Frigate-1 Wellhead Oil Pollution Emergency Plan (OPEP)

PROJECT/FACILITY	Drilling and Completions
REVIEW INTERVAL	60 Months
SAFETY CRITICAL DOCUMENT	NO

Rev	Owner	Reviewer/s Managerial/ Technical/ Site	Approver	Functional Endorser
	Senior Oil Spill Response Coordinator	Team Leader – Environment Emergency Response Co-ordinator	Manager – HSE Offshore WA	Crisis, Emergency, Response and Security
0		Dawn Macinnes 		

Rev	Rev Date	Author/Editor	Amendment
A	14/02/2022	Consultant/Santos	Internal review
B	21/03/2022	Consultant/Santos	Internal review
0	28/04/2022	Santos	Submitted to NOPSEMA

Distribution	OPEP	
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DoT	●	
AMSA	●	
OSRL	●	
Santos Intranet – Emergency Preparedness	●	

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List of Acronyms

Abbreviation	Description
AIS	Automatic Identification System
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMP	Australian Marine Park
AMSA	Australian Marine Safety Authority
APPEA	Australian Petroleum Production & Exploration Association
API	American Petroleum Institute
AUV	Autonomous Underwater Vehicle
BAOAC	Bonn Agreement Oil Appearance Codes
CM	Control Measure
CMT	Crisis Management Team
DAWR	Department of Agriculture and Water Resources
DBCA	Department of Biodiversity, Conservation and Attractions
DoE	(Australian) Department of the Environment (now DAWE)
DoEE	(Australian) Department of the Environment and Energy (now DAWE)
DAWE	(Australian) Department of Agriculture, Water and Environment
DISER	Department of industry, Science, Energy and Resources
DoT	Department of Transport
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environment Regulation
EMBA	Environment that May Be Affected
EP	Environment Plan
EPA	Environmental Protection Authority
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
EPO	Environmental performance outcome/objective
EPS	Environmental performance standard
ER	Emergency Response
ESC	Environmental Scientific Coordinator
ETL	Environment Team Leader
FOB	Forward Operations Base/s
GIS	Geographic Information System
HMA	Hazard Management Agency

Abbreviation	Description
IAP	Incident Action Plan
ICC	Incident Command Centre
IMO	International Maritime Organisation
IMSMP	Invasive Marine Species Management Plan
IMT	Incident Management Team
IRT	Incident Response Team
IS	Information Systems
JSCC	Joint Strategic Coordination Committee
MBES	Multi-beam echo sounding
MDO	Marine Diesel Oil
MEECC	Maritime Environmental Emergency Coordination Centre (DoT)
MEER	Maritime Environmental Emergency Response (DoT)
MFO	Marine Fauna Observer
MNES	Matters of National Environmental Significance
MOU	Memorandum of Understanding
MP	Marine Park
MSA	Master Services Agreement
MSP	Monitoring Service Providers
N/A	Not Applicable
NC	No Contact
NEBA	Net Environmental Benefit Analysis
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NRT	National Response Team
NW	North-West
OPEP	Oil Pollution Emergency Plan
OPGGS(E)(R)	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPICC	Offshore Petroleum Coordination Committee
OSC	On-scene Commander
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organisation
OSTM	Oil Spill Trajectory Modelling
OWA	Oiled Wildlife Advisor
OWR	Oiled wildlife Response

Abbreviation	Description
ROV	Remote Operated Vehicle
SBP	Sub-bottom profiling
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SLA	Service Level Agreement
SMP	Scientific Monitoring Plan
SMPEP	Shipboard Marine Pollution Emergency Plan
SMPC	State Marine Pollution Coordinator
SOPEP	Shipboard Oil Pollution Emergency Plan
SRT	State Response Team
SSS	Side-scan sonar
TRP	Tactical Response Plan
UAV	Unmanned Aerial Vehicle
VBA	Vessel Based Activities
VI	Varanus Island
VMS	Vessel Monitoring System
VOCs	Volatile Organic Compounds
VOO	Vessels of Opportunity
VPO	Santos Vice President Offshore Upstream WA
WA	Western Australia
WAOWRP	WA Oiled Wildlife Response Plan
WSP	Waste Service Provider

1 Quick Reference Information

<table>
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<tr><td>Petroleum Activity</td><td colspan="3">Vessel based site survey involving geophysical survey techniques in Commonwealth waters</td><td>Section 2 of the EP</td></tr>
<tr><td>Modelled Spill Locations (Lat/Long)</td><td colspan="3">Frigate-1 wellhead
Latitude: 13° 10' 48" S
Longitude: 127° 55' 25" E</td><td>Table 3-1 of the EP</td></tr>
<tr><td>Permit Areas</td><td colspan="3">WA-40-R (Commonwealth waters)</td><td></td></tr>
<tr><td>Installation Type</td><td colspan="3">N/A</td><td></td></tr>
<tr><td rowspan="3">Water Depth

Worst-case Spill Scenarios</td><td colspan="3">Approximately 112 m</td><td></td></tr>
<tr><td>Scenario</td><td>Hydrocarbon</td><td>Worst case volume (m³)</td><td rowspan="2">Section 6.1</td></tr>
<tr><td>Surface diesel release (surface spill)</td><td>Marine Diesel Oil</td><td>60</td></tr>
<tr><td>Hydrocarbon Properties</td><td colspan="3">Marine Diesel Oil (MDO)
Specific gravity = 0.843
Dynamic viscosity (cP) = 3.9 @ 20° C
API Gravity = 36.4</td><td>Appendix A</td></tr>
<tr><td>Weathering Potential</td><td colspan="3">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.
Under low winds (1 m/s), 59% of the surface slick is predicted to remain after 120 hours (five days). With moderate winds (5 m/s), no MDO is predicted to remain on the surface after 72 hours and under high winds (10 m/s) after 6 hours. Conversely, stronger wind speeds will generate breaking waves at the surface, causing a higher amount of MDO to be dispersed into the water column and reducing the amount available to evaporate.</td><td>Appendix A</td></tr>
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2 First Strike Response Actions

For an oil spill to the marine environment, initial response actions to major incidents are under the direction of the Vessel Master and in accordance with vessel-specific procedures (e.g. emergency management plan or Shipboard Oil Pollution Emergency Plans (SOPEPs)).

Following those initial actions undertaken by the Vessel Master to ensure the safety of personnel on the vessel and to control the source of the spill, the Santos Company Site Representative will assess the situation based on:

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

Further response information contained within this OPEP is concerned primarily when the Santos Incident Management Team (IMT) is engaged for support.

For an oil spill to the marine environment the On-scene Commander (OSC) is to contact the Incident Commander (IC) in Perth via the on-call Duty Manager (as per below). The OSC is either the Santos Company Site Representative (if present) or the Vessel Master. This will be determined during the planning stages of the activity.

The worst-case spill scenario for the Frigate OPEP (60 m^3 MDO) is considered to most likely require a Level 1, or potentially a Level 2 spill response. A level 3 spill is not credible for the activity.

Level 1 spills do not typically require the stand-up of the IMT 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 2-1** 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 spills do not apply, unless specified by the Incident Commander.

Table 2-1: First strike activations

When (indicative)	Activations		Who
	Objective	Action	
All spills			
Immediate	Manage the safety of personnel	Implement site incident response procedures (vessel-specific procedures, as applicable)	OSC/Vessel Master
Immediate	Control the source using site resources, where possible	Implement site source control procedures (Vessel emergency management plan or SOPEP, as applicable) Refer to source control plan – Section 9	OSC/Vessel Master
Within 30 minutes of incident being identified	Notify Santos Offshore Duty Manager / Incident Commander	Verbal communication to Offshore Duty Manager/Incident Commander's duty phone	OSC via Company Site Representative
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	OSC via Company Site Representative
Within 60 minutes	Gain situational awareness and begin onsite spill surveillance	Level 1 spills may only require use of onsite resources to conduct monitor and evaluate activities (e.g. vessel surveillance and tracking buoys). Refer to Monitor and Evaluate Plan (**Section 10**).	OSC via Company Site Representative 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**	Initial notifications by Environment Unit Leader/ Safety Officer – **Table 7-1**
Level 2 spills (in addition to actions above)			
Immediately once notified of spill (to Incident Commander)	Activate IMT, if required	Notify IMT	Offshore Duty Manager / Incident Commander

When (indicative)	Activations		Who
	Objective	Action	
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 Incident Action Planning process Go to **Section 8** Review First Strike Activations (this table)	Incident Commander Planning Section Chief
Refer timeframes **Section 7**	Make regulatory notifications as required Notify and mobilise/put on standby external Oil Spill Response Organisations (OSROs) and Support Organisations, as required	Go to **Section 7**	Initial notifications by Environment Unit Leader/ Safety Officer OSROs (Australian Marine Oil Spill Centre [AMOSC] and 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 (**Section 10.4**) Satellite Imagery (**Section 10.5**) Initial Oil Characterisation (**Section 10.5**) Operational Water Quality Monitoring **(Section 10.6)**	IMT Operations Section Chief IMT Logistics Section Chief/Supply Unit Leader IMT Environment Unit Leader
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 Section Chief IMT Logistics Section Chief/Supply Unit Leader

When (indicative)	Activations		Who
	Objective	Action	
Activate on Day 1 for applicable scenarios Refer **Section 11**.	Reduce exposure of shorelines and wildlife to floating oil through mechanical dispersion	Activate the Mechanical Dispersion Plan Go to **Section 11**	IMT Operations Section Chief IMT Logistics Section Chief/Supply Unit Leader
Day 1	Identify environmental sensitivities at risk and conduct NEBA	Review situational awareness and spill trajectory modelling Review strategic NEBA and begin operational NEBA (**Section 6.7**)	IMT Environment Unit Leader
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 Santos *Oil Spill Response Health and Safety Management Manual* (SO-91-RF-10016)	IMT Safety Officer
If/when initiated Refer **Section 12**	Prevent or reduce impacts to wildlife	Activate the Oiled Wildlife Response Plan. Go to **Section 12**	IMT Environment Unit Leader IMT Operations Section Chief IMT Logistics Section Chief /Supply Unit Leader
If/when initiated Refer **Section 13**	Safely transfer, transport and dispose of waste collected from response activities.	Activate the Waste Management Plan. Go to **Section 13**	Operations Section Chief Logistics Section Chief / Supply Unit Leader
If/when initiated Refer **Section 14**	Assess and monitor impacts from spill and response	Activate the Scientific Monitoring Plan. Go to **Section 14**	IMT Environment Unit Leader IMT Logistics Section Chief/Supply Unit Leader IMT Operations Section Chief

When (indicative)	Activations		Who
	Objective	Action	
IMT Actions (48+ hours)			
Ongoing	+ For ongoing incident management – indicatively 48 + hours – a formal incident action planning process is to be adopted to continue with spill response strategies identified above. An Incident Action Plan (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 the Australian Maritime Safety Authority (AMSA) or Western Australia (WA) Department of Transport (DoT) may be the 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's support to DoT for a State waters response is detailed in **Section 4.5.2**		Control Agency IMT Santos to provide the following roles to DoT Maritime Environmental Emergency Coordination Centre (MEECC)/IMT for WA State waters response (refer to Table 5-5): + CMT Liaison Officer + Deputy Incident Controller + Deputy Intelligence Officer + Deputy Planning Officer + Environment Support Officer + Deputy Public Information Officer + Deputy Logistics Officer + Deputy Waste Management Coordinator + Deputy Finance Officer + Deputy Operations Officer + Deputy Division Commander (Forward Operating Base [FOB]).

3 Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the *Frigate-1 Wellhead Environment Plan (EP)* (*SO-91-BI-20024*) (referred to throughout this OPEP as the Frigate EP) 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 Energy Ltd. (Santos) proposes to conduct a well inspection survey to confirm the status and location of the plugged and abandoned Frigate-1 wellhead; to inform decommissioning options. The well was drilled in 1978 but did not encounter any hydrocarbons (i.e. was 'dry'); and was abandoned the same year, with the wellhead left in place.

The well is within permit WA-40-R in approximately 112 m water depth, located in Commonwealth waters (**Figure 3-1**).

The wellhead inspection survey will involve an ROV deployed from a small utility vessel to locate and inspect the wellhead using general video inspections and acoustic techniques. The survey may take <7 days; notionally proposed for September 2022, depending on the availability of vessels as well as the timing of the neap tides (though the EP allows for the survey to be undertaken at any time of year).

A small utility vessel will transport equipment and personnel, and be used to deploy an ROV. The vessel will be fuelled by marine diesel oil (MDO), however there is no planned vessel refuelling to take place in the operational area.

The worst-case credible spill scenario was identified as:

- A vessel collision/failure resulting in a 60m^3 marine diesel oil (MDO) spill.

Refer to Section 2 of the Frigate EP (SO-91-BI-20024) for details on the activity.

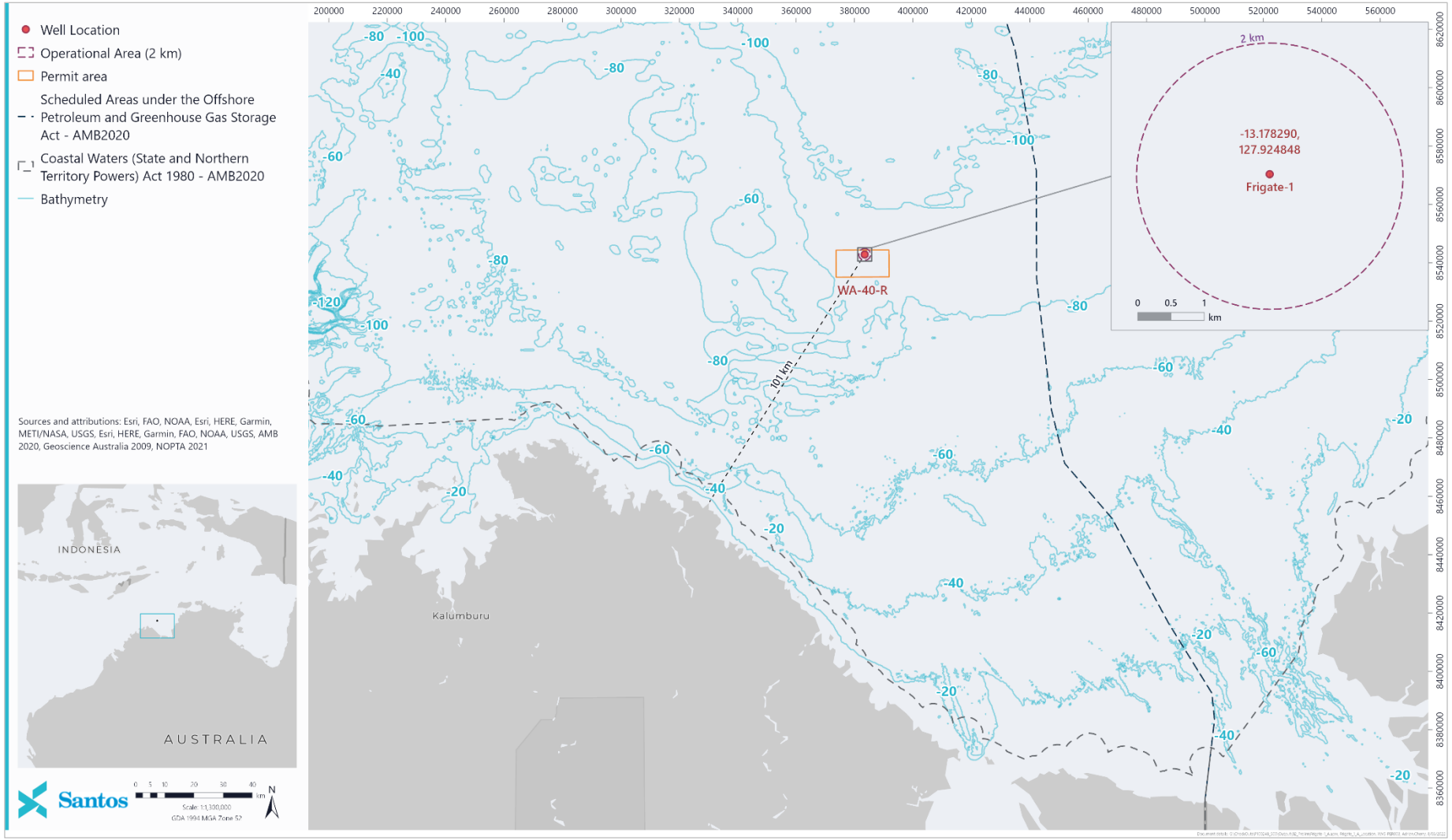

Figure 3-1: Location of Frigate-1 wellhead survey activity

3.2 Purpose

The purpose of this Oil Pollution Emergency Plan (OPEP) is to describe Santos' response to a hydrocarbon spill during vessel-based activities at the Frigate-1 wellhead.

This OPEP has been developed to meet all relevant requirements of the Commonwealth (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 the Australian Maritime Safety Authority (AMSA) and the WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE).

This OPEP is to be read in conjunction with the Frigate-1 Wellhead Environment Plan (referred to as the Frigate EP; SO-91-BI-20024) 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 Frigate EP (SO-91-BI-20024) 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 Net Environmental Benefit Assessment' (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
- Keep stakeholders informed of the status of the hydrocarbon spill response to aid in the reduction of social and economic impacts.

3.4 Operational Area

The Frigate EP covers well inspection survey vessel-based activities conducted entirely within Commonwealth waters in Santos permit area WA-40-R within an operational area of 2 km by 2 km centred around the wellhead (**Table 3-1**). The operational area is shown in **Figure 3-1** and **Figure 3-2**. The nearest shoreline to the operational area is approximately 101 km to the south-west (**Figure 3-2**). The operational area is located approximately 186 km from the Australian mainland at its closest point (Kalumburu; **Figure 3-1**). Water depths in the operational area are approximately 112 m.

Section 3 of the Frigate EP includes a comprehensive description of the existing environment. A summary of nearest regional features and distances from the operational area are provided in **Table 3-2**.

Table 3-1: Co-ordinates of Frigate-1

Wellhead	Title	Approx. Water Depth (m)	Coordinates (Datum/Projection: GDA 94 Zone 50)	
			Latitude	Longitude
Frigate-1	WA-40-R	112.2	13° 10' 41.84" S	127° 55' 29.45" E

Table 3-2: Distances from the operational area to key regional features

Key Features	Relative Distance and Direction from Operational Area
Tern-1	14 km NW
Oceanic Shoals Australian Marine Park	53 km N
Joseph Bonaparte Gulf Australian Marine Park	122 km SE
North Kimberly Marine Park	162 km W
Darwin	466 km E
Kalumburu	186 km SW
Wadeye	209 km SE

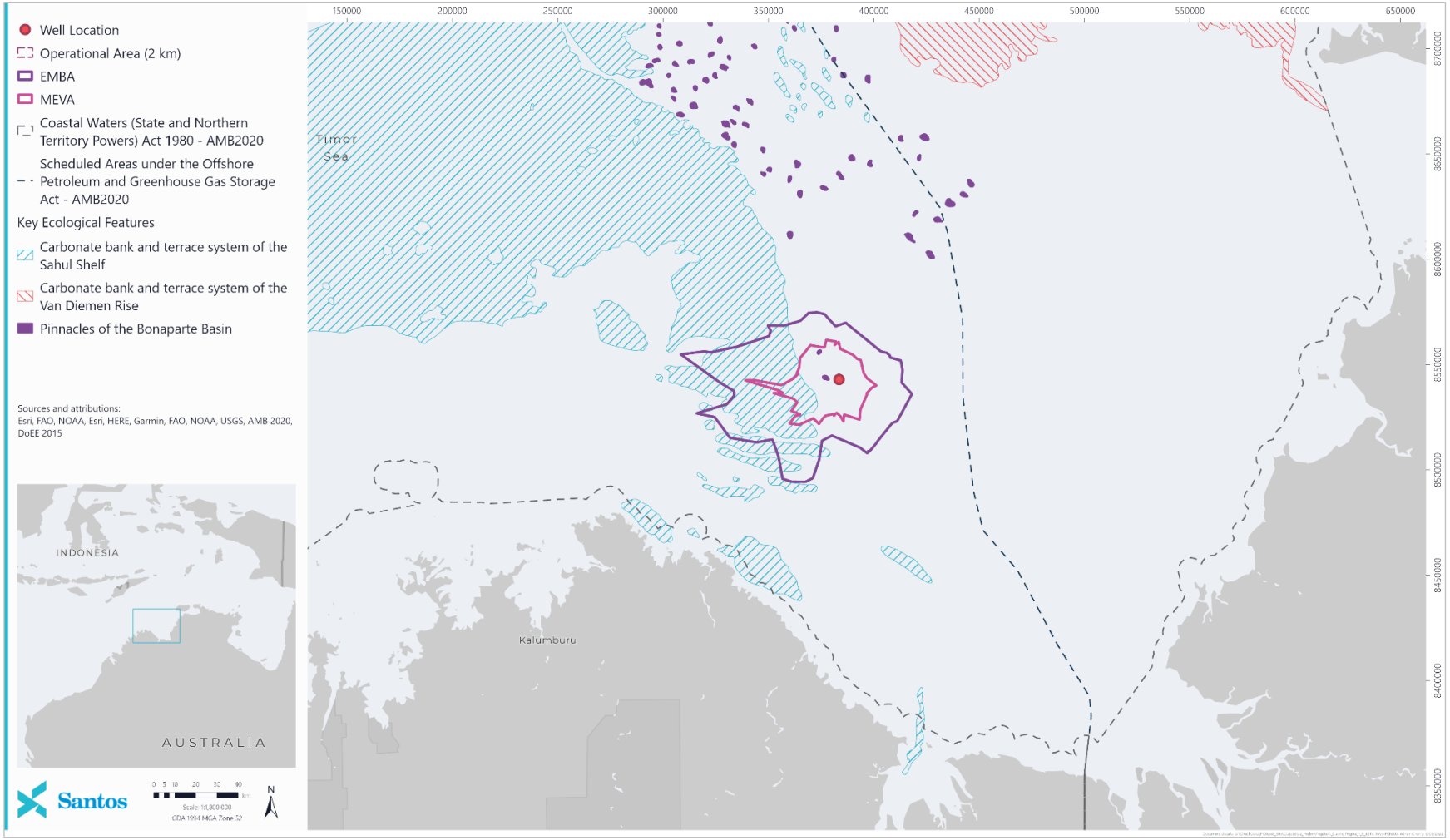

Figure 3-2: Frigate EP Operational Area, HEVA, MEVA, EMBA and regional features

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)
+ Frigate-1 Wellhead EP (SO-91-BI-20024)
+ Incident Response Telephone Directory (SO-00-ZF-00025.020)
+ Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)
+ Santos Wildlife Framework Plan (SO-91-BI-20014)
+ 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 (SO-91-RF-20022)
+ Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)
+ Oil Spill Response Readiness Guideline (SO-91-OI-20001).

3.6 Interface with external documents

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.
+ HazPlan – 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).

+ Vessel emergency management plan / Shipboard Oil Pollution Emergency Plans (SOPEP)
  - AMSA's Marine Order Part 21 [Safety and emergency arrangements] requires vessels to have an emergency management plan which includes recommended actions for dealing with emergencies, including damage to the vessel and pollution from the vessel. The emergency management plan/s must include damage control procedures and a decision support system for emergency management.
  - Under 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.
+ 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.

3.7 OPEP Administration

3.7.1 Document Review and Revision

Upon NOPSEMA acceptance, the document may be reviewed and revised, if required, in accordance with the Santos Environment Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to:

+ when major changes have occurred which affect oil spill response coordination or capabilities
+ changes to the EP 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.

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.

3.7.2 OPEP Custodian

The custodian of the OPEP is the Santos Senior Oil Spill Response Coordinator.

4 Oil Spill Response Framework

4.1 Spill Response Levels

Santos uses a tiered system of three incident response levels consistent with the National Plan for Maritime Environmental Emergencies (National Plan) (AMSA, 2020) and the WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE) (WA DoT, 2021). 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** for hydrocarbon spills.

The worst-case spill scenario for the Frigate OPEP (60 m^3 MDO) is considered to most likely require a Level 1, or potentially Level 2 spill response. A Level 3 response would not be required, due to:

+ The spill extent is locally restricted, with the actionable (moderate) thresholds extending at maximum 46 km from the release location; and low thresholds <78 km from the release location;
+ The spill extent is not predicted to cross jurisdictions – the closest that actionable (moderate) thresholds approach the WA State waters boundary is >42 km;
+ There is no contact with shorelines, emergent or intertidal features predicted at any threshold.

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/does 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 Control 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:

+ **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.
+ **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

The relevant Jurisdictional Authority and Control Agency are shown in **Table 4-2**.

To aid in the determination of whether a spill is classed as a vessel spill, the following guidance is adopted:

+ A vessel is a ship at sea to which to which the *Navigation Act 2012* applies. Defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA, 2020) as a seismic vessel, supply or support vessel, or offtake tanker.

Table 4-2: Jurisdictional authorities and control agencies for oil spill response

Jurisdictional boundary	Jurisdictional authority	Control agency (Levels 1/2/3)	Relevant documentation
Commonwealth waters (three to 200 nautical miles from territorial/state sea baseline)	AMSA	AMSA	Vessel SOPEP National Plan Frigate-1 Wellhead OPEP
Western Australian (WA) state waters (State waters to three nautical miles and some areas around offshore atolls and islands)	WA Department of Transport (DoT)	WA DoT	Vessel SOPEP State Hazard Plan: Maritime Environmental Emergencies Oil Spill Contingency Plan (OSCP) (WA DoT 2015) Frigate-1 Wellhead OPEP

4.3 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 (AMSA, 2020) on behalf of the Australian Government, working with State governments, emergency services and private industry to maximise Australia's marine pollution response capability. This includes vessels undertaking surveys and associated supply or support vessels.

WA Department of Transport (DoT) manages the State Hazard Plan for Maritime Environmental Emergencies (WA DoT, 2021) and is the Control Agency for all vessel-based spills in WA waters outside of a port proclaimed pursuant to the Port Authorities Act. For vessel-based spills within a port proclaimed pursuant to the Port Authorities Act, the relevant Port Authority or DoT may be the Control Agency.

In all circumstances, the Vessel Master is responsible for implementing source control arrangements detailed in the vessel specific emergency management plan or SOPEP.

Once initial notifications to the Control Agency are made, Santos shall maintain direct contact with the Control Agency and act as a Supporting Agency throughout the response. This includes providing essential services, personnel, material or advice in support of the Control Agency. In addition, Santos will be required to implement monitoring activities as outlined in the Monitor and Evaluate Plan (**Section 10**) and Scientific Monitoring Plan (**Section 14**).

4.4 Cross-jurisdictional Vessel Spills

If a Level 2/3 vessel spill crossed jurisdictions between Commonwealth and State waters, two Jurisdictional Authorities exist: AMSA for Commonwealth waters and DoT for State waters. Coordination of Control Agency responsibilities will be determined by DoT and AMSA based on incident specifics, with Santos providing first strike response and all necessary resources (including personnel and equipment) as a Supporting Agency, as detailed in **Section 4.4**.

The predicted actionable threshold is >42 km from the State waters boundary; therefore, a cross-jurisdictional response is not expected; however, relevant information has been included below.

4.5 Integration with government organisations

4.5.1 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 the AMSA Joint Rescue Coordination Centre (JRCC) Australia (Santos Incident Response Telephone Directory (SO-00-ZF-00025.020)).

A memorandum of understanding (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.

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.

4.5.2 Western Australian Department of Transport

In the event that vessel-based Marine Oil Pollution Incident enters, or has potential to enter, State waters, the HMA (DoT Chief Executive Officer or proxy) will take on the role as the State Marine Pollution Coordinator (SMPC) and DoT will take on the role as a Control Agency.

Moderate and low thresholds are not predicted to enter WA State waters and a Level 1 or 2 spill response is most likely; therefore, it is not expected that DoT will require activation as the Control Agency.

For any oil spill entering or within WA State waters/shorelines, DoT as the Control Agency is the ultimate decision maker regarding identification and selection of protection priorities. DoT will utilise their internal processes which typically includes the following:

+ Evaluation of situational awareness information, including all surveillance, monitoring and visualisation data provided by the Titleholder
+ Evaluation of resources at risk including use of the WA Oil Spill Response Atlas and any other relevant WA/Commonwealth government databases or other information sources
+ Evaluate shoreline types, habitat types and seasonality of environmental, socio-economic and cultural values and sensitivities
+ Consultation with the State Environmental Scientific Coordinator and other relevant State and Federal government departments with environmental responsibilities
+ Consultation with other relevant oil spill agencies, including the AMSA Environment, Science and Technology network or any other experts as necessary
+ All information is utilised in a NEBA/SIMA type process, to determine protection priorities and response strategies.

DoT will adjust/amend their internal processes to suit the spill situation at the time. Santos will notify the DoT Maritime Environmental Emergency Response (MEER) unit as soon as reasonably practicable (within two hours of spill occurring) of such an incident. On notification, the HMA will activate their MEECC and the DoT IMT.

For vessel-based oil spills entering State waters (i.e. across jurisdictions) both AMSA 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 (WA DoT, 2020), 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, noting that DoT only has jurisdictional/control agency authority within State waters.

Appendix 2 within DoT's *Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements* (WA DoT, 2020) 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 SMPC 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 11 personnel to fill roles in the DoT IMT or FOB (refer **Section 5.2**) and operational personnel to assist with those response strategies where DoT is the Lead IMT. Concurrently DoT will also provide two of their personnel to the Santos IMT as described in **Table 5-4** and Table 5-5. Santos' CMT Liaison Officer and the Deputy Incident Controller are to attends the DoT Fremantle incident command centre (ICC) as soon as possible after the formal request has been made by the SMPC. 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 SMPC. Santos personnel designated to serve in DoT's FOB will arrive no later than 24 hours after receipt of formal request from the SMPC.

Figure 4-1 shows the organisational structure of Santos incident management personnel within Santos IMT and embedded within DoT's MEECC/IMT.

Figure 4-2 shows the overall cross jurisdictional organisational structure referenced from the SHP-MEE.

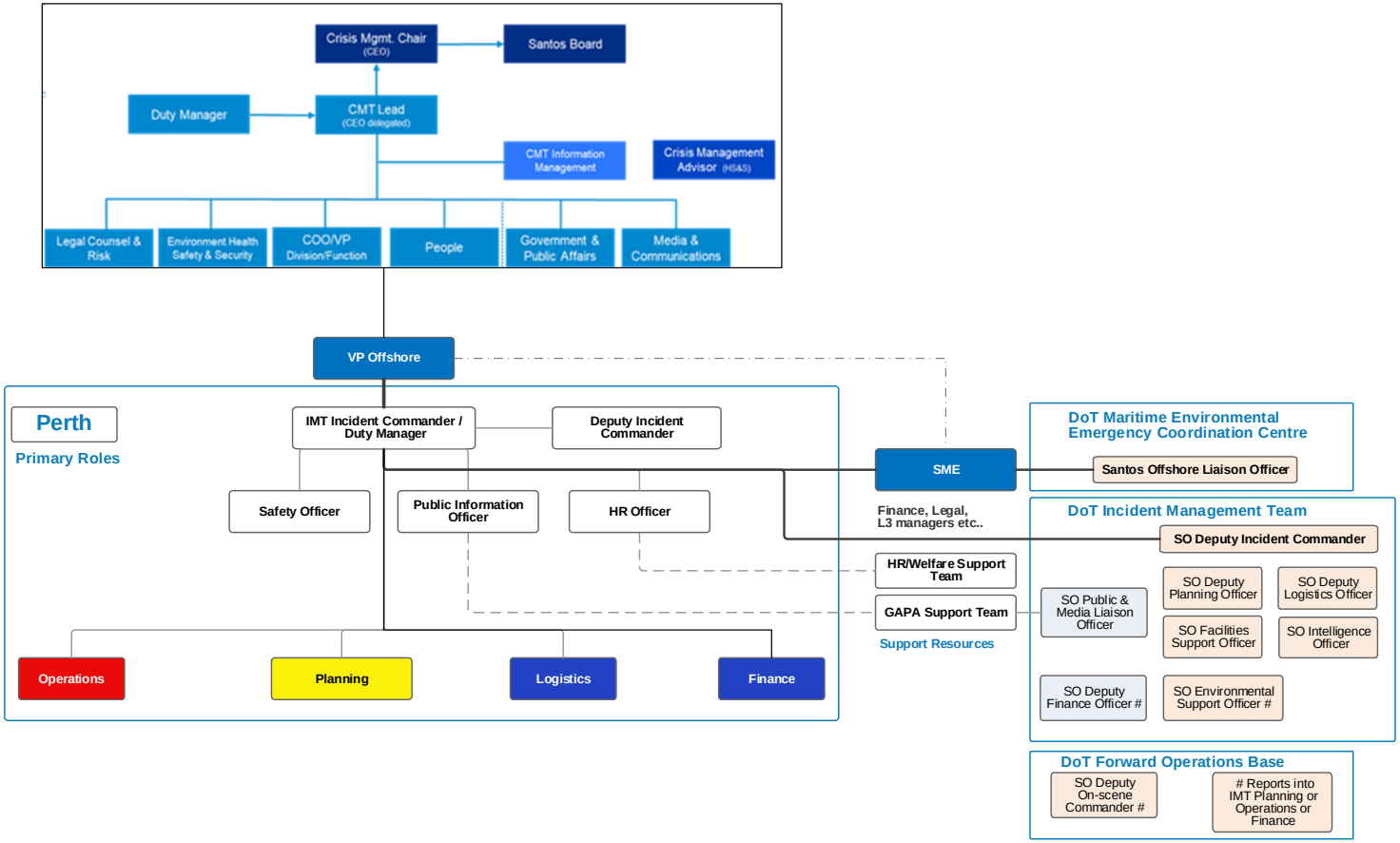

Figure 4-1: Santos cross jurisdictional incident management structure for Commonwealth waters Level 2 facility oil pollution incident entering State waters

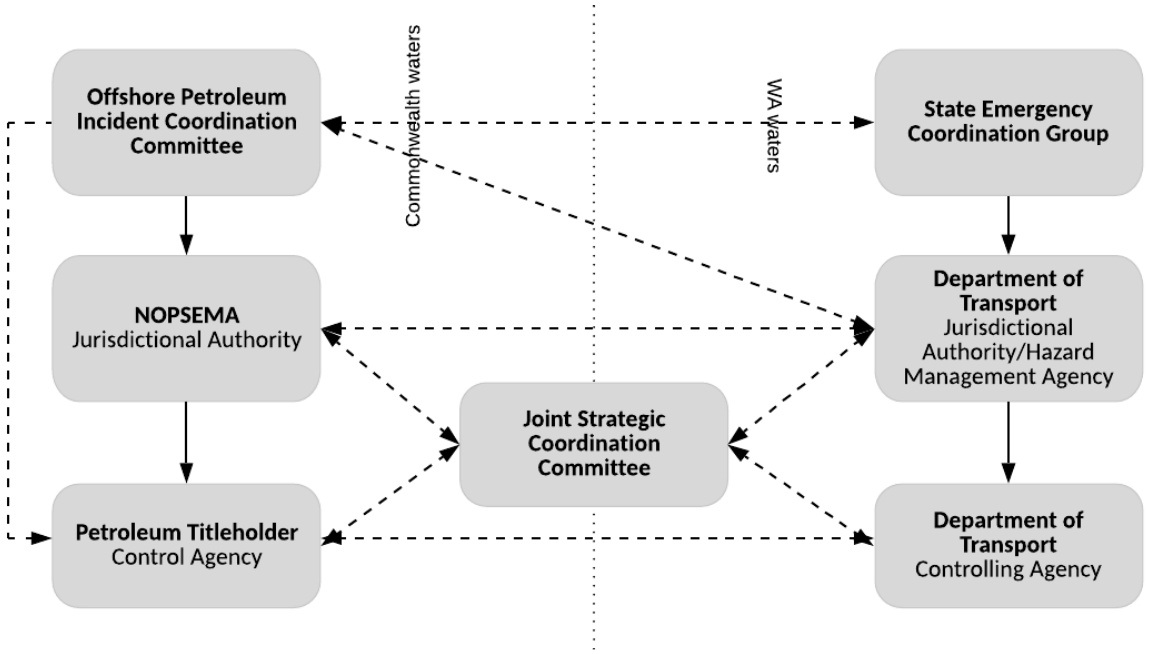

Figure 4-2: Overall control and coordination structure for offshore petroleum cross-jurisdiction incident

4.5.3 Western Australian Department of Biodiversity, Conservation and Attractions

The WA 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.

Moderate and low thresholds are not predicted to enter WA State waters and a Level 1 or 2 spill response is most likely. Due to the distance from shore and lack of BIAs within the EMBA, it is not expected that DBCA will require activation as the Jurisdictional Authority.

For a Level 2 spill that originates within or moves into State waters, DoT will be the Control Agency responsible for overall command of an OWR. 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 SMPC 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.

4.5.4 Department of Agriculture, Water and Environment

The Commonwealth Department of Agriculture, Water and Environment (DAWE) has responsibilities associated with wildlife and activities in Australian Marine Parks (AMPs). Modelling does not predict that the spill will intersect with any AMP, at any threshold.

In Commonwealth waters, DAWE is the Jurisdictional Authority for Oiled Wildlife Response (OWR), providing advice to the Control Agency (AMSA).

For a Level 2 spill that originates within Commonwealth waters, AMSA will be the Control Agency responsible for overall command of an OWR. Santos will provide all necessary resources (equipment and personnel primarily through AMOSC membership) to AMSA to facilitate this response.

4.6 Integration with external organisations

Santos has contracts in place enabling access to Oil Spill Response Organisations (OSROs). OSROs have put specific measures in place to ensure that they are able to continue to meet their commitments to members. This support can be provided directly or remotely to aid the IMT and/or IRT.

4.6.1 Australian Marine Oil Spill Centre

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 requirements, as outlined in Santos' *Master Service Contract* and *Principle and Agency Agreement* with AMOSC.

The mutual aid arrangements that AMOSC operates under are collaborated under the AMOSPlan. This provides the mechanism for members of AMOSC to access oil spill response capability of other members. To further enhance the mutual aid arrangements, Santos, BHP, Chevron and Woodside have signed a MoU that defines the group's mutual aid arrangements. Under this MoU, Santos, BHP, Chevron and Woodside have agreed to use their reasonable endeavours to assist in the provision of emergency response services, personnel, consumables and equipment.

4.6.2 Oil Spill Response Limited

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 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 Santos Incident Management

5.1 Incident management structure

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. Santos maintains internal resources (trained personnel and equipment) across its activities that provide first strike response capability and to also support an ongoing response. Should an incident occur, the IMT Duty Manager would be notified immediately. This rostered role is on-call, filled by trained Incident Commanders and available 24 hours/day and 7 days/week. The IMT Duty Manager would then activate the IMT via an automated call-out system. Documentation required in a response is accessed via the Santos Emergency Response (ER) intranet site.

As outlined in **Section 4**, control of the response may be taken over by the relevant Control 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 the establishment of an ICC[1]. 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.

The worst-case spill scenario for the Frigate-1 activity is considered to most likely require a Level 1, or potentially Level 2 spill response. A Level 3 response would not be required.

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

+ Field-based IRT (on vessel)
+ Santos IMT – Perth based ICC 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 corporate requirements as an operator in conjunction with the Perth Based Santos - Vice President Offshore Upstream WA
+ Other field-based command, response and monitoring teams for implementing strategies outlined within the OPEP.

The Santos incident response organisational structure is defined in the Santos Incident Command and Management Manual Planning (SO-00-ZF-00025), and shown in **Figure 5-1** for reference. The Santos IMT roles and field-based teams are scalable; roles can be activated and mobilised according to the nature and scale of the incident response.

[1] The Santos ICC is located in the Santos WA Perth office.

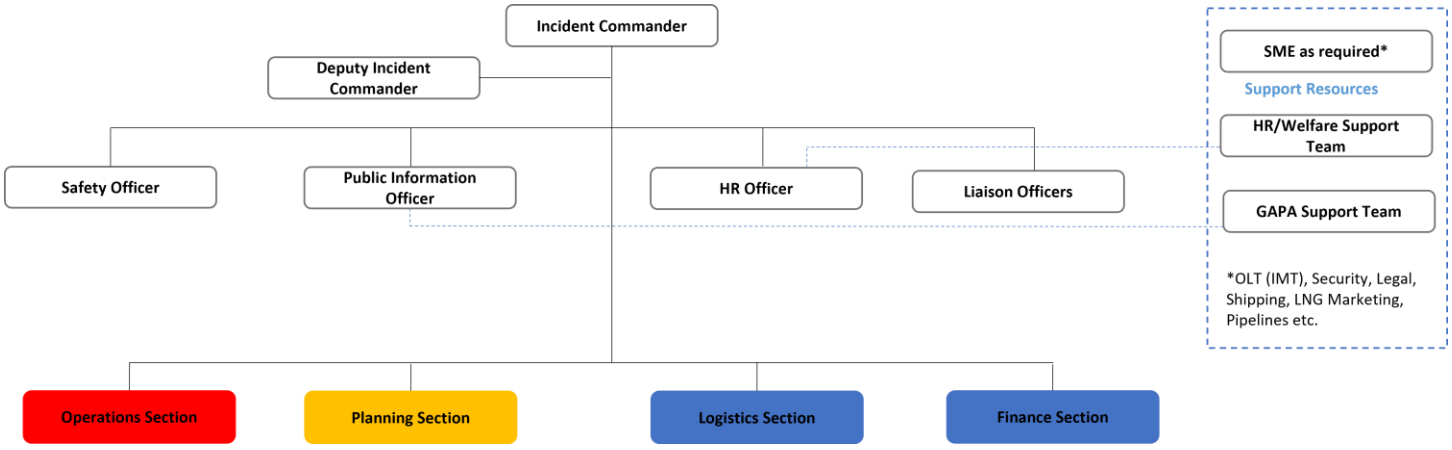

Figure 5-1: Santos Incident Management Team organisational structure

Note: For a Level 2 Petroleum Activity spills whereby DoT is involved as a Control Agency, for a cross-jurisdictional spill (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 4.5.2****.*

5.2 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 (**Table 5-3**) in responding to an incident. 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**.

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.

The details on IMT resourcing requirements for roles identified in **Table 5-2** and Table 5-5 to manage the response in the event of a worst-case discharge scenario and demonstration of the resourcing capacity available for Santos to meet those requirements are described in **Table 5-7.**

Table 5-1: Roles and responsibilities in the Crisis Management Team

Santos CMT Role	Main Responsibilities
Crisis Management Chair (CEO)	The CM Chair (Santos Chief Executive Office) is responsible for the following: + Leads crisis management direction + Provides governance and oversight of CMT operations. + Provides enterprise and strategic direction to the CMT for the resolution of the crisis event. + Delegates the CM Lead role and accountability to the appropriate ExCom designee. + Engage with the CM Leader to endorse the crisis resolution plan. + Liaise with the Santos Board and strategic stakeholders. + Provide the full extent of the company's resources to bring about a resolution and recovery from the crisis impact.
CMT Leader / Duty Manager	The CMT Leader is responsible for: + Determine the need for establishing a Level 3 response and for activating the CMT. + Determine which / if any Crisis Management Support Teams (CMSTs) are mobilized. + Leading the crisis resolution process. + Ensures internal and external notifications to key stakeholders. + Uses the crisis resolution process to determine enterprise level impacts (potential or actual) and strategic objectives. + Ensures a crisis resolution plan is developed and direct the CMT functions to implement strategies, action plans and tasks. + Determines when it is appropriate to conclude the crisis response and stand down all or a portion of the CMT.
CMT Information Management	The CMT Information Managers directly support the CMT as follows: + Support the CMT during crisis management operations. + Sets up the crisis management room, assist with set-up of communications, video conferences and information transfer within the CMT. + Advises on CMT operating processes and available resources. + Assisting with reserving break out rooms for the CMT functions and CMSTs. + Ensuring CMT crisis resolution forms are used and displayed on the monitors. + Provides incident action plan information when an IMT is established. + Monitoring and managing the welfare needs of the CMT.

Santos CMT Role	Main Responsibilities
Crisis Management Advisor	The CMT Management Advisor is responsible for the following: + Provides CMT process guidance and advice to CMT Leader, Function Leads, and CMST. + Supports and facilitates the crisis resolution planning process. + Acts as the liaison between the CMT and IMT. + Work with CMT Information Managers to manage roster and handovers for extended CMT operations. + Schedules and facilitates post crisis debriefs and after-action reviews. The CMT Advisor will support the CMT Leader as follows: + Facilitates CMT activation requirements with the CMT Leader. + Assists the CMT Leader in maintaining an ongoing assessment of incident potential and analysis of stakeholder impacts. + Advises the CMT Leader on CMT structure and requirements for CMST engagement. + Coordinates tasks delegated by CMT Leader. + Provide tools to the CMT Leader for review and crisis assessment meetings.
CMT Core Function Leaders	CMT Core Function Leaders include Leaders for the following areas: + Legal Counsel and Risk, + Environment Health Safety and Security, + COO/VP Division/ Function, + People, + Government and Public Affairs, + Media and Communications The CMT Core Function Leaders are responsible for the following: + Participate and contribute to the crisis resolution planning process. + Each Function Leader shall determine critical communications pertaining to their area. + Mobilize and coordinate activities of the function CMST. + Advise the CMT Leader on strategic impacts, threats and mitigation created by the crisis event. + Develop and execute strategies to meet objectives endorsed by the CM Chair. + Provide support and resources via the CMST to divisional IMTs. + Ensures critical actions, decisions or points of strategic criticality are included in the CMT log. + Participates in the crisis management debrief and after-action reviews.

Table 5-2: Roles and responsibilities in the Santos Management and Incident Management Team

Santos Management/ IMT Role	Main Responsibilities
Vice President Offshore (VPO) Upstream WA	+ Depending on the level of the incident, the VPO (and/or their delegate) will act as the primary liaison to the CMT Duty Manager. + On the activation of the IMT, the VPO is advised by the Incident Commander.
Incident Commander	+ Incident Commander is responsible for the overall management of the incident. Will set response objectives and strategic directions and oversee the development and implementation of Incident Action Plans.
Safety Officer	+ Safety Officer is responsible to develop and recommend measure for assuring personnel safety and to assess and/or anticipate hazardous and unsafe situations. Safety Officer may have specialists as necessary.
Public Information Officer	+ Public Information Officer is responsible for developing and releasing information about the incident to media, incident personnel and to appropriate agencies and organisations.
Human Resources Officer	+ HR Officer is responsible for advising and assisting the Incident Commander, Command Staff and Section Chiefs on any HR related aspects of an incident.
Operations Section Chief*	+ The Operations Section Chief leads the Operations Section within the IMT and is responsible for the management of all tactical operations directly applicable to the primary assignments. The Operations Section Chief activates and supervises operational elements in accordance with the IAP and directs its execution.
Planning Section Chief*	+ Planning Section Chief will lead the Planning Section within the IMT and is responsible for the collection, evaluation, dissemination and use of incident information and maintaining status of assigned resources.
Logistics Section Chief*	+ Logistics Section Chief is responsible for providing facilities, services and materials in support of the incident. The Logistics Section Chief participates in the development and implementation of the Logistics Section of the IAP.
Finance Section Chief*	+ Finance Section Chief is responsible for all the financial, administrative and cost analysis aspects of the incident and for supervising members of the Finance Section.

* Note: The Section Chiefs are supported by various other roles that will be mobilised depending on the severity of the incident.

Table 5-3: Roles and responsibilities in the field-based response team (on vessel)

Field-Based Position	Main Responsibilities
On-Scene Commander*	+ Assess facility-based situations / incidents and respond accordingly. + Single point of communications between facility/site and IMT. + Communicate the incident response actions and delegates actions to the Incident Commander. + Manage the incident in accordance with Facility Incident Response Plan, Third Party Incident Response Plan, and/or activity specific Oil Spill Contingency Plan or OPEP. + Coordinate medical evacuations as required. + Refer to the Facility Incident Response Plan for detailed descriptions of roles and responsibilities.
Company Site Representative	+ Notify the Perth based Incident Commander of oil spills. + Coordinate onsite monitoring of oil spill and ongoing communication with Incident Commander.
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 OPEP for detailed descriptions of roles and responsibilities within the Off-Asset Oil Spill Response Team
Oiled Wildlife Response Branch	+ Respond to oiled wildlife incidents to minimise the impacts to wildlife. + Refer to the Western Australia Oiled Wildlife Response Plan (WAOWRP) for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team.
Monitoring Branch	+ 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.

** The OSC is either the Santos Company Site Representative (if any on board) or the Vessel Master. Detail agreed during the activity planning stage.*

Table 5-4: Department of Transport roles embedded within the Santos CMT/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 Control Agency)**	+ Provide a direct liaison between the Santos IMT and the MEECC. + Facilitate effective communications between DoT's State Marine Pollution Coordinator (SMPC) / the Incident Controller and Santos' appointed CMT Leader/ Incident Commander. + 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/Department of Transport (DoT) IMT

Santos roles embedded in the State MEECC/DoT IMT	Main Responsibilities
CMT Liaison Officer[2]	+ Provide a direct liaison between the Santos CMT and the State MEECC. + Facilitate effective communications and coordination between the Santos CMT Leader and the State Marine Pollution Coordinator (SMPC). + Offer advice to SMPC 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 DoT 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. + 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. + Facilitate the provision of relevant mapping originating from the Santos IMT. + Assist in the interpretation of mapping originating from the Santos IMT.

[2] The role described as the *Santos Liaison Officer (CMT*) in **Figure 4-1**

Santos roles embedded in the State MEECC/DoT IMT	Main Responsibilities
Deputy Planning Officer	+ As part of the DoT Planning Team, assist the 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. + Assist in the interpretation of the Santos 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.

Santos roles embedded in the State MEECC/DoT IMT	Main Responsibilities
Deputy Public Information Officer[3]	+ As part of the Public Information Team, provide a direct liaison between the Santos Media team and DoT IMT Media team. + Facilitate effective communications and coordination between Santos and DoT media teams[4]. + 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. + 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 in the performance of their duties in relation to the provision of supplies to sustain the response effort. + 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 Coordinator	+ As part of the Operations Team, assist the Waste Management Coordinator in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters. + Facilitate the disposal of waste through the Santos's existing private contract arrangements related to waste management and in line with legislative and regulatory requirements. + Collects Waste Collection Request Forms from DoT to action via the Santos IMT.

[3] In the event of an incident, access to media and communications response strategy and a comprehensive stakeholder list inclusive of all potentially relevant stakeholders, including indigenous organisations are contained via Santos internal intranet site for use by CMT/IMT members

[4] In the event DoT assumes the role of Control Agency in State Waters, Santos acknowledges that the DoT IMT will be the lead IMT for public information and warnings and community liaison. In such circumstances, Santos retains the right to manage its own media interests but acknowledges the strong preference for DoT and Santos to issue joint media statements and conduct joint media conferences and the importance of close liaison between the respective Media Teams.

Santos roles embedded in the State MEECC/DoT IMT	Main Responsibilities
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's 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. + Identify efficiencies and assist to resolve potential conflicts around resource allocation and simultaneous operations of Santos and DoT response efforts.
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's Forward Operations Base/s (FOB/s) and the DoT FOB. + Facilitate effective communications and coordination between Santos Division Commander and the DoT Division Commander. + Offer advice to the DoT Division 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 Coordinator deployed in the FOB on matters pertaining to Santos safety policies and procedures.

5.3 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 Control Agencies (e.g. AMSA) and third-party spill response service providers.

5.4 Training and Exercises

In order to refresh IMT roles and responsibilities and provide familiarisation with OPEP processes and arrangements, IMT workshops are conducted as per the Santos *Offshore Division Incident and Crisis Management Training and Exercise Plan* (SO-92-HG-10001).

To familiarise the IMT with functions and processes, an OPEP Desktop and Activation Exercise is undertaken as per the Santos *Offshore Division Incident and Crisis Management Training and Exercise Plan* (SO-92-HG-10001). Exercise planning takes into consideration virtual/remote access requirements and government mandate border restrictions (e.g. Covid-19).

All workshops and exercises undertaken are recorded in the Santos EHS Toolbox, with the key recommendations recorded and tracked.

5.4.1 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 Section Chief	One Level 3 exercise annually or two Level 2 desktop exercises annually[5]	+ PMAOMIR320 + PMAOMIR418 + AMOSC – IMO3 Oil Spill Command & Control
Planning Section Chief Logistics Section Chief Environment Unit Leader		+ PMAOMIR320 + AMOSC – IMO2 Oil Spill Management Course
Safety Officer Supply Unit Leader GIS Team Leader Data Manager[6] HR Officer		+ PMAOMIR320 + AMOSC – Oil Spill Response Familiarisation Training

5.4.2 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**).

[5] All IMT members are required to participate in at least one Level 3 exercise every two years
[6] Data Manager is an administrative support role, not an IMT role, but is included here for completeness

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 two years) AMOSC – IMO1 Oil Spill Operators Course	11
Santos Facility Emergency Response (ER) Teams	Present at Devil Creek, Varanus Island and Ningaloo Vision Facilities for first strike response to incidents	Internal Santos training and exercises as defined in each facility's Incident Response Plan OSC to have AMOSC – Oil Spill Response Familiarisation Training.	One ER team per operational facility per shift
Santos Aerial Observers	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 two years). AMOSC – IMO1 Oil Spill Operators Course and/or IMO2 Oil Spill Management Course	As defined in Core Group Member Reports[7] Target to maintain at least 84 members (Ref.: AMOSC Core Group Program and Policies)
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 responders guaranteed
AMOSC Staff	Professionals, providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract	As per AMOSC training and competency matrix	16
Oiled Wildlife Response Roles (Level 4)	Refer OPEP **Section 12** and **Appendix I**		

[7] An average of 35 personnel as of March 2022 (AMOSC Member's website), plus 16 AMOSC staff members (AMOSPlan, 2021).

Responder	Role	Training	Available Number
Monitoring Service Provider: Monitoring Coordination Team (MCT) and SMP Teams	Monitoring Coordination Team (MCT) SMP Teams: + Technical Advisers + Field Team Leader + Field Team Member	As defined in the Santos Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Capability defined in Monthly Capability Reports MCT – five personnel SMP Teams 12+ per team
Level 1 Oiled Wildlife Responders (Workforce Hire)	Provide oiled wildlife support activities under supervision.	No previous training required; on the job training provided	Nominally over 1,000

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 Control Agency:

+ National Plan: National Response Team (NRT) – Trained oil spill response specialists, including aerial observers, containment and recovery crews, 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, 2021); and
+ WA 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 State Hazard Plan (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 clean-up, oiled wildlife response and scientific monitoring.

5.5 Response Testing Arrangements & Audits

Santos has oil spill response testing arrangements in place in accordance with the Santos Oil Spill Response Readiness Guideline (SO-91-OI-20001) which provides a process for continual monitoring of OSRO capability. This also includes regular oil spill response equipment inventory checks from the various sources. Testing of key response provider arrangements may be 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.

5.5.1 Testing Arrangements

Santos employs a range of tests to ensure that the various response arrangements function as required. These tests include:

1. Contract/Plan Review
2. Audit
3. Notification/Communication Check
4. Desktop Exercise
5. Deployment Exercise

6. Level 2/3 IMT Exercise

The above tests and the testing schedule are detailed in full within the Santos Oil Spill Response Readiness Guideline (SO-91-OI-20001); an excerpt of the testing arrangements plan is provided in **Figure 5-2**. Objectives are set for the various tests identified for each of the response arrangements. The effectiveness of response arrangements against these objectives are assessed using pre-identified Key Performance Indicators (KPIs).

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
1	**Source Control**				
	Source Control a) Relief Well Drilling - Access to MODU	Review - MODU Register	Once per month for the duration of drilling campaign	Identify suitable MODU that can be utilized in the event of a Source control incident requiring a relief well	Document the identified suitable MODU by: •Name •MODU Type •Location •Contract Status
	Source Control b) Well Capping - Access to Capping Stack	Review - Contract/Agreement	Annually (when drilling activity is occurring)	To confirm access to capping stack for well capping	Review to confirm access to Capping Stack through maintenance of service provision contract
	Source Control c) Access to Source Control Emergency Response Personnel	Desktop Exercise	Annually (when drilling activity is occurring)	To check arrangements for access to Well Control Specialists from WWC as per Source Control Planning and Response Guideline DR-00-OZ-20001	Confirmation (email) from WWC that listed Well Control specialists can be made available and will be mobilized within 72 hours of a notification
	Source Control d) Vessel Fuel Tank Rupture - SOPEP	Review - Plan	Prior to vessel arrival in field	To confirm that each vessel within the field has an approved SOPEP in place	Review to confirm approved SOPEP in place for vessels
2	**Operational Monitoring**				
	Operational Monitoring - Vessel Surveillance a) Access to vessels	Review - Contract/Agreement	Annually	To confirm access to vessels for surveillance	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels
	Operational Monitoring - Aerial Surveillance a) Access to aircrafts	Review - Contract/Agreement	Annually	To confirm access to aircrafts for surveillance	Review to confirm Master Service Agreements (MSAs) with aircraft providers to gain access to aircrafts for surveillance
	Operational Monitoring - Aerial Surveillance b) Access to trained aerial observers	Review - Contract/Agreement	Annually	To confirm access to trained aerial observers	Review to confirm access to trained aerial observers through; •Trained Santos personnel or •AMOSC Member Contract or •OSRL Associate Member Contract

Figure 5-2: Excerpt of Testing Arrangement Plan, taken from Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001)

All testing activities are documented, and all reports generated will be saved in Santos's EHS Toolbox system and any actions, recommendations or corrective actions identified are assigned a responsible party for completion and tracked to closure. The status of completion is tracked through the 'Action module' in the EHS Toolbox and communicated widely through monthly EHS KPI reporting.

5.5.2 Audits

Oil spill response audits will follow the Santos Assurance Management Standard (SMS-MS15.1) and are scheduled as per the Santos Assurance Schedule (E-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 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 OPEPs and AMOSC's Service Level Statement.

The deployment readiness and capability of OSRL's oil spill response equipment and personnel 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' OPEPs and OSRL's SLA.

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 vessel-based activities. Of the credible spill scenarios identified in the Frigate EP, a worst-case scenario has been selected from a response perspective taking into account the following characteristics:

+ The scenario represents the maximum credible release volume
+ The scenario represents the greatest spatial extent from a response perspective based on surface oil and shoreline accumulation as these are the key factors contributing to response
+ Proximity to sensitive receptors, shorelines, State/Commonwealth boundaries, etc.

The worst-case credible spill risk selected to inform this OPEP is presented in **Table 6-1**. Detail on the derivation of this maximum credible spill is provided within the Frigate EP.

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 Frigate vessel-based activity

Worst-case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)	Release duration	Maximum extent of surface hydrocarbons >1g/m^2
Surface diesel release (surface spill)	Marine Diesel Oil	60	6 hours	~78 km

6.2 Response Planning Thresholds

Environmental impact assessment thresholds are addressed in Section 7.5 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 K**).
>50	+ Estimated minimum floating hydrocarbon threshold for containment and recovery and surface dispersant application*.
>100	+ Estimated floating hydrocarbon threshold for effective containment and recovery and surface dispersant application*. + Estimated minimum shoreline accumulation threshold for shoreline clean-up**.

** Containment and recovery and surface dispersant application are not applicable spill response strategies under this OPEP.*

*** There is no shoreline contact for the maximum credible spill scenario*

6.3 Stochastic Spill Modelling Results

Table 6-3 and **Table 6-4** present the spill modelling results at Protection Priority locations for selected worst-case scenarios only (for surface and shoreline oil; and entrained and dissolved oil respectively). All scenarios were modelled using a stochastic approach running multiple simulations (110 simulations per season) across all seasons using a number of unique environmental conditions sampled from historical metocean data.

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. However, they are still useful for indicating where a scientific monitoring response may be needed. Refer to Section 7.1.4 of the EP for dissolved and entrained thresholds and Section 7.1.5 for impacts to receptors.

Refer to Section 7.2 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 – Surface and shoreline

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total contact probability (%) floating oil >10 g/m²	Minimum arrival time floating oil > 10 g/m² (days)	Total probability (%) shoreline oil accumulation >10 g/m²	Minimum arrival time shoreline oil accumulation >10 g/m² (days)	Total probability (%) shoreline oil accumulation >50 g/m²	Minimum arrival time shoreline oil accumulation >50 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
Vessel collision/fuel tank failure - surface spill (MDO) of 60 m³ over 6 hours (Xodus, 2022)										
Pinnacles of the Bonaparte Basin KEF	49%	0.08	49%	0.08	NC	NC	NC	NC	NC	NC
Carbonate bank and terrace system of the Sahul Shelf KEF	22%	0.3	25%	0.4	NC	NC	NC	NC	NC	NC
Joseph Bonaparte Gulf AMP	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
JBG West Coast	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Van Cloon/Deep Shoals	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Kimberly Coast PMZ	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Gale Bank	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Kimberly AMP	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

NC = No Contact

Table 6-4: Worst-case spill modelling results – Dissolved and Entrained

Location	Total contact probability (%) dissolved oil (10 ppb)	Minimum arrival time dissolved oil (10 ppb) (days)	Total contact probability (%) dissolved oil (50 ppb)	Minimum arrival time dissolved oil (50 ppb) (days)	Total contact probability (%) entrained oil (10 ppb)	Minimum arrival time entrained oil (10 ppb) (days)	Total contact probability (%) entrained oil (100 ppb)	Minimum arrival time entrained oil (100 ppb) (days)
Vessel collision/fuel tank failure - surface spill (MDO) of 60 m^3 over 6 hours (Xodus, 2022)								
Pinnacles of the Bonaparte Basin KEF	72%	0.08	72%	0.08	72%	0.08	62%	0.1
Carbonate bank and terrace system of the Sahul Shelf KEF	59%	0.3	57%	0.4	56%	0.4	NC	NC
Joseph Bonaparte Gulf AMP	NC	NC	NC	NC	NC	NC	NC	NC
JBG West Coast	NC	NC	NC	NC	NC	NC	NC	NC
Van Cloon/Deep Shoals	NC	NC	NC	NC	NC	NC	NC	NC
Kimberly Coast PMZ	NC	NC	NC	NC	NC	NC	NC	NC
Gale Bank	NC	NC	NC	NC	NC	NC	NC	NC
Kimberly AMP	NC	NC	NC	NC	NC	NC	NC	NC

NC = No Contact

6.4 Deterministic Modelling

No deterministic modelling was undertaken. Stochastic modelling is considered suitable to inform the response strategies, given there is no predicted shoreline contact at any threshold and responses to surface hydrocarbons are limited to monitor and evaluate and mechanical dispersion for MDO.

6.5 Evaluation of Applicable Response Strategies

Based on the nature and scale of the credible spill scenario outlined in **Section 6.1** and spill modelling results (**Sections 6.3** and **6.4**) the following spill response strategies have been assessed as potentially applicable for combatting a spill (**Table 6-5**).

Note: The information contained in **Table 6-5** 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 spills 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 6-5: Evaluation of applicable response strategies

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
Source Control	Spill kits	✔ 1	Relevant for containing spills that may arise on board a vessel.
	Secondary containment	✔ 1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel. 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.
	Vessel emergency management plan or Shipboard Oil Pollution Emergency Plan (SOPEP)	✔ 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 emergency management plan or 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 spilled.
In-Situ Burning	Controlled burning of oil spill	X	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	✔ 2	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.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
	Aerial surveillance	✔ 1	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	✔ 1	2 x tracking buoys available in Darwin for mobilisation to site if required. 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	✔ 1	Can be implemented rapidly. 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	✔ 1	Can work under large range of weather conditions (e.g. night time, cloud cover, etc). Mobilisation restricted to image availability. Requires processing. May return false-positives.
	Operational Water Quality Monitoring	✔ 1	Used to determine the location and distribution of the entrained oil and dissolved aromatic hydrocarbon components and validate the spill fate modelling predictions.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
	Shoreline and Coastal Habitat Assessment	X	Not required. Modelling does not predict any shoreline contact at any threshold. The closest proximity that actionable oil is predicted to approach to shore is approximately 70 km.
Chemical dispersion	Vessel Application	X	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 marine diesel as it has a low additional benefit of increasing the dispersal rate of the spill while introducing the potential for increased impacts.
	Aerial Application	X	
Offshore Containment and Recovery	Use of offshore booms/skimmers or other collection techniques deployed from vessel/s to contain and collect oil.	X	Not suitable for marine diesel given its rapid weathering nature. Marine diesel spreads quickly to a thin film, making recovery via skimmers difficult and ineffective.
Mechanical Dispersion	Vessel prop-washing	✔ 2	Marine diesel is a light oil 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. 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. The suitability of mechanical dispersion 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.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
Protection and Deflection	Booming in nearshore waters and at shorelines	X	Not required. Modelling does not predict any shoreline contact at any threshold. The closest proximity that actionable oil is predicted to approach to shore is approximately 70 km.
Shoreline clean-up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	X	Not required. Modelling does not predict any shoreline contact at any threshold. The closest proximity that actionable oil is predicted to approach to shore is approximately 70 km.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
Oiled wildlife response	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation.	✔ 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. Given limited size and rapid spreading of the MDO spill, large scale wildlife response is not expected. However, there is the potential that individual birds could become oiled in the vicinity of the spill. The modelling predicts a worst-case radius of <46 km of surface exposure above the actionable threshold. Given the distance to the closest shore (approximately 70 km) and lack of important wildlife habitat (BIAs) in the area, it is not expected there would be many individuals. The feasibility of collecting oiled fauna from the deck of a vessel is difficult; given deck heights, and that a calm sea state and low wind are required, meaning there is a potential risk of injuring fauna during field collection and handling. Steam time from Frigate-1 to Darwin is approximately 17.4 hours, and the survey vessel is likely stricken (due to collision or failure), meaning a support vessel may be required to mobilise. Therefore, if oiled fauna were recovered, it could take >2 days before they could be transported to an appropriate facility on the mainland for treatment and rehabilitation. During this time, there is a risk of injury/death from inappropriate husbandry. OWR is included as a secondary response strategy; and would be undertaken pending outcomes of the operational NEBA. 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.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
Scientific Monitoring	The monitoring of environmental receptors to determine the level of impact and recovery from the oil spill and associated response activities.	✔ 1	Monitoring activities include: + water and sediment quality + 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 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 scientific monitoring plans associated with marine and coastal sensitivities.

6.6 Identify Protection Priority Areas and Initial Response Priorities

Combined spill modelling results were used to predict the Environment that may be Affected (EMBA) for Frigate-1 vessel activities (refer Section 3.1 of the Frigate 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 Frigate spill) for which detailed oil spill risk assessment has been conducted (refer Section 7.5.5.3 of the Frigate EP). From these Hot Spot areas, protection priority areas for spill response have been identified (as per Section 7.5.5.4 of the Frigate EP).

In the spill response preparedness strategy, it is not necessary for all Hot Spots to have detailed planning. For example, wholly submerged Hot Spots may only be contacted by entrained oil, and the response would be largely to implement scientific monitoring to determine impact and recovery. Hot Spots with features that are not wholly submerged (i.e., emergent features) are considered for Priority for Protection. This final determination of 'Priority for Protection' sites, for the oil spill response strategy, is based on the worst-case estimate of floating oil concentration, shoreline loading and minimum contact time at response threshold concentrations.

Receptors are evaluated in Section 7.2.4.1 of the EP. **Table 6-5** details the hotspots and PPAs from this list of contacted receptors. Rationale is included in the table when a hotspot is included, or not included as a priority for protection.

Table 6-6: Determination and rationale for the priorities for protection

Hotspots	Type	HEV ranking	Frigate-1		Rationale
			Hotspot	PPA	
Carbonate bank and terrace system of the Sahul Shelf KEF*	Submerged	5	Y	Y	+ Moderate dissolved exposure + HEV rank 5
Pinnacles of the Bonaparte Basin KEF*	Submerged	5	Y	Y	+ Moderate dissolved exposure + HEV rank 5

* Discretionary hotspots are further described in the EP, Section 7.1.5.3

Table 6-7 lists the key sensitivities and associated locations within the protection priority areas identified for the worst-case spill scenario. 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 1: Kimberley* (DoT, 2019). 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 6-7**. 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 6-7: Initial response priorities during a surface MDO release (surface spill)

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[8]	DoT Ranking (Dissolved oil)*	Relevant key periods	Minimum Arrival Time of Dissolved Oil (50 ppb)	Minimum Arrival Time of Entrained Oil (10 ppb)	Maximum time-averaged oil ashore (m^3) >100 g/m^2	Minimum arrival time to shore (days)	Initial response priority
Pinnacles of the Bonaparte Basin KEF	Hard substrate Fish and sponge habitat	2	3	N/A	0.08 days	0.08 days	NC	NC	Low
	Demersal fish aggregations Sponge biodiversity	2	3	N/A			NC	NC	Low
Carbonate bank and terrace system of the Sahul Shelf KEF	Complex submerged algal banks	2	3	N/A	0.3 days	0.4 days	NC	NC	Low
	Benthic habitats and communities	2	3	N/A			NC	NC	Low

[8] Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 1: Kimberley (DoT, 2019)

*NC= No Contact

6.7 Net Environmental Benefit Analysis

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

The Environmental Unit Leader will use the information in **Section 6.6** 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 incident action planning 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 Control 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 (refer to **Table 6-8**). 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:

+ 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 6-5**)
+ assist in determining appropriate response strategies with support of real time met-ocean 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
+ Potential effects of response strategies on each sensitivity are assessed in terms of their benefit or otherwise to the socioeconomic sensitivities
+ All persons involved and data inputs have been considered for the analysis.

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.

Table 6-8: Strategic NEBA matrix – MDO

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
Pinnacles of the Bonaparte Basin KEF (submerged)										
Habitats				N/A		N/A	N/A	N/A	N/A	
Benthic invertebrates				N/A		N/A	N/A	N/A	N/A	
Demersal fish aggregations				N/A		N/A	N/A	N/A	N/A	
Carbonate bank and terrace system of the Sahul Shelf KEF (submerged)										
Habitats				N/A		N/A	N/A	N/A	N/A	
Algal banks				N/A		N/A	N/A	N/A	N/A	
Benthic habitats and communities				N/A		N/A	N/A	N/A	N/A	
Legend										
	Beneficial impact.									
	Possible beneficial impact depending on the situation (e.g., time frames and met-ocean conditions to dilute entrained oil).									
	Negative impact.									
N/A	Not applicable for the environmental value or not applicable for hydrocarbon type.									

6.8 Oil Spill Response As-Low-As-Reasonably-Practicable 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: Oil Spill Response ALARP Framework & Assessment 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 OSC (Vessel Master or Company Site Representative) will notify Perth office for delegation of further notifications to relevant Regulatory Authorities and for further spill response assistance for Level 2 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 Officer and the Environmental Team Leader.

Contact details for the Regulatory agencies outlined in **Table 7-1** are provided within the Santos 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 spills. 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 (Joint Rescue Coordination Centre) and WA DoT (MEER unit).

State water notifications to WA DoT will apply to spills in State waters or spills originating in Commonwealth waters and moving to State waters.

The Santos Incident Response Telephone Directory (SO-00-ZF-0025.02) 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 Santos Incident Response Telephone Directory (SO-00-ZF-0025.02) 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 Environmental Performance

Table 7-3 lists the environmental performance standards and measurement criteria for external notifications and reporting.

Table 7-1: External notification and reporting requirements (Commonwealth and State waters)

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 two hours Written report as soon as practicable, but no later than three days	*Petroleum and Greenhouse Gas Storage Act 2006* *Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009 (as amended 2014)*	A spill associated with Frigate operations in Commonwealth waters that has the potential to cause moderate to significant environmental damage[1]	Notification by IMT Environment Unit Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
NOPTA **(National Offshore Petroleum Titles Administrator)** **DMIRS (WA Department of Mines, Industry Regulation and Safety)**	Written report to NOPTA and DMIRS within seven 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 Environment Unit Leader (or delegate)	Provide same written report as provided to NOPSEMA
AMSA and DoT spill reporting requirements					
AMSA Rescue Coordination Centre (RCC)[2]	Verbal notification within two hours of incident	Under the MoU between Santos and AMSA	Santos to notify AMSA of any marine pollution incident[1]	Notification by IMT Environment Unit Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
WA Department of Transport (WA DoT)[2] **(Maritime Environmental Emergency Response (MEER) Duty Officer)**	+ Verbal notification within two hours + Follow up with POLREP (**Appendix C**: POLREP) as soon as practicable after verbal notification + If requested, submit SITREP (**Appendix D**: SITREP) within 24 hours of request	*Emergency Management Act 2005* 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) that are in, or may impact, State waters. 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 Environment Unit Leader (or delegate)	WA DoT POLREP (**Appendix C**: POLREP): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf WA DoT SITREP (**Appendix D**: SITREP): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
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 Environment Unit Leader (or delegate)	Not applicable
Department of Biodiversity Conservation and Attractions **(Pilbara and/or Kimberley Regional Office)**	Verbal notification within two hours	DBCA consultation	Santos to notify DBCA of any marine pollution incident[1] Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environment Unit Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
Department of Biodiversity Conservation and Attractions **(State Duty Officer and Pilbara and/or Kimberley Regional Office)**	Verbal notification within two hours	Western Australian Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environment Unit Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
Parks Australia **(24-hour Marine Compliance Duty Officer)**	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 Environment Unit 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 + confirmation of providing access to relevant monitoring and evaluation reports when available + Details of the relevant contact person in the IMT

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
Department of Primary Industry and Regional Development (DPIRD) - Fisheries	Verbal phone call notification within 24 hours 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 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.
2. Santos reporting requirements only listed. For oil spills from vessels, Vessel Masters also have obligations to report spills from their vessels to AMSA Rescue Coordination Centre (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 but within two hours of incident having been identified	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 dispersant, containment, recovery, 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 Unit Leader (or delegate) will notify AMOSC (upon approval from Incident Commander)
Aviation Service Provider	Within two hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place.	Phone call.	IMT Logistics Section Chief (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
Duty Officers/Incident Commanders (Woodside, BHP, Chevron)	Within two hours of incident having been identified	Verbal	Mutual aid resources (through AMOSC Mutual Aid Arrangement).	Phone call.	Incident Commander (or delegate)
Darwin Supply Base	Within two hours of incident having been identified	Verbal	Assistance with mobilising equipment and loading vessels.	Phone call.	IMT Logistics Section Chief (or delegate)
Astron (Monitoring Service Provider)	Scientific Monitoring Plan initiation criteria are met (**Section 14**)	Verbal and written	Astron has been contracted by Santos to provide Standby Services for Scientific Monitoring Plans (SMPs) 1-12. 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 Unit Leader (or delegate)
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When characterisation of oil is activated (**Section 10.6**)	Verbal	Oil analysis including GC/MS fingerprinting.	Phone call.	IMT Environment Unit Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
Oil Spill Response Limited (OSRL), OSRL Duty Manager	Within two hours of incident having been identified	Verbal OSRL Mobilisation Authorisation Form	Santos has a Service Level Agreement 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 3.** 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 two 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 modelling on behalf of Santos, if required, as part of contracting arrangements with RPS Group.	Contact RPS Group Duty Officer.	IMT Environment Unit Leader (or delegate)

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**		
	Santos Incident Response Telephone Directory (SO-00-ZF-00025.020)	Santos Incident Response Telephone Directory is revised every six 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

8 Incident Action Planning

Santos incident response personnel use the incident action planning 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 incident action planning 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.
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**.

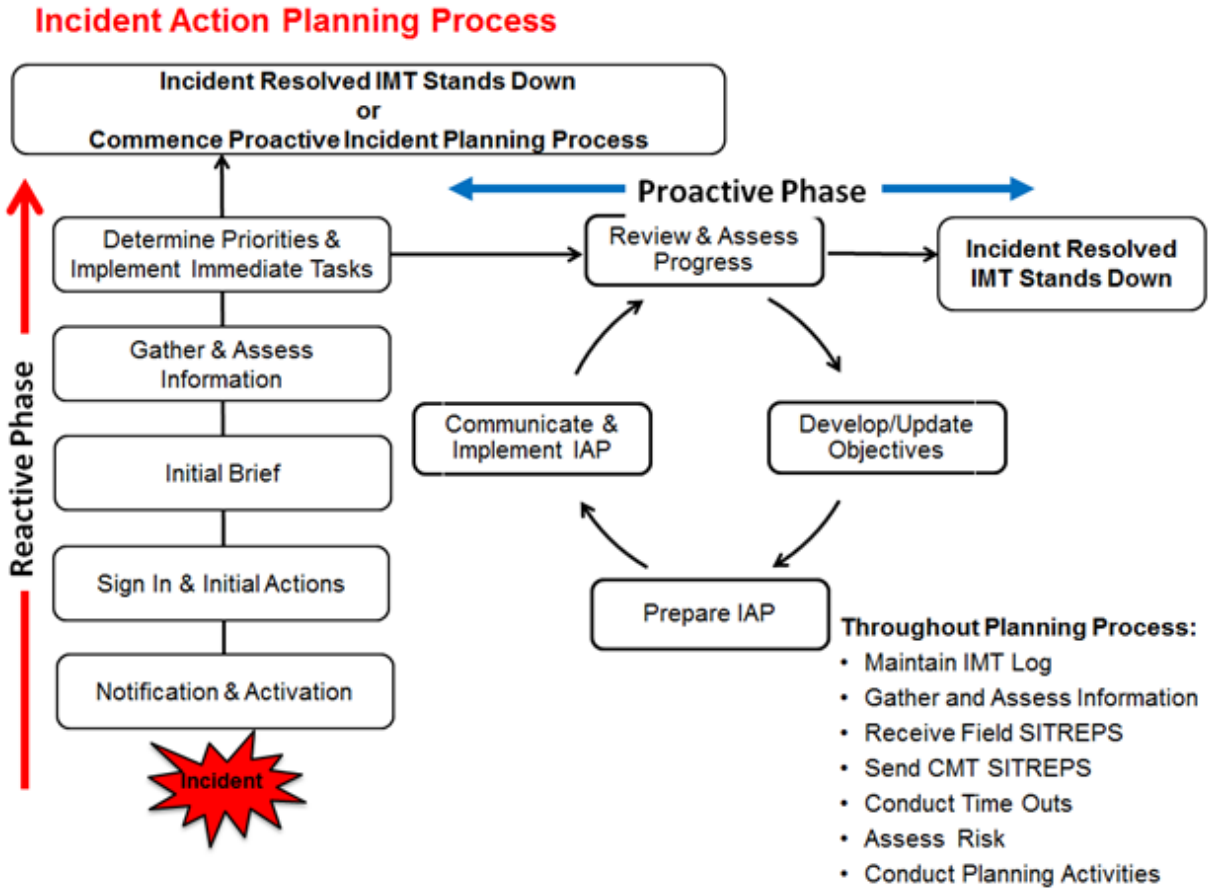

Figure 8-1: Incident Action Plan process

8.1 Reactive Phase Planning

The initial phase of the incident action planning 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 Incident Action Plan 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 the credible oil spill scenario covered by this OPEP the first strike response actions have been informed by a pre-assessment of applicable oil spill response strategies, priority response locations and a strategic net environmental benefit analysis (NEBA) also referred to as a spill impact mitigation assessment (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 6.7**). 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

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's 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 Santos *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 incident action planning. 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 incident action planning.

Table 8-1: Environmental performance – incident action planning

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

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.

Further information is detailed in vessel emergency management plans/SOPEP (as required by AMSA Marine Orders Part 21 and 91).

For vessels with a Shipboard Oil Pollution Emergency Plan (SOPEP), the SOPEP will provide the relevant initial actions to control the source of the spill.

The sections below provide an outline of source control activities noting that the Vessel SOPEP where applicable, will provide a higher level of detail for specific incidents.

9.1 Hydrocarbon Storage or Fuel Tank Rupture

Table 9-1 provides the environmental performance outcome, initiation criteria and termination criteria for source control response of a hydrocarbon storage or fuel tank rupture. The OSC 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 1/2 incident
Applicable hydrocarbons	**MDO**
	✔
Termination criteria	+ The inventory in the ruptured fuel or storage tank is secured and release to the marine environment stopped

9.2 Implementation Guidance

Implementation guidance is summarised in **Table 9-2.** In the event hydrocarbon (MDO) is released from a vessel due to a ruptured fuel tank (the worst-case scenario defined for Frigate-1), the relevant vessel specific procedures will be applied. For vessels associated with Frigate, the vessel's emergency management plan/SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident.

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 emergency management plan or Shipboard Oil Pollution Emergency Plan (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: + Reduce the head of fuel by dropping or pumping the tank contents into an empty or slack tank. + Consider pumping water into the leaking tank to create a water cushion to prevent further fuel loss. + If the affected tank is not easily identified, reduce the level of the fuel in the tanks in the vicinity of the suspected area if stability of the vessel will not be compromised. + Evaluate the transfer of fuel to other vessels. + Trim or lighten the vessel to avoid further damage to intact tanks. + Attempt repair and plugging of hole or rupture.	Vessel Master	☐

9.3 Environmental Performance

Table 9-3 indicates the environmental performance outcomes, controls and performance standards for the Source Control response strategy.

Table 9-3 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 – vessel collision	Vessel Spill Response Plan (emergency management plan/SOPEP)	Vessels associated with the Frigate-1 wellhead activity have an emergency management plan or shipboard oil pollution emergency plan (SOPEP) that outlines steps taken to combat spills	Audit records Inspection records
		Spill exercises on vessels are conducted as per the vessel emergency management plan or SOPEP	Spill exercise close out reports

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
+ Oil spill trajectory modelling
+ Satellite imagery
+ Initial oil characterisation
+ Operational water quality monitoring.

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 spill - may be deployed in a Level 1 incident (to be determined by OSC)
Applicable hydrocarbons	**MDO**
	✔
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 the affected vessel 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 OSC 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.

Section 10.8 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	Vessels of Opportunity (VOO) can be used. AIS vessel tracking is available through ER intranet page	OSC Operations Section Chief	☐
	Source additional contracted vessels if needed for assistance		Logistics Section Chief	☐
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms, located in **Appendix E** and provide to OSC (Level 1 spills) or IMT (Level 2 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 OSC	☐
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 Leader	☐
	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 Darwin or offshore location. Locations verified through AIS Vessel Tracking Software (WA VMS).	Pending availability and location. Expected within 48 hours.

Table 10-4: Vessel surveillance – First Strike response timeline

Task			Time from IMT call-out
IMT begins sourcing Santos contracted vessel or vessel of opportunity (VOO) for on-water surveillance			<90 minutes
VOO onsite for surveillance			< 48 hours (daylight dependent)
Minimum Resource Requirements			
One vessel. No specific vessel or crew requirements.			
Approximate Steam Time			
Operational Area	Nearest Deployment Location	Approximate Distance to Operational Area[9] (nautical miles)	Approximate Steam Time[10] (hours)
Frigate-1	Darwin	174	18
	Broome	437	44

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 spill - may be deployed in a Level 1 incident (to be determined by OSC)
Applicable hydrocarbons	**MDO**
	✔
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 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.

[9] As measured to geometric centre point of operational area

[10] At average rate of 10 knots

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 OSC 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.

Section 10.8 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 (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 met-ocean conditions (e.g. sea state, wind, current) + photographic/video images	Operations Section Chief Logistics Section Chief	☐ ☐

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 Section Chief Logistics Section Chief	☐
	Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation ops.	Flight plan to confirm with OSC that aircraft are permitted in the vicinity of the spill. Flights are only to occur during daylight and in weather conditions that do not pose significant safety risks.	Operations Section Chief/ Aviation Superintendent	☐
	Pre-flight briefing.		Aerial Observers Contracted aircraft provider/pilots	☐
	Aerial Observers to commence surveillance.	Consider procedure for interacting with marine fauna.	Operations Section Chief	☐
	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 Oil Appearance Code (**Appendix F**).	Aerial Observer	☐
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix H**).		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 Section Chief Operations Section Chief	☐
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 Section Chief/ Aviation Superintendent Planning Section Chief	☐

Action		Consideration	Responsibility	Complete
	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities.		Logistic Section Chief	☐
	Update Common Operating Picture with surveillance information and provide updates to spill trajectory modelling provider.		Planning Section Chief 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)	Two contracted (one primary + one back-up) + additional as required	Darwin Karratha Learmonth Onslow	Wheels up within one hour for Emergency Response. Spill surveillance <6 hours (daylight dependent)
Aerial Surveillance Crew	Santos aerial observers AMOSC Industry mutual aid	7 x Santos staff 9 x AMOSC staff 5 x AMOSC Core Group Additional trained industry mutual-aid personnel available	Perth & Varanus Island (VI) (Santos aerial observers) AMOSC and Core Group – 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 – Third-Party UAV provider Local WA hire companies	2 x pilots 2 x qualified remote pilots, however response is on best endeavour	Geelong Perth Perth and regional WA	<48 hours OSRL – depending on the port of departure, one to two days if within Australia

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
		10+		

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 (based in Darwin) + Santos trained Aerial Observers			
Approximate Flight Times			
Operational Area	Nearest Airport	Approximate distance[11] (nm)	Approximate flight time (hours: minutes)[12]
Frigate-1	Darwin	178 nm	1:29

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 spill - may be deployed in a Level 1 incident (to be determined by OSC)
Applicable hydrocarbons	**MDO**
	✔
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.

[11] As measured to geometric centre point of operational area

[12] At average flight speed of 120 knots

The OSC 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.

Section 10.8 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 mobilise tracking buoy from Darwin Supply Base	Personnel and vessel safety is priority Current Santos on hire vessels or Vessels of Opportunity (VOO) can be used. AIS vessel tracking is available through ER intranet page	Operations Section Chief	☐
	Deploy tracking buoy at leading edge of slick	Note deployment details and weather conditions in incident log	Vessel Master	☐
	Inform IMT that tracking buoy has been deployed and provide deployment details Monitor movement of tracking buoy	Refer login details of tracking buoy monitoring website on Santos ER intranet site	OSC Planning Section Chief/GIS	☐
	Use tracking buoy data to maintain Common Operating Picture	Data tracked online	Planning Section Chief/GIS	☐
	Relay information to spill fate modelling supplier for calibration of trajectory modelling		Planning Section Chief/GIS	☐
Ongoing Actions	Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations.	Incident Action Plan to provide guidance regarding any additional deployments of tracking buoys	Planning Section Chief	☐
	Mobilise additional tracking buoys if required from AMOSC stockpiles		Logistics Section Chief	☐
	Direct the deployment of the Tracking Buoys – for continuous releases over multiple days use a rolling deployment/collection of buoys to provide better coverage of plume direction		Operations Section Chief	☐
	Deploy tracking buoys		Vessel Master	☐

Action		Consideration	Responsibility	Complete
	Monitor movement of tracking buoys		Planning Section Chief/GIS	☐
	Relay information to spill trajectory modelling supplier for calibration of trajectory modelling		Planning Section Chief/GIS	☐

Table 10-11: Tracking buoys resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Tracking buoy	Santos	2	Darwin	24-48 hrs to site pending vessel availability
AMOSC tracking buoys	AMOSC	0 5 2	Broome Fremantle Geelong	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 (refer to **Table 10-12**)

Table 10-12: AMOSC equipment mobilisation timeframes

	Perth	Darwin	Exmouth	Dampier	Broome
Geelong	40 hrs 3,395 km	44 hr 3,730 km	64 hrs 4,520 km	70 hrs 4,840 km	68 hrs 4,970 km
Perth	NA	48 hrs 4,040 km	15 hrs 1,250 km	19 hrs 1,530 km	27 hrs 2,240 km
Exmouth	15 hrs 1,250 km	38 hrs 3,170 km	NA	7 hrs 555 km	16 hrs 1,370 km
Broome	27 hrs 2,240 km	22 hrs 1,870 km	16 hrs 1,370 km	11 hrs 855 km	NA

Table 10-13: Tracking buoy – first strike response timeline

Task			Time from IMT call-out
Tracking buoy deployed from Darwin			24 to 48 hours pending vessel availability
OR			
Tracking buoy deployed from Darwin using vessel of opportunity			24 to 48 hours pending vessel availability
Minimum Resource Requirements			
+ One tracking buoy for initial deployment			
Approximate Steam Time			
Operational Area	Deployment from location	Approximate Distance to Operational Area[13] (nautical miles)	Approximate Steam Time[14] (hours)
Frigate-1	Darwin	174	18

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 spill - may be deployed in a Level 1 incident (to be determined by OSC)
Applicable hydrocarbons	**MDO**
	✔
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

Oil spill trajectory modelling 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

[13] As measured to geometric centre point of operational area

[14] At average rate of 10 knots

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.

A particular 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 OSC 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.

Section 10.8 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-15: Implementation guidance – oil spill trajectory modelling

Action		Consideration	Responsibility	Complete
Initial Actions	Initiate oil spill trajectory modelling (OSTM) by submission of an oil spill trajectory modelling request form (Santos Procedure Index). Request for 3-day forecast trajectory modelling.		Environment Unit 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 is to be considered for any tactics that monitor/recover oil – especially at close proximity to release site.	Safety Officer Environmental Unit 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 Section Chief/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 Section Chief /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 Section Chief /GIS	
	Identify location and sensitivities at risk, based on the trajectory modelling and inform IMT. Conduct Operational NEBA on proposed response strategies.		Environment Unit Leader	

Action		Consideration	Responsibility	Complete
Ongoing Actions	Request spill trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture		Planning Section Chief /GIS	
	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon as input data (if or when available) to improve model accuracy		Planning Section Chief /GIS	

Table 10-16: Oil spill trajectory modelling resource capability

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

Table 10-17: Oil spill trajectory modelling – first strike response timeline

Task	Time from IMT call-out
RPS Oil Spill Trajectory Modelling (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 spill - may be deployed in a Level 1 incident (to be determined by OSC)
Applicable hydrocarbons	**MDO**
	✔
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.

Section 10.8 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 Section Chief	☐
	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 Section Chief	☐
	Assess suitability and order imagery		Planning Section Chief	☐
	Integrate satellite imagery into Common Operating Picture and provide to trajectory modelling provider for model validation		GIS Team Leader Planning Section Chief	☐
Ongoing Actions	Review surveillance information to validate spill fate and trajectory		Planning Section Chief	☐
	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 Section Chief	☐

Table 10-20: Satellite imagery resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Satellite Imagery	KSAT – Activated through AMOSC GDS – Activated through OSRL	Dependent upon overpass frequency (TBC on activation)	Digital	KSAT: one hour if satellite images available GDS: Within four hours of satellite image acquisition (i.e., latest pass with no cloud)

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 spill – may be deployed in a Level 1 incident (to be determined by OSC)
Applicable hydrocarbons	**MGO**
	✓
Termination criteria	+ Oil sample and analysis to terminate once enough data has been collected to profile the oil characteristics throughout weathering and to provide oil for toxicity testing, OR + As directed by the relevant Control Agency

Given MDO is a common fuel type with known properties, the general physical and chemical characteristics of the hydrocarbon are known and have been presented in **Appendix A**: Hydrocarbon Characteristics and Behaviour. 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.

10.6.1 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 OSC 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.

Section 10.8 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

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 Section Chief Logistics Section Chief	❑
	Source sampling equipment. Confirm sampling methodology. Confirm laboratory for sample analysis. Develop health and safety requirements/controls.	Refer **Table 10-23** for resource availability. Appendix A and D of CSIRO oil spill monitoring handbook provide suitable procedure.	Environment Unit Leader Safety Officer	❑
	Vessel directed to sampling location.	Sampling of oil at thickest part of slick – typically leading edge.	Operations Section Chief	❑
	Vessel crew to undertake sampling and delivery of samples to Darwin for dispatch to laboratory. Environment Unit Leader to confirm analysis of oil with lab.	Logistics personnel to assist with logistics of sending oil samples to laboratory for analysis.	Operations Section Chief Environment Unit Leader Logistics Section Chief	❑
Ongoing Actions	Continue sample collection 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.	Operations Section Chief Environment Unit Leader Logistics Section Chief	❑

Table 10-23: Initial oil characterisation – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Oil sampling kits	Santos	1	Darwin	Within 48 hours
Bulk oil sampling bottles	Intertek/Santos	As required	Perth Exmouth, Varanus Island, Dampier	Within 48 hours
Santos Contracted Vessel Providers VOO identified through AIS vessel tracking system	Availability dependent upon Santos and Vessel Contractor activities.	Availability dependent upon Santos and Vessel Contractor activities.	Pending availability and location. Expected within 24 hours	Santos-contracted vessel providers VOO identified through AIS Vessel Tracking
National Association of Testing Authorities (NATA) accredited laboratory/ personnel for analysis	Intertek	NA	Perth	24+ hours

10.6.2 Oil sampling and analysis

Laboratory Analysis

Using onsite VOOs, oil samples are to be taken daily where possible from fresh oil, and from the weathered oil locations, nominally representing 24 hours old, 48 hours old and 72 hours old (as they occur), and dispatched to the laboratory for analysis.

Laboratory analysis of the chemical and physical properties of the recovered oil, including gas chromatography/mass spectrometry 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 sample required for analysis will be confirmed by the laboratory but is expected to be in the order of 6 to 10 L. 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 fitted to the data (e.g. by using the Burrlioz software program).

Table 10-24: Initial oil characterisation – first strike response timeline

Task	Time from IMT call-out
Oil sample collection	<48 hours (daylight dependent)
Oil samples arrive at lab for analysis	<5 days
Minimum Resource Requirements	
• One vessel; no special requirements; oil sampling can be done concurrently with other tasks • One oil sampling kit • Sampling jars for bulk oil collection	

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 spill - may be deployed in a Level 1 incident (to be determined by OSC)
Applicable hydrocarbons	**MDO**
	✔
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 (SMP1) delivered through the Oil Spill Scientific Monitoring Plan in terms of methodology and required skillset and can be provided through Santos's Scientific Monitoring Provider (**Section 14**).

10.7.2 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.

Section 10.8 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 Incident Action Planning (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. + 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 (dissolved oxygen). + 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. + 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 Unit Leader	
	Obtain spill trajectory modelling and provide to Monitoring Service Provider.		Environment Unit Leader Planning Section Chief GIS Support	
	Develop Monitoring Action Plan (Including Sampling and Analysis Plan) for operational water quality monitoring.	Sites to be selected using oil spill trajectory modelling and distribution of oil from surveillance tactics Refer **Table 10-26** for considerations for Sampling and Analysis Plan	Monitoring Service Provider Environment Unit Leader	
	Develop health and safety plan including potential exposure to volatile gases/VOCs.	Refer Santos Oil Spill Response HSE Management Manual (SO-91-RF-10016)	Monitoring Service Provider Safety Officer	
	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 Section Chief	
	Sampling and analysis undertaken. Daily communication and confirmation of sampling plan with OSC and IMT. Daily activity/data reports provided to IMT. Oil/water samples dispatched to nominated laboratories for analysis.		Monitoring Service Provider OSC Operations Section Chief Environment Unit Leader Logistics Section Chief	
Ongoing Actions	Monitoring results to be conveyed to IMT through Common Operating Picture and provided to spill trajectory modeller to validate predictions.		Planning Section Chief GIS Support Environment Unit 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. 6 (based on capability reports)	Perth based	Personnel and equipment within 72 hours 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. Suitable vessels identified through AIS Vessel Tracking	Vessels mobilised from Darwin. 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)	

10.8 Environmental Performance

Table 10-30: Environmental performance- monitor and evaluate

Environmental Performance Outcome	Implement 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 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		
	Vessel surveillance	Minimum first strike resource requirements	Incident log

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Monitor and Evaluate – vessel and aerial surveillance		mobilised in accordance with **Table 10-4**	
		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	Vessel contractor procedures align with Santos's Protected Marine Fauna Interaction and Sighting Procedure
		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; Incident Action Plan
		Trained Aerial Observers supplied from Day 2 of response	Incident log

Environmental Performance Outcome	Implement 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
		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 2 x tracking buoys at Darwin throughout the activity	Computer tracking software Tracking 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 two hours) upon notification of a Level 2 spill	Incident Log
		Modelling delivered to IMT within two hours of request to service provider	Incident Log
	Response Preparedness		
Monitor and Evaluate – satellite imagery	Satellite imagery	Maintain membership with AMOSC and OSRL to enable access and analysis of satellite imagery	Membership contracts with AMOSC and OSRL
	Response Implementation		
Monitor and Evaluate – satellite imagery	Satellite imagery	Data incorporated into Common Operating Picture and provided to spill modelling provider	Incident Log; Incident Action Plan

Environmental Performance Outcome	Implement 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 sampling kit pre-positioned at Darwin	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 10-23**	Incident Log
		Oil samples sent to laboratory for initial fingerprinting	Laboratory Sample Chain of Custody Record
		Oil samples to be sent immediately for laboratory ecotoxicity testing of oil	Laboratory Sample Chain of Custody Record
		90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results (minimum 5 species' tests) within 24 hours of receiving all results	Ecotoxicity report from environmental contractor
	Operational Oil and Oil in Water Monitoring	IMT activates monitoring service provider within 4 hours	Incident Log

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		Operational water sampling and analysis surveys mobilised within 72 hours of approval	Incident Log

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	**MDO**
	✔
Termination criteria	+ There is no longer a noticeable reduction of surface oil resulting from the activity, or + NEBA is no longer being achieved, or + Unacceptable safety risks associated with gas and VOCs at the sea surface, or + 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 by using a vessel's propellers and wake, 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 and vessel wake 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 OSC 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 wildlife before spill naturally disperses. This activity is to be conducted during daylight hours only and once the safety plan has been developed.	Operations Section Chief Environment Unit Leader Planning Section Chief	☐
	Safety team lead to develop a safety plan for the activity with respect to potentially dangerous gasses and VOCs (including applicable controls).		Operations Section Chief Safety Officer	☐
	Notify vessel-based responders to trial mechanical dispersion.		Operations Section Chief	☐
	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. Availability dependent upon Santos and Vessel Contractor activities	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Pending availability and location.

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 Oiled Wildlife Response Plan

Note: AMSA is the Control Agency and DAWE is the Jurisdictional Authority for oiled wildlife response within Commonwealth waters for vessel spills. DoT is the Control Agency and Department of Biodiversity, Conservation and Attractions (DBCA) is the Jurisdictional Authority for oiled wildlife response in State (WA) waters.

Table 12-1: Oiled wildlife response – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) or as directed by the relevant Control Agency 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	**MDO**
	✔
Termination criteria	+ Oiling of wildlife have not been observed over a 48-hour period + Oiled wildlife has been successfully rehabilitated + Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response

12.1 Overview

Santos will provide all necessary resources to assist the relevant Control Agency in an oiled wildlife response, mainly, and initially, through its access to AMOSC oiled wildlife resources. Timely provision of equipment and personnel will be provided by AMOSC to 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 AMSA 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 AMSA.

The key plan for oiled wildlife response (OWR) in WA is the WA Oiled Wildlife Response Plan (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 WAOWRP 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 as hydrocarbons from a worst-case release scenario are predicted to weather offshore. The East Kimberley Regional Operational Plan, which sits under the WAOWRP, provides operational guidance to respond to injured and oiled wildlife in the East Kimberley region and can be used as guidance to cover the areas potentially contacted by a spill from Frigate-1 vessel operations.

The sections below provide guidance to the Santos IMT on OWR stages of response and implementation. In some cases, the implementation guidance (**Table 12-5**) includes detail which is additional to what is provided in the WAOWRP. The information below should be used in conjunction with the WAOWRP.

12.2 Stages of Response to Oiled Wildlife

The stages of OWR are described based on the WAOWRP. The WAOWRP includes eight stages to an OWR, which are described in **Table 12-2**. If an OWR is initiated, implementation will follow these stages, as appropriate to the nature and scale of the incident.

Table 12-2: 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 operational components (relevant to the scale of the OWR), being: + 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 + 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	Description
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 Response Sub-plan. This decision will be made in consultation with the relevant jurisdictional authorities and support agencies

12.3 Oiled Wildlife Response Levels and Resourcing

An impact assessment threshold of 10g/m^2 for impacts on fauna from floating hydrocarbons is provided in the Frigate-1 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 indicates that floating hydrocarbon concentrations above 10 g/m^2 may extend up to 46 km from the spill location.

Conservative estimates for OWR planning predict a worst-case OWR for this activity will be an OWR Level 1 as defined in the WAOWRP (DPaW, 2014), given the lack of shoreline contact, distance from shore, no marine mammal or bird BIAs; and no seabird roosting or marine turtle nesting sites. It is only expected that transient individuals may be present.

For a Level 1 response, it is expected that up to 6 personnel will be required, with a range of skill levels (**Table 12-4** – OWR 1 = basic training to OWR 4 = OWR Advisor; Information drawn from WAOWRP). Personnel at skill levels OWR 2 to 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 one day) for OWR personnel can be delivered as just-in-time training through an arrangement with DBCA.

Table 12-3: 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
1	6	<3 days	1 to 2/day <5 total	None	None	None	None	None
2	26	>4 to 14 days	1 to 5/day <20 total	None	<20 hatchlings No juv/adults	None	None	None
3	59	>4 to 14 days	5 to 10/day	1–5/day < 10 total	<5 juv/adults <50 hatchlings	None	<5	None
4	77	>4 to 14 days	5 to 10/day <200 total	5 to 10/day	<20 juv/adults <500 hatchlings	<5, or known habitats affected	5 to 50	Habitat affected only
5	116	>4 to 14 days	10 to 100/day >200 total	10 to 50/day	>20 juv/adults >500 hatchlings	<5 dolphins	>50	Dugongs oiled
6	122	>4 to 14 days	> 100/day	10 to 50/day	>20 juv/adults >500 hatchlings	>5 dolphins	>50	Dugongs oiled

Table 12-4: 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**

12.4 Implementation Guidance

Oiled wildlife response activities can be resource intensive and require additional personnel to be positioned within the IMT. 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 12-2** will form the key management system which will provide control and oversight over the response.

Table 12-5 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 12-5**) 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 12-6**.

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 I**.

Table 12-5: Implementation guidance – oiled wildlife response

Action		Consideration	Responsibility	Complete
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 two hours of detection.	Record all reports of wildlife potentially impacted and impacted by spill. Record reports on: + location + access + number + species + 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 DBCA State Duty Officer (who will then activate their respective Oiled Wildlife Advisors) and/or DAWE Duty Officer.	Obtain approval from IC prior to activating AMOSC Oiled Wildlife Advisor and/or DCBA Oiled Wildlife Advisor	Environment Unit 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 of the EP (Section 3)	Environment Unit Leader	☐
	Review all wildlife reports from surveillance or opportunistic activities and contact personnel who made the reports (if possible) to confirm information collected.		Environment Unit Leader Wildlife Response Branch Director	☐

Action		Consideration	Responsibility	Complete
	Use information from initial assessments to prepare an Operational NEBA. Use this information to help determine: + Initial OWR Response Level (1 to 6), as defined in the WA OWRP (**Table 12-3**). + 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 available, but an Operational NEBA should not be delayed if they are not immediately available)	Environment Unit Leader If Wildlife Response Branch is activated: Wildlife Response Branch Director	☐
Mobilisation of wildlife resources				
Determine resources required to undertake 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)	AMOSC OWA If Wildlife Response Branch is activated: + Wildlife Response Branch Director + Wildlife Reconnaissance Officer	☐
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, DBCA and/or DAWE.		Refer to **Table 12-4** Consider need for veterinary care	AMOSC OWA Logistics Section Chief If Wildlife Response Branch is activated: + Wildlife Response Branch Director	☐
Commence mobilisation of equipment (including adequate PPE) and personnel to required location/s.			Logistics Section Chief	☐

Action	Consideration	Responsibility	Complete
Contact OSRL to activate Sea Alarm if additional support is likely to be required to sustain an ongoing OWR.		Environment Unit Leader	☐

Table 12-6: 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/AMSA oiled wildlife equipment and industry OWR team to 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 (**Table 12-4**) as per the WAOWRP: + Six trained industry oiled wildlife response team personnel (AMOSC staff and contractors/AMOSC Industry OWR group) + one AMOSC OWR treatment container + one AMOSC Oiled Wildlife Deterrence Kit.	

12.5 Environmental Performance

Table 12-7 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 12-7: Environmental performance – oiled wildlife response

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.		
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 Santos, AMOSC, AMSA National Plan and Oil spill Response Limited (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

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.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Labour hire onboarding procedure (for low skilled shoreline clean-up personnel)	Development of onboarding procedure for oil spill response labour hire	Onboarding procedure
	Santos Oiled Wildlife Response Framework Plan (SO-91-BI-20014)	Santos Oiled Wildlife Response Framework Plan provides guidance for coordinating an OWR and outlines Santos's response arrangements	Santos Oiled Wildlife Response Framework Plan
	Maintain Santos personnel trained on OWR and positioned at Perth and VI	Santos personnel trained in OWR	Training records
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 12-6** unless directed otherwise by relevant Control Agency	Incident log
	OWR managed in accordance with the Santos Oiled Wildlife Response Framework Plan (SO-91-BI-20014) in Commonwealth waters, WAOWRP in state waters.	Prepare operational NEBA to help classify OWR level and determine if OWR activities are likely to result in a net environmental benefit (particularly in relation to hazing/pre-emptive capture)	Records indicate operational NEBA completed prior to OWR operations commencing
		Wildlife Response Sub-plan developed and included in the IAP to provide oversight and management of OWR operation	Records indicate IAP Wildlife Response Sub-plan prepared prior to OWR operations commencing

13 Waste Management

Table 13-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 13-1: 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	**MDO**
	✓
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

13.1 Overview

The implementation of some spill response strategies will generate 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.

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 licensed waste management facilities. All transport will be undertaken via controlled-waste-licensed vehicles. Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053) provides detailed guidance to the WSP in the event of a spill.

13.2 Implementation Guidance

Table 13-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting 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 13-2: Implementation guidance – waste management

	Action	Consideration	Responsibility	Complete
Initial Actions	Contact WSP (Primary or Secondary Contact Person) and activate Waste Project Manager.	Refer to Santos Incident Response Contacts Directory (SO-00-ZF-00025.020) for contact details.	Logistics Section Chief	❑
	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 Section Chief Planning Section Chief	❑
	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 the WA Department of Water and Environmental Regulation (DWER).	Logistics Section Chief Planning Section Chief Environment Unit 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 • Any approvals required from Ports, Local Governments, Landowners, State Government Agencies (Refer to Santos Oil Pollution Waste Management Plan (QE-91-IF-10053)).	Consider facilities for waste segregation at source.	Logistics Section Chief Planning Section Chief	❑

	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 (WA), the respective Port, Port Operator and/or Ship Owner's waste management plan.	Logistics Section Chief (or delegate) Planning Section Chief 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 Section Chief (or delegate)	❑
Ongoing Actions	Provide ongoing point of contact between IMT and WSP.	Facilities Unit Leader shall be the point of contact between the relevant Control Agency and the WSP.	Logistics Section Chief	❑
	Ensure all waste handling, transport and disposal practices comply with legislative requirements.	Alert Logistics Section Chief (or delegate) 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 (WA), the respective Port, Port Operator and/or Ship Owner's waste management plan.	WSP Location Responsible Person or Operations Supervisor	❑
	Ensure records are maintained for all waste management activities, including: • 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)		WSP Location Responsible Person or Operations Supervisor	❑

Action		Consideration	Responsibility	Complete
	• types of waste generated at each site • approvals obtained (as required).			

13.3 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 the WA DWER.

DWER administers the *Environmental Protection Act 1986* (WA). DWER is the relevant regulatory authority for waste management approvals in WA. 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.

13.4 Waste service provider capability

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

+ Maintain emergency response standby preparedness arrangements, including:
  - Have 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.
  - Participate in exercises undertaken by Santos.
+ Maintain 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.

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).

13.5 Resource requirements

Based on the credible spill scenarios, Santos do not anticipate that large volumes of waste will be generated. The potential types and total volumes of waste anticipated for each response option are provided in **Table 13-3**.

Given that large volumes of a waste are not anticipated, storage space on the spill response vessels is anticipated to be adequate. However, as soon as the details of an actual spill are available, waste management arrangements to allow a continuous response to be maintained should be reviewed.

The waste products are likely to be transported by vessel from the response location to Darwin Port or Broome Port. Waste will be transported from port to licensed waste disposal facilities by a dedicated waste contractor. Santos has existing service agreements with a WSP which include the provision of waste management services during a spill response. Transport to the licensed waste management facilities would be undertaken via controlled-waste-licensed vehicles and in accordance with the NT *Waste Management and Pollution Control Act, 2015* (if taken to Darwin Port), or the *Environmental Protection Act 1986* (WA).

Table 13-3: Waste types and volumes anticipated during a spill response

Spill Response Option	Oily Liquid Waste	Solid Oily Waste	PPE and Consumables
Monitor and evaluate	None	None	< 1 m^3/day
Mechanical dispersion	None	None	< 1 m^3/day
Wildlife response	< 1 m^3/day	< 1 m^3/day	< 3 m^3/day
Shoreline clean-up	< 1 m^3/day	12 m^3/day	< 1 m^3/day

13.6 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.

13.7 Environmental performance

Table 13-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 13-4: 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 WSP for emergency response services
	Response Implementation		
	Implement Oil Pollution Waste Management Plan (QE-91-IF-10053)	WSP to appoint a Project Manager within 24 hours of activation	Incident Log
		WSP shall track all wastes from point of generation to final destination	Waste tracking records
		WSP to provide monthly waste management reports and more regular situation reports during the response until termination criteria are met	Waste reports

14 Scientific Monitoring Plan

Table 14-1: 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 Scientific Monitoring Plans (SMPs) – **Appendix J**
Applicable hydrocarbons	**MDO**
	✔
Termination criteria	+ Refer to individual SMPs – **Appendix J**

Oil spill scientific monitoring is the principal tool for detecting and quantifying environmental impact and recovery to sensitive receptors from an oil spill. Santos is required to have an oil spill scientific monitoring plan (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.

14.1 Objectives

The overarching objective of Santos' Scientific Monitoring Plans (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 J**.

14.2 Scope

Santos will implement its SMPs, as applicable, for Frigate-1 vessel operations oil spills across both State and Commonwealth waters.

Moderate and low thresholds are not predicted to enter WA State waters; and a Level 1 or 2 spill response is most likely.

In the event that control of scientific monitoring in State waters is taken over by DoT under advice from the State Environmental Scientific Coordinator (ESC), Santos will follow the direction of DoT and provide all necessary resources (monitoring personnel, equipment and planning) to assist as a Supporting Agency.

14.3 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 Scientific Monitoring Plan.

14.4 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 Scientific Monitoring Plans relevant to Frigate-1 operations **(Table 14-2**). Those specific for shoreline receptors are not relevant, as the outer boundary of the EMBA is predicted to be 46 km from the closest shore.

These are detailed further in **Appendix J**; 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 14-2: Oil spill scientific monitoring plans relevant to Frigate-1 vessel activities

Study	Title	Relevance to Frigate-1	
SMP1	Marine Water Quality	✓	
SMP2	Marine Sediment Quality	✓	
SMP3	Shorelines and Coastal Habitats – Sandy Beaches and Rocky Shores	**X**	Modelling does not predict shoreline impact.
SMP4	Shorelines and Coastal Habitats – Mangroves	**X**	Modelling does not predict shoreline impact.
SMP5	Shorelines and Coastal Habitats – Intertidal Mudflats	**X**	Modelling does not predict shoreline impact.
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	**X**	Not relevant as the EMBA does not intersect a whale shark foraging BIA (though transient individuals may be present).

14.5 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.

14.6 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 relevant SMPs (**Table 14-2**). These services are provided by Astron Environmental Services (Astron) and primary sub-contractor (BMT) (**Appendix L**).

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

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

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

14.7 Activation

SMPs are activated as per the initiation criteria for each as outlined in **Appendix J**. The SMP Activation Process is outlined in **Appendix K**. 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 ETL 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 14-3**.

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 14-3: Scientific monitoring – first strike response timeline

Task	Time from activation of SMP
Monitoring Service Provider commences activation process once initial notification form is received from Santos	30 mins
Santos IMT approve initial monitoring plan	<24 hours
Santos to mobilise sampling platforms to deployment location	<120 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. The first strike response process for scientific monitoring field teams are presented in **Appendix K**: SMP Activation Process: + 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 + scientific monitoring equipment as detailed in the relevant SMP	

14.8 Scientific Monitoring Environmental Performance

Table 14-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 14-4: 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**		

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**
	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
	Water quality monitoring vessels	Maintenance of vessel specification for water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil sampling kit located at Exmouth, Dampier and Varanus Island	Evidence of deployment to site
	Response implementation		
	Activate Scientific Monitoring Plans	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	Incident Action Plan and Incident Log
		If any SMPs are activated, the subsequent activation of Monitoring Service Provider is to follow the process outlined in the Santos Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Incident Log
		MSP shall commence activation process within 30 mins of initial notification form being received from Santos	MSP records

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**
		Santos personnel to support MSP 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 14-3**	Incident log

15 Spill Response Termination

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

+ 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
+ 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
+ Assess long-term environmental monitoring requirements.

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Appendix A: Hydrocarbon Characteristics and Behaviour

Marine diesel oil (MDO)

In the marine environment MDO will behave as follows:

+ MDO 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 such as those present around northern Australia; and
+ MDO 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 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.

MDO is most often light and non-persistent, which because of its' volatile nature and low viscosity tend to disappear rapidly from the sea surface. Under low winds (1 m/s), 59% of the surface slick is predicted to remain after 120 hours (five days). With moderate winds (5 m/s), no MDO is predicted to remain on the surface after 72 hours and under high winds (10 m/s) after 6 hours (Xodus, 2022) (**Figure A-1**).

Under lower wind speeds the MDO will remain on the surface longer, spread quicker and in turn increase the evaporative process. Conversely, stronger wind speeds will generate breaking waves at the surface, causing a higher amount of MDO to be dispersed in the water column and reducing the amount available to evaporate. OWM predicted that after 120 hours, approximately 41% evaporated and 1% dispersed under low winds, 46% and 54% under moderate winds and 26% and 74% under high winds, respectively (Xodus, 2022).

For full details on the properties of MDO, refer to Section 7.1 of the Frigate EP.

Table A-1: Characteristics of MDO

Oil Name	API Gravity	Specific Gravity	Wax Content (%)	Pour Point (°C)	Asphaltene (%)	Viscosity (cSt)
Diesel	36.4	0.843	0.05	-36	0.05	3.9 @20°C

Source: Xodus 2022

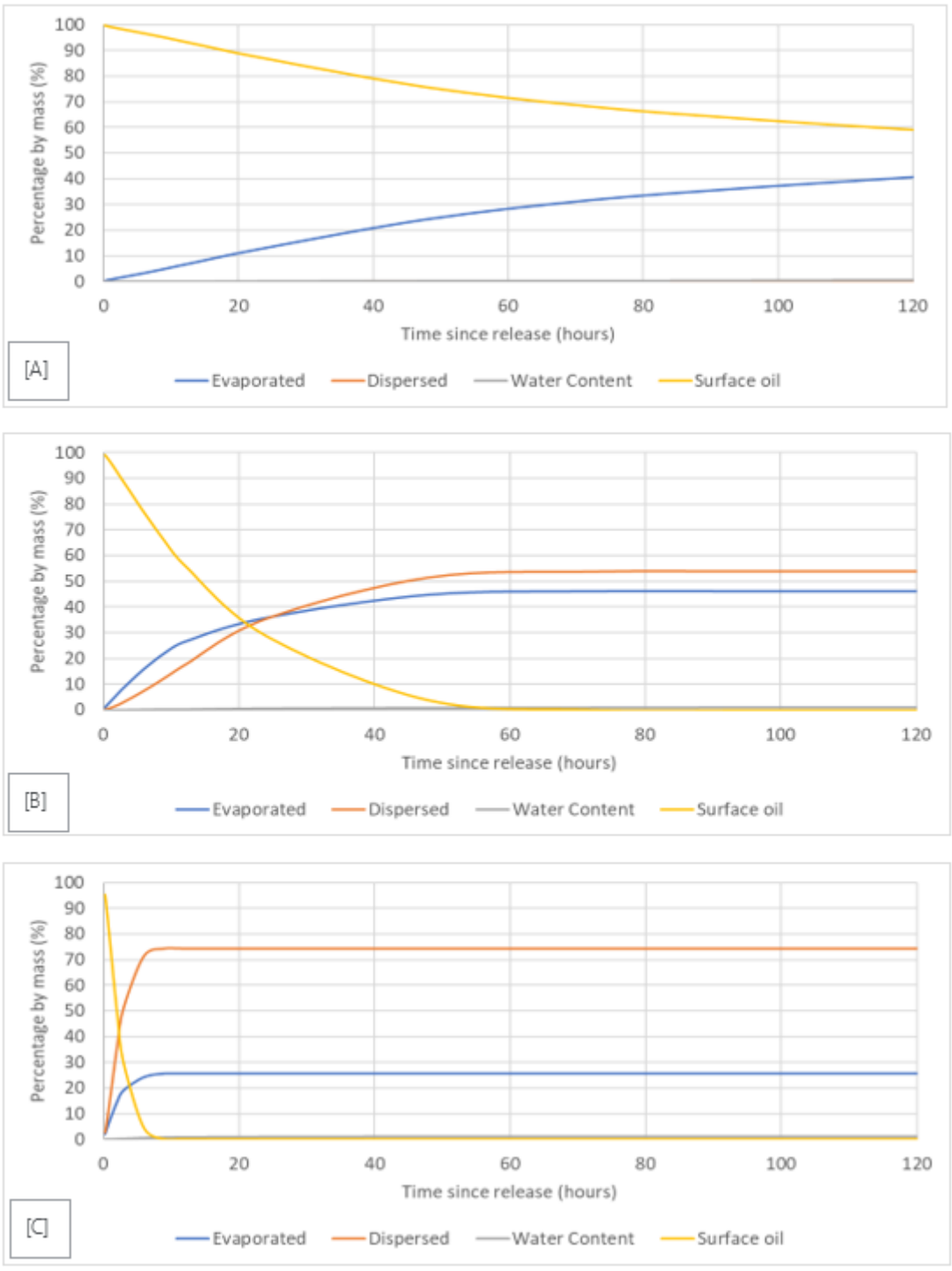


Figure A-1: Weathering of a 60 m^3 MDO release over 6 hours (tracked for 5 days) during three static wind conditions (A = 1 m/s, B = 5 m/s and C = 10 m/s) (Xodus, 2022)

Appendix B: Oil Spill Response ALARP Framework & Assessment

ALARP Assessment Framework

1 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 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.

2 Guidance Documents

Guidance documents used in the preparation of this framework include:

- NOPSEMA Guideline Environment Plan Decision Making GL1721 June 2021
- NOPSEMA Oil Pollution Risk Management GN1488 July 2021
- NOPSEMA Oil Spill Modelling Environment Bulletin A652993 April 2019
- NOPSEMA Guidance Note Environment Plan Content Requirement GN1344 September 2020
- NOPSEMA Information Paper Operational and Scientific Monitoring Programs IP1349 October 2020
- NOPSEMA Guidance Note Petroleum Activities and Australian Marine Parks GN1785 June 2020
- NOPSEMA Guidance Note Well Operations Management Plan – Content and Level of Detail GN1602 June 2020
- NOPSEMA Guidance Note Well Operations Management Plan – Lifecycle Management GN1601 May 2020
- NOPSEMA Information Paper Reducing marine pest biosecurity risks through good practice biofouling management IP1899 July 2021

3 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 B-1**.

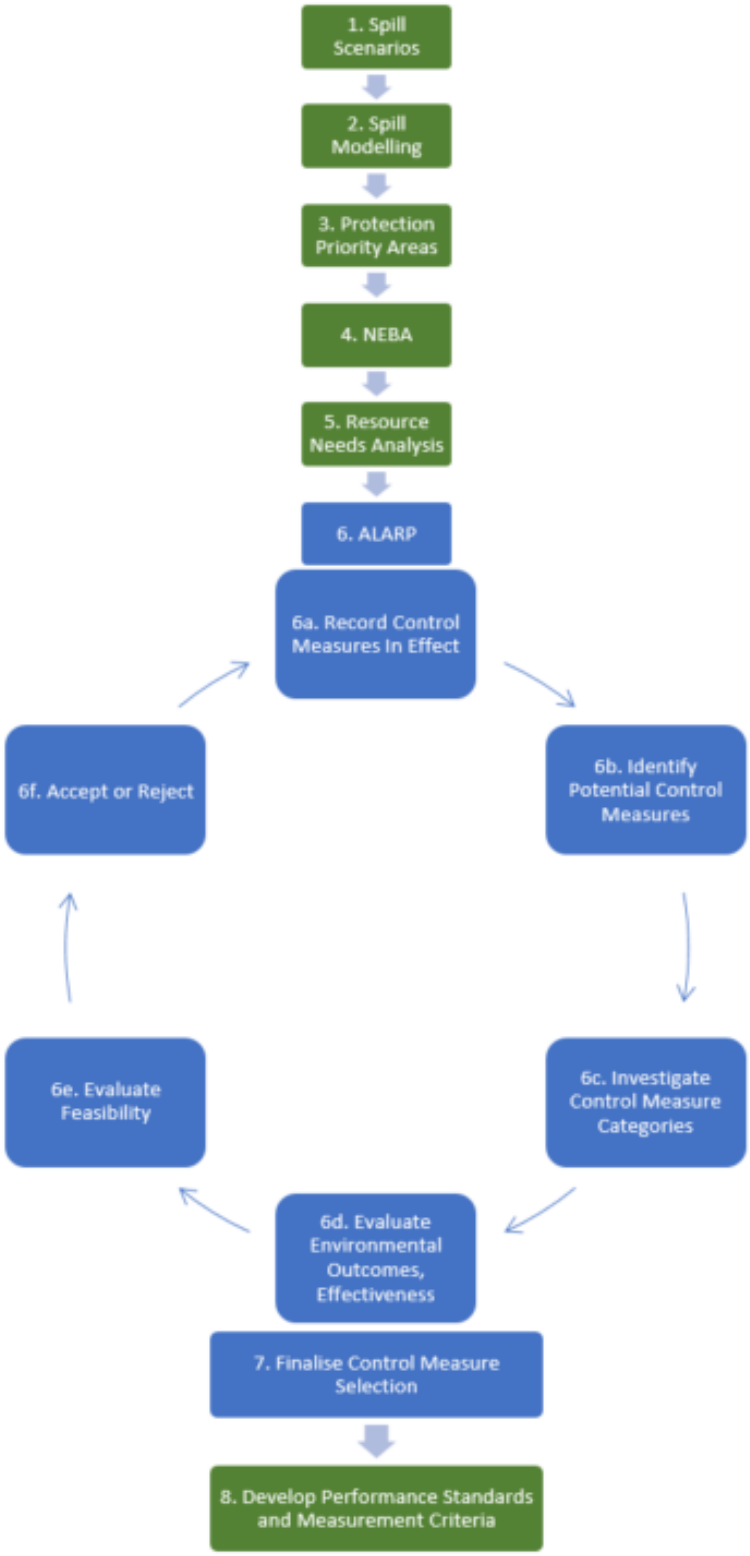


Figure B-1: ALARP Assessment Framework

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

1. Spill Scenarios: 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.

2. Spill Modelling: A quantitative spill modelling assessment is conducted for the worst-case credible scenarios identified in Step 1.
3. 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
4. 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.
5. 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 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 B-1**, Step 6 (in BLUE). Criteria and definitions used to evaluate control measures are shown in **Table B-1**.

6a) Record Control Measures In Effect: The spill response control measures currently in place for Santos 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.

6b) 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.

6c) 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.

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

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

6f) 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 B-1**, Steps 7 and 8 show the conclusion of the ALARP Assessment Framework:

7. Finalised Control Measure Selection: Outputs from the ALARP Assessment shown in Step 6 comprise finalised control measures (in BLUE).
8. 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.

4 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 B-1**.

Table B-1: 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
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 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.

Column	Description
	To achieve their purpose, oil spill response control measures should have high survivability. However, some control measures, such as those involving equipment deployment from an FPSO would have low survivability in an incident that involves an FPSO explosion or fire. <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. Several control measures are reliant on equipment, people and vessels, hence have high dependence. <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 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

Frigate Oil Spill Response ALARP Assessment

ALARP Assessment Summary - Source Control
Source control is limited to minimising potential volumes of MDO lost to the marine environment and no areas of improvement were identified. No 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 performance requirements are to follow the response actions listed in the respective vessel emergency management plan or SOPEP and conduct spill exercises in line with these documents.
ALARP Assessment Summary - Monitor and Evaluate
Various, independent inputs from multiple service providers are used to build a detailed Common Operating Picture in an incident. An area of improvement for monitor and evaluate activities was the availability of a tracking buoy at Darwin. An additional Control Measure of purchasing 2 x tracking buoys to be available at Darwin was assessed and accepted. 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. 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. Nine potential Control Measures were identified and assessed. Three Control Measures were identified as reasonably practicable. The accepted Control Measures were: + Determine required vessel specifications and improve accuracy of Vessel Tracking System + 2 tracking buoys purchased and to be available in Darwin during activity + 1 oil sampling kit purchased and to be available in Darwin during activity Six other potential Control Measures were also identified and assessed. All six were rejected as cost was grossly disproportionate to the reduction in risk. Rejected response measures were: + Two tracking buoys taken from Varanus Island, Dampier Supply Base or Exmouth Freight and Logistics to be positioned at Darwin. + Purchase of oil spill modelling system and internal personnel trained to use system + Ensure trained aerial observers based at Darwin + Trained monitoring specialists available in Darwin + Ensure trained marine mammal/fauna observers based at Darwin + Two vessels are in use by Santos servicing the Bayu-Undan operations could be used for surveillance purposes in response to a spill. 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

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 - Scientific Monitoring

Oil spill scientific monitoring will be conducted on behalf of Santos by a contracted monitoring service provider as detailed in the Santos Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and the relevant Scientific Monitoring Programs. Three potential additional Control Measures were identified and assessed. Mobilisation timeframe of personnel and equipment was identified as an area of potential improvement. One potential Control Measure weas identified and assessed to address this - a potential Control Measure on the purchase and standby of scientific monitoring resources, which was found to be grossly disproportionate in cost in comparison to the reduction in risk. Two potential Control Measures relating to improved record keeping for scientific monitoring consumable requirements and suppliers and the provision of an oil sampling kit to be located at Darwin were both found to be reasonable and practicable, both were adopted.

Three additional potential Control Measures were identified and assessed.

Two additional Control Measures were accepted as reasonably practicable. The accepted Control Measures were:

- Maintain equipment list and list of suppliers for implementation of Scientific Monitoring Plans
- Determine required vessel specifications required for scientific monitoring implementation and improve accuracy of Vessel Tracking System.

One additional Control Measure was rejected as grossly disproportionate. The rejected Control Measure was:

- Scientific monitoring personnel and equipment on standby in Darwin.

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.

ALARP Assessment Summary – Oiled Wildlife

Santos has developed a Santos Oiled Wildlife Response Framework Plan as a Control Measure to ensure that a procedure is in place for OWR, where they are the Control Agency or Support Organisation, in order to provide an effective and coordinated OWR. Oiled wildlife equipment including first strike kits and containers can be mobilised from various locations around Australia. 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 **Section 12**.

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 Darwin/Broome. 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.

Three potential Control Measures were identified and assessed. All were rejected as grossly disproportionate. Rejected Control Measures were:

- Additional Santos OWR trained personnel positioned at Darwin/Broome and Perth
- 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 Performance Standards.

Waste

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 Section 13.5. Further detail is captured in the Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053). Given the waste service provider arrangements and pre-planning 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.

Two potential Control Measures were rejected as grossly disproportionate. Rejected Control Measures were:

- 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 **Table 13-4**. 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.

Appendix C: POLREP

Department of
Transport

When blank, this form is classed as **OFFICIAL**, when filled out, this form is classed as **OFFICIAL-SENSITIVE.**

Marine Pollution Report (POLREP)

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

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: _____

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: _____

☐ **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.
Please email completed form to marine.pollution@transport.wa.gov.au

Appendix D: SITREP

Department of
Transport

When blank, this form is classed as **OFFICIAL**, when filled out, this form is classed as **OFFICIAL-SENSITIVE.**

Marine Pollution Situation Report (SITREP)

Send completed form to:
Maritime Environmental Emergency Response
Department of Transport
GPO Box C102 PERTH, WA 6839
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

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:

Santos

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)

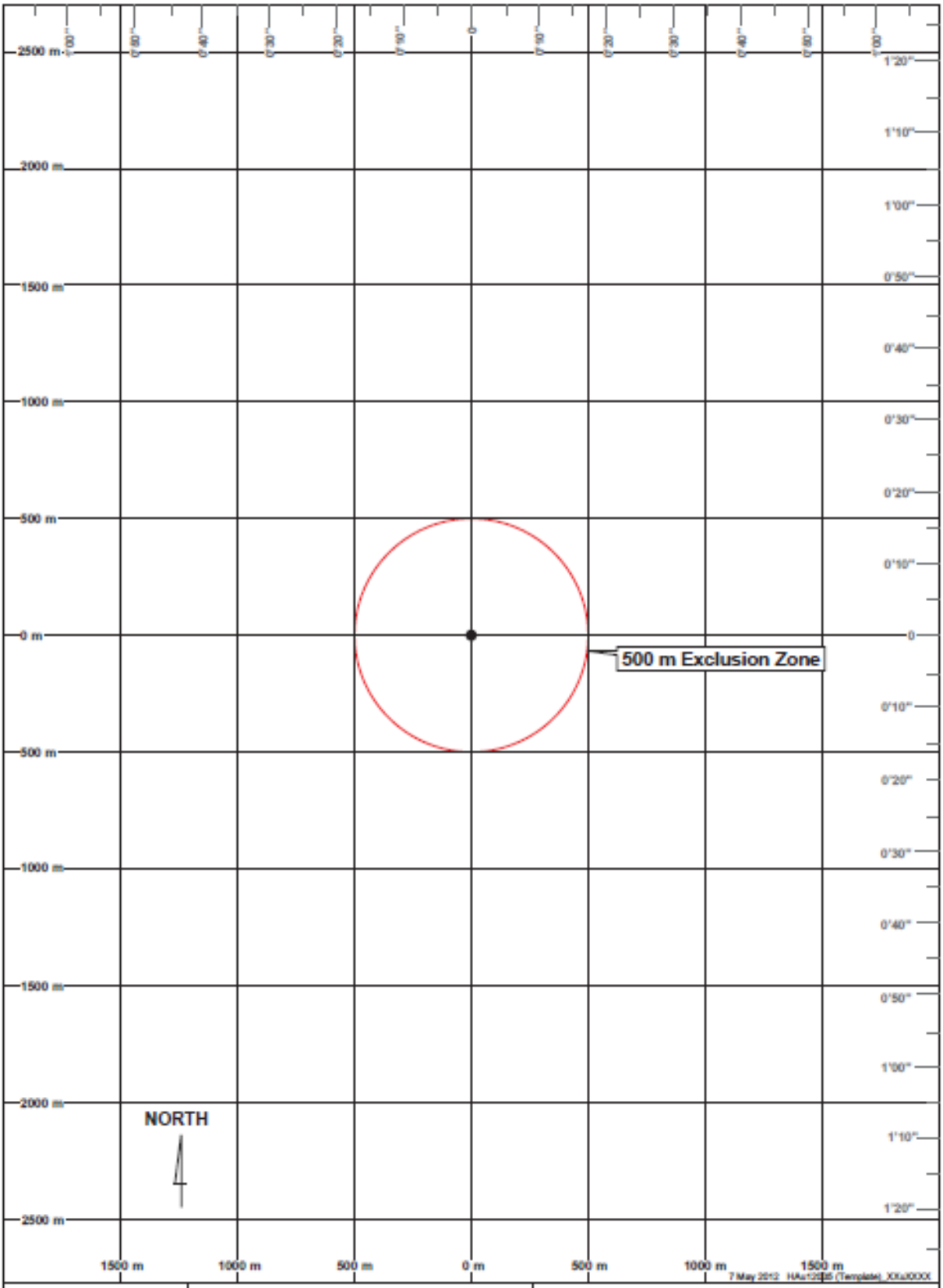
Santos

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

○ Whale shark

○ Dugong

○ Hawksbill turtle

○ Loggerhead turtle

○ Green turtle

○ Flatback turtle

○ Bottlenose dolphin

○ Spinner dolphin

○ Dolphin species unknown

○ Leatherback turtle

○ Turtle species unknown

Santos

FAUNA DETAILS					
Category	**Type/species?** **Adult/juvenile?** **ID confidence?**	**Number**	**Date/Time**	**Photo/ video taken?** **Reference No.**	**Behaviour / Comments.** **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: Oiled Wildlife Response Personnel and Equipment

In the event of a spill impacting wildlife, Santos 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 I-1** and an overview of 'first-strike' equipment for initial deployment is provided in **Table I-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 East Kimberley regional operational OWR plan (as per the WAOWRP) provides detail of local organisations and suppliers for personnel and equipment.

In addition to OWR providers mobilised through AMOSC and OSRL/Sea Alarm, Santos maintains access to the workforce marketplace during an emergency response. Level 1 oiled wildlife responders, of which the WAOWRP indicates ~6 could be required for a Level 1 event, could be provided through Santos 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 regional operational OWR plan (as per the WAOWRP) provides contact details for local trade personnel, vets and wildlife specialists that could be employed for manning/maintenance of forward response wildlife response facilities.

Table I-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*

AMOSC / INDUSTRY RESPONDERS		Activated through	Capability
NatPlan Mutual Aid			50-100*
Perth Zoo – Duty Veterinarian	Wildlife care and rehabilitation advice, expertise and management	Personnel potentially available to petroleum industry (currently there is no formal arrangement)	
	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 Oiled Wildlife Response Capacity Statement, 25 Jun 2020
** As per Sea Alarm/OSRL SLA Statement

Table I-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**	**Location**
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 Search and rescue medical package 2 x Cleaning and rehabilitation response package 1 x Cleaning and rehabilitation medical package	OSRL Duty Officer	UK

1 x Cleaning and rehabilitation response package		Singapore
2 x Search and rescue response package 1 x Cleaning and rehabilitation response package		Bahrain
1 x Cleaning and rehabilitation response package		Fort Lauderdale, USA

* As per AMOSC Oiled Wildlife Response Capacity Statement, 25 Jun 2020
** As per OSRL SLA Equipment Report March 2022

Appendix J: 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:	English et al. (1997), Snedecor and Cochran (1989)

Principle	Explanation	Key guiding references
	Environmental covariates are considered in sampling design recorded and incorporated statistically. A hierarchical or stratified sampling design is used to address variation at multiple scales Design is standardized, by sampling equivalent strata (e.g., level of exposure, depth etc.).	
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)
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)

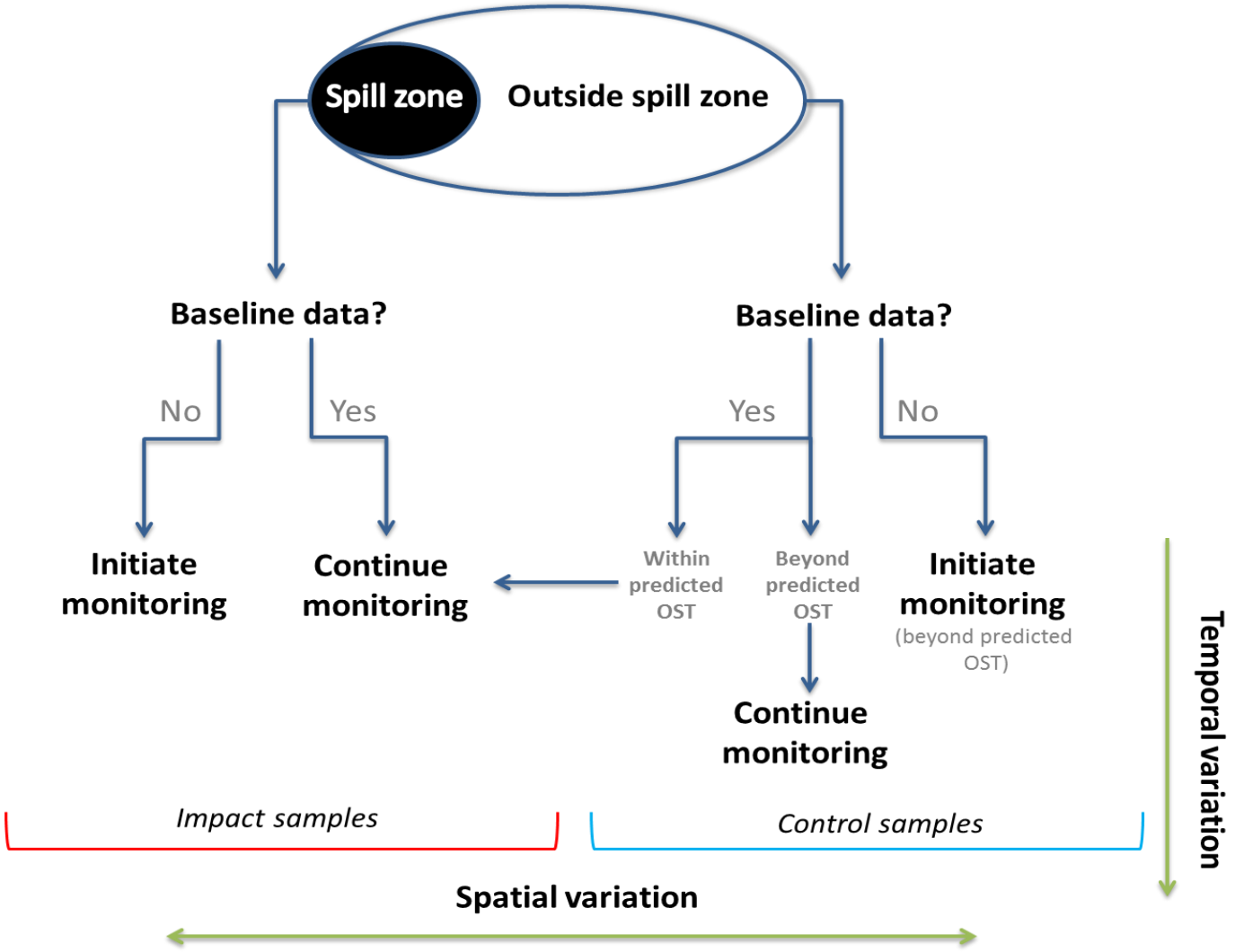


Figure 1: Structured Decision Making Process Based on Gregory et al. (2012) in Reference to Monitoring Programs, the Availability of Baseline Data, and Oil Spill Trajectory. An ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

1.2 Data Analysis

Appendix B details the most important approaches to statistical analysis and related sampling design. These approaches are summarised in Table 2 (below). An important consideration is how this information is best summarised and communicated to guide further decision making and management. **Appendix B** also describes the reporting of environmental outcomes through the use of report card systems and includes a summary of their structure and design.

Table 2: Summary of Data Analysis Techniques.

Analysis type		Description	Strength	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.

Analysis type	Description	Strength	Limitations	Addressing limitations
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

Table 3 provides a glossary of an SMP as prepared in this report.

Table 3: Glossary of Scientific Monitoring Plans.

SMP Receptor	
Rationale	Importance of receptor, possible impact and importance of monitoring program.
Aim	Description of program aim(s)
Baseline	Refer to **Table 2**, detailed in Baseline Data Review (Astron Environmental Services 2019) (QE-00-BI-20001)
Contact	Contact is defined as occurring where any aerial, visual or florescence observation reports submitted to the Incident Command Team (ICT) show presence or likely presence of oil; or spill fate modelling predicts oil at sensitive receptors of > 1g/m^2 for surface oil, and >10 ppb for entrained and dissolved oil. This then activates the relevant SMP, which determines if any impact has occurred based upon applicable thresholds.
Initiation criteria	Initiation criteria, based on data from OMPs.
Termination criteria	Termination criteria based on analysis of Scientific Monitoring data translated to the Incident Management Team (IMT) through the planning function.
Receptor impact	Measured states and pressures according to the State-Pressure-Response model.
Methodological approach	Descriptions of sampling methods in order to carry out scientific monitoring, including reference to methods described in an appendix.
Scope of works	Timeline for scope of works (SoW) development.
Statistically significant	The basis of the significance is determined by the methodological approach as outlined in the relevant SMP.
Resources	List of required resources which may not necessarily be listed within a description of a particular method as described in **Appendix C**.
Implementation	Mobilisation requirements for service provider(s).
Analysis and reporting	Summary of analysis, data management and reporting.

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 OMP1 (Surveillance and Monitoring), to inform the sampling design of other SMPs where objectives are to evaluate impact to 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 to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). In addition, relevant available metadata 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.
Methodological approach	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): 1. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied; 2. 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;

SMP1 – Marine Water Quality	
	3. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See **Appendix B** and **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> SMP1 – Marine Water Quality A water quality probe will be used to measure conductivity (to derive salinity in PSU), temperature and depth (CTD), dissolved oxygen (% and mg/L), turbidity (FNU or NTU), 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).

SMP1 – Marine Water Quality	
Scope of work	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.
Resources	+ Marine scientist with experience in water quality sampling + Geographic Information Systems (GIS) personnel + National Association of Testing Authorities (NATA) accredited laboratories for water sample analysis + Vessel and tender in operation + Refuelling facilities + Sample containers and preservative + Sampling equipment + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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.

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.

SMP2 – Sediment Quality	
Baseline	Refer to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). In addition, relevant available databases 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 as defined in **Table 1**.
Termination criteria	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.
Receptor impact	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

SMP2 – Sediment Quality	
	+ Shading from marine infrastructure + Climate change
Methodological approach	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): 1. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied; 2. 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; 3. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See **Appendix B** and **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 extent 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.

SMP2 – Sediment Quality	
	Sediment samples shall be analysed for key contaminants of concern including metals, hydrocarbons, nutrients, particle size distribution, and nutrients. Infauna samples A subset of the sediment sample shall be sieved in the field (if time permits) with collected infauna preserved (10% buffered formalin or 70% ethanol as prescribed by the receiving laboratory) 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.
Scope of work	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.
Resources	+ Marine scientist with field experience in deep sea sediment sampling + Scientist with skills in infauna identification + GIS personnel + NATA accredited laboratory for sample contaminant analysis + Laboratory for infauna sorting and taxonomic identification + Vessel with appropriate davit/winch to deploy grab/corer equipment and tender in operation + Refuelling facilities + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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

SMP2 – Sediment Quality	
	of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

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 to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). In addition, relevant available databases shall be reviewed for applicable rocky shoreline and sandy beach biota baseline data.
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 as defined in **Table 1**.
Termination criteria	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.
Receptor impact	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

SMP3 – Sandy Beaches and Rocky Shores	
	+ Over-collection + Nutrification + Climate change.
Methodological approach	Monitoring will be designed as follows: 1. Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. 2. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 3. 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 (10% buffered formalin or 70% ethanol as prescribed by the receiving laboratory) 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.

SMP3 – Sandy Beaches and Rocky Shores	
Scope of work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Senior Scientist with experience in shoreline macroinvertebrates sampling + Supporting Scientist + GIS personnel + Helicopter or available vessel and tender in operation + Refuelling facilities + Sample containers and preservative + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby + Laboratory facilities for sorting and taxonomic identification of specimens
Implementation	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.
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.

SMP4 – Shorelines and Coastal Habitats - Mangrove Communities	
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.

SMP4 – Shorelines and Coastal Habitats - Mangrove Communities	
Aim	To monitor changes to mangrove extent and health in relation to an oil spill and associated activities.
Baseline	Refer to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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 as defined in **Table 1**.
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.
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 on-ground monitoring should be carried out to complement any analysis of remote sensing. Analysis of long-term on-ground monitoring data will be as follows: 1. Where long-term baseline data sites (only) are contacted a control chart (time-series) design will be applied.

SMP4 – Shorelines and Coastal Habitats - Mangrove Communities	
	1. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 2. Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied (See **Appendix B** for detailed description of these approaches and **Figure 1,** detailed in Baseline Data Review (Astron Environmental Services 2019) (QE-00-BI-20001)). 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 operations (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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Senior Scientist with experience in mangrove condition assessment + Supporting Scientist + GIS and remote-sensing personnel + Available vessel in operation + Satellite and/or aerial imagery
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.

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

SMP5 – Shorelines and Coastal Habitats - Intertidal Mudflats	
	penetrating oil. At high tide, these habitats become foraging grounds for vertebrates such as rays and sharks. 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 to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). In addition, relevant available baseline databases 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 as defined in **Table 1**.
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.
Methodological approach	Monitoring will be designed as follows: 1. Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. 2. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 3. Where no baseline data sites are involved a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied (See **Appendix B** for detailed description of these approaches and **Figure 1**).

SMP5 – Shorelines and Coastal Habitats - Intertidal Mudflats	
	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 or 70% ethanol as prescribed by the receiving laboratory) 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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Senior Scientist with experience in epifauna and infauna assessment and sampling + Supporting Scientist + GIS personnel + Helicopter or available vessel and tender in operation + Refuelling facilities + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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 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.

SMP6 – Benthic Habitats	
Rationale	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 that 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 life cycles. 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 region.
Aim	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.
Baseline	Refer to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). In addition, relevant available baseline metadata databases will be reviewed for applicable benthic habitat and coral health and reproduction baseline data. Remote sensing data, satellite and aerial imagery previously acquired 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.
Initiation criteria	<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 as defined in **Table 1**.

SMP6 – Benthic Habitats	
Termination criteria	Benthic habitat cover and composition 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. Coral health and reproduction 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.
Methodological approach	Monitoring design will be as follows: 1. Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. 2. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 3. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied (See **Appendix B** for detailed description of these approaches and **Figure 1**). Benthic Habitat Cover and Composition Field survey methodology will be based upon acquiring repeat digital imagery (video or still images) of benthic habitats along random 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.

SMP6 – Benthic Habitats	
	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 may also be recorded where practicable (for example following methodologies employed by Babcock et al. (2008) to contribute to SMP11. <u>Coral Health and Reproduction</u> 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, ecotoxicology 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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Senior Marine Scientist with experience in benthic habitat assessment + Supporting Scientist + Divers or ROV operators + GIS personnel + Available vessel in operation + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby + Diving equipment or ROVs + Video recording facilities + Satellite imagery
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 ecotoxicological laboratory in addition to standard suite of ecotoxicological tests using released hydrocarbon. Data will be entered to spatially explicit database and analysed 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.

SMP7 – Seabirds and Shorebirds	
Rationale	Marine waters and coastal habitats in the EMBA contain key habitats that are important to birds, including offshore islands, sandy beaches, tidal flats, mangroves and coastal and pelagic waters. These habitats support a variety of birds which utilise the area in different ways and at different times of the year. Birds can be broadly grouped according to their preferred foraging habitat as coastal/ terrestrial birds, seabirds and shorebirds, both migratory and resident. 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.
Aim	Quantify seabirds and shorebirds, in the spill and response areas.

SMP7 – Seabirds and Shorebirds	
	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.
Baseline	Refer to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). The Oil Spill Response Atlas (Australian Maritime Safety Authority (AMSA)), National Conservation Values Atlas (Department of Agriculture, Water and the Environment (DAWE) (http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) and any local oiled wildlife response plans should also be consulted.
Initiation criteria	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 as defined in **Table 1**.
Termination criteria	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 (relevant regional authority and/or DAWE).
Receptor impact	Impact to seabirds and shorebirds 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.

SMP7 – Seabirds and Shorebirds	
Methodological approach	Monitoring design will be as follows: 1. Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. 2. 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. 3. Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied (See **Appendix B** for detailed description of these approaches and **Figure 1,** detailed in Baseline Data Review (Astron Environmental Services 2019) (QE-00-BI-20001)). 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, such as Birdlife Australia's Australian Shorebird Monitoring Program and survey guidelines standardised by the DAWE (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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Experienced seabird biologist + Experienced shorebird biologist + Personnel with pathology or veterinary skills + NATA accredited laboratory for sample analysis and necropsy + Available vessel and tender in operation + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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).

SMP7 – Seabirds and Shorebirds	
	Actual mobilisation 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. 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.

SMP8 – Marine Mammals	
Rationale	At least 11 species of listed marine mammals are known to, or are thought to occur, in Australian waters within the environment that may be affected. These include cetaceans (whales and dolphins) and sirenians (dugong). 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 that may have resulted from the hydrocarbon spill and associated response.
Baseline	Refer to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). The Oil Spill Response Atlas (Australian Maritime Safety Authority (AMSA)), National Conservation Values Atlas (DAWE -http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) and local oiled wildlife response plans should also be consulted.
Initiation criteria	Operational monitoring indicates that marine mammals are contacted or predicted to be contacted by a hydrocarbon spill as defined in **Table 1**.
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 of the region; AND No further instances of dead marine mammals with detectable levels of hydrocarbons attributable to the hydrocarbon spill; AND Monitoring is terminated in consultation with the relevant environmental authority (relevant regional authority and/or DAWE).

SMP8 – Marine Mammals	
Receptor impact	Impact to marine mammals 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), **Appendix C8** + Marine surveys will follow the protocols of Watson et al. (2009), **Appendix C8** 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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	**Aerial survey** + Senior Marine Scientist + Trained marine wildlife observers x 2 + Fixed wing aircraft (incl. pilot/s) + Refuelling facilities **Vessel-based survey** + Senior Marine Scientist + Trained marine wildlife observers x 2 + Personnel with pathology or veterinary skills + NATA accredited laboratory for sample analysis and necropsy + Available vessel in operation + Sample container and preservative + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby

SMP8 – Marine Mammals	
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.
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. 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.

SMP9 – Marine Reptiles	
Rationale	At least 10 species of listed marine reptiles are known to, or are thought to occur, in Australian waters within the environment that may be affected. This includes six species of marine turtle that occur in, use the waters, and nest on sandy beaches, two species of sea snake and one species of estuarine crocodile found in most major rivers systems of the Kimberley region and in the Northern Territory. 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.
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 marine reptile populations in relation to an oil spill and associated activities.
Baseline	Refer to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). The Oil Spill Response Atlas (Australian Maritime Safety Authority (AMSA)), National Conservation Values Atlas (DAWE -http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) and local oiled wildlife response plans should also be consulted.
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 as defined in **Table 1**.

SMP9 – Marine Reptiles	
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 (relevant regional authority and/or DAWE).
Receptor impact	Impact to marine reptiles from pressures including hydrocarbons is measured through change in: + Abundance + Health/condition + Nesting success (turtles and crocodiles). 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.
Methodological approach	**Abundance** In-water impacts – aerial surveys. Shoreline impacts – ground surveys (either rapid 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).

SMP9 – Marine Reptiles	
	Reproductive success Shoreline impacts – ground surveys (detailed tagging and/or nesting success studies). Design of ground surveys will be applied as follows: 1. Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. 2. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 3. Where no baseline data sites are involved, and timing allows, a post spill pre-impact approach will be attempted. 4. If a post-spill pre-impact approach is not practicable, a gradient approach to quantifying impacts will be applied
Scope of work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	**Aerial survey** + Senior marine scientist + Trained marine wildlife observers x 2 + Fixed wing aircraft (incl. pilot/s) + Refuelling facilities **Vessel-based Survey** + Senior Marine Scientist + Trained marine wildlife observers x 2 + Personnel with pathology or veterinary skills + NATA accredited laboratory for sample analysis and necropsy + Available vessel in operation + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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.
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.

SMP9 – Marine Reptiles	
	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 for the region. 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.

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 to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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 predict or observes contact of oil to target species for consumption as defined in **Table 1**.
Termination criteria	The following termination criteria will be adopted in consultation with responsible fisheries and human health agencies. Hydrocarbon concentrations in seafood tissues are not above levels considered a human health risk; 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.

SMP10 – Seafood Quality	
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) in **Appendix C10**, following the duo-trio method (Standards Australia 2005).
Scope of work	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Resources	+ Senior marine scientist + Marine vessel + Sample containers and preservative + NATA accredited laboratory for sample analysis + Decontamination/washing facilities
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.
Analysis and reporting	Laboratories will be NATA-accredited for food standards analyses. Data will be stored in spatially explicit database and analysed 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.

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

SMP11 – Fish, Fisheries and Aquaculture	
	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 to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). In addition, available relevant survey databases shall 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 as defined in Table 1.
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 responsible fisheries agencies.
Receptor impact	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 + Overfishing + Introduction of marine pests + Habitat disturbance + Climate change.
Methodological approach	Fish assemblages will be assessed using the stereo-baited remote underwater videos (BRUVs) following Shortis et al. (2009), **Appendix C11**. Fish assemblages will be randomly sampled within discrete habitats at cross-shelf impact areas and non-impact areas.

SMP11 – Fish, Fisheries and Aquaculture	
	Sampling design for fish assemblages will be as follows: 1. Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. 2. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 3. If baseline data is not available, a gradient approach to quantifying impacts will be applied (See **Appendix B** for detailed description of these approaches and **Figure 1**). Where relevant, data available from responsible fisheries agencies 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.
Scope of work	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Resources	+ Senior marine scientist + Marine scientist trained in fish identification and necropsy + Marine scientist with BRUV experience + NATA accredited laboratory for sample analysis + Available vessel and tender in operation + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby + Resources to analyse BRUV data.
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.
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.

SMP11 – Fish, Fisheries and Aquaculture	
	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.

SMP12 – Whale Sharks	
Rationale	The whale shark (*Rhincodon typus*) is known to occur within the region. One of the best known aggregation sites occurs along the central and north-west coast of Western Australia from March to July. Whale sharks are also known to be highly migratory and a biologically important area for foraging extending into the Kimberley region of Western Australia also overlaps with the environment that may be affected. Effects to the whale shark 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 quantify impacts of an oil spill on whale sharks within Biologically Important Areas (BIAs) along the north-west and north Western Australian coastline.
Baseline	Refer to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). The Oil Spill Response Atlas (Australian Maritime Safety Authority (AMSA)), National Conservation Values Atlas (DAWE -http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) and Pilbara Region Oiled Wildlife Response Plan (Department of Parks and Wildlife and Australian Marine Oil Spill Centre 2014) should also be consulted.
Initiation criteria	Operational monitoring indicates that whale shark aggregations are contacted or likely to be contacted by a hydrocarbon spill as defined in **Table 1**.
Termination criteria	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.
Receptor impact	Impact to whale sharks from pressures including hydrocarbons is measured through observed injury and mortality. Other pressures to these states are: + Intentional and unintentional mortality from fishing outside Australian waters

SMP12 – Whale Sharks	
	+ Boat strike + Habitat disruption from mineral exploration, production and transportation + Marine debris + Climate change.
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 work	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Resources	+ Senior marine scientist + Trained marine wildlife observers x 2 + Fixed wing aircraft (incl. pilot/s) + Refuelling facilities + Personnel with pathology or veterinary skills + NATA accredited laboratory for sample analysis + Available vessel and tender in operation + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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.
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 K: SMP Activation Process

Oil Spill Operational and Scientific Monitoring Activation Form

astron
astron.com.au

Instructions

In the event of a spill requiring a response from Astron follow these steps:

1. **Activate a response – call 1300 902 700**
2. **Immediately complete this Activation Form and email to spillresponse@astron.com.au**

You will receive a call back from the Monitoring Coordinator within 30 minutes. In the event that a call back is not received, please call 1300 902 700 again.

Note: If new information should become available after submitting this form, or the situation changes, please advise the Astron Monitoring Coordinator as soon as possible.

Section 1: Contact Details

Name of notifying person		
Position in Incident Command Team		
Direct phone		
Mobile		
Email address		
Command centre location		
Command centre direct phone		
Date and time of notification	Click here to enter a date.	Enter time, i.e. 1400 WST

Section 2: Spill Details

Date and time of spill		Click here to enter a date.			Enter time, i.e. 1400 WST		
Spill source location (GDA94, MGA Zone 50)		Insert coordinates in GDA94 MGA Zone 50 format (easting and northing).					
		Insert location description					
Source of spill							
Cause of spill (if known)							
Status of spill		☐ Secured	☐Uncontrolled	☐Unknown			
Release rate	Instantaneous release						State units
	OR						
	Continuous release		per hour for		☐Hours	☐Days	
Description of spill	Estimated quantity						State units
	Incident tier	☐1	☐2	☐3			
	Direction of travel						
	Trajectory						
Modelling provider log in details							

Oil Spill Operational and Scientific Monitoring Activation Form

Section 3: OMP/SMP activation	
SMPs to be activated. Where there is doubt whether an SMP should be activated the SMP should be selected. Refer to the Oil Spill Scientific Monitoring Plan (EA-00-RI-10099) for initiation criteria for SMPS.	☒SMP1 – Water quality ☒Operational water quality monitoring ☐SMP2 – Sediment quality ☐SMP3 – Sandy beaches and rocky shores ☐SMP4 – Mangroves ☐SMP5 – Intertidal mudflats ☐SMP6 – Benthic habitats ☐SMP7 – Seabirds and shorebirds ☐SMP8 – Marine megafauna ☐SMP9 – Marine reptiles ☐SMP10 – Seafood quality ☐SMP11 – Fish, fisheries and aquaculture ☐ Yet to be determined ☐ Other:_____

Section 4: Safety	
Detail any known safety or security risks	

Section 5: Approval	
I authorise the activation of a response by Astron Environmental Services Pty Ltd in connection with the above incident under the terms of Contract # [insert contract].	
Signature:	
Date and Time:	

Activate Our Team

In the event of a spill requiring scientific monitoring response call:

1300 902 700

Advise the operator:

1. **Your company**
2. **Your name and contact number**
3. **Brief reason for call (i.e. Exercise or Spill)**

A message will be relayed to our team to call you back.

↓

Provide additional details as requested by the Monitoring Coordinator on call-back

↓

Complete and submit the *Activation Form*

↓

Astron initiates Oil Spill Scientific Monitoring Activation & Response Process – refer to next page

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 (including relevant conservation/management plans) from relevant EP, Santos GIS mapping and online resources (DoT oil spill response atlas, DoE conservation values atlas, DoE species profile and threats database) • 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 L: Scientific Monitoring Capability

Scientific Monitoring Assurance

Assurance arrangements

Astron Environmental Services (Astron) is currently Santos' primary Monitoring Service Provider for the implementation of SMPs 1-12. 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 1-12.

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. Santos has previously 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 project, governed through an APPEA-Industry Steering Committee. This project, being progressed throughout 2022, 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.