Barossa Gas Export Pipeline Installation Oil Pollution Emergency Plan

PROJECT / FACILITY	Barossa Gas Export Pipeline
REVIEW INTERVAL	No Review Required
SAFETY CRITICAL DOCUMENT	NO

Rev	Owner	Technical Reviewer	Approver	Functional Endorser
3	Barossa HSE Manager	Senior Oil Spill Response Coordinator	Barossa Project Director	Crisis, Emergency Response and Security Manager
Signed				

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REV No	DATE	REVISION
0	25/07/2019	Issued for use
1	30/10/2019	Issued for use
1A	01/08/2021	Internal Review
1B	08/09/2021	Internal Review
2	16/09/2021	Internal Revision – updating OPEP to cover transition from ConocoPhillips format and management systems across to Santos. Covered by MoC 245 (Doc ID BAA-100 0400)
2A	11/11/2021	Internal Review
3	07/12/2021	Revision for submission to NOPSEMA – updating OPEP to incorporate changes associated with new stage of GEP (additional ~23 km segment in Commonwealth waters)

Distribution	Oil Pollution Emergency Plan	
	Electronic	Hardcopy
Intranet – Emergency Preparedness	link only	
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Drilling Superintendent	link only	
Drilling Supervisor	link only	
Senior Oil Spill Response Coordinator	link only	
Santos Company Site Representative (CSR)	link only	
IMT Room – Perth office		● x 4
AMOSC	●	
DEWPS	●	
AMSA	●	
OSRL	●	

Contents

List of Tables

List of Figures

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
APASA	Asia-Pacific Applied Sciences Associates
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
BAOAC	Bonn Agreement Oil Appearance Codes
CMT	Crisis Management Team
CSR	company site representative
DEPWS	Department of Environment, Parks and Water Security
DFAT	Department of Foreign Affairs and Trade
DISER	Department of Industry, Science, Energy and Resources
DoE	(Australian) Department of the Environment (now Department of the Environment and Energy)
DPIRD	Department of Primary Industries and Regional Development
EMBA	environment that may be affected
EP	Environment Plan
ER	emergency response
GDA	Geodetic Datum of Australia
GIS	geographic information system
GPS	global positioning system
HMA	Hazard Management Agency
IAP	Incident Action Plan
ICC	incident command centre
IMT	Incident Management Team
MARPOL	International Convention for the Prevention of Pollution from Ships
MGA	Map Grid of Australia
MNES	matters of national environmental significance
MoU	Memorandum of Understanding
MP	marine park
MSA	Master Services Agreement
MSP	monitoring service providers
N	north

Abbreviation	Description
NEBA	net environmental benefit analysis
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NT	Northern Territory
NT IC	Northern Territory Incident Controller
OPEP	Oil Pollution Emergency Plan
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSC	on-scene commander
OSRL	Oil Spill Response Limited
OSTM	oil spill trajectory modelling
OWR	oiled wildlife response
SIMA	spill impact mitigation assessment
SMP	Scientific Monitoring Plans
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plans
TMPC	Territory Marine Pollution Coordinator
VOC	volatile organic compound
VOO	vessels of opportunity
VPO	Vice President Offshore Upstream WA
W	west
WSP	waste service provider

1 Quick reference information

Parameter	Description			Further Information
Petroleum Activity	Barossa Gas Export Pipeline (GEP) – installation and commissioning phases only			Section 3 - Barossa GEP Environment Plan (EP) (BAA-100 0329)
Location	Pipeline running from the pipeline end termination (PLET) in the Barossa development area (Easting MGA52: 638539; Northing: 8914135) along the west coast of Bathurst Island to additional Barossa GEP Segment ~KP23) (Easting: 614607; Northing: 8666193)			Section 3.3 - Barossa GEP Environment Plan (EP) (BAA-100 0329)
Petroleum Title/s (Blocks)	NT/L1 (Production Licence)			N/A
Facilities/Vessels	Pipelay vessel (classified as a facility when laying pipeline; classified as a vessel when not laying pipeline) Support vessels			
Water Depth	Approximately 36 to 265 m			N/A
Worst-case Spill Scenarios	+ Marine Diesel Oil (MDO) released from a vessel collision + MDO released from a bunkering incident.			
Hydrocarbon Type, International Tanker Owners Pollution Federation (ITOPF) Grouping, Worst Case Volume		**Hydrocarbon type (ITOPF Group)**	**Worst case volume**	**Appendix A: Hydrocarbon Characteristics and Behaviour**
	Vessel collision	MDO (Group II)	700 m^3	
	Bunkering incident	MDO (Group II)	10 m^3	
Hydrocarbon Properties	MDO: Density at 25 °C = 829 kg/m^3 Dynamic viscosity = 4 cP @ 25° C API Gravity = 37.6° Wax content = 1% Pour point = -14 °C Oil property classification = Persistent (medium)			**Appendix A: Hydrocarbon Characteristics and Behaviour**
Weathering Potential	MDO is a mixture of volatile and persistent hydrocarbons with low viscosity. It will spread quickly and thin out to low thickness levels, thereby increasing the rate of evaporation. Up to 60% will generally evaporate over the first two days. Approximately 5% is considered “persistent”, which are unlikely to evaporate and will decay over time.			**Appendix A: Hydrocarbon Characteristics and Behaviour**

Parameter	Description	Further Information
Protection Priorities	Vernon Islands are surrounded by coral reefs and extensive coralline algal terraces, and contain extensive mangrove forests that are vulnerable to pollution. The Tiwi Islands and Cox-Finniss (NT mainland) shorelines contain a range of shoreline types that are vulnerable to pollution, including nesting beaches for flatback turtles, olive ridley turtles and crested terns, and cultural heritage sites. The Oceanic Shoals Australian Marine Park contains significant habitats, species and ecological communities, including four key ecological features, two of which occur within the oil spill environment that may be affected (EMBA).	

2 First strike response actions

The initial response actions to major oil spill incidents will be undertaken by the relevant Vessel Master.

Following those initial actions 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?

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

Response information contained within this Oil Pollution Emergency Plan (OPEP)) is concerned primarily with a large scale (Level 2/3) hydrocarbon spill where the Perth-based Incident Management Team (IMT) and Santos Crisis Management Team (CMT) are engaged for support and implementation of response strategies. Level 1 spills are managed through on-site response and IMT is available to assist with regulatory requirements/notifications and support as required. 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 2/3 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 or vessel-specific procedures, as applicable	On-Scene Commander/Vessel Master
Immediate	Control the source using site resources, where possible	Control the source using available onsite resources (vessel) Refer to vessel SOPEP	On-Scene Commander/Vessel Master
30 minutes of incident being identified	Notify Santos Offshore Duty Manager / Incident Commander	Verbal communication to Offshore Duty Manager / Incident Commander's duty phone	On-Scene Commander 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	On-Scene Commander via Company Site Representative
60 minutes	Gain situational awareness and begin onsite spill surveillance	If spill reaches marine waters gain further situational awareness by undertaking surveillance of the spill from vessel Refer to Monitor and Evaluate Plan – **Section 9**	On-Scene Commander via Company Site Representative Incident Commander
Refer timeframes Go to **Section 6**	Make regulatory notifications within regulatory timeframes	Activate the External Notifications and Reporting Procedures – **Section 6**	Initial notifications by Environment Unit Leader / Safety Officer Oil Spill Response Organisations (Australian Marine Oil Spill Centre [AMOSC] and Oil Spill Response Ltd [OSRL]) activation by designated call-out authorities (Incident Commanders/Duty Managers)
Level 2/3 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 to 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 Data Manager
	Gain situational awareness and set incident objectives, strategies and tasks	Begin reactive Incident Action Planning process Go to **Section 5.2** Review First Strike Activations (this table)	Incident Commander Planning Section Chief
Refer timeframes **Section 6**	Make regulatory notifications as required Notify and mobilise/put on standby external oil spill response organisations and support organisations, as required	Go to **Section 6**	Initial notifications by Environment Unit Leader/ Safety Officer Oil Spill Response Organisations (Australian Marine Oil Spill Centre [AMOSC] and Oil Spill Response Ltd [OSRL]) activation by designated call-out authorities (Incident Commanders/Duty Managers)
Refer timeframes **Section 9**	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	Activate Monitor and Evaluate Strategy Go to **Section 9**	Operations Section Chief Logistics Section Chief /Supply Officer Environment Unit Leader
Day 1	Identify environmental sensitivities at risk and conduct Net Environmental Benefit Analysis (NEBA)	Review situational awareness and spill trajectory modelling Review applicable response strategies and begin operational NEBA (**Section 7.3**)	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 Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	Safety Officer

When (indicative)	Activations		Who
	Objective	Action	
If/when initiated Refer **Section 12**	Prevent or reduce impacts to wildlife	Activate the Oiled Wildlife Response Plan Go to **Section 12**	Environment Unit Leader Operations Section Chief 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 Leaders
If/when initiated Refer **Section 14**	Assess and monitor impacts from spill and response	Activate the Scientific Monitoring Plan Go to **Section 14**	Environment Unit Leader Logistics Section Chief / Supply Unit Leader Operations Section Chief
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, Australian Maritime Safety Authority (AMSA), and/or the Northern Territory (NT) IMT may be relevant Control Agencies (refer **Section 4.2**). + Where another Control Agency has taken control of aspects of the response, Santos will provide support to that Control Agency. Santos' support to the NT IMT (for a spill that impacts the NT shoreline) is detailed in **Section 4.5.**		Control Agency IMT Santos to provide support to the NT IMT, as requested.

3 Introduction

3.1 Purpose

This Oil Pollution Emergency Plan (OPEP) outlines the emergency management arrangements and oil spill response options for activities associated with the Barossa GEP Installation.

This OPEP addresses the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environmental) Regulations 2009 (OPGGS (E) Regulations)) and forms a supporting document to the Barossa GEP Installation Environment Plan (EP) (BAA-100 0329). It is also consistent with the National Plan for Maritime Environmental Emergencies (AMSA 2020), and the NT Oil Spill Contingency Plan (NT DoT, 2014).

This OPEP covers the response to oil spill incidents associated with Barossa GEP installation activities. This OPEP aids the IMT in planning and decision-making from when the IMT is first notified of the incident. Credible spills associated with Barossa GEP installation activities are listed in **Section 7.1.**

The location of the activity covered by this OPEP is shown in **Figure 3-1** and includes Commonwealth waters. While there are no activities for the Barossa GEP installation within NT waters, a spill within Commonwealth waters may enter NT waters.

3.2 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.

3.3 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)
- Barossa GEP Installation EP (BAA-100 0329)
- Incident Response Telephone Directory (SO-00-ZF-00025.020)
- Refuelling and Chemical Management Standard (QE-91-IQ-00098)
- Oil Pollution Waste Management Plan (QE-91-IF-10053)
- Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)
- Santos Oiled 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 (QE-00-BI-20001)
- Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).
- Santos Offshore Division Oil Spill Response Readiness Guideline (SO-91-OI-20001)

Details of the training, exercises, drills and audits that will be undertaken to provide preparedness and capability for delivery of this OPEP in the event of a spill are outlined in the Barossa GEP Installation EP (BAA-100 0329) (Implementation Strategy -Section 7).

3.4 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.
- 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.
- Territory Emergency Plan:
  - Describes the NT approach to emergency and recovery operations, the governance and coordination arrangements, and roles and responsibilities of agencies (available online: https://pfes.nt.gov.au/sites/default/files/uploads/files/2021/NTES_Territory_Emergency_Plan_2021.pdf
- Northern Territory (NT) Oil Spill Contingency Plan
  - Outlines the approach to management of marine oil pollution that are the responsibility of the NT Government.
- NT Oiled Wildlife Response Plan (NTOWRP)
  - An industry prepared plan, which is designed to ensure timely mobilisation of appropriate resources (equipment and personnel) in the event of an incident affecting wildlife in NT waters.
- Shipboard Oil Pollution Emergency Plans:
  - Under International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I requirements, all vessels of over 400 gross tonnage are required to have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill including steps taken to contain the source with equipment available onboard the vessel.
- 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.

3.5 Document review

In line with regulatory requirements, this document shall be reviewed, updated and submitted to NOPSEMA every five years from date of acceptance.

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

- when major changes have occurred that affect oil spill response coordination or capabilities
- changes to the Environment Plan that affect oil spill response coordination or capabilities (e.g., a significant increase in spill risk)
- following routine testing of the OPEP if improvements or corrections are identified
- after a Level 2/3 spill incident.

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.

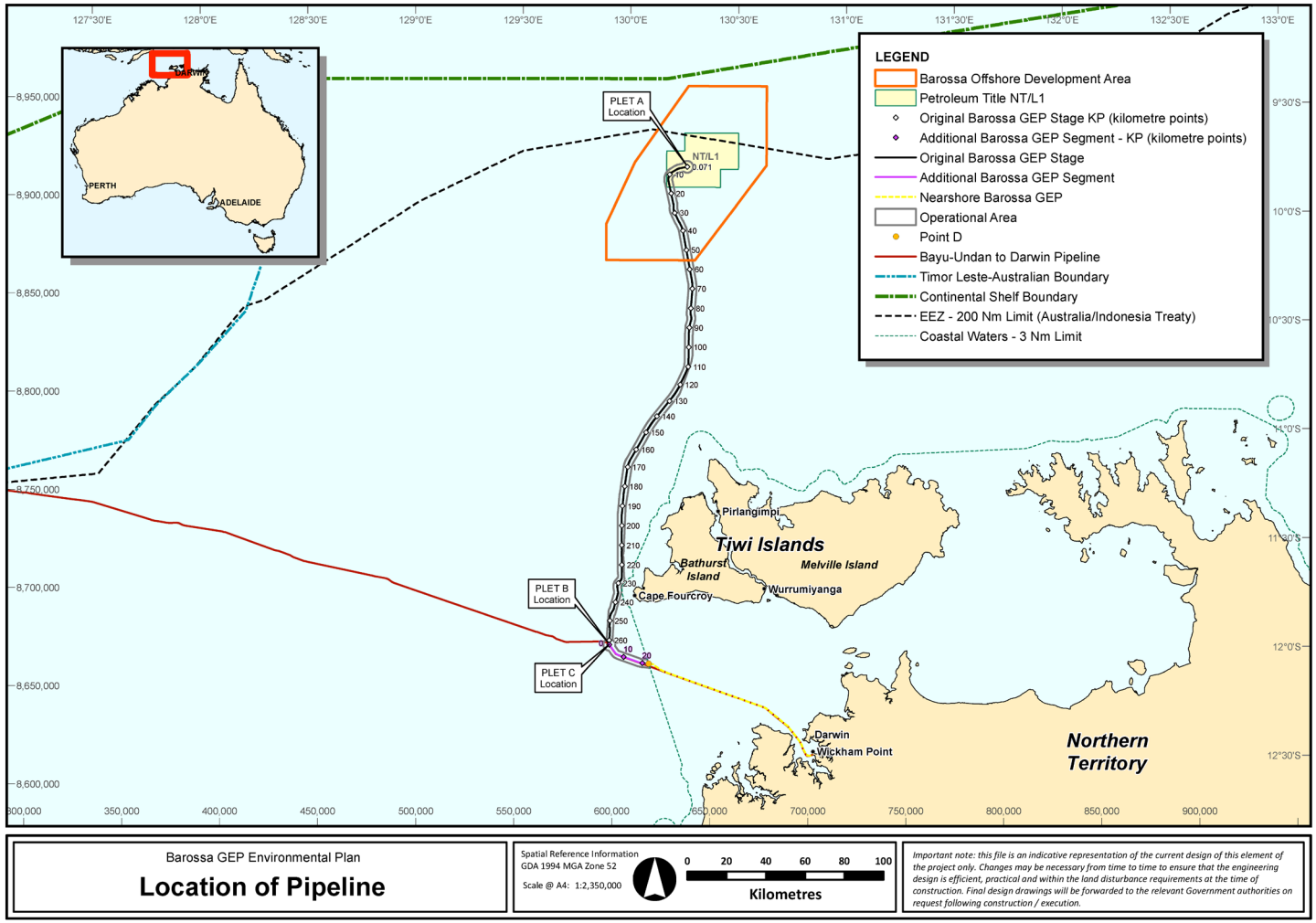


Figure 3-1: Barossa field and gas export proposed pipeline route location

4 Spill management arrangements

4.1 Response levels and escalation criteria

Santos uses a tiered system of three incident response levels consistent with the National Plan for Maritime Environmental Emergencies (National Plan) (AMSA 2020). 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.

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 On-site Incident Response Team (IRT) and its resources.	Source of spill has been contained. Oil is evaporating quickly and no danger of explosive vapours. Spill likely to naturally dissipate. No media interest/not have an adverse effect on the public.
Level 2	
An incident that cannot be controlled by the use of onsite resources alone and requires external support and resources to combat the situation; or **An incident that can be controlled onsite but which may have an adverse effect on the public or the environment.**	
Danger of fire or explosion. Possible continuous release. Concentrated oil accumulating in close proximity to the site or vessel. Potential to impact other installations.	Level 1 resources overwhelmed, requiring additional regional resources. Potential impact to sensitive areas and/or local communities. Local/national media attention/may adversely affect the public or the environment.
Level 3	
An incident which has a wide ranging impact on Santos and may require the mobilisation of external state/territory, 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

The responsibility for an oil spill is dependent on location and spill origin. The National Plan for Maritime Environmental Emergencies (AMSA, 2020) sets out the divisions of responsibility for an oil spill response. 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 Agencies: 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.

Table 4-2 provides guidance on the designated Control Agency and Jurisdictional Authority for Commonwealth and State/Territory waters and for vessel and facility spills.

To aid in the determination of a vessel versus a facility 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, 2017) as a seismic vessel, supply or support vessel, or offtake tanker.
- A petroleum activity including a fixed platform, FPSO/FSO, MODU, subsea infrastructure, or a construction, decommissioning and pipelaying vessel. As defined by Schedule 3, Part 1, Clause 4 and & Volume 2, Part 6.8, Section 640 of the OPGGSA 2006.

Table 4-2: Jurisdictional and Control Agencies for Hydrocarbon Spills

Jurisdictional boundary	Spill source	Jurisdictional authority	Control agency		Relevant documentation
			Level 1	Level 2/3	
Commonwealth waters (three to 200 nautical miles from territorial/state sea baseline)	Vessel	AMSA	AMSA		Vessel SOPEP National Plan
	Petroleum activities	NOPSEMA	Titleholder		Barossa GEP Installation OPEP (this document)
Northern Territory (NT) waters (territorial sea baseline to three nautical miles and some areas around offshore atolls and islands)	Vessel	Department of Environment, Parks and Water Security (DEPWS)	Vessel owner	NT IMT[1]	Vessel SOPEP Barossa GEP Installation OPEP (this document) NT Oil Spill Contingency Plan (2014)
	Petroleum activities	DEPWS	Titleholder[2]		Barossa GEP Installation OPEP (this document) NT Oil Spill Contingency Plan (2014)
NT shorelines	Vessel	DEPWS	Vessel owner	NT IMT[1]	Barossa GEP Installation OPEP (this document) NT Oil Spill Contingency Plan (2014)
	Petroleum activities	DEPWS	Titleholder	NT IMT[1]	Barossa GEP Installation OPEP (this document) NT Oil Spill Contingency Plan (2014)

[1] NT IMT will be the Control Agency but will be supported by the Titleholder (additional support from AMOSC if required)
[2] Titleholder will be the Control Agency but will request approval of IAPs from the NT IC.

Jurisdictional boundary	Spill source	Jurisdictional authority	Control agency		Relevant documentation
			Level 1	Level 2/3	
International waters	Petroleum activities	Relevant foreign authority	Santos will liaise with the Australian Government Department of Foreign Affairs and Trade (DFAT) in the event that an oil spill may enter international waters. Santos will work with DFAT and the respective governments to support response operations.		
	Vessel				

4.3 Petroleum activity spill in Commonwealth waters

For an offshore petroleum activity spill in Commonwealth waters, the Jurisdictional Authority is National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA). NOPSEMA is responsible for the oversight of response actions to pollution events from offshore Petroleum Activities, in areas of Commonwealth jurisdiction. During a spill incident, NOPSEMA's role will be to implement regulatory processes to monitor and secure compliance with the *OPGGS Act 2006* and *OPGGS (E) Regulations*, including the issuing of directions as required, and investigate accidents, occurrences and circumstances involving deficiencies in environment management.

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

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

4.4 Vessel spills

AMSA manages the National Plan for Maritime Environmental Emergencies (AMSA, 2020) and is the Control Agency for all vessel-based spills in the Commonwealth jurisdiction. This includes supply or support vessels and the pipelay vessel when it is not laying the pipeline, regardless of whether they are in the Operational Area or not.

The Northern Territory Government's Incident Management Team (IMT) would assume the Control Agency role for Level 2/3 vessel-based spills in NT waters. In all circumstances, the Vessel Master is responsible for implementing source control arrangements detailed in the vessel specific 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 9**) and Scientific Monitoring Plan (**Section 14**).

4.5 Spills Entering Northern Territory Waters

If a Level 2/3 spill arises which has potential to enter Territory waters, Santos must notify the Regional Harbourmaster and the NT Pollution Response Hotline (DEPWS) which will provide the communication link to the Territory Marine Pollution Coordinator (TMPC), who will establish an NT Incident Controller (NT IC) as the ongoing point of contact.

Notification to the TMPC and Regional Harbourmaster is to be completed as soon as practicable (within the first 24 hours of spill occurring or sooner) which will allow sufficient time to accurately determine the predicted time of any potential shoreline impact. The TMPC will appoint an NT IC.

Santos will commence coordination with the NT IC, mobilising resources and personnel into Darwin.

For Level 2/3 vessel spills that cross from Commonwealth waters into Territory waters, AMSA will remain Control Agency for Commonwealth waters and the NT Government (via NT Incident Management Team (IMT)) will be Control Agency for NT waters.

The NT IMT with advice from NT Environment, Scientific and Technical advisors will work with AMSA (and support from Santos, if requested) to confirm protection priorities and undertake an operational NEBA to determine the most appropriate response in Territory waters.

If a Level 2/3 facility spill reaches the Northern Territory shoreline, the NT IMT will be the Control Agency for the shoreline.

The NT IMT will be established in Darwin and consist of staff from across NT Government. The NT IMT will be supported by existing NT emergency response arrangements[3] and Santos, as Supporting Agency. Additional support, if required, will be provided under the provisions of the *NT Emergency Management Act 2013*, through the Territory Emergency Management Council and the NT Government Functional Groups.

At the request of the TMPC, Santos will be required to provide all necessary resources, including personnel and equipment, to assist the NT IMT in performing duties as the Control Agency. This may include the provision of personnel to work within the NT IMT located in Darwin, to assist response activities such as shoreline protection, with the required numbers to be determined based on the nature and scale of the spill and response requirements at the time.

The Territory Emergency Management Council will delegate responsibilities associated with wildlife and activities in National parks, reserves and Territory marine parks. Direct coordination will be managed through the designated NT Government Functional Group.

4.6 Cross-jurisdictional vessel spills

If a Level 2/3 vessel spill crosses jurisdictions between Commonwealth and Territory/State waters, two Jurisdictional Authorities will exist (AMSA for Commonwealth waters; and NT IMT for Territory Waters). Control Agency responsibilities will be determined by NT Government and AMSA, with Santos providing all necessary resources (including personnel and equipment) as a Supporting Agency, as detailed in **Section 4.4.**

4.7 Oiled Wildlife Response

Relevant guidance to support an oiled wildlife response in the event of an oil spill is outlined in the Northern Territory Oiled Wildlife Response Plan (NTOWRP) (AMOSC, 2019) (**Section 12**), the plan is designed to ensure timely mobilisation of appropriate resources (equipment and personnel) in the event of an incident affecting wildlife in NT waters.

5 Santos incident management arrangements

5.1 Incident management structure

The Santos IMT (Perth) and 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.

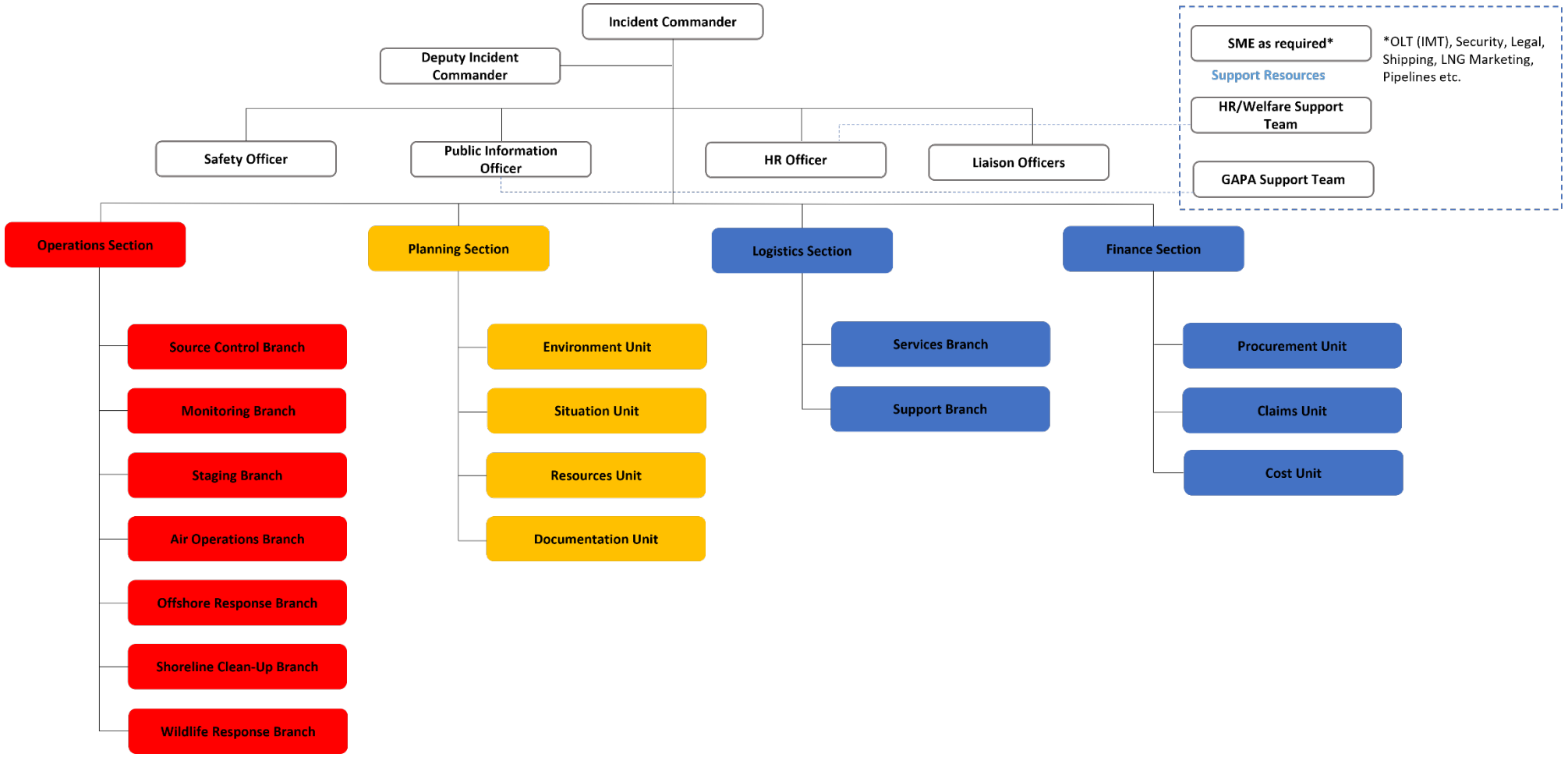
The Santos IMT (Perth) and CMT will be activated in the event of a Level 2/3 hydrocarbon spill regardless of the type of spill or jurisdiction. As outlined in **Section 4** control of the response may be taken over by the relevant Control Agency as the incident progresses. The Santos response structure to a major emergency incident is detailed in the Santos Incident Command and Management Manual (SO-00-ZF-00025). The Incident Command and Management Manual describes response planning and incident management that would operate under emergency conditions – describing how the Santos IMT operates and interfaces with the CMT and external parties.

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

Santos' incident response structure relevant to a Barossa GEP Installation incident includes:

+ Santos IMT – Perth-based to coordinate and execute responses to an oil spill incident
+ Santos Crisis Management Team (CMT) – to coordinate and manage threats to the company's reputation and to handle Santos' corporate requirements in conjunction with the Perth-based Santos – Vice President Offshore (VPO) 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 Incident Command and Management Manual (SO-00-ZF-00025) and 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. Additional detail on roles and responsibilities is presented in Section 7.11.4 of the EP.



Note: Due to the nature of activity, the Source Control Branch is not expected to be activated.

Figure 5-1: Santos incident management team organisational structure

5.2 Incident action plan

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 IMT will use an IAP for each operational period following the initial first-strike assessments, notifications, and activations undertaken.

When acting as the Support Agency, Santos may be requested by the Control Agency to develop or support the development of an IAP to help guide the incident response.

The Santos IAP process is built on the phases described in **Figure 5-2**.

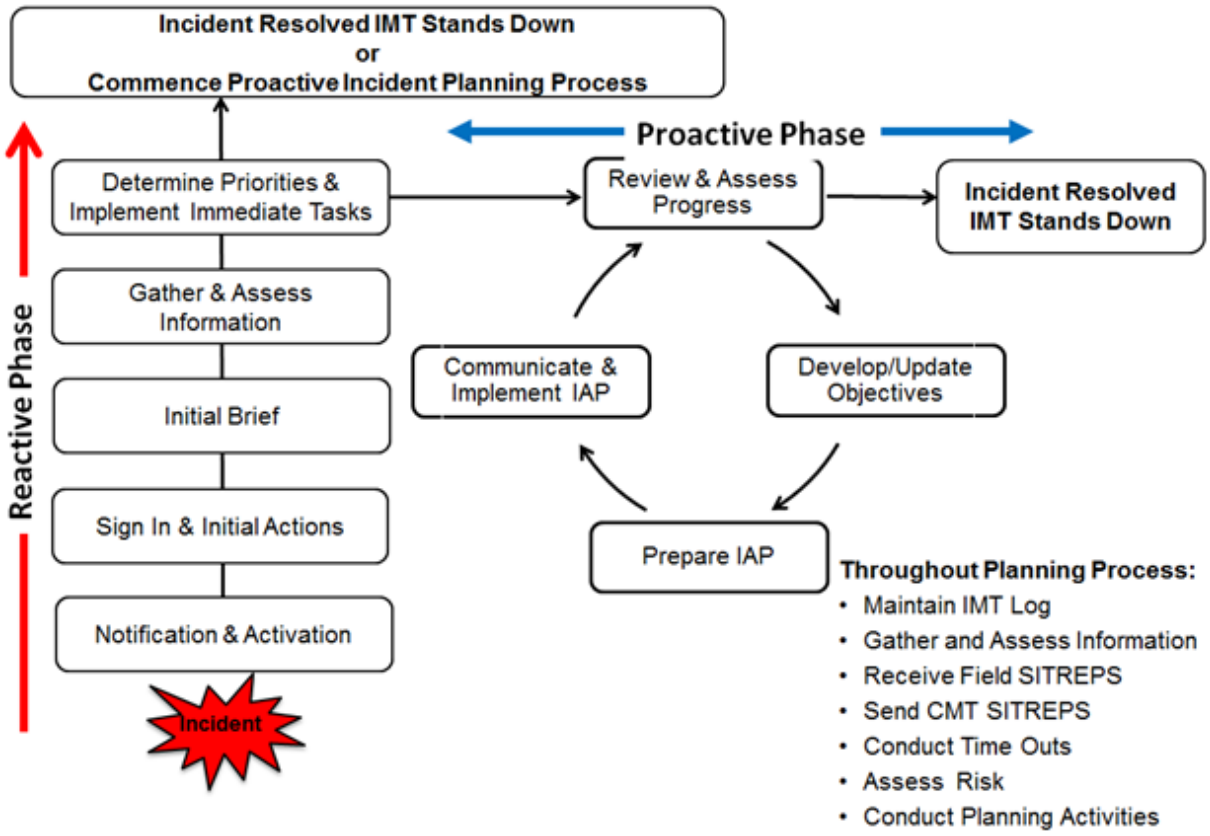


Figure 5-2: Incident Action Plan process

5.2.2 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 each 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 NEBA (also referred to as a SIMA) (**Section 7**). 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. This assessment helps verify that the response strategies pre-selected for each spill scenario are providing the best environmental outcome for the incident response.

5.2.3 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' 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) who report on the effectiveness of the response strategies.

IAP forms and processes are documented in the *Incident Command and Management Manual* (SO-00-ZF-00025) and in the 'Emergency Response' folder sets at *L:\Resource\Emergency*

Response\Incident-Exercise Number-Name. Begin the response by copying and saving *Incident-Exercise Number-Name* folder set with a unique incident name and Id number on the lead folder; this is the Incident Log. Access subfolders to display all forms required to conduct incident action planning. Each functional position within the IMT and CMT has subfolders carrying forms and processes unique to the functional position.

5.3 Environmental performance

Table 5-1 lists the Environmental Performance Standards and Measurement Criteria for incident action planning.

Table 5-1: Environmental performance – incident action planning

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Response Implementation		
Manage incident via a systematic planning process	IMT to complete status boards during the initial phase of the incident, followed by an IAP for each operational period	Records demonstrate status boards completed ICS during the initial phase of the incident, followed by an IAP for each operational period
	IMT to monitor effectiveness of tactics being implemented and use information in the development of IAPs	Records demonstrate IMT used information on effectiveness of tactics in the development of IAPs
Maintain contracts with support agencies to obtain additional support or technical expertise to monitor and/or respond to a spill	Service Level Agreement maintained with OSRL, Master Services Contract maintained with AMOSC and agreement maintained with RPS Group for the duration of the activity	Records demonstrate that Service Level Agreement maintained with OSRL, Master Services Contract maintained with AMOSC and agreement maintained with RPS Group for the duration of the activity

6 External notifications and reporting requirements

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

6.1 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 Unit Leader.

Contact details for the Regulatory agencies outlined in **Table 6-1** are provided within the Incident Response Telephone Directory (SO-00-ZF-00025.020).

Table 6-1 outlines the external regulatory reporting requirements specifically for oil spill incidents outlined within this OPEP in Commonwealth, State and Territory jurisdictions, noting that regulatory reporting may apply to smaller Level 1 spills that can be responded to using onsite resources as well as larger Level 2/3 spills. There are also additional requirements for Vessel Masters to report oil spills from their vessels under relevant marine oil pollution legislation (e.g., MARPOL). This includes, where relevant, reporting oil spills to AMSA (Rescue Coordination Centre) and the NT Government.

Notifications to NT Regional Habourmaster/ DEPWS will apply to spills in Territory waters or spills originating in Commonwealth waters and moving to Territory waters.

The Incident Response Telephone Directory (SO-00-ZF-00025.02) 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).

6.2 Activation of external oil spill response organisations and support agencies

Table 6-2 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 that have pre-established roles in assisting Santos in an oil spill response. It is not an exhaustive list of all providers that Santos may use for assisting an oil spill response.

The Incident Response Telephone Directory (SO-00-ZF-00025.02) contains a more detailed list and contact details for incident response support and is updated every six months with up-to-date revisions available within the IMT room and online (intranet procedures and emergency response pages).

Table 6-1: External notification and reporting requirements (commonwealth, state/territory and international 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 2020)	A spill associated with the activity in Commonwealth waters that has the potential to cause moderate to significant environmental damage[4]	Notification by Environment Unit Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
National Offshore Petroleum Titles Administrator (NOPTA) (Titles Administrator)	Written report to NOPTA 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 Environment Unit Leader (or delegate)	Provide same written report as provided to NOPSEMA
AMSA Rescue Coordination Centre (RCC)[2]	Verbal notification within two hours of incident Written POLREP form, within 24 hours on request from AMSA	Under the MoU between Santos and AMSA	Santos to notify AMSA of any marine pollution incident[5]	Notification by Environment Unit Leader (or delegate)	Not applicable
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 Matters of National Environmental Significance (MNES) are considered at risk from a spill or response strategy, or where there is death or injury to a protected species	Notification by Environment Unit Leader (or delegate)	Not applicable

[4] *For clarity and consistency across Santos' regulatory reporting requirements, Santos will meet the requirement of reporting a marine oil pollution incident to NOPSEMA 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 Barossa Gas Export Pipeline Installation EP (BAA-100-0329).*

[5] *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)*

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 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
Australian Fisheries Management Authority (AFMA)	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution[1] Fisheries within the environment that may be affected (EMBA) Consider a courtesy call if not in exposure zone	Notification by Environment Unit Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification/ Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
If spill is heading towards NT waters					
NT Regional Harbourmaster	Verbal notification Follow up with POLREP as soon as practicable after verbal notification	Northern Territory Oil Spill Contingency Plan. As per Territory legislation (i.e. Marine Pollution Act 1999)	All actual or impending spills in NT waters, regardless of source or quantity Notify if spill has the potential to impact wildlife in Territory waters (to activate the Oiled Wildlife Coordinator)	Notification by Environment Unit Leader (or delegate)	POLREPs to be emailed to rhm@nt.gov.au (Regional Harbourmaster) Instructions for submitting POLREPs (including a POLREP Template) are provided on the NT Government webpage https://nt.gov.au/marine/marine-safety/report-marine-pollution
NT Department of Environment, Parks and Water Security (DEPWS) (Pollution Response Hotline; Environmental Operations)	Verbal notification as soon as practicable Written report to be provided as soon as practicable after the incident, unless otherwise specified by the Minister	Northern Territory Oil Spill Contingency Plan. As per State legislation (i.e. Marine Pollution Act 1999)	All actual or impending spills in NT waters	Notification by Environment Unit Leader (or delegate)	Marine Pollution Reports (POLREPs) are to be emailed to pollution@nt.gov.au (Environmental Operations) Instructions for submitting POLREPs (including a POLREP Template) are provided on the NT Government webpage https://nt.gov.au/marine/marine-safety/report-marine-pollution

Agency or Authority	Type of Notification/ Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
NT Department of Primary Industry and Fisheries (DPIF)	Verbal notification, timing not specified	Not applicable	Fisheries within the EMBA Consider a courtesy call if not in exposure zone	Notification by Environment Unit Leader (or delegate)	Not applicable

Table 6-2: List of spill response support notifications

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
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.	Environment Unit Leader (or delegate) will notify AMOSC (upon approval from Incident Commander)
Aviation Service Provider - Helicopters	Within two hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place	Phone call.	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)
Freight & Logistics Provider	Within two hours of incident having been identified	Verbal	Assistance with mobilising equipment and loading vessels	Phone call.	Logistics Section Chief (or delegate)
Waste Service Provider	As required for offshore and shoreline clean-up activities	Verbal	Santos has contract arrangements in place to take overall responsibility to transport and dispose of waste material generated through clean-up activities	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	Logistics Section Chief (or delegate)
Monitoring Service Provider (Currently Astron)	Scientific Monitoring Plan initiation criteria are met (**Appendix E: Scientific Monitoring Plans**)	Verbal and written	Astron has been contracted by Santos to provide Standby Services for Scientific Monitoring Plans (SMPs) 1 to 11. This includes provision of personnel and equipment. Astron annually reviews the SMPs for continual improvement	**Step 1.** Obtain approval from Incident Commander to activate Astron for Scientific Monitoring. **Step 2.** Verbally notify Astron followed by the submission of an Activation Form (Environment Unit 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.	Environment Unit Leader (or delegate)
Intertek Geotech (WA) Environmental	When characterisation of oil is activated (**Section 8**)	Verbal	Oil analysis including gas chromatography/mass spectrometry fingerprinting	Phone call.	Environment Unit Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
Services and Ecotoxicology					
Oil Spill Response Limited, 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 (spill modelling)	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.	Environment Unit Leader (or delegate)

7 Response strategy selection

7.1 Spill Scenarios

There are two worst-case credible spill scenarios associated with marine vessel operations during pipeline installation activities, which could occur at any location along the GEP route. These scenarios are outlined in **Table 7-1.** Additional detail on hydrocarbon characteristics and weathering data are included in **Appendix A**.

Table 7-1: Barossa GEP Installation Spill Scenario Summary (RPS, 2019; RPS, 2021)

Worst Case Credible Spill Scenario	Hydrocarbon Type	Maximum Credible Volume Released (m3)	EMBA for Surface Hydrocarbons	Estimated Minimum Time and Volumes for Shoreline Contact
Scenario 1: Pipelay vessel collision – fuel tank rupture	MDO (Group II)	700 m^3 surface release over a 6-hour period	Location 1 (closest to Bathurst Island): Moderate exposure threshold (10 - 25 g/m^2) at the sea surface up to approximately 41.3 km from release location (Winter)	Location 1 (closest to Bathurst Island): Estimated minimum time for contact with Bathurst Island is 6 hours (20% probability of contact). Maximum volume ashore: 224.5 m^3
			Location 2 (closest to Melville Island): Moderate exposure threshold at the sea surface up to approximately 77.7 km from release location (Transitional).	Location 2 (closest to Melville Island): Estimated minimum time for contact with Melville Island is 3.2 days (1% probability of contact). Maximum volume ashore: 20 m^3
			Location 3 (GEP KP0 - offshore development area): Moderate exposure threshold at the sea surface up to approximately 92.2 km from release location (Transitional).	Location 3 (KP0 offshore development area): No shoreline contact predicted.
			Location 4: Additional GEP Segment KP23 - location closest to NT mainland): Moderate exposure threshold at the sea surface up to approximately 39.8 km from release location (Summer).	Location 4 (Additional GEP Segment KP23 - location closest to NT mainland): Estimated minimum time to contact above the moderate exposure threshold is 15.5 days with Bathurst Island (5% probability of contact). Maximum volume ashore: 16.6 m^3 (Bathurst Island – Winter)
Scenario 2: Bunkering incident. Note: no bunkering within 20 km of Tiwi Islands shorelines	MDO (Group II)	10 m^3 instantaneous surface release	Above moderate exposure threshold (10 g/m^2) up to approximately 9.5 km from release location (Summer)	No shoreline contact predicted.

7.2 Priority Protection Areas

Results from hydrocarbon spill modelling were compared against the location of key sensitive receptors with high conservation valued habitat or species or important socio-economic/heritage value within the EMBA. Sensitive receptors within the EMBA with shortest potential timeframes to contact above the following moderate impact thresholds were identified:

- Floating oil: 10 g/m^2;
- Shoreline accumulation: 100 g/m^2.

More information on the development of the moderate impact thresholds is provided in Section 5.3.7 of the EP.

Table 7-2 outlines the list of priority protection areas in the event of a spill associated with the pipeline installation activities. Depending on the spill scenario (i.e. volume and location), the priority protection areas could be impacted by surface hydrocarbons at or above moderate threshold concentrations.

Implementation of operational and scientific monitoring may focus on Priority Protection Areas relative to other areas due to their high environmental value (**Appendix F: Scientific Monitoring Capability**).

Table 7-2: Priority protection areas in the EMBA

Priority protection area	Description
Vernon Islands	Located in the Clarence Strait in the Northern Territory, between the Australian mainland and Melville Island. Contains a range of shoreline types and species that are vulnerable to oil pollution, including: • Mangroves; • Coral reefs and extensive coralline algal terraces; • Sandy beaches; • Mudflats; • Dugongs; and • Turtles. Contains sites of socioeconomic and cultural importance, including: • Culturally significant heritage sites for Tiwi, Larrakia and Wulna people; • Important diving sites ('Blue Holes'); and • Shipwrecks.

Priority protection area	Description
Cox-Finniss	Located south west of Darwin on the Northern Territory mainland. Contains a range of shoreline types and species, including; • Mangroves • Sandy beaches; • Delta river mouths; • Tidal flats; and • Turtle nesting beaches.
Tiwi Island shorelines (Bathurst and Melville Islands)	Contains a range of shoreline types and species that are vulnerable to oil pollution, including: • Mangroves; • Sandy beaches; • Exposed rocky shores; • Wavecut platforms; • Tidal flats; • Turtle nesting beaches (flatback and olive ridley turtles); and • Nesting beaches for crested terns Contains cultural heritage sites, including: • Culturally significant heritage sites for Tiwi Islanders.
Oceanic Shoals Marine Park	The Oceanic Shoals Marine Park is protected under the EPBC Act. The Oceanic Shoals Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Transition. It contains four key ecological features: carbonate bank and terrace systems of the Van Diemen Rise; carbonate bank and terrace systems of the Sahul Shelf; pinnacles of the Bonaparte Basin; and shelf break and slope of the Arafura Shelf (all valued as unique seafloor features with ecological properties of regional significance).

7.3 Net Environmental Benefit Analysis

A pre-spill net environmental benefit analysis (NEBA) was completed to identify the potential net environmental benefit to key sensitive receptors associated with the implementation of potential spill response options (Appendix C of the Barossa GEP Installation EP (BAA-100 0329). **Table 7-3** presents a summary of the outcomes of the NEBA process and outlines response options which may result in a net environmental benefit based on the credible hydrocarbon spill scenarios defined in **Table 7-1**.

The pre-spill NEBA identified primary response options recommended to be used during the response. Primary response options are the principal methods that have been assessed to have a net environmental benefit of managing the spill. Additional secondary (contingency) response options are those that may either be used to supplement the primary response option, or which may be appropriate under specific circumstances.

Response option selection requires an evaluation of trade-offs associated with each response option (e.g. health and safety, feasibility, flexibility etc.), in addition to geographic/environmental conditions and the fate and weathering characteristics of the spill. As a result of this evaluation, mechanical physical dispersion, chemical dispersion and containment and recovery were not selected as suitable response options. The pre-spill NEBA identified shoreline protection and deflection, and shoreline clean-up, as secondary responses that could be implemented for priority protection areas, if it was safe and practical to do so (Refer to **Table 7-3**).

During a response, the EUL in the IMT is responsible for ensuring a spill response (operational) NEBA is conducted, to determine if output from the pre-spill NEBA is still appropriate. The spill response (operational) NEBA should incorporate post-spill modelling data, surveillance and operational monitoring data and should be incorporated into the IAP. The spill response (operational) NEBA will also be used to inform decision making around the initiation and termination of response options. Environmental Performance Outcomes, Standards and Measurement Criteria are listed in **Table 7-4**.

Table 7-3: NEBA summary of response options

Response Option	Scenario 1 – Pipelay Vessel Collision – Fuel Tank Rupture (700 m^3 MDO)	Scenario 2 – Bunkering Incident (10 m^3 MDO)	NEBA Summary
Monitor and evaluate	Primary response option	Primary response option	The requirement for situational awareness is critical to implementing an effective spill response and to understand the impacts that may result from a spill. Therefore, the benefits of undertaking this response are considered to significantly outweigh the potential environmental risks/impacts for both worst-case credible spill scenarios.
Oiled wildlife response	Primary response option	N/A	Wildlife surveillance/reconnaissance is a critical component of an oiled wildlife response and should be undertaken in consultation with the planning for monitor and evaluate activities. Wildlife surveillance provides the situational awareness to ascertain the level of impact to wildlife in order to determine what other oiled wildlife response strategies may be required. The benefits of undertaking this response are considered to significantly outweigh the potential environmental risk/impacts for scenario 1.
(Mechanical) physical dispersion	N/A	N/A	Mechanical dispersion may assist natural dispersion (e.g. prop wash or use of fire monitor sprays from vessels) to remove MDO from the sea surface. However, MDO is expected to weather rapidly at the sea surface and the benefits of undertaking this response are not considered to significantly outweigh the potential risk to human health. The volatile components in MDO have the potential to cause human health issues such as difficulty breathing, and also present a fire / explosion risk. As such mechanical dispersion is not considered a suitable response for these scenarios
Chemical dispersion – surface application	N/A	N/A	MDO is not a persistent hydrocarbon and has high natural spreading, dispersion and evaporation rates in the marine environment. Dispersant application has a low probability of being effective in increasing the dispersal rate of MDO and

Response Option	Scenario 1 – Pipelay Vessel Collision – Fuel Tank Rupture (700 m^3 MDO)	Scenario 2 – Bunkering Incident (10 m^3 MDO)	NEBA Summary
			would introduce more chemicals to the marine environment. The benefits of applying chemical dispersant do not significantly outweigh the potential environmental risks/ impacts and therefore this response option is not considered suitable.
Containment and recovery	N/A	N/A	Containment and recovery is unlikely to be effective in either scenario. This is due to the hydrocarbon type and the scenarios being in open ocean where MDO forms a thin film and weathers rapidly making recovery via skimmers difficult and ineffective.
Protection and deflection	Secondary	N/A	Considered if operational monitoring shows or predicts contact with sensitive shorelines. <u>Scenario 1 – 700 m^3 MDO vessel spill</u> Shoreline protection and deflection activities can result in physical disturbance to intertidal and shoreline habitats and the remote environments of Northern mainland Australia and the Tiwi Islands also present a range of safety challenges, such as • Remote working location; • Exposure to elements – tropical environment; • Dangerous wildlife – feral pigs, saltwater crocodiles and Irukandji jellyfish; and • Lack of transport infrastructure – very difficult to access sites by land. Given the relatively small volumes predicted to come ashore, and the high rates of natural biodegradation of marine diesel, it would be better to focus on priority areas for protection. This strategy is considered to be a secondary response strategy where it is safe and practical to implement and where priority protection areas are at risk of impact from marine diesel.

Response Option	Scenario 1 – Pipelay Vessel Collision – Fuel Tank Rupture (700 m^3 MDO)	Scenario 2 – Bunkering Incident (10 m^3 MDO)	NEBA Summary
			Scenario 2 – 10 m^3 MDO vessel spill Modelling indicates no shoreline contact above moderate shoreline accumulation thresholds (>100 g/m^2).
Shoreline clean-up	Secondary	N/A	Considered if operational monitoring shows or predicts contact with sensitive shorelines. Scenario 1 – 700 m^3 MDO vessel spill Shoreline clean-up activities can result in physical disturbance to shoreline habitats and the remote environments of Northern mainland Australia and the Tiwi Islands also present a range of safety challenges, such as • Remote working location; • Exposure to elements – tropical environment; • Dangerous wildlife – feral pigs, saltwater crocodiles and Irukandji jellyfish; and • Lack of transport infrastructure – very difficult to access sites by land. Given the high rates of natural biodegradation of marine diesel, it would be better to focus on priority areas for protection. This strategy is considered to be a secondary response strategy where it is safe and practical to implement and where priority protection areas are at risk of impact from marine diesel. Scenario 2 – 10 m^3 MDO vessel spill Modelling indicates no shoreline contact above moderate shoreline accumulation thresholds (>100 g/m^2).
Scientific monitoring	Primary	N/A	Monitoring activities include: + water and sediment quality

Response Option	Scenario 1 – Pipelay Vessel Collision – Fuel Tank Rupture (700 m^3 MDO)	Scenario 2 – Bunkering Incident (10 m^3 MDO)	NEBA Summary
			+ biota of shorelines (sandy beaches, rocky shores and intertidal mudflats) + mangrove monitoring + benthic habitat monitoring (seagrass, algae, corals, non-coral benthic filter feeders) + seabirds and shorebirds + marine megafauna (incl. whale sharks and mammals) + marine reptiles (incl. turtles) + seafood quality + fish, fisheries and aquaculture 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.

7.4 Environmental performance

Table 7-4 lists the Environmental Performance Standards and Measurement Criteria for response strategy selection.

Table 7-4: Environmental performance – response strategy selection

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Response Implementation		
Implement emergency response options that result in net environmental benefit.	IMT to undertake spill response (operational) NEBA to determine initiation and termination of response options.	Records demonstrate spill response (operational) NEBA undertaken during OPEP implementation.
	IMT to undertake an operational NEBA during the preparation and review of IAPs.	Records demonstrate IMT completed an operational NEBA during the preparation and review of IAPs.

8 Source control

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

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

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

8.1 Vessel collision – fuel tank rupture

Table 8-1 provides the environmental performance outcome, initiation criteria and termination criteria for source control response to a 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 8-1: Vessel collision – 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	Notification of a spill	
Applicable hydrocarbons	**MDO**	**Crude**
	✓	✗
Termination criteria	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbons	

8.1.1 Implementation guidance

Implementation guidance is summarised in **Table 8-2.** In the event MDO is released from a vessel due to a tank rupture, the relevant vessel-specific procedures will be applied. For support vessel collisions, the vessel's SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident. **Table 8-3** lists the environmental performance standards and measurement criteria for this strategy.

Table 8-2: Implementation guidance – fuel tank rupture

Responsibility	Task	Consideration	Complete
Vessel Master	The vessel's SOPEP, as applicable under MARPOL, or procedure for responding to a ruptured tank will be followed, as applicable.	Notwithstanding vessel-specific procedures for source control, the following activities would be evaluated immediately for implementation, providing it is 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 inventory 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.	❑

8.2 Environmental performance

Table 8-3 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 8-3: Environmental performance – source control

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Response preparedness		
Implementation of source control methods to stop the release of hydrocarbons into the marine environment.	Support vessels have a SOPEP or shipboard marine pollution emergency plan (SMPEP) that outlines steps taken to combat spills	Audit records Inspection records
	Spill exercises on support vessels are conducted as per the vessels SOPEP or SMPEP	Spill exercise close out reports
Response Implementation		
Implementation of source control methods to stop the release of hydrocarbons into the marine environment.	Actions to control spill associated with a vessel incident followed in accordance with SOPEP	Vessel logs

9 Monitor and evaluate

Monitor and evaluate involves the collection and evaluation of information to provide and maintain situational awareness in the event of a spill. This response option includes fate and weathering modelling, trajectory modelling, satellite surveillance and spill tracking via use of buoys and field observations.

Monitor and evaluate activities should be conducted throughout the spill response, as it provides the IMT with ongoing information on sensitive receptors at risk of impact from the spill and the effectiveness of spill response operations. This information should be used by the IMT when updating response (operational) NEBAs and in the development of IAPs.

Monitor and evaluate can include one or more of the following tactics:

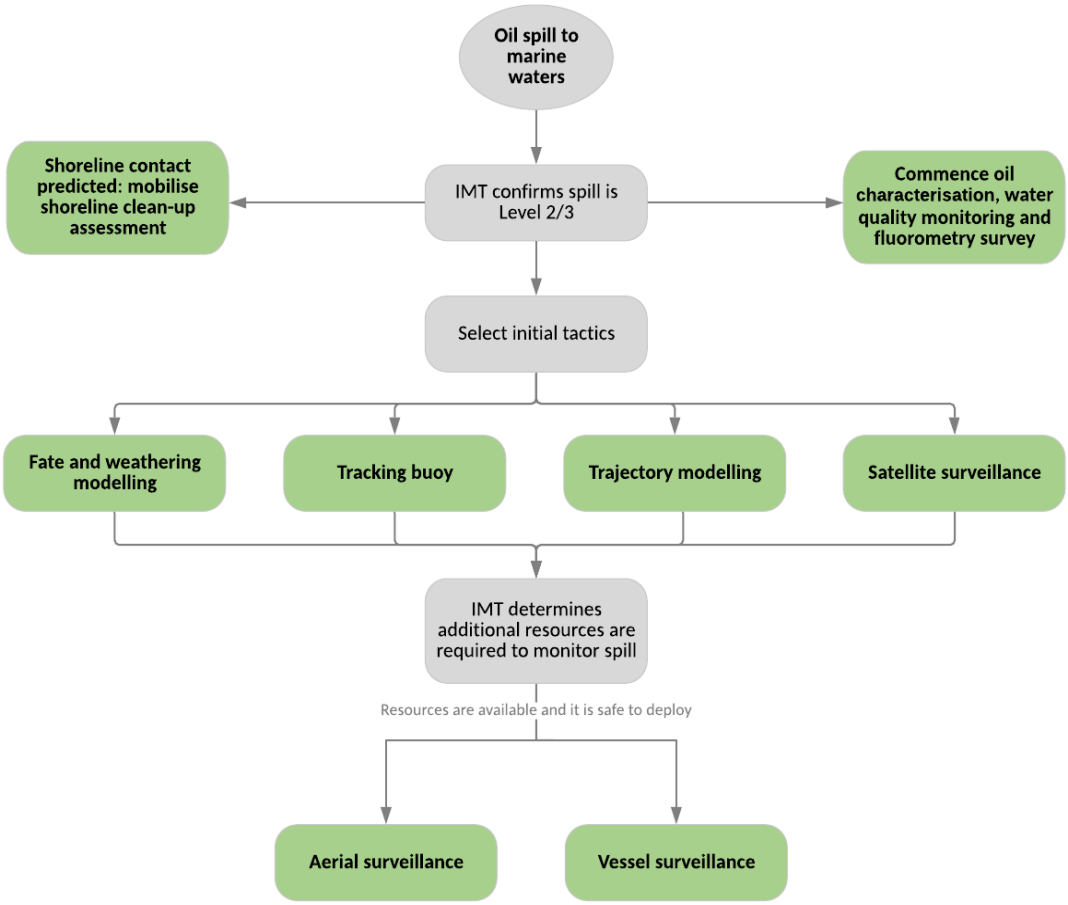
+ Deployment of tracking buoy(s) – requires a buoy to be deployed to the water at the leading edge of the spill to track the movement of the spill
+ Fate and weathering modelling – uses computer modelling to estimate the weathering of an oil spill
+ Oil spill trajectory modelling – uses computer modelling (e.g. SIMAP) to estimate the movement, fate and weathering of spills
+ Visual observation (via aerial and/or vessel surveillance) – requires trained observers to identify and characterise spills. Survey platforms typically include aircraft and/or vessels. Is also used to ground truth oil spill trajectory modelling and monitor the effectiveness of response options
+ Satellite surveillance and data capture – uses satellite technology to identify and track oil spills
+ Initial oil characterisation - sampling and analysis of the released hydrocarbon to provide the most accurate information on the hydrocarbon properties at the time of release
+ Operational water quality monitoring - sampling of oil and oil in water 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. This monitoring is complimentary to scientific water quality monitoring (SMP1) delivered through the Oil Spill SMP in terms of methodology and required skillset and can be provided through Santos' Scientific Monitoring Provider (**Section 14**).
+ Continuous fluorometry survey - may be run across the expected slick/plume extent, as well as vertically through the water column. This allows a far greater area of coverage than discrete sampling, aiding in the mapping of entrained and dissolved oil movement
+ Shoreline clean-up assessment - requires trained personnel to establish shoreline segments, establish protection priorities and identify site-specific protection tactics.

The process for selecting which tactic to apply is shown in **Figure 9-1** (excluding initial oil characterisation, water quality monitoring and fluorometry survey as these would be initiated when

a Level 2/3 spill occurs). **Table 9-1** provides guidance on tasks and responsibilities that should be considered when implementing this response option.

Note: these are provided as a guide only. The On-Scene Commander and Incident Commander are ultimately responsible for the implementation of the response and may therefore determine that some tasks be varied, should not be undertaken or should be reassigned.

Information on resources, implementation times and termination criteria for this option are shown in **Table 9-2.** Environmental Performance Outcomes, Standards and Measurement Criteria are listed in **Table 9-3.**



Limitation/s: *Surveillance activities should not be deployed in areas where the hydrocarbon release potentially poses a safety hazard to response personnel (e.g. VOCs associated with diesel).*

Termination criteria: *The response will be terminated when either a silvery-grey sheen (as defined by Bonn Agreement Oil Appearance Code 1- Sheen) is no longer evident to observers from the release area or when the spill response is terminated. This decision will be made by the control agency.*

Figure 9-1: Decision guide for monitor and evaluate

Table 9-1: Monitor and Evaluate Implementation Guide

Responsibility	Task	Consideration/s	Complete
Fate and Weathering Modelling (if selected)			
IMT	Conduct hydrocarbon distribution, fate and weathering assessment using information available on oil type in **Appendix A: Hydrocarbon Characteristics and Behaviour** of this OPEP	-	❑
Tracking Buoy (if selected)			
IRT	Use available support vessel to deploy tracking buoy as close as possible to spill location (vessel safety is priority)	Tracking buoy available on the support vessel	❑
IMT	Inform IMT that tracking buoys have been deployed and provide deployment details. Monitor movement of tracking buoys.	Refer login details of tracking buoy monitoring website on Santos ER intranet site.	❑
IMT	Use tracking buoy data to maintain Common Operating Picture.	Data tracked online.	❑
IMT	Relay information to spill fate modelling supplier for calibration of trajectory modelling.	-	❑
Trajectory Modelling (if selected)			
IMT	Initiate oil spill trajectory modelling (OSTM) by submission of an oil spill trajectory modelling request form (Santos Procedure Index). Request for three-day forecast trajectory modelling.	Modelling to be undertaken within 3 hours of the request sent to RPS, then every operational day during the spill response or, if additional response options are employed, to identify possible changes to trajectory etc.	❑
IMT	Determine requirement for gas/VOC modelling and request initiation.	Hydrocarbon releases have human health and safety considerations for responders (volatile gases and organic compounds). This to be considered for any tactics that monitor/recover oil – especially at close proximity to release site.	❑
IMT	Operational surveillance data (aerial, vessel, tracker buoys) to be provided to modelling provider to verify	-	❑

Responsibility	Task	Consideration/s	Complete
	and adjust fate predictions of the spill and improve predictive accuracy.		
IMT	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 quality assurance and control procedures.	❑
IMT	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.	❑
IMT	Identify location and sensitivities at risk based on the trajectory modelling and inform IMT. Conduct operational NEBA on proposed response strategies.	-	❑
IMT	Request spill trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture.	-	❑
IMT	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input data (if or when available) to improve model accuracy.	-	❑
Satellite Surveillance (if selected)			
IMT	Assess requirement for satellite imagery.	-	❑
IMT	Notify AMOSC and OSRL Duty Officer to request initiation of satellite services	Formal written activation of resources from AMOSC by designated call-out authorities (Santos Duty Managers/Incident Commanders) is required.	❑
IMT	Assess suitability and order imagery.	-	❑
IMT	Integrate satellite imagery into Common Operating Picture and provide to trajectory modelling provider for model validation.	-	❑
IMT	Review surveillance information to validate spill fate and trajectory.	-	❑

Responsibility	Task	Consideration/s	Complete
IMT	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.	❑
Aerial Surveillance (if selected)			
IMT	Contact contracted aviation provider – provide details of incident and request mobilisation to spill site for initial surveillance.	If aviation asset available at 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 before deployment. There should be an attempt to obtain the following data during initial surveillance: + name of observer, date, time, aircraft type, speed and altitude of aircraft + location of slick or plume (global positioning system [GPS] positions, if possible) + spill source + size of the spill, including approximate length and width of the slick or plume + visual appearance of the slick (e.g. colour) + edge description (clear or blurred) + general description (windrows, patches etc.) + wildlife, habitat or other sensitive receptors observed + basic metocean conditions (e.g. sea state, wind, current) + photographic/video images.	❑

Responsibility	Task	Consideration/s	Complete
IMT	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 Offshore ER Intranet page.	❑
IMT	Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation ops. Expected that two overpasses per day of the spill area are completed.	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.	❑
IMT	Pre-flight briefing.	-	❑
IRT	Aerial Observers to commence surveillance	Consider procedure for interacting with marine fauna.	❑
IRT	Determine spill extent by completing Aerial Surveillance Log **(Appendix B: Aerial Surveillance Observer Log)** . Take still and/or video images of the slick.	Thickness estimates are to be based on the Bonn Agreement Oil Appearance Code.	❑
IRT	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix H: Aerial surveillance marine fauna sighting record**).	-	❑
IRT	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	❑
IMT	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	❑
IMT	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities	-	❑
IMT	Update Common Operating Picture with surveillance information and provide updates to spill trajectory modelling provider	-	❑

Responsibility	Task	Consideration/s	Complete
Vessel Surveillance (if selected)			
IRT	Vessel Master of support vessel to provide IMT initial report on estimated spill volumes and movement based on visual observation (if possible)	Preliminary observations are intended to provide initial projections of spill trajectory and scale prior to more detailed modelling and surveillance. These observations should be immediately verified by more detailed surveillance. The following data should be obtained during surveillance activities: + name of observer, date, time, vessel type, speed of vessel + location of slick or plume (GPS positions) + spill source and access + visual appearance of the slick (e.g. colour, emulsification) + quantity of hydrocarbons on surface and how this was calculated + wildlife, habitat or other sensitive receptors observed + information on any response activities observed + basic metocean conditions (e.g. sea state, wind, current) + photographic/video images 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.	❑
IMT	Source additional contracted vessels if required for assistance.	-	❑
IRT	Continue to 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.	-	❑
IMT	Review surveillance information to validate spill fate and trajectory.	-	❑
IMT	Use available data to conduct operational NEBA and confirm that pre-identified response options are appropriate.	-	❑

Responsibility	Task	Consideration/s	Complete
IMT	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	❑
Initial Oil Characterisation			
IMT	Source available vessels (on hire or VOO) for oil sampling.	Can be multi-tasked – e.g., for vessel surveillance or tracking buoy deployment.	❑
IMT	Source sampling equipment. Confirm sampling methodology. Confirm laboratory for sample analysis. Develop health and safety requirements/controls.	Appendix A and D of CSIRO oil spill monitoring handbook (CSIRO, 2016) provides a suitable procedure.	❑
IRT	Vessel directed to sampling location.	Sampling of oil at thickest part of slick – typically leading edge.	❑
IRT/IMT	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.	❑
IRT	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.	❑
Operational water quality sampling and analysis			
IMT	Activate Santos Monitoring Service Provider for Operational Water Quality Monitoring.	-	❑
IMT	Obtain spill trajectory modelling and provide to Monitoring Service Provider.	-	❑
IMT	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 **Appendix C: Operational Water Quality Sampling and Analysis Plan considerations** for considerations for Sampling and Analysis Plan.	❑

Responsibility	Task	Consideration/s	Complete
	Plan to also consider oil characterisation sampling - Monitoring Service Provider to take over this sampling once mobilised.		
IMT	Develop health and safety plan including potential exposure to volatile gases/VOCs.	Refer Santos Oil Spill Response HSE Management Manual (SO-91-RF-10016).	❑
IMT	Monitoring Service Provider to assemble team/s and water quality monitoring equipment.	-	❑
IMT	Organise vessels, accommodation and transport requirements to mobilise monitoring team/s to site.	Monitoring Service provider to outline requirements in resource request form.	❑
IRT	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.	-	❑
IRT	Monitoring results to be conveyed to IMT through Common Operating Picture and provided to spill trajectory modeller to validate predictions.	-	❑
Continuous fluorometry surveys			
IMT	Activate Monitoring Service Provider and engage to provide towed fluorometry services (personnel and equipment) as part of Operational Water Sampling and Analysis	-	❑
IMT	Activate OSRL monitoring and determine availability of subsea gliders and towed fluorometry equipment.	OSRL can provide specialist technical advice on operation of towed fluorometers. Consider: Engaging OSRL for review and input into monitoring action plan for towed fluorometry.	❑
IMT	Determine suitability of subsea gliders for monitoring.	Sub surface gliders containing fluorometers built into the body of the glider may be used for this monitoring and would be preferential for monitoring a continuous subsea release (well leak scenario).	❑

Responsibility	Task	Consideration/s	Complete
IMT	If gliders and pilot/s available and suitable for incident, engage provider to develop Monitoring Action Plan.	Arrange joint meeting with spill modelling provider and OSRL/glider operator to develop monitoring design and ongoing data transfer protocols to meet objective of model validation.	❑
IMT	Source vessels and other logistics to support monitoring.	-	❑
IRT	Conduct monitoring as per monitoring action plan with deployment area guided by other operational monitoring studies.	The scope of monitoring will be dictated by the response strategies being employed.	❑
IRT	Provide daily data reports and spatial outputs IMT.	-	❑
IMT	Monitoring results to be incorporated into Common Operating Picture.	-	❑
Shoreline clean-up assessment			
IMT	Ensure initial notifications to NT DEPWS have been made.	Refer to **Section 6** for reporting requirements.	❑
IMT	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for assistance in identification of priority protection areas and Operational NEBA.	Existing shoreline sensitivity mapping information for potential oil contacted locations is available on the Santos ER intranet site.	❑
IMT	Mobilise the AMOSC core group responders as required for industry support to Control Agency.	Refer to **Table 9-2** Unmanned Aerial Vehicles (UAVs) may be necessary for some sensitive environments and where personnel safety is at risk (dangerous fauna in remote locations).	❑
IRT	Conduct assessment of shoreline character, habitats and fauna.	Refer to **Appendix G: Shoreline Clean-up Assessment Implementation Considerations** Refer to the **WA DoT Shoreline Assessment Form** for guidance	❑
IRT	Conduct assessment of shoreline oiling (if present).	Refer to **Appendix G: Shoreline Clean-up Assessment Implementation Considerations**	❑

Responsibility	Task	Consideration/s	Complete
IRT	Develop recommendations for clean-up activities and clean-up end points and communicate recommendations and SCAT forms back to IMT at the end of each operating period.	Refer to **Appendix G: Shoreline Clean-up Assessment Implementation Considerations**	❑
General			
IRT	Record relevant data e.g. equipment used, time deployed, weather conditions, Job Safety Analysis (JSA) for all tasks	-	❑
IRT	Hold pre-mobilisation survey team meeting, including communication of field survey schedules (provision for field personnel rotation)	-	❑
IMT	Obtain weather and tidal information from the Bureau of Metrology and on-scene observers	-	❑
IMT	Assemble competent field team(s) (if required), including required personal protective equipment (PPE). Arrange any required inductions and/or permits	-	❑
IMT	Arrange transportation (e.g. flights, vehicles), accommodation and food/equipment for field teams	-	❑
IMT	Activate Geographic Information Systems (GIS) personnel to develop maps that can overlay surveillance data to enhance situational awareness of the spill	-	❑
IMT	Review fate and weathering, tracking buoy, oil spill modelling data and satellite data with field surveillance data (aerial and vessel surveillance) to validate spill fate and trajectory	Use available data to conduct response (operational) NEBA and confirm that pre-identified response options are appropriate	❑
IMT	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required	-	❑

Responsibility	Task	Consideration/s	Complete
IMT	Review OSMP to determine which operational and/or scientific monitoring initiation criteria have been reached, and activate OSMP personnel to implement relevant monitoring programs	Situational awareness data will be used by the IMT to help determine response effectiveness; operational monitoring teams to direct monitoring; and by the scientific monitoring teams to prioritise the sampling areas for impact assessment	❑

Table 9-2: Monitor and evaluate resource capability

Tactic	Resources Available	Service Providers	Mobilisation Timeframe	Termination Criteria
Fate and weathering modelling	Programs installed on IMT computers	N/A	Within 2 hours of IMT activation	The response will be terminated when either a silvery-grey sheen (as defined by Bonn Agreement Oil Appearance Code 1- Sheen) is no longer evident to observers from the release area or when the spill response is terminated. This decision will be made by the control agency
Tracking buoy	Tracking buoys available onboard support vessel	AMOSC (additional buoys)	Immediately available in field onboard vessels. 48-72 hours for additional tracking buoys (if required) from AMOSC (Fremantle or Geelong)	
Trajectory modelling	Spill response modelling software provided by RPS Modelling staff provided by RPS	RPS under direct contract to Santos, also available through AMOSC	Within 2-4 hours of request being sent to RPS	
Satellite surveillance	Satellite data from supplier sourced through AMOSC subscription (OSRL subscription available as secondary option)	KSAT – activated through AMOSC MDA – activated through OSRL	AMOSC: one hour if satellite images available OSRL: Within 4 hours of satellite image acquisition (i.e. latest pass with no cloud)	

Tactic	Resources Available	Service Providers	Mobilisation Timeframe	Termination Criteria
Aerial surveillance	Santos contracted provider/s (primary provider currently Babcock) Santos aerial observers AMOSC Industry Mutual aid	Aircraft sourced through existing contracts with aviation service providers. Aerial surveillance observers using the following resources: 7 × Santos staff 9 × AMOSC staff AMOSC Core Group personnel available Additional trained industry mutual aid personnel	4 hours for aircraft to be ready for mobilisation 24-48 hours for national pool trained/experienced aerial observers	
Vessel surveillance	Support vessel Availability dependent upon Santos and Vessel Contractor activities	Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Within 12 hours for vessels situated close to the spill source (if available)	
Initial oil characterisation	+ Oil sampling kits + Bulk oil sampling bottles + Santos Contracted Vessel Providers + National Association of Testing Authorities (NATA) accredited laboratory/ personnel for analysis	+ Santos + Intertek/Santos + Vessels of opportunity identified through AIS Vessel Tracking. + Intertek	+ Within 48 hours + Within 48 hours + Expected within 24 hours + 24-28 hours	+ 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

Tactic	Resources Available	Service Providers	Mobilisation Timeframe	Termination Criteria
Operational water quality sampling and analysis	+ Water quality monitoring personnel and equipment + Contracted water quality monitoring vessels	+ Monitoring Service Provider (currently Astron/BMT) + Suitable vessels identified through AIS Vessel Tracking	+ 72 hours from approval of work + <72 hours	+ 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.
Continuous fluorometry surveys	+ Towed fluorometers + Glider mounted fluorometers + Water quality monitoring personnel to operate towed fluorometers + Glider (remote) pilot/s and deployment crew	+ OSRL + Monitoring Service Provider (currently Astron/BMT) + Monitoring Service Provider (currently Astron/BMT) + Third-party provider via OSRL	+ <72 hours + <120 hours + <120 hours + <72 hours	+ Continuous fluorometry surveys will continue for 24 hours following control of the source provided oil is no longer detectable, OR + As directed by the relevant Control Agency.
Shoreline clean-up assessment	Santos and industry AMOSC core group staff and responders (team leaders)	Santos Core Group (x 12) Industry Core Group (84 minimum), AMOSC staff (x 16)	<24 hours from time of shoreline contact prediction	+ As directed by the relevant Control Agency
	Shoreline assessment team members	Santos contracted Work Force Hire company (e.g. Dare)	Subject to availability (indicatively 72+ hours)	

Tactic	Resources Available	Service Providers	Mobilisation Timeframe	Termination Criteria
	Drones and pilots ** To assist shoreline and vessel-based surveillance	AMOSC OSRL – Third-Party UAV provider Local WA hire companies	<48 hours OSRL – depending on the port of departure, one to two days if within Australia	

9.1 Environmental performance

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

Table 9-3: Environmental performance – monitor and evaluate

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Response preparedness		
Maintain contracts with support agencies to obtain additional support or technical expertise to monitor and/or respond to a spill	Service Level Agreement maintained with OSRL, Master Services Contract maintained with AMOSC and agreement maintained with RPS Group for the duration of the activity	Records demonstrate that Service Level Agreement maintained with OSRL, Master Services Contract maintained with AMOSC and agreement maintained with RPS Group for the duration of the activity
Response Implementation		
Maintain situational awareness and inform IMT decision making using monitor and evaluate tactics	IMT to undertake fate and weathering modelling to estimate the current and projected weathering of the spill	Records demonstrate fate and weathering modelling undertaken within 2 hours of IMT activation
	IMT to select appropriate monitor and evaluate tactics based on the nature and scale of the spill.	Records demonstrate monitor and evaluate response option decision-making by the IMT are appropriate for the nature and scale of the spill.
	Use monitor and evaluate data to periodically reassess the spill and modify the response, using the IAP	Records demonstrate monitor and evaluate data incorporated into the IAP

10 Shoreline protection and deflection

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

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

Protection and deflection is part of an integrated nearshore/shoreline response to be managed by the relevant Control Agency. Where Santos is not the Control Agency (refer to **Table 4-2**), it will undertake first-strike protection and deflection activities as required. In this circumstance, the relevant Control Agency will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline protection. Santos will provide all relevant information on shoreline character and oiling collected as part of surveillance activities carried out under its control (refer **Section 4.2**).

In the event of a spill with the potential for shoreline contact where Santos is not the Control Agency, the ongoing response objectives, methodology, deployment locations and resource allocation will be controlled by the relevant Control Agency and therefore may differ from that included below.

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

Shoreline protection and deflection techniques include:

- nearshore booming, which can involve different booming arrangements, including:
  - exclusion booming: boom acts as a barrier to exclude the spill from areas requiring protection
  - diversion booming: booms divert the spill to a specific location where it may be removed (e.g. sandy beach)
  - deflection booming: booms deflect the spill away from an area requiring protection.
- berms, dams and dykes – uses sandbags or embankments to exclude oil from sensitive areas
- shoreside recovery – uses nearshore skimmers to collect oil corralled by nearshore booms (also used during shoreline clean-up)
- passive recovery – uses sorbent booms or pads to collect oil and remove it from the environment. This can be used as a pre-impact tactic where sorbents are laid ahead of the spill making contact with the shoreline
- non-oiled debris removal – removes debris from the shoreline before it is impacted to reduce overall waste volumes from shoreline clean-up.

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

Table 10-1 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-2** provides a list of resources that may be used to

implement this strategy. The Incident Commander of the Control Agency's IMT (once they assume control) is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-1: Implementation guidance – shoreline protection and deflection

Responsibility	Task	Consideration	Complete
IMT	Ensure initial notifications to the relevant Control Agency have been made.	Refer to **Section 6** for reporting requirements.	❑
IMT	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for confirmation of priority protection areas and NEBA.	-	❑
Actions below are indicative only and are at the final determination of the relevant Control Agency.			
IMT	Conduct Operational NEBA to determine if protection and deflection is likely to result in a net environmental benefit using information from shoreline clean-up assessments (**Section 9**).	-	❑
IMT	If NEBA indicates that there is an overall environmental benefit, develop a Shoreline Protection Plan (IAP Sub-Plan) for each deployment area.	Shoreline Protection Plan may include: + priority nearshore and shoreline areas for protection (liaise with Control Agency for direction on locations) + locations to deploy protection and deflection equipment + permits required (if applicable) + protection and deflection tactics to be employed for each location + list of resources (personnel and equipment) required + logistical arrangements (e.g. staging areas, accommodation, transport of personnel) + timeframes to undertake deployment + access locations from land or sea + frequency of equipment inspections and maintenance (noting tidal cycles) + waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes	❑

Responsibility	Task	Consideration	Complete
		+ no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (use existing roads and tracks first) + shift rotation requirements	
IMT	If required identify vessels with relevant capabilities (e.g. shallow draft) for equipment deployment in consultation with Control Agency.	Ensure vessels have shallow draft and/or a suitable tender (with adequate towing capacity and tie-points) if they are required to access shorelines.	❑
IMT/IRT	Deploy shoreline protection response teams to each shoreline location selected and implement response.	If passive recovery and/or non-oiled debris removal has been selected as a tactic, ensure deployment activities prioritise their implementation prior to hydrocarbon contact.	❑
IMT	Conduct daily re-evaluation of NEBA to assess varying net benefits and impacts of continuing to conduct shoreline protection and deflection activities.	-	❑
IRT	Report to the Operations Section Chief on the effectiveness of the tactics employed.	-	❑
IRT	Response teams to conduct daily inspections and maintenance of equipment.	Shoreline protection efforts will be maintained through the forward operation(s) facilities set-up at mainland locations under direction of the Control Agency. Response crews will be rotated on a roster basis, with new personnel procured on an as needs basis from existing human resource suppliers.	❑

Table 10-2: Shoreline protection and deflection – resource capability

Equipment Type/ Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
AMSA nearshore boom/skimmer equipment	AMSA	Structurflex (9 x 20 m) Canadyne Inflatable (5 x 20 m) Versatech Zoom Inflatable (10 x 25 m) Skimmers: Nearshore oleophilic skimmers (x2) and towable waste storage bladders	Darwin	Access to National Plan equipment through AMOSC
AMOSC nearshore boom and skimming equipment'	AMOSC	Beach Guardian (98 × 25 m lengths) Zoom Boom (199 x 25 m lengths) HDB Boom (two 200 m lengths) Curtain Boom (58 x 30 m lengths) Skimmers: Passive Weir GT 185 Desmi 250 Weir Ro-skim Weir boom	Broome – 4; Exmouth – 20; Fremantle – 23; Geelong – 51 Broome – 8; Exmouth – 20; Fremantle – 30; Geelong – 141 Broome – 2 Fremantle – 18; Geelong – 40 Exmouth – 1; Fremantle – 1; Geelong – 1 Exmouth – 1; Geelong – 1 Geelong – 1 Geelong – 2	Response via duty officer within 15 minutes of first call; AMOSC personnel available within one hour of initial activation call. Equipment logistics varies according to stockpile location.
Santos owned nearshore boom/skimming equipment	Santos	Beach Guardian (8 x 25 m lengths) Zoom Boom (16 x 25 m lengths) 2 x Desmi DBD16 brush skimmer	Varanus Island (VI) VI One each: Dampier and VI	Within 12 hours for deployment by vessel from VI

Equipment Type/ Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Personnel (field responders) for OSR strategies	AMOSC Staff	16	Fremantle – 5 Geelong – 11	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site
	AMOSC Core Group (Santos)	12	Perth/NW Australia facilities – 10 Port Bonython (South Australia) – 2	From 24 hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation

10.1 Environmental performance

Table 10-3 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 10-3: Environmental performance – shoreline protection and deflection

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Response preparedness		
Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities	Maintenance of access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity as per **Table 10-2.**	MoU for access to National Plan resources through AMSA
		AMOSC Participating Member Contract
		OSRL Associate Member Contract
	Maintenance of a list of small vessel providers for North West Region	List of small vessel providers
Response Implementation		
Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities	Santos IMT to confirm protection priorities in consultation with Control Agency	IAP/Incident Log
	Prepare operational NEBA to determine if shoreline protection and deflection activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to shoreline protection and deflection activities commencing
	IAP Shoreline Protection and Deflection Sub-plan developed to provide oversight and management of shoreline protection and deflection operation	Records indicate IAP Shoreline Protection and Deflection Sub-plan prepared prior to shoreline protection and deflection operations commencing
	NEBA undertaken each operational period by the relevant Control Agency to determine if response strategy is continuing to have a net environmental benefit. NEBA included in development of following period Incident Action Plan	IAP/Incident Log
	Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation which may include secondary contamination	Incident Log IAP
	A NEBA is undertaken for every operational period	Incident Log contains NEBA
	Shallow draft vessels are used for shoreline and nearshore operations, unless directed otherwise by the designated Control Agency	Vessel specification documentation contained in IAP.

Environmental Performance Outcome	Performance Standard	Measurement Criteria
	Unless directed otherwise by the designated Control Agency, a rapid shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities	IAP records assessment records

11 Shoreline clean-up

Shoreline clean-up aims to remove hydrocarbons from shorelines and intertidal habitat to achieve a net environmental benefit. Removal of these hydrocarbons helps reduce remobilisation of hydrocarbons and contamination of wildlife, habitat and other sensitive receptors. Shoreline clean-up is often a lengthy and cyclical process, requiring regular shoreline clean-up assessments (**Section 9**) to monitor the effectiveness of clean-up activities and assess if they are resulting in any adverse impacts.

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be managed by the relevant Control Agency. Where Santos is not the Control Agency (refer to **Table 4-2**), it will undertake first-strike activations as required. In this circumstance, the relevant Control Agency will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline clean-up. The information obtained from Operational Monitoring (refer **Section 9**), will be used by the IMT in the development of the operational NEBA to inform the most effective clean-up tactics (if any) to apply to individual sites. Intrusive shoreline clean-up techniques have the potential to damage sensitive shorelines. The appropriateness of clean-up tactics will be assessed against natural attenuation for sensitive sites. Selection of shoreline clean-up methods and controls to prevent further damage from the clean-up activities are to be undertaken in consultation with the Control Agency and selected based on NEBA.

MDO is likely to be difficult to remove given its light nature and high weathering potential. It can be readily washed from sediments by wave and tidal flushing. The likely waste products from a diesel spill shoreline response would be contaminated sand and debris.

Shoreline clean-up techniques include:

- Shoreline Clean-up Assessment – uses assessment processes (refer to **Section 9**) to assess shoreline character, assess shoreline oiling and develop recommendations for response. Typically, this should be the first step in any shoreline clean-up response.
- Natural Recovery – oiled shorelines are left untreated and the oil naturally degrades over time.
- Manual and Mechanical Removal – removes oil and contaminated materials using machinery, hand tools, or a combination of both.
- Washing, Flooding and Flushing – uses water, steam, or sand to flush oil from impacted shoreline areas.
- Sediment Reworking and Surf Washing – uses various methods to accelerate natural degradation of oil by manipulating the sediment.

Table 11-1 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 11-2** 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 11-1: Shoreline clean-up implementation guide

Responsibility	Task	Consideration	Complete
Actions below are indicative only and are at the final determination of the relevant Control Agency.			
IMT	Initiate Shoreline Clean-up Assessment (if not already activated).	Refer to **Section 9** for additional information. Unmanned Aerial Vehicles (UAVs) may be necessary for some sensitive environments and where personnel safety is at risk (e.g. dangerous fauna in remote locations).	❑
IMT	Using results from Shoreline Clean-up Assessment, conduct Operational NEBA to assess shoreline clean-up suitability and recommended tactics for each shoreline location.	Shoreline Clean-up Assessment Teams are responsible for preparing field maps and forms detailing the area surveyed and make specific clean-up recommendations. The condition of affected shorelines will be constantly changing. Results of shoreline surveys should be reported as quickly as possible to the IMT to help inform real-time decision-making. Engage a Heritage Adviser if spill response activities overlap with potential areas of cultural significance.	❑

Responsibility	Task	Consideration	Complete
IMT	If operational NEBA supports shoreline clean-up, prepare a Shoreline Clean-up Plan for inclusion in the IAP.	Shoreline Clean-up Plan may include: + clean-up objectives + clean-up end points (may be derived from Shoreline Clean-up Assessment) + clean-up priorities (may be derived from Shoreline Clean-up Assessment) + assessment and location of staging areas and worksites (including health and safety constraints, zoning) + utility resource assessment and support (to be conducted if activity is of significant size in comparison to the size of the coastal community) + permits required (if applicable) + chain of command for on-site personnel + list of resources (personnel, equipment, personal protective equipment) required for selected clean-up tactics at each site + details of accommodation and transport management + security management + waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes + establish no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (use existing roads and tracks first) + shift rotation requirements. Refer to IPIECA-IOGP (2015) for additional guidance on shoreline clean-up planning and implementation.	❑
IMT	In consultation with the Control Agency, procure and mobilise resources to a designated port location for deployment, or directly to location via road transport.	-	❑

Responsibility	Task	Consideration	Complete
IMT/IRT	Deploy shoreline clean-up response teams to each shoreline location to begin operations under direction of the Control Agency.	Each clean-up team to be led by a Shoreline Response Team Leader, who could be an AMOSC Core Group Member or trained member of the AMSA administered National Response Team (as per the MoU agreement between Santos and AMSA). Clean-up teams and equipment will be deployed and positioned as per those observations by the Shoreline Clean-up Assessment Teams in consultation with the Control Agency. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change.	❑
IMT/IRT	Shoreline Response Team Leader shall communicate daily reports to the IMT Operations Section Chief to inform of effectiveness of existing tactics and any proposed tactics and required resources.	Where possible, maintain some consistency in personnel within Shoreline Response Teams. If the same personnel are involved in Shoreline Clean-up Assessment and clean-up, they will be better placed to adapt their recommendations as the clean-up progresses and judge when the agreed end points have been met.	❑
IMT	The IMT Operations Section Chief shall work with the Planning Section Chief to incorporate recommendations into the Incident Action Plans for the following operational period, and ensure all required resources are released and activated through the Supply Unit Leader and Logistics Section Chief.	-	❑
IMT/IRT	Monitor progress of clean-up efforts and report to the Control Agency.	-	❑

Table 11-2: Shoreline clean-up resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Manual clean-up tools (shovels, rakes, wheelbarrows, bags, etc)	AMOSC shoreline kits	Shoreline support kits first strike	Fremantle – 1 Geelong – 1	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call
	Hardware suppliers	As available	Darwin, Broome, Perth	
Shoreline flushing (pumps/hoses)	AMOSC	Shoreline flushing kit Shoreline impact lance kit	Fremantle –1; Geelong – 1 Geelong – 1	Response via duty officer within 15 mins of first call – AMOSC personnel available within one hour of initial activation call
Nearshore skimmers/hoses	AMOSC AMSA	Refer to Protection and Deflection (**Table 10-2**)		
Decontamination/staging site equipment	AMOSC	Decontamination station – 3	Fremantle –1; Exmouth –1; Geelong – 1	Response via duty officer within 15 mins of first call – AMOSC personnel available within one hour of initial activation call
	AMSA	Decontamination station – 4	Karratha –2; Fremantle – 2	Access to National Plan equipment through AMOSC
	Oil spill equipment provider (e.g., Global Spill., PPS)	As available	Perth	Subject to availability
Waste storage (including temporary storage and waste skips and tanks for transport)	AMOSC temporary storage	Fast tanks – (9,000 L & 3,000 L)) Vikotank (13,000 L) Lamor (11,400 L) IBCs (1 m3)	Broome –1; Geelong –4; Fremantle –2; Exmouth – 2 Broome – 1; Geelong – 1; Fremantle – 4; Geelong - 13	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
	AMSA temporary storage	Fast tanks – (10 m^3) Structureflex – (10 m^3) Vikoma – (10 m^3)	Darwin –2; Karratha –2; Fremantle – 4; Adelaide – 1; Brisbane – 2; Devonport – 2; Melbourne – 1; Sydney – 4; Townsville - 4 Brisbane – 1; Adelaide – 2; Darwin – 1; Adelaide – 1; Brisbane – 1; Devonport – 2; Fremantle – 4; Fremantle – 3; Melbourne – 2; Sydney – 2; Townsville - 4	Access to National Plan equipment through AMOSC
	Santos Waste Management Service Provider		Darwin, Broome, Perth	24+ hours
Personnel (field responders) for OSR strategies	AMOSC Staff	16	Fremantle – 5 Geelong – 11	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site
	AMOSC Core Group (Santos)	12	Perth/NW Australia facilities – 10 Port Bonython (South Australia) – 6	12+ hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation
	Santos contracted Work Force Hire company (e.g., Dare)	As per availability (up to 2,000)	Australia-wide	Subject to availability (indicatively 72+ hours)

11.1 Environmental performance

Table 11-3 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 11-3: Environmental performance – shoreline clean-up

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Response preparedness		
Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery	Maintenance of access to clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity.	MoU for access to National Plan resources through AMSA
		AMOSC Participating Member Contract
		OSRL Associate Member Contract
	Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	Maintenance of vessel specification for resource transfer for offshore island response	Vessel specification
	Maintenance of contract with labour hire provider	Contract
Response Implementation		
Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery	Santos IMT to confirm protection priorities in consultation with the Control Agency	IAP Incident Log
	Prepare operational NEBA to determine if shoreline clean-up activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to shoreline clean-up activities commencing
	Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation which may include secondary contamination	Incident Log IAP
	IAP Shoreline Clean-up Sub-plan developed to provide oversight and management of shoreline clean-up operation	Records indicate IAP Shoreline Clean-up Sub-plan prepared prior to shoreline clean-up operations commencing
	Clean-up strategies will be implemented under the direction of the Control Agency	Incident Log
	Santos will make available to the Control Agency Shoreline Supervisor/Specialist personnel from AMOSC/OSRL for shoreline clean-up team positions.	Incident Log

Environmental Performance Outcome	Performance Standard	Measurement Criteria
	Santos will make available to the Control Agency equipment from AMOSC and OSRL stockpiles	Incident Log
	NEBA undertaken every operational period by the relevant Control Agency to determine if response strategy is having a net environmental benefit. NEBA included in development of following period Incident Action Plan	IAP/Incident Log
	Unless directed otherwise by the designated Control Agency, access plans for shoreline operations will prioritise use of existing roads and tracks	IAP demonstrates requirement is met
	Unless directed otherwise by the designated Control Agency, a soil profile assessment is conducted prior to earthworks	Documented in IAP and Incident Log
	Vehicles and equipment provided by Santos are verified as clean and invasive species free prior to deployment to offshore islands	Documented in IAP and Incident Log
	Unless directed otherwise by the designated Control Agency, a Heritage Adviser is consulted if shoreline operations overlap with areas of cultural significance	Documented in IAP and Incident Log
	Any establishment of forward staging areas at shoreline areas done under direction or in consultation with the Control Agency	Documented in IAP and Incident Log
	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Unless directed otherwise by the Control Agency, demarcation zones are mapped out in sensitive habitat areas	IAP demonstrates requirement is met
	Unless directed otherwise by the Control Agency, action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met
	Consultation is undertaken with relevant stakeholders prior to deployment of resources to townships and marine/coastal areas	Consultation records

12 Oiled wildlife

Note: the NT IMT is the Control Agency, and the Department of Environment, Parks and Water Security (DEPWS) is the Jurisdictional Authority for oiled wildlife response within NT waters. Santos and AMSA are the Control Agencies for oiled wildlife response within Commonwealth waters from facility and vessel spills respectively.

Oiled wildlife response (OWR) includes wildlife surveillance/reconnaissance, wildlife hazing, pre-emptive capture and the capture, cleaning, treatment, and rehabilitation of animals that have been oiled. In addition, it includes the collection, post-mortem examination, and disposal of deceased animals. Long-term effects of a spill on wildlife may be associated with loss/degradation of habitat, impacts to food sources, and impacts to reproduction. An assessment of such impacts is covered under scientific monitoring (**Section 14**).

Santos has an Oiled Wildlife Framework Plan (SO-91-BI-20014) which aligns to the current Commonwealth and Territory arrangements for OWR and provides operational guidance to the IMT for the protection of wildlife during a hydrocarbon spill event. This Plan will be referred to for guidance for coordinating an OWR when Santos is the Control Agency, otherwise the relevant Territory OWR Plan will be referred to, as described below.

For Level 2/3 spills that contact NT shorelines the NT IC will assume the role of Control Agency with support from Santos. AMOSC on behalf of AMOSC Titleholder Members ConocoPhillips, Inpex and Shell Australia have developed a Northern Territory Oiled Wildlife Response Plan (NTOWRP), this plan also has application for other titleholders as it provides operational guidance to respond to injured and oiled wildlife along the NT coastline and island groups.

12.1 Wildlife response levels

To guide OWR resourcing requirements, **Table 12-1** has been adapted from the incident classification outlined in the National Plan (AMSA, 2020) in terms of wildlife at risk, incident duration and resourcing requirements.

The credible spill scenarios for Barossa GEP Installation activities show some shoreline contact with certain locations likely to have seasonal wildlife aggregations. There is therefore potential for some wildlife to be impacted by a spill requiring a level 2 wildlife response (**Table 12-1**).

Table 12-1: Wildlife Incident Level Guidance

Characteristic	Level 1	Level 2	Level 3
Wildlife	Individual fauna	Groups of fauna or threatened fauna	Large numbers of fauna
Duration	0-3 days	Days to weeks	Weeks to months
Establishment of a wildlife facility	Not required	Likely required	Required

Table 12-2 provides guidance to the IMT on the actions and responsibilities that should be considered when implementing an oiled wildlife first-strike plan. This will enable an initial

assessment of the OWR response level and initiation of a Wildlife Division for wildlife Level 2/3 spills where Santos is the control agency and as outlined in the Santos Oiled Wildlife Response Framework Plan (SO-91-BI-20014). Mobilisation times for the minimum resources that are required to commence initial oiled wildlife operations are listed in **Table 12-3.**

Wildlife surveillance/reconnaissance is a critical component of an OWR and provides the situational awareness used to determine which other OWR strategies will be required. Refer to the Santos Wildlife Framework Plan, Section 7.3 for a list of the wildlife reconnaissance aims and objectives, tactics, species and life-cycle stages to consider when developing a wildlife reconnaissance plan. Wildlife reconnaissance should be undertaken in close consultation with personnel undertaking relevant monitor and evaluate activities.

Table 12-2: Implementation guidance – oiled wildlife response

Responsibility	Task	Consideration/s	Complete
Initial wildlife assessment and notifications			
IRT	Vessel Master to report all wildlife sightings (including those contacted with hydrocarbons or at risk of contact) near the spill source to the IMT within 2 hours of detection	-	❑
IRT	Personnel conducting aerial surveillance activities (as part of monitor and evaluate and/or operational monitoring activities) shall report wildlife sightings in or near the spill trajectory (including those contacted with hydrocarbons or at risk of contact) and report them to the IMT within 2 hours of detection	Many species are not visible due to the lack of time they spend on the ocean surface. Record all reports of wildlife potentially impacted and impacted by spill. Record reports on: + location + access + number + species + condition of impacted animals (if available).	❑
IMT	If wildlife are sighted and are at risk of contact (or have been contacted), initiate wildlife response by notifying AMOSC Duty Manager; and if in Territory waters also notify DEPWS (Pollution Response Hotline; Environmental Operations)	Obtain approval from IC prior to activating AMOSC Oiled Wildlife Adviser. If a Level 2/3 facility spill reaches the Northern Territory shoreline, the NT IMT will be the Control Agency for the shoreline.	❑
IMT	Notify Department of Agriculture, Water and the Environment if there is a risk of death or injury to a protected species (including Matters of National Environmental Significance [MNES]).	Refer to **Table 6-1** for reporting requirements. A list of MNES is provided in the Existing Environment Section of the EP (Section 3).	❑
IMT	Review all wildlife reports from surveillance or opportunistic activities and contact personnel who made the reports (if possible) to confirm information collected.	-	❑

Responsibility	Task	Consideration/s	Complete
IMT	Use information from initial assessments to prepare an operational NEBA. Use this information to help determine: + initial OWR Response Level (1 to 3), refer to Table 12-3 + for level 2/3 wildlife incidents where Santos is the control Agency, a Wildlife Division should be established (refer to the Santos Oiled Wildlife Framework Plan [SO-91-BI-20014]) + if OWR activities are likely to result in a net environmental benefit + prepare a Wildlife Plan for inclusion in the IAP.	Oiled wildlife response activities such as hazing and pre-emptive capture 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 strategies such as hazing/pre-emptive capture will result in a net environmental benefit. This may be done in consultation with the designated NT Government Functional Group and AMOSC Oiled Wildlife Advisers and any Subject Matter Experts as relevant (if available, but an operational NEBA should not be delayed if they are not immediately available).	❑
IMT	Prepare a Wildlife Plan for inclusion in the IAP	Refer to the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014), Section 7.1	❑
Mobilisation of wildlife resources			
IMT	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., Monitor and Evaluate activities, Scientific Monitoring).	❑
IMT	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, or DEPWS.	Consider need for veterinary care.	❑
IMT	Commence mobilisation of equipment (including adequate PPE) and personnel to required location/s.	-	❑
IMT	Contact OSRL to activate Sea Alarm if additional support is likely to be required to sustain an ongoing OWR.	-	❑
General			
IRT	Record relevant data e.g. equipment used, time deployed, weather conditions, Job Safety Analysis (JSA) for all tasks	-	❑

Responsibility	Task	Consideration/s	Complete
IRT	Hold pre-mobilisation survey team meeting, including communication of field survey schedules (provision for field personnel rotation)	-	❑
IMT	Assemble trained personnel (if required), including required personal protective equipment (PPE). Arrange any required inductions and/or permits	-	❑
IMT	Arrange transportation (e.g. flights, vehicles), accommodation and food/equipment for survey teams	-	❑
IMT	Prepare a communications plan for field personnel	-	❑

Table 12-3: 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**	<24 hours
Mobilisation of AMOSC oiled wildlife equipment and industry OWR team to forward staging area	<48 hours
Minimum Resource Requirements	
The requirements for oiled wildlife response will be situation specific and dependent upon reconnaissance reports. Indicative minimum resource requirements below align with personnel requirements for a scenario with low wildlife impact: + Six trained industry oiled wildlife response team personnel (AMOSC staff & contractors/ AMOSC Industry OWR group) + One AMOSC OWR treatment container + One AMOSC Oiled Wildlife Deterrence Kit	

12.2 Environmental performance

Table 12-4 indicates the environmental performance outcome, performance standards and measurement criteria for this response strategy.

Table 12-4: Environmental performance – wildlife response

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Implement tactics in accordance with relevant Territory Oiled Wildlife Response Plan(s) (OWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife	**Response preparedness**	
	Maintenance of access to oiled wildlife response equipment and personnel through Santos, AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
		AMOSC Participating Member Contract.
		OSRL Associate Member Contract.
	Santos Oiled Wildlife Response Framework provides guidance for coordinating an OWR when Santos is the Control Agency and outlined Santos's response arrangements	Santos Wildlife Framework Plan
	Maintenance of contract with labour hire provider	Contract
	Development of onboarding procedure for oil spill response labour hire	Onboarding procedure
	Response implementation	

Environmental Performance Outcome	Performance Standard	Measurement Criteria
	Minimum requirements mobilised in accordance with **Table 12-3** unless directed otherwise by relevant Control Agency	Incident log
	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 Plan developed and included in the IAP to provide oversight and management of OWR operation	Records indicate IAP Wildlife Plan prepared prior to OWR operations commencing

13 Waste management

The implementation of some spill response options will collect and generate waste that will require management, storage, transport and disposal, and may consist of solid and liquid waste.

Waste management aims to ensure wastes are handled and disposed of safely and efficiently and prevent contamination of unaffected areas.

The type and amount of waste generated during a spill response will vary depending on the spill type/characteristics, volume released, and response options 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.

The potential types and total volumes of waste anticipated for each response option are provided in **Table 13-1.**

Table 13-1: 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
Shoreline clean-up*	<1 m^3/day	<5 m^3/day	<12 m^3/day
Wildlife response	< 1 m^3/day	< 1 m^3/day	< 2 m^3/day

* Based on two small clean-up teams of 6 people in each team removing approximately 1 m^3/person/day

Table 13-2 summaries the waste storage, treatment and disposal options available to manage waste associated with the spill response options. The capacity is considered appropriate and acceptable to manage the maximum waste volumes that may be produced through implementation of the various response options.

Based on the credible spill scenarios modelled, Santos do not anticipate that large volumes of waste will be generated. As soon as the details of an actual spill are available, waste management arrangements to allow a continuous response to be maintained would be reviewed.

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

Table 13-2: Spill Response Waste Storage, Treatment and Disposal Options

Waste Category	On-site Storage	Treatment/Disposal Option	End Disposal Destination
Solid waste – oiled organic matter, sand, PPE and consumables	Lined skips, oil drums, industrial waste bags, plastic rubbish bags	Recovery (e.g. thermal desorption or fixation process) and recycling Incineration Landfill	Waste management Provider
Liquid waste	Liquid waste barrels, IBCs	Recovery (e.g. thermal desorption or fixation process) and recycling	
Oiled wildlife response	Industrial waste bags, plastic rubbish bags	Incineration Landfill	

13.1 Environmental Performance

Table 13-3 indicates the environmental performance outcome, performance standards and measurement criteria for this response strategy.

Table 13-3: Environmental Performance – Waste Management

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Collect, manage, transport and dispose of waste produced from response options to minimise secondary contamination of sensitive receptors	Implement Santos Oil Pollution Waste Management Plan (QE-91-IF-10053)	Incident Log
	Waste management, storage, transport and disposal will comply with relevant legislation, conventions and standards, including: + Relevant NT and Commonwealth Regulations, including: – Marine Order 91 (Marine pollution prevention – oil) (as appropriate for vessel class) – *Waste Management and Pollution Control Act 1998* (NT)	Records demonstrate waste generated during a hydrocarbon spill response is managed, stored, transported and disposed of in accordance with relevant legislations, conventions and legislation, including: + Marine Order 91 + *Waste Management and Pollution Control Act 1998* (NT)
	Santos to maintain contracts with third-party providers to provide access to suitably qualified and competent personnel and equipment to assist in the implementation of waste management activities	Records demonstrate that Santos maintains contracts with waste management service providers capable of handling the types and volumes of wastes generated.

14 Scientific monitoring

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 SMP in place for Petroleum activities in Territory and Commonwealth waters.

Santos will activate and implement scientific monitoring in Territory 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' 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 D: Scientific Monitoring Plans.**

14.2 Scope

Santos will implement its SMPs, as applicable, for Barossa GEP Installation activity oil spills across both Territory and Commonwealth waters. For oil spills that contact NT shorelines, Santos will liaise directly with the NT IMT and provide all of the required support to implement scientific monitoring on NT shorelines. In the event that control of scientific monitoring in Territory waters is taken over by NT IMT under advice from the Territory Environmental Scientific Coordinator, Santos will follow the direction of NT IMT 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 9**) is monitoring undertaken to obtain information which will provide situational awareness and assist in the planning and execution of the oil spill response.

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

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

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 Barossa GEP Installation activities

(**Table 14-1**). These are detailed further in **Appendix D: Scientific Monitoring Plans.** Each SMP has corresponding objectives, initiation/termination criteria, methodologies, baseline data sources and analysis and reporting requirements, noting that in a response controlled by NT IMT the methodology, termination criteria and analysis/reporting requirements may differ.

Table 14-1: Oil spill scientific monitoring plans relevant to Barossa GEP Installation activities

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

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. **Appendix F: Scientific Monitoring Capability** provides further information on Santos baseline data reviews and outlines a baseline data assessment conducted on high priority areas for scientific monitoring in the event of a Barossa GEP Installation oil spill.

14.6 Monitoring service providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos by contracted monitoring service providers (MSPs) and applies to the implementation of SMPs 1 to 12 (**Table 14-1**). These services are provided by Astron Environmental Services (Astron) and primary sub-contractor (BMT).

The MSP for SMP12 is the Australian Institute of Marine Science (AIMS), noting that there are no whale shark BIAs within the EMBA.

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

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

Appendix F: Scientific Monitoring Capability provides an overview of Santos' processes in place to provide assurance that its oil spill scientific monitoring arrangements for SMPs 1-12 are fit for purpose to meet the worst case first-strike monitoring requirements associated with the Barossa GEP Installation activities.

14.7 Activation

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

The Santos Environment Unit Leader (EUL) with support from Environment Unit members is responsible for activating the primary MSP. The Santos Environment Unit 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 EUL 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 14-2.**

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 14-2: Scientific monitoring – first strike response timeline

Task	Time from activation of SMP
Santos IMT approve initial monitoring plan	<24 hours
Santos to mobilise sampling platforms to deployment location	<120 hours (72 hours from monitoring plan approval)
SMP teams and monitoring equipment mobilised to deployment locations	<120 hours (72 hours from monitoring plan approval)
Minimum Resource Requirements	
Initial resourcing requirements will be dependent upon the number of SMPs activated and the requirement for post spill baseline data to be collected. First strike personnel requirements for scientific monitoring field teams at Scientific Monitoring Priority Areas are presented in **Appendix F: Scientific Monitoring Capability** + Suitable vessels for on-water monitoring or transfer of personnel to remotes areas/islands + Vehicle/s as required + Helicopter for aerial surveys as required + Scientific monitoring personnel for first strike teams (refer **Appendix F: Scientific Monitoring Capability)** + Scientific monitoring equipment as detailed in the relevant SMP.	

14.8 Environmental performance

Table 14-3 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 14-3: Environmental performance – scientific monitoring

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill	**Response preparedness**	
	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Regular review of baseline data	Baseline data review report
	Maintenance of vessel specification for water quality monitoring vessels	Vessel specification
	Oil sampling kits are located at Darwin, Exmouth, Dampier and Varanus Island	Evidence of deployment to site
	Response implementation	
	Initiation criteria of SMPs will be reviewed during the preparation of the initial IAP 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 MSP is to follow the process outlined in 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	Monitoring Service Provider records
	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
	Minimum requirements mobilised in accordance with **Table 14-2**	Incident log

15 Response termination

The decision to terminate the spill response is made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other Statutory Authorities that play an advisory role. 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:

- 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.

16 References

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Appendix A: Hydrocarbon Characteristics and Behaviour

Marine diesel

Marine diesel oil (MDO) (classified as Group 2 by ITOPF 2011) non-persistent fuel used in the maritime industry.

MDO is a mixture of volatile and persistent hydrocarbons with low viscosity. When released to the marine environment it will spread quickly and thin out to low thickness levels, thereby increasing the rate of evaporation. Physical characteristics of MDO are summarised in **Table A-1.** Due to its chemical composition, up to 60% will generally evaporate over the first two days depending upon the prevailing conditions and spill volume. Approximately 5% is considered "persistent hydrocarbons", which are unlikely to evaporate and will decay over time.

The MDO also has a strong tendency to entrain into the upper water column (0–10 m) (and consequently reduce evaporative loss) in the presence of moderate winds (> 10 knots) and breaking waves. However, MDO re-surfaces when the conditions calm. It does not emulsify.

Table A 1: Characteristics of MDO

Hydrocarbon	Initial density (kg/m³)	Viscosity (cP) @ 20°C	Component	Volatiles (%)	Semi-volatiles (%)	Low volatility (%)	Residual (%)
			Boiling Points (°C)	<180	180–265	265–380	>380
Diesel	829	4.0	% of total	6	35	54	5

Source: APASA (2013a)

Figure A-1 provides the predicted weathering and fates of surface MDO. The graph shows that MDO on the sea surface is expected to evaporate rapidly, with > 50% of the spilled hydrocarbon expected to evaporate within 2 days.

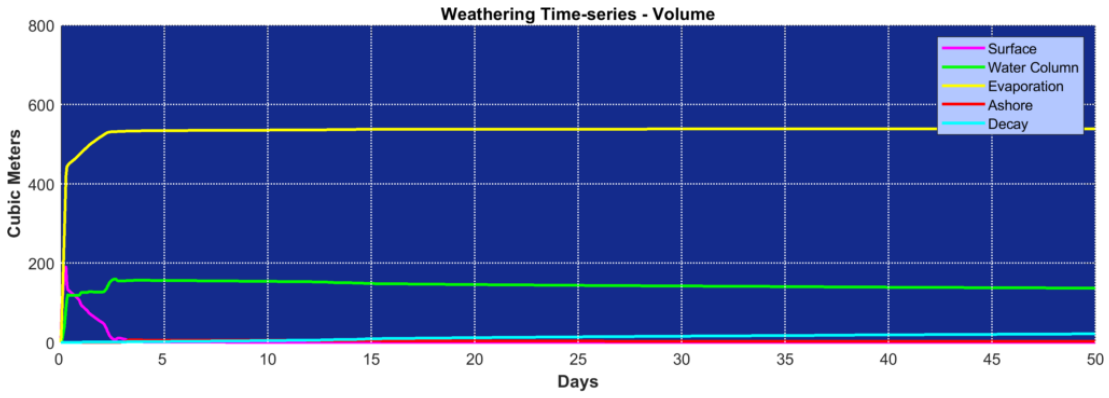

Figure A-1: Predicted weathering and fates of MDO for a 700 m³ spill

Appendix B: Aerial Surveillance Observer Log

Survey Details				
Date:	Start time:	End Time:	Observer/s:	
Incident:			Area of Survey:	
Aircraft type:	Call sign:		Average Altitude:	Remote sensing used:
Weather Conditions				
Wind speed (knots)			Wind direction	
Cloud base (feet)			Visibility	
Time high water			Current direction	
Time low water			Current speed (nM)	

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

Appendix C: 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 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 initially be conducted using a conductivity-temperature-depth (CTD) meter along a depth profile which captures the three-dimensional distribution of the oil. The CTD would require fluorometry and dissolved oxygen sensors as part of the sensor package to record the presence of oil (fluorometry) and the activity of hydrocarbon degrading bacteria (dissolved oxygen). Fluorometers appropriate to the hydrocarbon type will need to be selected. + Where surface oil is present in shallow water (<5 m) sampling should involve a depth profile from the seabed to surface waters. Profiles should ensure that the full gradient of oil in water concentration can be determined. + Oil and oil in water samples are to be collected using suitable pumping or sampling apparatus. For samples at depth a Niskin bottle(s) or similar device that allows remote closing and discrete sampling at depth is to be used. Alternatively, water samples can be pumped from defined depths using a hose suspended vertically using a suitable pump for water sampling (e.g., a peristaltic pump). + Samples are to be collected in clean, fully labelled glass jars, filled to the top and refrigerated/ kept cool and in darkness during storage and transport. Handling, storage and documentation requirements to be confirmed with laboratory but holding time <7 days is expected requirement. + Oil and oil in water samples will be replicated at each site to allow intra-site variability to be assessed and appropriate quality assurance and control samples incorporated into replicates. + Santos will coordinate transportation of samples from the sampling location to the laboratory. Samples will be accompanied with a completed Chain of Custody form. + Water samples also to be provided to an independent National Association of Testing Authorities-accredited laboratory in Perth for hydrocarbon suite analysis including polycyclic aromatic hydrocarbons.
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.

Appendix D: Scientific Monitoring Plans

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; 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.

SMP1 – Marine Water Quality	
	Water profiles 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). Water quality 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).
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.

SMP1 – Marine Water Quality	
	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.
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

SMP2 – Sediment Quality	
	Other pressures to these states are: + Discharge of other toxicants + Physical disturbance including dredging + Sedimentation + Introduction of marine pests + Shading from marine infrastructure + Climate change
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. Sediment samples shall be analysed for key contaminants of concern including metals, hydrocarbons, nutrients, particle size distribution, and nutrients. <u>Infauna samples</u> A subset of the sediment sample shall be sieved in the field (if time permits) with collected infauna preserved (10% buffered formalin or 70% ethanol as prescribed by the receiving

SMP2 – Sediment Quality	
	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 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.

SMP3 – Sandy Beaches and Rocky Shores	
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 + 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.

SMP3 – Sandy Beaches and Rocky Shores	
	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.
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. 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, 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.

SMP4 – Shorelines and Coastal Habitats - Mangrove Communities	
	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 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.

SMP5 – Shorelines and Coastal Habitats - Intertidal Mudflats	
	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). 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.

SMP5 – Shorelines and Coastal Habitats - Intertidal Mudflats	
	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**.
Termination criteria	<u>Benthic habitat cover and composition</u> Cover and composition of benthic habitats are not statistically significantly different from that of their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages.

SMP6 – Benthic Habitats	
	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. 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. Coral Health and Reproduction Using divers, selected coral colonies will have tissue samples removed for the purpose of laboratory analysis of the concentration of accumulated hydrocarbons and for determining reproductive state, noting sampling for reproductive state will be dependent upon the timing of coral spawning. Reproductive state will be determined from measures of gamete size, stage and fecundity determined from in-field examination and laboratory analysis of histological samples. In addition to the standard suite of ecotoxicology testing done on the released hydrocarbon as part of the Operational Monitoring Program, 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.

SMP6 – Benthic Habitats	
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.
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.

SMP7 – Seabirds and Shorebirds	
	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. 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.
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.

SMP7 – Seabirds and Shorebirds	
	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). 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.

SMP8 – Marine Mammals	
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).
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

SMP8 – Marine Mammals	
	+ Sample container and preservative + 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 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**.
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

SMP9 – Marine Reptiles	
	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). **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.

SMP9 – Marine Reptiles	
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. 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**.

SMP10 – Seafood Quality	
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.
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 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. 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).

SMP11 – Fish, Fisheries and Aquaculture	
	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. 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

SMP12 – Whale Sharks	
	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 + 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

SMP12 – Whale Sharks	
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.

Appendix E: 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 F: Scientific Monitoring Capability

Scientific Monitoring Assurance and Capability Assessment

Assurance arrangements

Astron Environmental Services (Astron) is currently Santos' primary Monitoring Service Provider for the implementation of SMPs 1-11. A contractual arrangement exists with Astron to maintain standby arrangements as per the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and have the resourcing capability to implement a first-strike response at all times. Astron maintains a relationship with a primary sub-contractor (BMT) for the provision of scientific monitoring for those SMPs where Astron does not have the required capability. Between Astron and BMT, capability exists to deliver first strike resourcing against SMPs 1-11 and SMP 12 will be conducted by capability obtained through the Australian Institute of Marine Science (AIMS).

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 also recently undertaken a Tier 2 audit of Astron (December 2018) 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 2021, is working towards a joint-industry capability for implementing a common suite of oil spill operational and scientific monitoring plans. The project aims to deliver efficiencies in implementing and testing oil spill scientific monitoring arrangements while increasing the level of resourcing and capability available to participating companies.

Baseline Data Assessment

The Santos approach to undertaking a baseline assessment is to focus on those sensitive receptors for which modelling predicts contact[6] within seven days at a probability > 5%, as indicated in RPS 2019 and RPS 2021 modelling reports. It is considered that contact within seven days would require

[6] Contact is defined as oil concentrations at sensitive receptors of >1 g/m^2 for surface oil, >10 g/m^2 shoreline oil and > 10 ppb for entrained and dissolved oil.

an enhanced understanding of available baseline data to ensure a timely response for scientific monitoring and these locations are referred to as Scientific Monitoring Priority Areas.

The Scientific Monitoring Priority Areas identified include the Vernon Islands, Bathurst Island, Melville Island, Cox-Finniss, Darwin, Litchfield, South Alligator, and the Oceanic Shoals Marine Park. A baseline assessment has been undertaken for Bathurst Island, Melville Island (collectively known as the Tiwi Islands) and the Oceanic Shoals AMP. An assessment is currently underway for the Cox-Finniss, Darwin, Litchfield and South Alligator regions, and will be complete before the Activity commences.

The following data sources were reviewed to identify baseline data related to the Scientific Monitoring Priority Areas identified:

+ all previously identified monitoring programs to confirm whether these programs were ongoing or complete
+ published scientific papers, searched for using relevant key words within Google Scholar, Web of Science and Research Gate
+ publicly available literature
+ monitoring plans from government agencies and industry
+ other internet references relevant to monitoring
+ agency progress reports and annual monitoring reports
+ Index of Marine Surveys for Assessments (IMSA) database
+ North West Atlas web portal
+ Australian Institute of Marine Science (AIMS), Western Australian Marine Science Institution (WAMSI), Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Marine Biodiversity Hub webpages and publication databases.

Following this an assessment of baseline data was undertaken and included the following steps:

1. A review of the following parameters for each program identified:
    - Integrated Marine and Coastal Regionalisation of Australia
    - Custodian- contact point for data
    - Spatial extent
    - Variables available for monitoring
    - Methods applied to monitoring
    - Year of most recent data capture
    - Total duration of monitoring program
    - Data completeness (number of years monitored as proportion of program duration)
    - How often data is captured
    - Appropriateness of variables (Judgement as to whether variables are appropriate for future oil spill monitoring)
    - Is there any clear indication that the monitoring will continue?

2. The quality of the following parameters were then ranked as high, medium, low or unknown:
   I. Year of most recent capture:
      - 2017-2021 (if a single data capture has occurred in the last two years, then the overall program can be considered of high quality) = high
      - 2011-2016 = medium
      - <2011 = low
   II. Duration:
      - >4 years = high
      - 2-4 years = medium
      - 1 year = low
   III. Data completeness:
      - 100% = high
      - 75-99% = medium
      - <75% = low
   IV. Frequency of capture
      - Annually = high
      - Bi-annually = medium
      - <Bi-annually = low
   V. Appropriateness of parameters
      - High/medium/low

      Appropriateness of parameters was based on reference to the Scientific Monitoring Plan's targeted states for each receptor and considering whether the monitoring parameters were sufficient to compare against these states. Parameters were considered highly appropriate if all targeted states for a receptor could be quantified, of medium appropriateness if only some states could be quantified and low if the monitored parameters had little relevance to the targeted states of an individual receptor.

3. An overall assessment of each study program was then made as follows:
   - All parameters rated high = overall 'good'
   - At least one parameter rated medium = overall 'fair'
   - At least one parameter rated low = overall 'poor'
   - Unknown = overall not enough data to rate

The above assessment process was also performed across monitoring programs which included either of the two Scientific Monitoring Priority Areas (Oceanic Shoals Marine Park and the Tiwi Islands). The above assessment was then used to determine if 1) the baseline data available could be used to detect change in the state in the event of a significant impact - Classified as "good" in the above assessment (i.e., data was current, of reasonable duration and frequency, and employed appropriate methodologies) or 2) the existing baseline data is unlikely to be suitable to detect change in state – classified as "fair" or "poor" by the above assessment (i.e., the data was dated, infrequent, of limited duration and/or relied on inappropriate methodologies).

A Scientific Monitoring Priority Area by SMP matrix summarising recommendations on baseline data status and recommendations for further action was then developed (**Table F-1** and **Table F-2**) based on three categories:

- Not applicable – SMP is not applicable to the priority protection area as sensitive receptor does not occur.
- Survey - current monitoring/knowledge is considered sufficient (i.e., could be used to detect change in state in the event of a significant impact) and is considered a lower priority for post-spill pre-impact data collection.
- Priority survey – current monitoring is not in place or not practicable; post-spill pre-impact baseline data collection should be prioritised.

ConocoPhillips commissioned the Australian Institute of Marine Science (AIMS) to conduct a seabed diversity survey in 2017 focussing on areas of the Oceanic Shoals AMP, including areas traversing the pipeline route (Radford et al. 2018). This survey provides a valuable baseline for benthic habitat and fish communities at the Oceanic Shoal locations, however noting that sampling occurred over a short duration (14 days).

In 2012, during a 21-day field expedition to the Oceanic Shoals AMP, mid-water baited remote underwater video systems documented numerous vertebrate species and the findings indicate that the Oceanic Shoals AMP is a reservoir of biodiversity comparable to other documented offshore oceanic hotspots (Bouchet et al. 2020). This study also suggested that that the Oceanic Shoals AMP is a possible distant foraging destination for sea turtles, and possible breeding and /or nursing ground for a number of cetacean species. Given the limited extent of data available and preliminary indications that the Oceanic Shoals Marine Park is a biodiversity hotspot, pre-impact baseline data collection should be prioritised for the majority receptors present (refer to **Table F-1**).

There have been a number of high-quality monitoring programs that have included the Tiwi Islands; however the relevance of this data is uncertain due to its age and priority would be to collect sufficient data to both contribute to baseline datasets and assess the applicability of previous survey data (refer to **Table F-2**). Jacobs (2019) collated all of the publicly available environmental, social, cultural and economic data sets in 2019 and then produced sensitivity maps of the Tiwi Islands with input from traditional stakeholders. The sensitivity rankings were grouped by the following categories: fauna; shoreline and habitats; cultural and heritage; economic; and social, amenity and recreation. If a spill were to occur, these sensitivity maps will aid scientific monitoring surveys on the Tiwi Islands, along with Indigenous stakeholder engagement.

For the Scientific Monitoring Areas currently undergoing a baseline assessment (Vernon Islands, Cox-Finniss, Darwin, Litchfield and South Alligator) a precautionary approach was taken and 'Priority survey' recommended for all receptors, apart from Mangroves (SMP4), given remote sensing data would be used.

Table F-1: Summary of recommendations for further action based on review of available baseline data

Receptors	Scientific Monitoring Priority Areas							
	Vernon Island	Bathurst Island	Melville Island	Cox-Finniss	Darwin	Litchfield	South Alligator	Oceanic Shoals AMP
Marine Water Quality (SMP1)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Sediment Quality (SMP2)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Sandy Beaches and Rocky Shores (SMP3)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Not Applicable
Mangrove Communities (SMP4)	Survey	Survey	Survey	Survey	Survey	Survey	Survey	Not Applicable
Intertidal Mudflats (SMP5)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Not Applicable
Benthic Habitats (SMP6)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Seabirds and Shorebirds (SMP7)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Marine Mammals (SMP8)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Marine Reptiles (SMP9)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Seafood Quality (SMP10)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey

Receptors	Scientific Monitoring Priority Areas							
	Vernon Island	Bathurst Island	Melville Island	Cox-Finniss	Darwin	Litchfield	South Alligator	Oceanic Shoals AMP
Fish, Fisheries & Aquaculture (SMP11)	Survey	Survey	Survey	Survey	Survey	Survey	Survey	Survey
Whale Sharks (SMP12)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Capability Assessment

Based on the assessment of Scientific Monitoring Priority Areas outlined in **Table F-1 ,** a capability assessment was undertaken to understand whether existing scientific monitoring capability would be sufficient to mount a first-strike monitoring program to gather baseline data within a short-timeframe (<7 days); noting that in the event of very short contact timeframes mobilisation of scientific monitoring teams to priority receptor sites may not be possible within contact timeframes and experimental designs not relying on pre-impact baseline would have to be employed. These experimental approaches are outlined in the Santos Oil Spill Scientific Monitoring Plan (EA-00-RI-10099) and are selected as appropriate to the receptor type.

Given that **Table F-1** lists Scientific Monitoring Priority Areas that could be contacted based on stochastic modelling data (i.e. the outcomes of hundreds of spill modelling simulations rather than a single spill event), it was not considered appropriate or credible that baseline monitoring would occur at all areas over this timeframe. To assess the first-strike scientific monitoring capability available, those locations with the highest probability of contact, and in close proximity to one another, were selected (Tiwi Islands, Vernon Island, Litchfield and South Alligator) (**Table F-2**).

The results of the Baseline Data Review document (QE-00-BI-20001) and subsequent baseline and capability assessment of Scientific Monitoring Priority Areas summarised herein (but detailed further in DC-40-RI-20017) has been provided within the Environment Functional Team Folder on the Emergency Response Intranet page so that this information is accessible to guide Santos IMT Environmental roles and monitoring provider roles in the event of activating oil spill scientific monitoring.

Table F-2: Capability assessment for rapid sampling of Tiwi Islands, Vernon Islands, Litchfield and South Alligator within seven days

Receptors	Required capability for rapid response				Actual Team Capability
	Vernon Islands	Litchfield	South Alligator	Tiwi Islands	
Water Quality (SMP1)	2 teams of 2 personnel			1 team of 2 personnel	3 teams of 2 personnel at least one member in each team to have experience in water sampling at least one member in each team to have experience in deep sea sediment sampling
Sediment Quality (SMP2)					
Sandy Beaches/Rocky Shorelines (SMP3)	1 teams of 2 personnel[8]		1 teams of 2 personnel	1 teams of 2 personnel	3 teams of 2 personnel at least one team member of team with experience in shoreline macrofauna/infauna assessment
Intertidal Mudflats (SMP5)					
Mangroves (SMP4)	Rapid priority response not required				Not required
Benthic Habitats (SMP6)	1 teams of 2 personnel			1 teams of 2 personnel	2 teams of 2 personnel at least one team member of team with experience in benthic habitat assessment ROV operator or divers
Seabirds/ shorebirds (SMP7)	1 ground-based survey team of 2 personnel[2, 6, 8]	1 ground-based survey team of 2 personnel[2, 6, 8]	1 ground-based survey team of 2 personnel[2, 6, 8]	2 ground-based survey team of 2 personnel[2, 6, 8]	4 teams of 2 available at least one member of team be experienced ornithologist
Marine mammals (SMP8)	1 aerial survey team of 2 personnel[1] 1 vessel-based survey team of 2 personnel[1]		1 aerial survey team of 2 personnel[1] 1 vessel-based survey team of 2 personnel[1]	1 aerial survey team of 2 personnel[1] 2 vessel-based survey teams of 2 personnel[1,7]	2 teams of 2 available (aerial) all to be experienced wildlife observers 2 teams of 2 available (vessel) all to be experienced wildlife observers

Receptors	Required capability for rapid response				Actual Team Capability
	Vernon Islands	Litchfield	South Alligator	Tiwi Islands	
Marine reptiles (SMP9)	1 aerial survey team of 2 personnel[1] 1 vessel-based survey team of 2 personnel[1] 1 ground-based survey team of 2 personnel[28]		1 aerial survey team of 2 personnel[1] 1 vessel-based survey team of 2 personnel[1] 1 ground-based survey team of 2 personnel[2, 8]	1 aerial survey team of 2 personnel[1] 2 vessel-based survey teams of 2 personnel[1,7] 2 ground-based survey teams of 2 personnel[2, 8]	2 teams of 2 available (aerial)[4] all to be experienced wildlife observers 3 teams of 2 available (vessel)[4] all to be experienced wildlife observers 3 teams of 2 available (ground-based)[5] at least one member with experience in turtle survey techniques
Seafood Quality (SMP10)	2 teams of 3 personnel			1 teams of 3 personnel	3 teams of 3 personnel at least one member of team to have experience in fish identification and necropsy at least one member of team to have BRUV experience
Fish, Fisheries & Aquaculture (SMP11)					
Whale sharks (SMP12)	Not applicable				Not required

[1]Aerial and vessel surveys could be conducted by the same team. The aerial-based surveys would be conducted first and then this would help inform target areas for vessel-based surveys.

[2]Ground based surveys for shorebirds/seabirds and marine reptiles could be conducted by the same survey team.

[3]Remote sensing data would be collected for mangroves, with no field team required to be mobilised.

[4]Two of these teams are those also assigned to SMP8.

[5]One of these teams is also assigned to vessel-based surveys for the same SMP. They can be moved according to priority for either vessel-based or ground surveys.

[6]Sightings of seabirds/ shorebirds will also be captured during aerial and vessel surveys for SMP8 and SMP9.

[7]Vessel surveys for SMP8 and SMP9 could be conducted by the same team.

[8]Where ground surveys are precluded by crocodiles, surveys may be conducted from vessels (where practicable) or via alternative methods (e.g., helicopters and/or drones)

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Appendix G: Shoreline Clean-up Assessment Implementation Considerations

To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character (topography, complexity, exposure, etc.), degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna, etc.) and information on shoreline processes and access routes that could aid or hamper response efforts. This detailed information can be collected from shoreline clean-up assessments. A well-established systematic approach known as Shoreline Clean-up Assessment Technique (SCAT) will be used to document the status of oiled shorelines in the event of a worst-case release and their subsequent treatment recommendations.

For petroleum activity spills, the NT IMT are the designated Control Agency for shoreline response in the NT. The designated Control Agency will direct resources provided through Santos for the purposes of shoreline clean-up assessments and shoreline response activities. Santos will provide additional information on shoreline character and oiling collected as part of aerial surveillance activities carried out under its control (refer **Table 4-2**).

Existing information on shoreline character and distribution of habitats/fauna can be obtained from Santos Energy GIS, including habitat/fauna distribution layers and aerial imagery.

The information provided below is included for planning purposes and represents how Santos would approach shoreline clean-up assessments to support the Control Agency. In the event of a spill with the potential for shoreline contact, the Control Agency is 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.

Table G-1 presents considerations for planning and conducting the assessments.

Table G-1: Shoreline clean-up assessment considerations

Considerations for Shoreline Clean-up **Assessment**	
Survey design	Shoreline Clean-up Assessment requires a systematic assessment of shorelines, which is typically undertaken in a number of stages (according to the extent of the spill): + Reconnaissance surveys: designed as an initial phase (or further as required, such as inaccessible shorelines) to characterise the distribution, extent, and condition of shoreline habitats + Continual monitoring surveys: monitors hydrocarbon spill extent at the shoreline to assess the potential impact, extent of actual impact, and the effectiveness of clean-up. A shoreline clean-up assessment may include the following tasks: + Assessment of shoreline character, habitats and fauna, including: – shoreline structured biotic habitats – distribution of fauna – shoreline and processes (e.g. wave, tidal flows) – shoreline substrate (e.g. mud, sand, pebble, rock) – shoreline form (e.g. width, shape and gradient) – access/safety constraints. + Assessment of shoreline oiling (if present): – surface distribution and cover

Considerations for Shoreline Clean-up Assessment	
	– subsurface distribution – oil type, thickness, concentration and physical character – sampling of oil for laboratory analysis. + Recommendations for response: – applicable strategies based on oil type and habitat – potential access, safety and environmental constraints – likely resourcing (personnel and equipment) requirements. + Post-treatment shoreline survey and sign-off/completion, including: – post-clean-up inspections to confirm if end points have been achieved or if they require further treatment – approve termination of response activities in each sector. Surveys undertaken on foot, by vehicles or by small vessel will occur at prioritised areas (access permitting) to provide a close-range assessment of shoreline physical characteristics, coastal habitats/fauna, scale and character of oiling and safety/access constraints. Shoreline clean-up assessment team leaders will include personnel from AMOSC Core Group, State and National Response Team and OSRL, or contracted staff who have completed SCAT training. Team members may include personnel who have completed a brief training course and are supervised on the job by team leaders, particularly for deployment to locations that are not contacted in the first few weeks of the spill. The deployment of survey teams will be directed by the relevant control agency. The deployments will be informed by the observed and predicted contact of oil and from existing baseline information on shoreline character. Shoreline surveys will be undertaken within segments that are recorded and/or mapped that share common traits based on coast geomorphology, habitat type, fauna presence, level of oiling or access. Information on shoreline character and habitat/fauna distribution for each segment should be recorded through the use of: + still or video imagery collected with simultaneous GPS acquisition + field notes together with simultaneous GPS acquisition + mud maps outlining key natural features, oil distribution, imagery locations of quantitative data (transects, oil samples) + transects (cross-shore, longshore) and vertical sediment profiles + samples of oil and/or oiled sediments. The parameters that should be assessed are: + physical characteristics: rocky, sandy beach, flat, dune, other wetland + major habitat types: mangrove, salt marsh, saltpan flats, fringing reef, rubble shore, seagrass verge + coastal fauna and key habitats (e.g. nests) including quantification/distribution of oiled fauna + state of erosion and deposition: deposition, erosion, stable + human modified coastline (access tracks, facilities, etc.) + oil character, if present, including appearance, surface thickness, depth (into sediments), distribution, area and percentage cover.
Analysis and reporting	Shoreline survey reports to be submitted to the Control Agency IMT at completion of assessments. All raw data collected will be included as appendices to the report and provided in a geospatial format for subsequent use in GIS mapping software.

Appendix H: Aerial surveillance marine fauna sighting record

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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

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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					

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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