u>Water quality</u>

Water quality samples will be taken along a similar depth profile as the CTD measures using a Niskin bottle, Van Dorn water sampler, rosette sampler or equivalent instrument.

The laboratory(ies) will inform and supply the appropriate sample containers, storage requirements, holding times, detection limits/limit of reporting for required analytes and the analysis required for each sample.

Water samples shall be analysed for key contaminants of concern including polycyclic aromatic hydrocarbons (PAHs), monocyclic aromatic hydrocarbons (including benzene, toluene, ethylbenzene, xylene), and nutrients, metals and chlorophyll-a.

At each site, replicate water samples (at least three samples) will be collected to allow appropriate statistical analyses to be made including samples for quality assurance and quality control (QA/QC) purposes (i.e. split sample, triplicate sample, field blanks, transport blanks).

Water sample collection and handling will align with Standard operating procedures found in the Oil Spill Monitoring Handbook (Hook et al., 2016), specifically the following sections:
• Appendix A & B hydrocarbon analysis;
• Appendix C Volatile Organic Compounds Analysis; and
• Appendix D Surface Oil Analysis.

Environmental DNA (eDNA) will also be collected to detect for the presence of marine species in the water column. Water samples will be collected in Nalgene bottles and sent to an appropriate laboratory for analysis. Sample processing will depend on holding times required (<8 hours ideal) and may involve filtering and freezing of each sample (Grochowsi and Stat 2017).</td></tr>
<tr><td>Scope of works</td><td>Prepared by monitoring provider for issue within 24 hours of SMP having been activated.</td></tr>
</table>

SMP1 – Marine Water Quality	
Implementation	Service provider able to mobilise within 72 hours of the SoW following approval by Santos (this time allows for costing, preparation of equipment and disposables and travel time to site).
Analysis and reporting	Chemical analysis will be carried out by NATA-accredited laboratories. A government endorsed laboratory for forensic fingerprinting (GS/MS) will be used. Data will be entered to spatially explicit database. Data will be analysed appropriately in order to determine if there was a statistical difference in water quality before and after a hydrocarbon impact. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.2 SMP2 Sediment Quality

SMP2 - Sediment Quality	
Rationale	Hydrocarbons released during a spill scenario may contact, settle and/or accumulate in marine sediments. Toxic substances found in accumulated hydrocarbons may lead to impacts to ecosystem processes associated with this primary producer habitat. Sediments and marine infauna will be sampled concurrently in order to establish potential correlations amongst the two parameters.
Aim	To monitor the fate and persistence of hydrocarbons in marine sediments following an oil spill and associated response activities. To monitor marine benthic infauna assemblages as an indicator of sediment quality, in relation to an oil spill and associated response activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM will be reviewed for applicable marine baseline sediment quality and infauna data. In the absence of baseline sediment quality data, hydrocarbon contaminant trigger values for marine sediments as listed in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Governments 2018) will be used as a proxy for baseline levels. Where other regulatory site-specific trigger levels exist, the lower of these levels and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Governments 2018) levels will be used as proxy baseline levels.
Initiation criteria	Operational Monitoring or SMP1 indicates that contacted sediment or sediment predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

<table>
<tr><th colspan="2">SMP2 - Sediment Quality</th></tr>
<tr><td>Termination criteria</td><td>Concentrations of hydrocarbons in marine benthic and shoreline sediments, attributable to the released hydrocarbon, are not significantly higher than baseline or similar non-impact sites.

In the absence of baseline or similar non-impact sites data, concentrations are below marine sediment quality interim guideline levels within the ANZG (2018), or the relevant regulatory site-specific trigger level (where these exist), if this is lower.

For infauna assemblages, abundance and species diversity/richness/composition are not significantly different from baseline (where baseline data exists) or are not statistically significantly different from comparable non-impacted benthic infauna assemblages.

Forensic fingerprinting of the released hydrocarbon and sediment quality samples by way of GC/MS may be used to determine the source of contaminants where this is not otherwise clear from operational monitoring.</td></tr>
<tr><td>Receptor impact</td><td>Impact to sediment quality is measured through change in hydrocarbon content and concentration. Change to sediment quality is also reflected by changes to infaunal assemblages. Potential impact to infaunal assemblages are measured through change(s) in:
• Taxonomic diversity
• Assemblage composition
• Abundance of indicator species.

Other pressures to these states are:
• Discharge of other toxicants
• Physical disturbance including dredging
• Sedimentation
• Introduction of marine pests
• Shading from marine infrastructure
• Climate change</td></tr>
</table>

<table>
<tr><th colspan="2">SMP2 - Sediment Quality</th></tr>
<tr><td>Methodological approach</td><td>
Overall sampling design approach will be enacted according to the availability of baseline data guided by the structured decision-making process based on Gregory et al. (2012):
<ol start="7">
If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied;
If insufficient long-term baseline data is available, where appropriately matched baseline data sites are impacted and non-impacted, a before-after-control-impact (BACI) approach to monitoring will be applied;
Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied.

See Figure 1 for detailed description of these approaches. The selection of potentially impacted and non-impacted sites will be informed by Operational Monitoring, including operational water quality monitoring and spill trajectory modelling.
Sampling frequency will be dictated by the spatial extent of the spill, the number and location of sampling sites and the philosophy of the sampling design
<u>Sediment quality</u>
Operational Monitoring (including spill trajectory modelling) and the results of SMP1 Marine Water Quality monitoring will be used to inform the location of potentially impacted sediment sites.
Sediment monitoring sites in nearshore and shoreline locations will also consider and align where practicable, with sites selected for habitat monitoring (i.e. SMP3, 4, 5 and 6).
Sampling frequency will be dictated by the spatial extend of the spill, the number and location of sampling sites and the philosophy of the sampling design.
At each site, replicate sediment samples will be taken including those for QA/QC purposes.
Sediment grab (i.e. Van Veen or Box corer) or coring equipment will be selected based on water depth (offshore, inshore or shoreline) and sample size requirements.
Sediment sample collection and handling will align with Standard operating procedures found in the Oil Spill Monitoring Handbook (Hook et al. 2016), specifically the following sections according to sampling equipment utilised:

Appendix G hydrocarbon analysis (Grab samplers)
Appendix H hydrocarbon analysis (Ship borne corer)
Appendix H Manual push corer, and
Appendix O Sediment infauna.

The laboratory(ies) will inform and supply the appropriate sample containers, storage requirements, holding times, detection limits/limit of reporting for required analytes and the analysis required for each sediment sample.
Sediment samples shall be analysed for key contaminants of concern including metals, hydrocarbons, nutrients, particle size distribution, and nutrients.
<u>Infauna samples</u>
A subset of the sediment sample shall be sieved in the field (if time permits) with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of infauna to lowest taxonomic resolution possible.
eDNA will also be collected to detect for the presence of marine infauna species in sediments. Sediment will be removed from the surface of a subset of the sediment sample and sent to an appropriate laboratory for analysis.
</td></tr>
</table>

SMP2 - Sediment Quality	
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.
Implementation	Service provider to be capable of mobilising within 72 hours of the SoW having been approved by Santos. Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.
Analysis and reporting	Sediment samples analysed by NATA-accredited laboratories for presence and concentrations of hydrocarbons associated with the spill including full suite PAHs and total organic carbon. A government endorsed laboratory for forensic fingerprinting (GC/MS) will be used. Infauna samples sorted and identified by qualified marine invertebrate specialist to acceptable taxonomic groups. Data will be entered to spatially explicit database and analysed statistically in order to detect significant differences among sites. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.3 SMP3 Sandy Beaches and Rocky Shores

SMP3 - Sandy Beaches and Rocky Shores	
Rationale	Contact of entrained oil and stranded floating oil of shoreline habitats may occur on sandy beaches and rocky shores. Rocky and sandy shores provide habitat for a variety of intertidal organisms, which in turn provide food for shorebirds. Large tides tend to create a large degree of horizontal zonation amongst taxa. Rocky and sandy shores are included within the one receptor as they are often spatially mixed and both represent high energy regions.
Aim	To monitor changes in biota of sandy and rocky shoreline habitats in relation to an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM shall be reviewed for applicable rocky shoreline and sandy beach biota baseline data. Minimal baseline data currently exists for rocky shorelines and sandy beaches.
Initiation criteria	Operational monitoring, SMP1 or SMP2 indicates that rocky and/or sandy shorelines are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

<table>
<tr><th colspan="2">SMP3 - Sandy Beaches and Rocky Shores</th></tr>
<tr><td>Termination criteria</td><td>Shoreline assemblage structure, and hydrocarbon concentration levels in representative invertebrate species, are not significantly different from their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages; AND

SMP2 Sediment Quality monitoring at the site has been terminated AND

Shoreline clean-up at the site has been completed.</td></tr>
<tr><td>Receptor impact</td><td>Impact to shoreline invertebrates from pressures including hydrocarbons is measured through change in:
• Species diversity
• Assemblage composition
• Abundance of indicator taxa.

Other pressures to these states are:
• Physical disturbance
• Discharge of toxicants
• Litter/waste
• Introduction of marine pests
• Over-collection
• Nutrification
• Climate change.</td></tr>
</table>

<table>
<tr><th colspan="2">SMP3 - Sandy Beaches and Rocky Shores</th></tr>
<tr><td>Methodological approach</td><td>Monitoring will be designed as follows:

• Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied.
• Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied.
• Where no baseline data sites are involved, a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied.

Owing to potentially high spatial variation in assemblage structure, post-spill pre-impact monitoring will be a priority where no baseline data exists. If this opportunity is not available, a gradient approach to monitoring will be applied.

Sampling frequency will be dictated by the number and location of sampling sites and the philosophy of the sampling design.

Rocky shoreline intertidal assemblages (fauna and flora) will be monitored using a quadrat/transect approach, with the positioning of quadrats/transects accounting for any natural variation in assemblage structure along a seaward-landward gradient. Assemblage structure to be recorded through in-situ counts of fauna and flora or still images taken for further analysis.

Sandy shoreline infauna will be sampled by way of replicated grab/core samples. Sampling sites within impacted and non-impacted areas to consider any cross-shore gradient in assemblage structure that may exist. Where baseline data exists, the methodology will be adapted to available data so that results are comparable.

Samples to be sieved with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of fauna to lowest taxonomic resolution possible. Process to follow that for baseline data where this pre-exists.

Biomonitoring of hydrocarbon concentrations in shoreline invertebrates will occur through collection of replicated tissue samples from representative, and preferably widely available species, across impact and non-impacted locations.

The laboratory(ies) will supply and inform the appropriate method for collection, storage and holding times of tissue samples for required laboratory analysis and to avoid cross-contamination among samples.

Where limitations in the distribution and abundance of representative invertebrate species preclude collection of sufficient samples for analysis, in-situ biomonitoring using a locally available species (e.g. the use of caged oysters) shall be considered for assessing spatial and temporal changes in bioaccumulation of hydrocarbon concentrations in invertebrates across impact and reference sites.</td></tr>
<tr><td>Scope of works</td><td>Prepared by monitoring provider for issue within 24 hours of SMP being activated.</td></tr>
<tr><td>Implementation</td><td>With the aim of collecting post-spill pre-impact data, service provider able to mobilise within 72 hours of the SoW having been provided to them (this time allowing for costing, preparation of equipment and disposables and travel to site).

Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.</td></tr>
</table>

SMP3 - Sandy Beaches and Rocky Shores	
Analysis and reporting	Specimens not identified in situ (in the field) will be processed and identified in the laboratory by appropriately qualified scientists. Biota tissue samples (if collected) analysed for hydrocarbon contaminants by NATA-accredited laboratories. Data will be entered to spatially explicit database and analysed in order to test for significant difference between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.4 SMP4 Mangrove Communities

SMP4 - Shorelines and Coastal Habitats – Mangroves	
Rationale	In the event of Tier 2 or 3 spill, mangroves may be contacted by floating or entrained oil. Mangrove health may be adversely affected due to increased concentration of hydrocarbons in sediments and coating due to surface oil, which in turn can lead to leaf-loss, mortality and a reduction in areal extent of mangrove habitat. This plan's focus is mangrove vegetation. Associated monitoring of sediment quality and mudflat fauna is described in SMP2 and SMP5, respectively.
Aim	To monitor changes to mangrove extent and health in relation to an oil spill and associated activities.
Baseline	On-ground monitoring is ongoing at several locations , refer Baseline Data Review (QE-00-BI-20001). Santos holds long term data from field mangrove health surveys at Varanus Island/ Bridled Island (Lowendal Group). Baseline extent and of mangroves is monitored by remote sensing in several regions, and further historical and post-impact data for mangrove health and extent can be obtained as remotely sensed imagery (e.g., Sentinel, Landsat and Worldview).
Initiation criteria	Operational Monitoring, SMP1 or SMP2 indicates that mangroves are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Mangrove extent and health are not significantly different from their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted mangroves; AND Sediment quality monitoring (SMP2) at the site has been terminated; AND Shoreline response at the site has been completed.

SMP4 - Shorelines and Coastal Habitats – Mangroves	
Receptor impact	Impact to mangroves from pressures including hydrocarbons is measured through change in: • Tree health • Aerial extent. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Litter • Introduction of marine pests • Dust • Sedimentation from human activities • Climate change.
Methodological approach	Remote sensing data will be accessed for the purpose of detecting change in aerial cover and change in canopy health through and index of plant health (e.g., NDVI or MSAVI) (Astron Environmental Services 2013). Where long term on-ground baseline monitoring has occurred, further post impact onground monitoring should be carried out to complement any analysis of remote sensing. Analysis of long-term onground monitoring data will be as follows: • Where long-term baseline data sites (only) are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied (See Figure 1). On-ground monitoring of mangroves will aim to detect change in mangrove health, including canopy cover and plant/leaf health indices. Field methodology will follow the routine monitoring techniques currently employed for Santos at Varanus Island (Quadrant Energy Australia Limited 2018), adapting where required to align with pre-existing baseline field data, where available. Sampling of sediments as per SMP2 will occur at mangrove health assessment sites to allow any changes in mangrove health to be related to sediment hydrocarbon levels. In-field mangrove health sampling frequency will be dictated by the number and location of sampling sites and the sampling design applied.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	On-ground monitoring will only occur where long-term baseline data has been collected, and hence no post-spill pre-impact data collection will be required. On-ground post-spill data will be collected at an appropriate time as guided by the analysis of remote sensing imagery, and potential on-ground assessment.
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to test statistically significant change to parameters associated with hydrocarbon spill. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.5 SMP5 Intertidal Mudflats

SMP5 - Shorelines and Coastal Habitats – Intertidal Mudflats	
Rationale	Intertidal mudflat communities are primary producer habitats which support invertebrate fauna, which in turn provides a valuable food source for shorebirds. High diversity of infauna (particularly molluscs) occur within these habitats and may be affected by penetrating oil. At high tide, these habitats become foraging grounds for vertebrates such as rays and sharks. While there is some localised disturbance, most of the communities in the area of interest are generally in an undisturbed condition. These habitats are at high risk of impact as the sheltered environments promote high faunal diversity combined with low-energy wave action.
Aim	To monitor changes in intertidal mudflat communities associated with an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) . In addition, the IGEM shall be reviewed for applicable intertidal mudflat infauna baseline data.
Initiation criteria	Operational Monitoring, SMP1 or SMP2 indicates that mudflat habitats are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Mudflat infaunal assemblages are not significantly different from their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages; AND SMP2 Sediment Quality monitoring at the site has been terminated; AND Clean-up of the shoreline site has been completed.
Receptor impact	Impact to mudflat epifauna and infauna from pressures, including hydrocarbons, is measured through change in: • Species diversity • Assemblage composition • Abundance of indicator taxa. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Overfishing (bait collecting) • Introduction of marine pests • Climate change.

SMP5 - Shorelines and Coastal Habitats – Intertidal Mudflats	
Methodological approach	Monitoring will be designed as follows: • Where long-term baseline data sites (e.g., Roebuck Bay) are contacted, a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied (See Figure 1). Owing to potentially high spatial variation in assemblage structure, post-spill pre-impact monitoring will be a priority if baseline data are not available. If this opportunity is not available, a gradient approach to monitoring will be applied. Mudflat infauna will be sampled by way of replicated grab/core samples. Sampling sites within impacted and non-impacted areas to consider any cross-shore gradient in assemblage structure that may exist. Where baseline data exists methodology to adapt to available data such that results are comparable. Sites selected for mudflat infauna sampling to be concurrently sampled for sediment quality as per SMP2. Sampling frequency will be dictated by the number and location of sampling sites and the philosophy of the sampling design. Samples to be sieved with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of fauna to lowest taxonomic resolution possible. Process to follow that for baseline data where this pre-exists.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	With the purpose of collecting post spill pre-impact data, service provider able to mobilise within 72 hours of the scope of work having been provided to them (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilization time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.6 SMP6 Benthic Habitats

<table>
<tr><th colspan="2">SMP6 - Benthic Habitats</th></tr>
<tr><td>Rationale</td><td>Benthic habitats are those habitats associated with the seafloor. Major benthic habitats at risk are:
• Coral reefs (likely high susceptibility to spill)
• Macroalgae and seagrass (likely moderate susceptibility to spill)
• Non-coral benthic filter feeders (likely moderate susceptibility to spill)
• Sub-tidal pavement (likely moderate susceptibility to spill)
• Soft-substrate (likely lower susceptibility to spill).

Macroalgal and seagrass communities are important primary producers which also provide habitat, refuge areas and food for fish, turtles, dugongs and invertebrates. Seagrass and macroalgae also increase structural diversity and stabilise soft substrates. Non-coral benthic filter feeders, which include sponges, molluscs, sea whips and gorgonians, are considered indicators of disturbance due to their immobility and long living. Corals are important primary producers that provide food, substrate and shelter for a diversity of marine life, including invertebrates and fish. They also protect coastlines from wave erosion and provide important substrate for algae. Undisturbed intertidal and subtidal coral reefs occur in several locations throughout the EMBA and are generally considered to be in good condition.</td></tr>
<tr><td>Aim</td><td>To monitor changes in the cover and composition of benthic habitats in relation to an oil spill and associated activities.

To monitor change in hard coral health and reproduction in relation to an oil spill and associated activities.</td></tr>
<tr><td>Baseline</td><td>Refer Baseline Data Review (QE-00-BI-20001)

In addition, the IGEM will be reviewed for applicable benthic habitat and coral health and reproduction baseline data.

Remote sensing data, satellite and aerial imagery previously acquired (for example Hyperspectral imagery along the Ningaloo lagoon) (Kobryn et al. 2013) may also be applicable for shallow clear-water benthic habitats to detect changes in benthic habitat cover and composition.

Pollution-induced change to benthic habitat cover and composition may take some time to be detected. Therefore post-spill, pre-impact benthic survey data will be collected when required to have a baseline state following initial oil contact.</td></tr>
<tr><td>Initiation criteria</td><td><u>Benthic habitat cover and composition</u>

Operational Monitoring, SMP1 or SMP2 indicates that subtidal benthic habitats are contacted or are predicted to be contacted by a hydrocarbon spill.

<u>Coral health and reproduction</u>

Operational Monitoring, SMP1 or SMP2 indicates that coral habitat is contacted or is predicted to be contacted by a hydrocarbon spill.

Contact is defined as hydrocarbon exceeding one of the following thresholds:
• 1 g/m^2 Floating oil
• 10 ppb Dissolved Aromatic Hydrocarbons
• 10 ppb Entrained hydrocarbons.</td></tr>
</table>

SMP6 - Benthic Habitats	
Termination criteria	<u>Benthic habitat cover and composition</u> Cover and composition of benthic habitats are not statistically significantly different from that of their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages. <u>Coral health and reproduction</u> Hydrocarbon concentration in corals, reproductive state and settlement indices are not statistically different from the baseline state (where baseline data exists) or from comparable non-impacted assemblages.
Receptor impact	Impact to benthic habitats from pressures including hydrocarbons is measured through change in: • Species diversity • Assemblage composition • Percent cover. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Introduction of marine pests • Shading • Climate change.

SMP6 - Benthic Habitats	
Methodological approach	Monitoring design will be as follows: • Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. Benthic Habitat Cover and Composition Field survey methodology will be based upon acquiring repeat digital imagery (video or still images) of benthic habitats along fixed transects (preferable), using a stratified sampling approach at each site to target different habitat types and depths where clear gradients in these conditions exist. Site selection and image acquisition methodology will aim to align applicable baseline studies where these exist, such that imagery is comparable. The number of sites and frequency of sampling will depend upon the sampling design philosophy. Divers, towed video or remotely operated vehicles (ROVs) will be employed to collect imagery considering safety aspects and the depth of water at survey locations. Where divers are employed, fish species will also be recorded where practicable (for example following methodologies employed by Babcock et al. (2008) to contribute to SMP11. Coral Health and Reproduction Using divers, selected coral colonies will have tissue samples removed for the purpose of laboratory analysis of the concentration of accumulated hydrocarbons and for determining reproductive state, noting sampling for reproductive state will be dependent upon the timing of coral spawning. Reproductive state will be determined from measures of gamete size, stage and fecundity determined from in-field examination and laboratory analysis of histological samples. In addition to the standard suite of ecotoxicology testing done on the released hydrocarbon as part of the Operational Monitoring Program, ecotox testing of the released hydrocarbon on the larval competency of representative coral species will be conducted. Settlement plates will be deployed to monitor settlement of coral recruits following spawning periods to ascertain the level of coral recruitment at impacted and non-impacted sites.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider is to be able to mobilise within 72 hours of the SoW being approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.

SMP6 - Benthic Habitats	
Analysis and reporting	Digital imagery will be analysed using a point-count technique (using software such as AVTAS, Coral Point Count with Excel extensions (CPCe) or TransectMeasure (SeaGIS)) to estimate the percentage cover of biotic and abiotic categories (in line with the CATAMI classification scheme) comprising the benthic habitat. Biotic categories to include the following as applicable: corals; macroalgae and seagrass; and non-coral benthic filter feeders. Live, dead and bleached coral cover shall be recorded. The imagery collected will allow for the determination of percent cover, abundance, measurement of size (if scaling lasers are included in the image) and a visual assessment of health (Kohler and Gill 2006). NATA accredited laboratory analysis to determine the concentration of hydrocarbons within coral tissue. Reproductive output to be determined by complementary means, including in-field and laboratory analysis of gametes, including microscopic examination of histological samples preserved in the field. Coral larval competency tests to be conducted by ecotox laboratory in addition to standard suite of ecotox tests using released hydrocarbon. Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card provided as part of report. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.7 SMP7 Seabirds and Shorebirds

<table>
<tr><th colspan="2">SMP7 - Seabirds and Shorebirds</th></tr>
<tr><td>Rationale</td><td>The region supports around 25 species of migratory shorebirds, 20 species of resident shorebirds, and approximately 30 species of seabirds. Shorebird foraging is most highly concentrated on tidal mudflats, while seabirds tend to nest on offshore islands.

Impacts to seabirds and shorebirds due to the presence of surface, entrained and dissolved hydrocarbons may include behavioural (e.g. deviation from migratory routes), physiological (e.g. disruption to digestion) or physical (e.g. matting of feathers, inability to fly). These effects may ultimately lead to death or failed breeding.

For the purposes of this document, seabirds and shorebirds are defined as:
• shorebirds – those birds that inhabit and feed in the intertidal zone and adjacent areas and are resident or migratory, using the area principally during the austral summer
• seabirds – those birds associated with the sea and deriving most of their food from it, and typically breeding colonially, including the marine raptors osprey and white-bellied sea eagle.</td></tr>
<tr><td>Aim</td><td>Quantify seabirds and shorebirds, in the spill and response areas.

Quantify lethal and/or sub-lethal impacts of hydrocarbon spill exposure on seabirds and shorebirds.

Monitor changes in seabird populations (reproductive success) in relation to the hydrocarbon spill and clean-up activities.</td></tr>
<tr><td>Baseline</td><td>Refer Baseline Data Review (QE-00-BI-20001)

The Oil Spill Response Atlas (Department of Transport (DoT)) and National Conservation Values Atlas (Department of the Environment and Energy - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) should also be consulted.

Long-term seabird monitoring has been conducted on Lowendal, Airlie and Serrurier Islands by Santos as part of seabird and shearwater monitoring programs.</td></tr>
<tr><td>Initiation criteria</td><td>Operational monitoring indicates that known foraging, roosting or nesting areas for seabirds and/or shorebirds has been contacted, or are predicted to be contacted, by a hydrocarbon spill; OR

Operational monitoring indicates that seabirds and shorebirds have been contacted, or are predicted to be contacted, by a hydrocarbon spill.

Contact is defined as hydrocarbon exceeding one of the following thresholds:
• 1 g/m^2 Floating oil
• 10 ppb Dissolved Aromatic Hydrocarbons
• 10 ppb Entrained hydrocarbons.</td></tr>
<tr><td>Termination criteria</td><td>Detectable levels of hydrocarbons attributable to the hydrocarbon spill are not present in seabird and shorebird tissues; AND

measured variables are not statistically significantly different from their baseline or pre-spill state (where these data exist) or from measured variables at non-impacted sites; AND

Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).</td></tr>
</table>

SMP7 - Seabirds and Shorebirds	
Receptor impact	Impact to sea and shore birds from pressures including hydrocarbons is measured through change in: • Species diversity • Bird abundance • Health/condition • Breeding success (resident species only). Other pressures to these states are: • Physical disturbance of foraging and nesting habitat • Accidental chemical spillage • Entanglement in litter • Displacement by less favourable species (e.g. Silver Gull) • Predation • Climate change.
Methodological approach	Monitoring design will be as follows: • Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. Given the ease of survey establishment, post-spill pre-impact monitoring will be attempted wherever practicable in order to established pre-impact state. • Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied. Monitoring for seabirds and shorebirds will measure abundance and diversity in key foraging/roosting areas with the timing of surveys to coincide with seasonal peaks in abundance. The seabird and shorebird roost count monitoring will follow current accepted survey methodology conducted in the area, such as Bamford and Moro (2011) at Barrow Island, and survey guidelines standardised by the Department of the Environment and Energy (2017). Monitoring of seabirds to focus on nesting (burrow) density, breeding participation and breeding success, taking measurements of the number of adults, eggs and chicks with the timing of surveys to allow assessments immediately after egg laying and immediately prior to chick fledging. Bird mortality to be recorded during monitoring of seabirds and shorebirds with tissue samples taken from dead birds for hydrocarbon analysis in the laboratory. Necroscopies will follow the process of Gagnon and Rawson (2010).
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been provided to them (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.

SMP7 - Seabirds and Shorebirds	
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Draft annual report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.8 SMP8 Marine Megafauna

SMP8 - Marine Megafauna	
Rationale	Thirty-eight species of marine mammals are known to occur within the region. These include cetaceans (whales and dolphin) and sirenians (dugong). The whale shark (*Rhincodon typus*) is also included within this plan. Effects to marine megafauna due to presence of surface oil, entrained oil and dissolved aromatic hydrocarbons may include behavioural (e.g. deviation from migratory routes), physiological (e.g. disruption to digestion) or physical effects. Given large spatial variation in occurrence and broad scale movement, population estimates and associated change are not often available. This plan will focus on assessing the extent of impacts to animals within the region, and where possible, the level of recovery. This will then be used to deduce potential impacts at a population level.
Aim	To monitor short and long-term environmental effects on marine mammals and whale sharks that may have resulted from the hydrocarbon spill and associated response.
Baseline	Refer Baseline Data Review (QE-00-BI-20001)
Initiation criteria	Operational monitoring indicates that marine megafauna are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP8 - Marine Megafauna	
Termination criteria	Restoration or resumption of key biological processes (e.g. abundance, distribution, breeding) necessary to ensure post-impact recovery is demonstrated. Specific criteria to be developed by Marine Scientist(s) with expertise in marine mammals in the north-west of Western Australia; AND No further instances of dead marine megafauna with detectable levels of hydrocarbons attributable to the hydrocarbon spill; AND Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).
Receptor impact	Impact to marine mammals and whale sharks from pressures including hydrocarbons is measured through observed injury and mortality. Other pressures to these states are: • Physical disturbance • Entanglement in fishing gear and litter • Accidental chemical spillage • Climate change • Over-exploitation.
Methodological approach	Aerial and marine surveys will be implemented to identify individuals in proximity of the spill and to quantify damage: • Aerial surveys will follow the protocols of Hedley et al. (2011) • Marine surveys will follow the protocols of Watson et al. (2009) Tissue sampling of dead or injured animals will follow the protocols of: • Department of Environment and Heritage (DEH) (2006) (Cetaceans) • Eros et al. (2000) (Dugongs).
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP8 - Marine Megafauna	
Analysis and reporting	Data will be entered to spatially explicit database. Data and conclusions will be summarised in an environmental report card. Statistical power related to these receptors is likely to be low, due to observational data and small sample sizes. Therefore, the assessment of quantified impacts will be corroborated with marine scientist(s) with expertise in relevant fauna in the north west of Western Australia. Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.9 SMP9 Marine Reptiles

SMP9 - Marine Reptiles	
Rationale	Six species of marine turtle, 22 species of sea snake and one species of estuarine crocodile are considered to occur within the region. Impacts to marine reptiles due to presence of surface oil, entrained oil and dissolved aromatic hydrocarbons may include behavioural, physiological (e.g. disruption to digestion) or physical effects. This plan is primarily focussed on marine turtles, while assessing other reptiles where encountered.
Aim	To observe and quantify the presence of marine reptiles in the spill and response areas, and broader regional areas. To assess and quantify lethal impacts or sub-lethal impacts of this exposure or interactions. To monitor changes in turtle populations in relation to an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) The Oil Spill Response Atlas (Department of Transport (DoT)) and National Conservation Values Atlas (Department of the Environment and Energy - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) should also be consulted.

SMP9 - Marine Reptiles	
Initiation criteria	Operational monitoring indicates that marine reptiles or nesting sites are contacted or likely to be contacted by a hydrocarbon spill; OR Operational monitoring indicates that marine reptiles are contacted, or are predicted to be contacted, by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Detectable levels of hydrocarbons attributable to the hydrocarbon spill are no longer present in marine reptile tissues collected from live or dead individuals; AND In the event that an impact attributable to the hydrocarbon spill is detected on marine reptiles, the measured parameters are not statistically significantly different from their baseline or pre-spill state (where these data exist) or from measured parameters at non impacted sites; AND Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).
Receptor impact	Impact to marine turtles from pressures including hydrocarbons is measured through change in: • Abundance • Health/condition • Nesting success. Impact to other marine reptiles from pressures including hydrocarbons is measured through change in observed injury and condition. Other pressures to these states are: • Lighting and flares causing disorientation (turtles) • Vessel strike • Physical disturbance of nesting sites • Predation • Entanglement in fishing gear and litter • Accidental chemical spillage • Habitat loss or change due to dredging • Climate change • Over-exploitation.

SMP9 - Marine Reptiles	
Methodological approach	**Abundance** In-water impacts – aerial surveys. Shoreline impacts – ground surveys (either rapid track census survey or tagging program). **Health/condition** In-water impacts – vessel surveys (collecting observations on animal condition and collection of tissue samples or dead specimens for analysis). Shoreline impacts – ground surveys (collecting observations on animal condition and collection of tissue samples or dead specimens for analysis). Dead reptiles will be collected for autopsy following Gagnon (2009) **Reproductive success** Shoreline impacts – ground surveys (detailed tagging and/or nesting success studies). Design of ground surveys for turtles will be applied as follows: • Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved, and timing allows, a post spill pre-impact approach will be attempted • If a post-spill pre-impact approach is not practicable, a gradient approach to quantifying impacts will be applied
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP9 - Marine Reptiles	
Analysis and reporting	Data will be entered to spatially explicit database. Turtle data will be analysed in order to test for significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Owing to their observational nature and potentially low sample size, observed impacts to other reptile fauna will be corroborated with marine scientist(s) with expertise in relevant fauna in the north-west of Western Australia. Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.10 SMP10 Seafood Quality

SMP10 - Seafood Quality	
Rationale	Exposure of commercial and recreationally targeted demersal and pelagic fish species to entrained and dissolved aromatic hydrocarbons can cause flesh tainting and increase the levels of toxicants above human consumption guidelines. Aromatic hydrocarbons are carcinogenic to humans. This scope includes finfish, sharks and invertebrates (principally crustacea).
Aim	To identify potential human health risks due to the presence of hydrocarbon concentrations in the flesh of targeted seafood species for consumption.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) Human health benchmarks relating to the exposure of PAHs shall be used to determine health effects as per Yender et al. (2002). Flesh samples from non-impacted sites to be used as baseline for olfactory analysis for flesh taint.
Initiation criteria	Operational monitoring and results from SMP1 predicts or observes contact of oil to target species for consumption. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP10 - Seafood Quality	
Termination criteria	Hydrocarbon concentrations in the tissues of seafood are not above levels considered a human health risk from consumption; AND Flesh taint is not detected from olfactory testing of seafood samples; AND Target species are no longer exposed to hydrocarbons in the water column.
Receptor impact	Impact to seafood quality from hydrocarbons is measured through change in: • Toxicity indicators • Olfactory taint. Other pressures to these states are: • Accidental chemical spillage • Disease.
Methodological approach	Target fish species determined from water quality monitoring results and relevant and available commercial and recreational-fished species. Sampling of target species will follow a gradient design (Gagnon and Rawson 2012) ranging from impacted to non-impacted (or non-suspect) catches using commercial and recreational fishing techniques undertaken by commercial and recreational fishers. Sampling method (netting, trawling, baited fish traps, spear fishing, line fishing) will be determined by habitat, target species and spill location. If more than one target species is affected, replicate samples of each species shall be collected, with a minimum of five replicate samples. Olfactory testing will follow Rawson et al. (Rawson et al. 2011), following the duo-trio method (Standards Australia 2005).
Scope of works	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP10 - Seafood Quality	
Analysis and reporting	Laboratories will be NATA-accredited for food standards analyses. Data will be stored in spatially explicit database and analysed in order to test for significant differences between impacted and non-impacted seafood. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.11 SMP11 Fish, Fisheries and Aquaculture

SMP11- Fish, Fisheries and Aquaculture	
Rationale	Impacts to fisheries species due to presence of entrained hydrocarbons may include lethal and sub-lethal physiological effects (e.g. reduced growth) and physical effects. The region comprises the Indo-West Pacific area which consists of a high diversity of fish species and assemblages and provides important spawning and nursery grounds for several fisheries species. Fish are concentrated in a number of biodiversity hotspots. The environment is also conducive to aquaculture including pearl production. Fisheries species that spawn or inhabit near shore areas face a greater risk to an oil spill than finfish found in deeper waters.
Aim	To monitor changes in structure and distribution of fish assemblages in relation to an oil spill and associated activities. To monitor the effect of hydrocarbon exposure and physiological condition on fisheries and aquaculture species.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM shall to be reviewed for applicable baseline data.
Initiation criteria	Operational monitoring indicates fish, fisheries or aquaculture are contacted or likely to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Fish assemblages are not statistically significantly different than those of baseline or similar non-impacted assemblages; AND Hydrocarbon concentrations, physiological condition indices, and biomarker levels in affected fish and aquaculture species are not statistically significantly different from those of non-impacted samples; AND Termination of monitoring is done in consultation with the Department of Primary Industries and Regional Development (DPIRD).

<table>
<tr><th colspan="2">SMP11- Fish, Fisheries and Aquaculture</th></tr>
<tr><td>Receptor impact</td><td>Impact to fish, fisheries and aquaculture from pressures including hydrocarbon concentrations is measured through change in:
• Species diversity
• Abundance of indicator taxa
• Assemblage structure
• Health.

Other pressures to these states are:
• Accidental chemical spillage
• Over fishing
• Introduction of marine pests
• Habitat disturbance
• Climate change.</td></tr>
<tr><td>Methodological approach</td><td>Fish assemblages will be assessed using the stereo-baited remote underwater videos (BRUVs) following Shortis et al. (2009). Fish assemblages will be randomly sampled within discrete habitats at cross-shelf impact areas and non-impact areas.
Sampling design for fish assemblages will be as follows:
• Where long-term baseline data sites are contacted a control chart (time-series) design will be applied.
• Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied.
• If baseline data is not available, a gradient approach to quantifying impacts will be applied (See Figure 1).

Where relevant, data available from DPIRD, including catch/effort data, will be assessed to determine potential changes from baseline levels in fishing grounds potentially affected by an oil spill compared to after the event.
For fish and aquaculture species potentially exposed to an oil spill, species will be sampled across the contamination gradient as per Gagnon and Rawson (2012).
Hydrocarbon concentrations (particularly PAH) within tissues of fish and aquaculture species will be determined. Exposure to hydrocarbons on fish health will also be determine through analysis of physiological indices and biochemical markers following Gagnon and Rawson (2012).
If fish kills are observed, whole specimens will be obtained and preserved (frozen) for necropsy to determine the cause of death.</td></tr>
<tr><td>Scope of works</td><td>Prepared by monitoring provider for issue within 24 hours of this SMP being activated.</td></tr>
<tr><td>Implementation</td><td>Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site).
Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.</td></tr>
</table>

SMP11- Fish, Fisheries and Aquaculture	
Analysis and reporting	BRUV imagery will be processed using EventMeasure (SeaGIS) software. NATA-accredited laboratories will be employed for health analyses. Data will be entered to spatially explicit database and analysed to test for statistically significant differences between non-impacted and impacted fish assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.12 SMP12 Whale Shark

SMP12- Whale Shark	
Rationale	Whale sharks inhabit most of the Western Australian coast and seasonally aggregate at Ningaloo Reef in the austral autumn and winter, coinciding with a pulse of productivity following mass coral spawning in early autumn, with the population during this period dominated by juveniles (Bradley et al. 2016). In addition to the monitoring that will be undertaken as part of SMP8 Marine Megafauna, additional scientific monitoring of whale sharks along the Ningaloo Coast will be undertaken (SMP12). Santos has historically and currently supported research on the behaviour, demography and migration patterns of whale sharks at Ningaloo Reef. In the event of a spill that could impact whale sharks, Santos will leverage off this long term research program to assess potential impacts to whale sharks at, and migrating to-and-from, Ningaloo Reef. SMP12 is regarded as complementary to SMP8 which will detect potential impacts to whale sharks from visual surveys of whale sharks wherever they may occur in relation to a spill.
Aim	To quantify impacts of an oil spill on whale sharks at the Ningaloo Coast

Baseline	Baseline monitoring information of whale sharks includes: 1) Aerial survey. Monthly surveys funded by Woodside Energy were completed from 2000 to 2002. DEC undertook monthly surveys of Ningaloo Reef during the whale shark season from 2006 to 2010. The results of work funded by Woodside were published by Sleeman *et al*. (2010). Because whale sharks are not constrained to visit the surface in the same way as marine mammals, both surveys recorded relatively few whale sharks. Analysis of the DEC survey data by Professor Helene Marsh of James Cook University concluded its surveys did not account for problems of availability and perception errors and that due to the relatively low numbers of sharks available to be counted in the Ningaloo region, aerial survey was probably not an appropriate means to census these sharks (DEC pers. comm.). Note that while aerial survey techniques have shortfalls for determining abundance patterns, they are still useful for identifying aggregation sites of whale sharks in the Exmouth sub-basin. 2) Photo-identification databases. Two databases of whale sharks sighted at Ningaloo Reef are available although there is likely to be considerable overlap in their content. The first of these is held by AIMS and uses open-source software to compare and match images of sharks. Access to this database is not restricted. The second is held by Ecocean and requires user-access agreements to deposit, match and retrieve images or access metadata. The software used by Ecocean to compare images is proprietary. In the case of the AIMS database, images are available from 1992 to the present day with most of them provided by ecotourism operators at the end of each whale shark season. As part of licence agreements with DBCA, videographers working with each tourist operator must surrender footage of each shark encountered by the operator. DBCA staff then download id-images from these videos. Metadata and id-images are provided to both Ecocean and AIMS databases. These databases can be used in mark-recapture modelling frameworks to examine trends in the composition and abundance of whale sharks at Ningaloo, but outputs must be considered in the light of the caveats mentioned earlier (i.e. representativeness, sampling protocol etc.). 3) Operator and researcher trip logs. Each time a whale shark is encountered by a tourist and research vessel, or by a spotter plane, a record is kept of the location, size and sex (where possible) of the animal and the date and time. These records now exist from 1994 to the present day. These data suffer from the same caveats applicable to photo-id databases (e.g. representativeness of sampling of the entire population within the Exmouth region). Furthermore, planes do not search for animals in any formally structured manner, but rather fly up and down the reef at varying distances from the reef crest until a whale shark is sighted. If animals are sighted early in the day and all operators have completed tourist swims with sharks, then searches are terminated and the plane returns to base. Conversely, if whale sharks are difficult to find the area of search is widened and the plane will search for longer. Thus, the area and duration of searches can be highly variable. There have been changes in the format of reporting (written logs to GPS records) of encounters both by the boats and the planes through time. Finally, at times when there are few whale sharks, encounters with the same shark may be shared among tourist vessels, so that there is the possibility of double (or even triple) counting of the same shark in the database. Despite these problems, analysis of tourist industry databases have returned valuable insights into physical drivers of whale shark abundance at Ningaloo Reef (e.g. Sleeman *et al*., 2010) Other relevant baseline datasets include: 4) Sightings by the oil and gas industry. Occasional sightings of whale sharks either from the decks of oil rigs or by remotely operated vehicles (ROVs) around oil platforms and deepwater facilities have been compiled by AIMS for the past six years. No formal sampling program exists and these sightings occur largely by

SMP12- Whale Shark	
	chance, although they do indicate the presence of these animals around oil and gas facilities offshore and in deep water on the shelf. 5) Tagging data. Satellite telemetry has been used to describe the movement patterns of whale sharks along the Ningaloo coast and extending into the Timor Sea and south-east Indian Ocean. This data cannot be used to estimate patterns of abundance, but does provide important insights into the feeding, residency and migratory behaviours of sharks under 'normal' oceanographic conditions within the Exmouth sub-basin. Much of this data has been gathered by tag deployments led or assisted by AIMS. Researchers from other institutions have also deployed tags on whale sharks at Ningaloo at tracked movement, including a recent study by Ecocean/University of QLD (Reynolds et al., 2017). 6) Food chain studies. Surveys of euphausiids (a major food item of whale sharks at Ningaloo; Jarman and Wilson, 2004) and other mesoplankton in the region of Ningaloo Reef have been published by Wilson et al. (2001; 2003). Preliminary work on the food chains leading to the prey of whale sharks is underway (Marcus et al., 2016, 2019). This ongoing research may identify the physical and biological factors correlated with whale shark abundance at Ningaloo and thus result in a better understanding of variability in the ecosystem. Such information is essential if the effects of an oil spill or development are to be discerned against a background of natural changes in distribution and abundance of whale sharks.
Initiation criteria	Operational monitoring indicates that Ningaloo Coast whale shark aggregations are contacted or predicted to be contacted by oil. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	The termination criteria for this monitoring program are: • Measured parameters of whale shark abundance and distribution are not significantly different to baseline levels ; **AND** • The water quality at feeding/ aggregation sites has been measured as not significantly different to baseline levels.
Methodological approach	During spill activities may require the following surveys and sampling: • Aerial surveys • Satellite tagging • Toxicology • Food chain studies • Photo-identification • Vessel and plane logs • Acoustic tagging The methodologies adopted will follow the approaches of those baseline studies identified allowing consistency of data from baseline to impact and recovery phases.
Scope of works	Prepared within 24 hours of this SMP being activated
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been approved
Analysis and reporting	Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

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Appendix O: SMP Activation Process

Oil Spill Scientific Monitoring Activation and Response Process

Step	Responsibility	Action	Timeframe#	Resources	Date/Time Complete
Phase 1 – Activation					
1	Santos IMT (Environmental Team Leader (ETL))	Astron Monitoring Coordinator notified of incident.	On approval from Santos Incident Commander	Astron oil spill response phone number and answering service	
2	Astron Monitoring Coordinator (MC)	Call back client for further details, request *Activation Form* if not received.	Within 30 minutes of receiving initial notification	Activation Form	
3	Astron MC	Call Planning & Logistics Officer to advise of incident.	Immediately following Step 2	n/a	
4	Santos IMT (ETL)	Complete *Activation Form* and submit to Astron via email.	Within one hour following initial notification (Step 2)	Activation Form	
5	Astron Planning & Logistics Officer (PLO)	Notify MCT, Technical Advisors and key subcontractors via SMS Global.	Within 30 minutes of Step 3	SMS Global Guidance	
6	Astron PLO	Notify all staff of incident via SMS Global.	Within one hour of receiving Activation Form	SMS Global Guidance	
Phase 2 – Response Planning					
7	Astron MC	Maintain verbal communication with Santos IMT (ETL).	At least twice daily (0800 and 1700)	n/a	

Step	Responsibility	Action	Timeframe#	Resources	Date/Time Complete
8	Astron MC Astron Operations Officer Astron PLO	Maintain Functional Log.	Daily	Functional Log	
9	Astron PLO	Set up Command Room.	Within 4 hours of activation (Step 5)	Command Room Resource Checklist	
10	Astron MC, PLO and BMT Oceanica Operations Officer	Attend Santos incident briefing and relay information to MCT.	As advised by the Santos IMT (ETL)	n/a	
11	Astron Operations Officer	MCT and Technical Advisors to meet at Royal St office, review personnel and equipment resource status.	Within 6 hours of activation (Step 5)	Capability report Training matrix Resource chart	
12	Astron PLO	Confirm availability of additional personnel and equipment resources.	Within 16 hours of activation (Step 5)	External Supplier Details Requisition Request Form	
13	Santos IMT (ETL)	Provide spill trajectory modelling and sensitive receptor information to Astron.	When available	APASA modelling Department of Transport database Santos GIS Mapping	
14	Astron MC in consultation with Santos ETL	Define the scale of response - identify which SMPs are activated. Identify if operational water quality monitoring is required.	Within 2 hours of receiving spill and receptor information (Step 13).	Scientific Monitoring Plan* Relevant OPEP Spill trajectory modelling Operational monitoring results	

Step	Responsibility	Action	Timeframe#	Resources	Date/Time Complete
15	Astron Technical Advisors in consultation with Santos ETL	**Determine monitoring locations for activated SMPs:** • Identify monitoring locations in order of priority for activated SMPs based on: o nature of hydrocarbon spill o spill trajectory modelling and time to shoreline impacts o sensitive receptors impacted or potentially at risk of being impacted o state of current baseline data o current environmental conditions o current results of operational monitoring. • Determine if post-spill pre-impact data is required to be collected from any locations. See SMP Work Method Statements for decision making process when considering availability of baseline data.	Within 6 hrs of relevant SMP activation (Step 14).	Relevant SMPs Information from Astron: • baseline information for relevant receptors. Information from Santos IMT: • sensitive receptor information from relevant EP, Santos GIS mapping and online resources (DoT oil spill response atlas, DoE conservation values atlas) • oil spill trajectory modelling • response strategies and priority protection areas • results from OMPs currently activated • baseline information for relevant receptors as reference in the relevant SMP.	
16	Astron Technical Advisors in consultation with Santos ETL	Submit Department of Parks and Wildlife Licence applications	Within 12 hrs of relevant SMP activation (Step 14)	• Proposed monitoring locations • SMP methods	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
17	Astron Operations Officer, PLO & Technical Advisors in consultation with Santos ETL	**Determine personnel requirements:** • Identify number and competencies of personnel required for monitoring teams for each SMP based on: o activated SMPs o number of locations to be monitored o number of locations where pre-spill baseline data needs to be collected o timing of hydrocarbon spill and overlap with sensitive receptors in activated SMPs o logistical and equipment resource constraints. • Arrange additional personnel if required.	Within 12 hrs of activation if pre-impact data is needed.**	Information from Astron: • Capability report • Training matrix • Resource chart • relevant SMPs and WMS. Information from Santos IMT: • sensitive receptor information • oil spill trajectory modelling • response strategies and priority protection areas • equipment (i.e. vessels, aircraft) availability • logistics (availability of flights, accommodation, etc).	
18	Astron Operations Officer, PLO & Technical Advisors in consultation with Santos ETL	**Determine equipment requirements:** • Identify number and competencies of equipment required for each SMP based on: o activated SMPs o number of locations to be monitored o number of field teams and timing of mobilisation to the field o logistical and equipment resource constraints. • Arrange additional equipment resources if required.	Within 12 hrs of activation if pre-impact data is needed.**	Information from Astron: • Resource chart • relevant SMPs and WMS. Information from Santos IMT: • equipment (i.e. vessels, aircraft) availability • logistics (availability of flights, accommodation, etc).	

Step	Responsibility	Action	Timeframe#	Resources	Date/Time Complete
19	Astron MC, Operations Officer, PLO & Technical Advisors	**Prepare and submit Monitoring Action Plan** (mission, objectives, strategies, tactics, tasks), including scope of works. **Prepare and submit cost estimate.** **Prepare and submit logistics request:** • Allocate personnel and equipment resources to field teams for relevant SMPs. • Submit SOW and logistics request for each activated SMP to Santos IMT for approval.	Within 24hrs of request for SoW (Step 15) for relevant SMP if pre-impact data is needed.**	Information from Astron: • Resource chart • relevant SMPs and WMS • agreed monitoring locations • Mobilisation and Logistics Form (incorporating SOW) • Monitoring Action Plan. Information from Santos IMT: • request for SoW • agreed monitoring locations.	
20	Santos IMT (ETL)	Santos to approve SOW, provide purchase order and initiate logistical arrangements.	Within 24 hours of SOW submission (Step 19).	Astron Mobilisation and Logistics Request	
21	Astron MC	Advise field personnel by email meeting invite, or phone if not in office.	Within 24 hours of SOW approval (Step 20).	Field team allocation	
22	Astron	Conduct incident briefing with all available Astron personnel.	Within 24 hours of SOW approval (Step 22).	Briefing template Monitoring Action Plan	
Phase 3 – Mobilisation					
24	Astron PLO	GIS and device preparation requests (field maps, data capture) submitted, and discussed with Geospatial team.	Within 24 hours of SOW approval (Step 22).	https://voyager/	
25	Astron Operations Officer	Conduct field team overview briefing, allocate tasks.	Within 36 hours of SOW approval (Step 22).	Briefing Template	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
26	Field Team Leaders	Compile SMP grab packs, GIS information, field equipment, and prepare and submit HSE documentation to Santos IMT.	Within 48 hours of SOW approval (Step 22).	Information from Astron • SoW • Grab packs, SMP WMS and HSE documentation • GIS information/field maps • field equipment. Information from Santos IMT: • booking and logistics confirmations.	
27	Astron Technical Advisors	Conduct scope specific pre-mobilisation briefings.	Prior to mobilisation.	Pre-mob Briefing Template	
28	Santos ETL	Santos to approve HSE plan.	Within 24 hours of receiving HSE Plan.	Mobilisation and Logistics Form HSE plan	
29	Astron PLO	Personnel mobilised to site.	Within 72 hrs of SOW approval (Step 22) if pre-impact data is needed.**	Approved SOW	
Phase 4 – Response Operations					
30	Astron MC	Conduct Monitoring Action Plan review with MCT and Technical Advisors and communicate to Santos IMT (ETL).	Daily	Monitoring Action Plan template	
31	Astron PLO	Hold post-demobilisation debrief with field teams.	Within 3 days of demobilisation.	Demob Meeting Template	
32	Santos ETL	Santos to arrange approval of Monitoring Action Plan revisions and any additional mobilisation/logistics requirements.	Daily or as required	Monitoring Action Plan Mobilisation and Logistics Form	
33	Astron Field Team Leaders	Provide activity reports to Santos ETL.	Daily	Daily Activity Report Template	

[#] Timeframes are indicative and may be require adjustment where activities are dependent on information availability or affected by logistical constraints

*The Scientific Monitoring Plan (EA-00-RI-10099) provides the most up to date list of SMPs and activation criteria. Refer to the OPEP for operational water quality monitoring requirements.

**If post-spill, pre-impact data is not required then timeframes will be specific to each SMP. The lead times for resourcing, preparation of SoW and mobilisation of field teams may be longer depending on the timing of the spill, likely trajectory and life stages of receptors present or likely to be impacted.

For example, in SMP4 if post-spill, pre-impact data collection is not required then mangrove decline is likely to take several weeks to occur and there is lower priority for mobilisation of field teams for this SMP within the 72 hr timeframe. In this case, mobilisation within 30 days may be more appropriate.

Abbreviations

EMBA – Environment that May Be Affected
IMT – Incident Management Team
OMP – Operational Monitoring Program
OPEP – Oil Pollution Emergency Plan
Santos – Santos Energy Australia Limited
SMP – Scientific Monitoring Plan/Program
SoW – Scope of Works
WMS – Work Method Statement

Appendix P: Scientific Monitoring Capability

Scientific Monitoring Capability:

Scientific Monitoring Assurance and Capability Assessment

Assurance arrangements

Astron Environmental Services (Astron) is currently Santos' primary Monitoring Service Provider for the implementation of SMPs 1-11. A contractual arrangement exists with Astron to maintain standby arrangements as per the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and have the resourcing capability to implement a first-strike response at all times. Astron maintains a relationship with a primary sub-contractor (BMT) for the provision of scientific monitoring for those SMPs where Astron does not have the required capability. Between Astron and BMT, capability exists to deliver first strike resourcing against SMPs 1-11.

Assurance on the continued maintenance of capability is provided through the delivery of monthly capability reports. These reports are generated by the Astron and BMT Planning and Logistics Officers and delivered to the Santos Spill Response Adviser along with a summary of any changes in resourcing or, and if required, how gaps in resourcing have been managed. Since the establishment of the scientific monitoring contract in 2015 Astron has always demonstrated through this process that it has the required capability to meet first strike resourcing as per the standby services contract.

Santos ensures that Astron/BMT standby arrangements are adequate through its exercise and auditing program. Santos regularly conducts exercises and tests with Astron and BMT to ensure that Santos IMT roles and Astron/BMT monitoring roles are familiar with the SMP activation arrangements while providing spot checks on resource availability. Santo WA has also undertaken an audit of Astron against its Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162). Assurance activities to date have demonstrated a high degree of compliance with standby service requirements.

Continuous improvement

Santos is committed to further improving its oil spill scientific monitoring capability. To that end, Santos is participating in a Joint Industry Operational and Scientific Monitoring Plans (OSMP) project, governed through an APPEA-Industry Steering Committee. This project, being progressed throughout 2020-2021, is working towards a joint-industry capability for implementing a common suite of oil spill operational and scientific monitoring plans. The project aims to deliver efficiencies in implementing and testing oil spill scientific monitoring arrangements while increasing the level of resourcing and capability available to participating companies.

Baseline Data and Capability Assessment

Santos is committed to undertaking a review of the status, availability, currency and suitability of existing baseline data for oil spill scientific monitoring sources every 2 years. The latest review was undertaken in March 2019 by Astron (Oil Spill Scientific Monitoring Plan Baseline Data Review document QE-00-BI-20001) and looked at all high biodiversity value receptors in the Santos EMBA. Following this an additional assessment was undertaken in September 2019 (DC-40-RI-20017) to determine whether existing baseline data is sufficient and accessible for sensitive receptors that could be impacted from worst case Commonwealth waters spills scenarios associated with operational activities at or around Devil Creek pipeline/Reindeer platform, Varanus Island and Ningaloo Vision facilities. This study concentrated on sensitive receptor areas with minimum hydrocarbon contact times of less than seven days as indicated by stochastic spill modelling; it is considered that contact within seven days would require an enhanced understanding of available baseline data to ensure a timely response.

The assessment of baseline data included:

1. A review of the following parameters for each program identified:
   - IMCRA
   - Custodian- contact point for data
   - Spatial extent
   - Variables available for monitoring
   - Methods applied to monitoring
   - Year of most recent data capture
   - Total duration of monitoring program
   - Data completeness (number of years monitored as proportion of program duration)
   - How often data is captured
   - Appropriateness of variables (Judgement as to whether variables are appropriate for future oil spill monitoring)
   - Is there any clear indication that the monitoring will continue?
2. The quality of the following parameters were then ranked as high, medium, low or unknown:
   I. Year of most recent capture:
      - 2015-2018 (if a single data capture has occurred in the last two years, then the overall program can be considered of high quality) = high
      - 2009-2014 = medium
      - <2009 = low

   II. Duration:
      - >4 years = high
      - 2-4 years = medium
      - 1 year = low

   III. Data completeness:
      - 100% = high
      - 75-99% = medium
      - <75% = low

   IV. Frequency of capture
      - Annually = high
      - Bi-annually = medium
      - <Bi-annually = low

   V. Appropriateness of parameters
      - High/medium/low

Appropriateness of parameters was based on reference to the Scientific Monitoring Plan's targeted states for each receptor and considering whether the monitoring parameters were sufficient to compare against these states. Parameters were considered highly appropriate if all targeted states for a receptor could be quantified, of medium appropriateness if only some states could be quantified and low if the monitored parameters had little relevance to the targeted states of an individual receptor.

3. An overall assessment of each study program was then made as follows:

- All parameters rated high = overall ‘good’
- At least one parameter rated medium = overall ‘fair’
- At least one parameter rated low = overall ‘poor’
- Unknown = overall not enough data to rate

The above assessment process was also performed across monitoring programs which specified at least one of the priority protection areas within their monitoring sites. For Priority Protection areas, the above assessment was then used to determine if 1) the baseline data available could be used to detect change in the state in the event of a significant impact - Classified as “good” in the above assessment (i.e.., data was current, of reasonable duration and frequency, and employed appropriate methodologies) or 2) the existing baseline data is unlikely to be suitable to detect change in state – classified as “fair” or “poor” by the above assessment (i.e.., the data was dated, infrequent, of limited duration and/or relied on inappropriate methodologies). Following this assessment a Protection Priority Area by SMP matrix summarising recommendations on baseline data status and recommendations for further action was developed (Table 1 – see *Note 1*) based on three categories:

• Not applicable – SMP is not applicable to the priority protection area as sensitive receptor does not occur.

• Survey - current monitoring/knowledge is considered sufficient (i.e. could be used to detect change in state in the event of a significant impact) and is considered a lower priority for post-spill pre-impact data collection.

• Priority survey – current monitoring is not in place or not practicable; post-spill pre-impact baseline data collection should be prioritised.

The assessment determined for the majority of sensitive receptors within the key areas contacted by oil for the Activity of this OPEP (Montebello Islands, Barrow Island, Lowendal Islands, Dampier Archipelago and Muiron Islands) post-spill pre-impact monitoring should be prioritised, noting that alternative approaches exist for detecting impacts where it is not feasible to conduct first-strike pre-impact baseline surveys, for example, impact versus multiple control sites and/or a gradient approach. These experimental design approaches are described within the Oil Spill Scientific Monitoring Plan (EA-00-RI-10099).

Note 1: Only contacted areas relevant for the Activity of this OPEP have been presented in Table 1

Table 1: Summary of recommendations for further action based on review of available baseline data.

Receptors	Priority Protection Areas				
	Montebello Islands	Barrow Island	Lowendal Islands	Dampier Archipelago	Ningaloo/Muiron Islands
Water Quality (SMP1)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Sediment Quality (SMP2)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Intertidal Mudflats (SMP5)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Mangroves (SMP4)	Survey	Survey	Survey	Survey	Survey (not applicable for Muiron Islands)
Benthic Habitats (SMP6)	Priority survey	Survey	Priority survey	Priority survey	Survey
Seabirds/ shorebirds (SMP7)	Priority survey	Survey	Survey	Priority survey	Survey
Marine megafauna (SMP8)	Survey	Not applicable	Priority survey	Survey	Survey (not applicable for Muiron Islands)
Marine reptiles (SMP9)	Priority survey	Survey	Survey	Survey	Survey

Receptors	Priority Protection Areas				
	Montebello Islands	Barrow Island	Lowendal Islands	Dampier Archipelago	Ningaloo/Muiron Islands
Seafood Quality (SMP10)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Fish, Fisheries & Aquaculture (SMP11)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey

Based on the assessment of priority survey areas/receptors outlined in Table 1 a capability assessment was undertaken to understand whether existing scientific monitoring capability would be sufficient to mount a first-strike monitoring program to gather baseline data within a short-timeframe (<7 days), noting that in the event of very short contact timeframes mobilisation of scientific monitoring teams to priority receptor sites may not be possible within contact timeframes and experimental designs not relying on pre-impact baseline would have to be employed.

Given that Table 1 lists key areas that could be contacted based on stochastic modelling data (i.e. the outcomes of 100s of spill modelling simulations rather than a single spill event) it was not considered appropriate or credible that baseline monitoring would have to occur at all areas over this timeframe. For the purposes of the assessment (for the Activity of this OPEP) it was considered credible that only one region: Montebello Islands would potentially require priority baseline monitoring within the 7 day time period.

Table 2 outlines the required scientific monitoring capability for rapid response in LOWC scenario in the protection priority areas, and Astron's actual capability. When determining actual team capability, personnel were only allocated to a single SMP team, unless otherwise stated.

The results of the Oil Spill Scientific Monitoring Plan Baseline Data Review document (QE-00-BI-20001) and subsequent baseline and capability assessment of protection priority areas summarised herein (but detailed further in DC-40-RI-20017) has been provided within the Environment Functional Team Folder on the Emergency Response Intranet page so that this information is accessible to guide Santos IMT Environmental roles and monitoring provider roles in the event of activating oil spill scientific monitoring.

Table 2: Scenario 2 capability assessment for rapid sampling of Montebello Islands area within seven days.

Receptors	Priority Protection Areas	Required capability for rapid response (per Priority Protection area)	Actual Team Capability
	Montebello Islands		
Water Quality (SMP1)	Priority survey	1 team of 2 personnel · at least one member in each team to have experience in water sampling · at least one member in each team to have experience in deep sea sediment sampling	3 teams of 2 available
Sediment Quality (SMP2)	Priority survey		
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	1 team of 2 personnel · at least one team member with experience in shoreline macrofauna/infauna assessment	3 teams of 2 available
Intertidal Mudflats (SMP5)	Priority survey		
Mangroves (SMP4)	Survey	Not required[3]	
Benthic Habitats (SMP6)	Priority survey	1 team of 2 personnel · at least one team member with experience in benthic habitat assessment · ROV operator or divers	2 teams of 2 available
Seabirds/ shorebirds (SMP7)	Priority survey	1 ground-based survey team of 2 personnel[2] · at least one member be experienced ornithologist	4 teams of 2 available
Marine megafauna (SMP8)	Survey	1 aerial survey team of 2 personnel[1] · both to be experienced wildlife observers 1 vessel-based survey team of 2 personnel[1] both to be experienced wildlife observers	2 teams of 2 available 2 teams of 2 available

Receptors	Priority Protection Areas Montebello Islands	Required capability for rapid response (per Priority Protection area)	Actual Team Capability
Marine reptiles (SMP9)	Priority survey	1 aerial survey team of two personnel[1] · both to be experienced wildlife observers 1 vessel-based survey team of two personnel[1] · both to be experienced wildlife observers 1 ground-based survey team of 2 personnel · at least one member with experience in turtle survey techniques	2 teams of 2 available 3 teams of 2 available 3 teams of 2 available
Seafood Quality (SMP10)	Priority survey	1 team of 3 personnel · at least one member to have experience in fish identification and necropsy	3 teams of 3 available
Fish, Fisheries & Aquaculture (SMP11)	Priority survey	· at least one member to have BRUV experience	

1 Aerial and vessel surveys could be conducted by the same team. The aerial-based surveys would be conducted first and then this would help inform target areas for vessel-based surveys if time allowed for it.

2 Remote sensing data would be collected for mangroves, with no field team required to be mobilised.

Appendix Q: Forward Operations Guidance

Forward Operations Guidance:

Forward Operating Base (FOB)

For a significant Level 2/3 response requiring coordination of resources deployed to the field, Santos will set up a FOB. For a Level 2/3 spill crossing from Commonwealth to State waters (cross-jurisdictional spills) DoT will establish a FOB. **Sections 5.1** and **5.2.3** detail requirements for Santos providing personnel to a DoT FOB.

Depending upon the scale of the incident, the trajectory and the extent of the spill, Santos' Dampier facilities leased from Toll Energy may be used. These facilities are located in Toll Energy's Yard 1 and Yard 2 on Streckfuus Road Dampier, the facilities consist of a conference room and multiple offices that could be used as break-out rooms.

The Toll Energy Dampier facilities are connected to the Santos internet and telephone system. These facilities are also available to the DoT to establish a FOB for State based response.

Additional FOBs may be set up as operational requirements dictate.

Staging Areas

Staging areas for shoreline operations will be set up at shoreline response locations under the direction of the DoT as the Control Agency for shoreline response activities.

Transport

Transportation on shoreline locations will be supported by 4x4 vehicles and all-terrain vehicles. These can be supplied by locally and nationally through hire/purchase 3rd parties.

Decontamination

Decontamination areas (High Density Polyethylene (HDPE) lining provided through the provider of PPE) will be constructed for maintaining the integrity of the 'Zones' at shoreline Staging Areas, location and terrain permitting and as directed by the DoT as Control Agency for the shoreline response. Contaminated water from the decontamination areas will be regularly pumped out. All contaminated waste water will be decanted into suitable transportable medium provided by Santos' WSP for removal.

Ablutions

Staging Areas may be supported by toilet / ablution solutions; these solutions will be dictated by the location and terrain of the clean-up operations. Available facilities include:

+ Portable Toilets;
+ Trailer Mounted Toilets; and
+ Transportable Toilets.

These solutions are chemical and fresh water based and supported by weekly / fortnightly flushing servicing. The requirement of the situation will dictate if this service is supplied out of Karratha or Perth. Santos' WSP can provide disposal as required of wastewater from ablutions.

Security

To ensure that Staging Areas are secure, Santos can provide temporary fencing to contain operations / equipment during the clean-up; suppliers of temporary fencing are available in Karratha, or larger quantities may need to be sourced from Perth. If required, the specialist services of security providers will be engaged.

Messing

Messing and catering facilities can be provided through one of Santos' current service providers, under local arrangements as determined by capacity and facilities geographically available.

Cleaning and repair

Cleaning and repair of booms and other operational equipment this can be carried out in bunded areas at the forward staging area or supply base facilities.

Suppliers

All material, associated equipment and services will be sourced, where possible, through existing Santos suppliers. Service Orders will be raised if other/new suppliers are to be engaged to provide services etc. in the event of an oil spill.

Accommodation

Accommodation options for field responders and FOB personnel will be dictated by proximity to their respective activity areas, to ensure maximum utilisation of the shift time available.

Mainland accommodation is available at Dampier/ Karratha, Onslow and Exmouth. Santos' Devil Creek accommodation close to Karratha may also be used.

Where possible local facilities will be utilised to accommodate response personnel, however transportable accommodation and messing facilities can be supplied through contract suppliers if required.

Santos has access to transportable accommodation and messing facilities supplied through Santos contracted service provider and its subcontractors.

Where additional support and remote accommodation is required, Santos would engage the market for provision of a complete service for remote messing and accommodation, inclusive of transportation, laundry, portable water etc.

Transportation to respective work sites would be facilitated via modal and multimodal transport solutions, dictated by the geographical constraints of each site. Under current contractual arrangements, Santos has access to transportation providers for Land, Air and Marine operations. In general, from accommodation locations to operational areas transport would be via road using the services of our third party supplier. Should additional services be required to meet the demand, this would be engaged under a Service Agreement as determined and authorised by the IMT.

Providoring

Providoring arrangements, when utilising local facilities would be covered under Service Orders / Purchase Order Terms and Conditions, however if required Santos has existing contracts with local who could be used for additional providoring support. These supplies would be transported to the respective spill response staging area by one of Santos' third party logistics providers.

For transportable and remote messing, the providoring requirements would be provided directly through accommodation provider including the transportation thereof.

PPE

Santos would utilise the services of specialist providers of PPE for clean-up operations. All PPE would be sourced in Perth and transported by one of QE's third party logistics providers to the forward operating centres.

The disposal of contaminated PPE is provided by Santos' WSP.

PPE requirements for spill responders is detailed in the Santos Oil Spill Response Health and Safety Manual (SO-91-RF-10016).

Response Personnel Clean-up Crew

Santos can provide an initial clean-up workforce from existing Santos and AMOSC staff and contractors. This could provide up to 150 personnel immediately from Varanus Island, Dampier Supply Base, Karratha and Perth office, and AMOSC core group responders from around Australia.

Santos has an arrangement in place with a number of service providers its day-to-day operations which would be utilised for providing skill response personnel. Additionally, Santos would access labour hire arrangements for untrained work force required for low skill labour intensive operations, including shoreline clean-up and roles within an oiled wildlife facility. On the job training and inductions would be provided to enable personnel to perform their functions safely and effectively.

Radio communications

Santos would utilise the services of a specialist communication provider, mutual aid arrangements, or control agency arrangements to access hand-held and vehicle mounted Ultra-High Frequency (UHF) radios to support response and clean-up personnel. Portable deployed repeater stations (battery or mains powered) can be positioned along the shoreline to provide a ‘voting’ system for transmitting and receiving during the clean-up operation.