Santos

Geophysical Survey Oil Pollution Emergency Plan

PROJECT / FACILITY	Exploration
REVIEW INTERVAL (MONTHS)	No Review Required
SAFETY CRITICAL DOCUMENT	NO

Rev	Owner	Reviewer/s *Managerial/Technical/Site*	Approver
	Senior Advisor – Oil Spill Response	**Team Leader – Security & Emergency Response**	**Manager - HSE**
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Rev	Rev Date	Amendment
A	23/12/2019	Issued for internal review
B	18/02/2020	Revised and re-issued for internal review
0	4/03/2020	Revised and submitted to NOPSEMA

Distribution List

Distribution	OPEP	
	Electronic	Hardcopy
Intranet – Emergency Preparedness	●	
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IMT Room – Perth office		● x 4
CCT Room – Perth office		●
AMOSC	●	
DoT	●	
AMSA	●	
OSRL	●	

How to use this OPEP in the event of a spill

Sections 1 to 4 contain background information only:

- **Activity Description and Location,**
- **OPEP Requirements,**
  - **Spill Response Levels**
  - **Spill Response Framework (Control Agencies and Jurisdictional Authorities),**
  - **Santos WA Incident Management Structure**
  - **Integration with other Organisations**
- **Spill modelling and Protection Priorities**
- **Response Option Selection and NEBA**

Sections 5 to 16 contain directions on how to respond to the spill:

- **Initial Response (First Strike Activation)**
- **Notifications and Reporting**
- **IAP Planning**
- **Spill Response Plans:**
  - **Source Control Plan**
  - **Monitor and Evaluate Plan**
  - **Shoreline Protection Plan**
  - **Shoreline Clean-up Plan**
  - **Onshore Response Plan**
  - **Oiled Wildlife Response Plan**
  - **Waste Management Plan**
  - **Scientific Monitoring Plan**
  - **Forward Operations Plan**
  - **Spill Response Termination**

Sections 17 to 18 contain information on:

- **Document Review and Revision**
- **OPEP Custodian**
- **References**

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1 Oil Pollution Emergency Plan overview

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Geophysical Survey Environment Plan (EP) (SO-91-RI-20058) required by Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R), and the Petroleum (Submerged Lands) (Environment) Regulations 2012 (P(SL)(E)R).

1.1 Description of activity

Santos WA Energy Ltd (Santos WA) proposes to conduct exploration drilling in permit area WA-499-P, located in Commonwealth waters. As part of the drilling preparatory work, a vessel-based site survey will be undertaken involving geophysical survey techniques to assess the shallow seabed soils' suitability to provide a safe foundation for a jack-up mobile offshore drilling unit (MODU). The survey activity ('the activity') will involve surveying the planned drilling location and tie-in lines extending from the proposed drilling location to existing data points in the nearby area. The survey tie-in lines intersect both State and Commonwealth waters.

The activity will involve a single vessel over a period of up to ten days. Credible spill scenarios relating to this activity are limited to the potential for spills from the survey vessel, the worst case being a loss of fuel tank contents. For modelling and impact assessment purposes, a volume of spilled marine diesel oil (MDO) of 329 m^3 was used, however, actual tank volumes used in the activity will be less. Figure 1-1 shows the location of the activity.

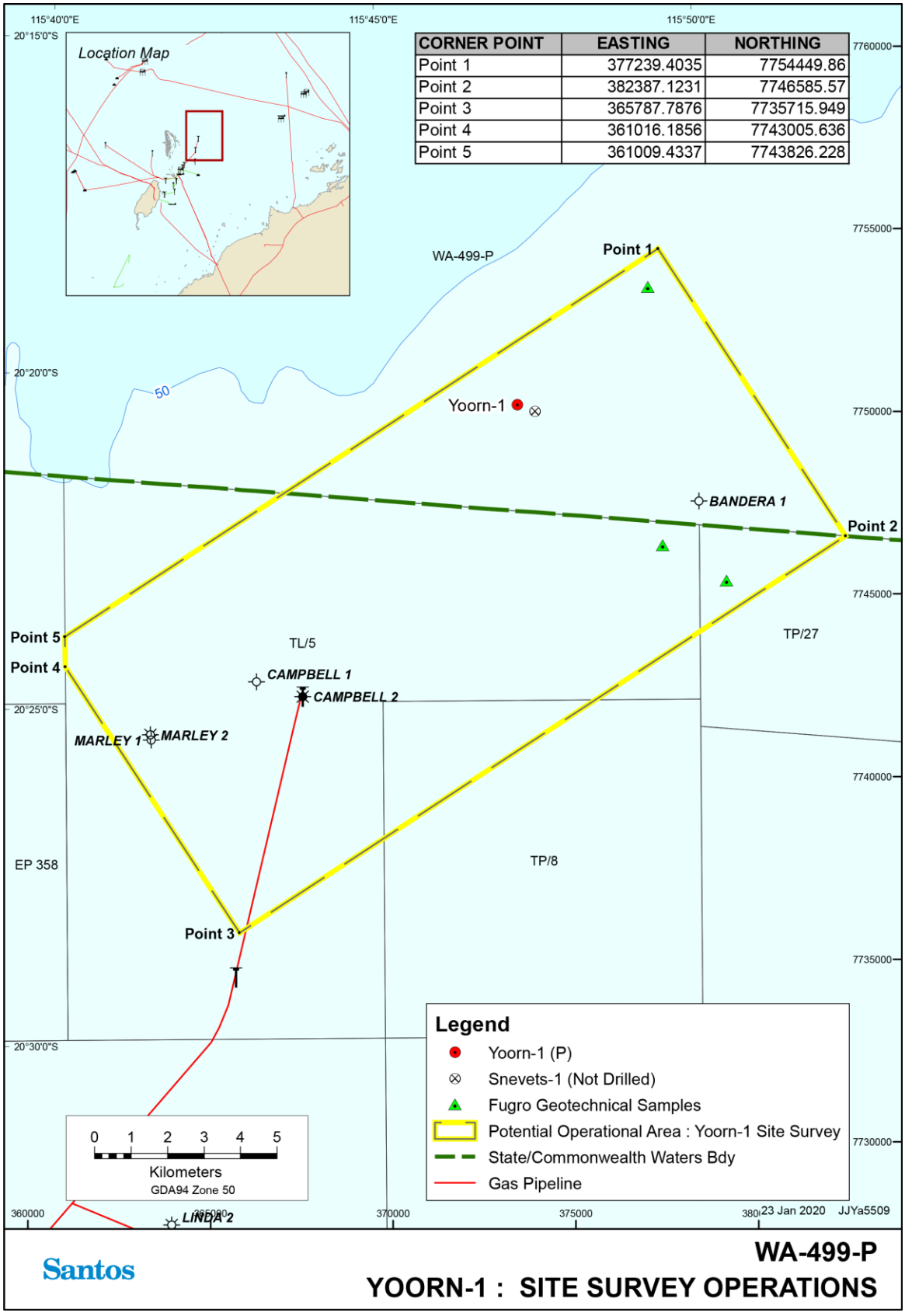

Figure 1-1: Activity location

1.2 Purpose and scope of OPEP

The purpose of this OPEP is to describe Santos WA's response to a hydrocarbon spill, associated with the activity, anywhere within the operational area in State or Commonwealth waters.

This OPEP has been developed to meet all relevant requirements of the Commonwealth OPGGS(E)R and State P(SL)(E)R. It is consistent with the national and State (WA) systems for oil pollution preparedness and response, being the National Plan for Maritime Environmental Emergencies (NatPlan) managed by the Australian Maritime Safety Authority (AMSA) and the WA State Hazard Plan: Maritime Environmental Emergencies (MEE).

1.3 High level objectives of OPEP

The overall aim of this OPEP is to prevent 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 as low as reasonably practicable (ALARP).

The objectives of this OPEP are to:

+ Provide guidance to the Santos WA Incident Management Team (IMT) in relation to spill response implementation; and
+ Demonstrate the capability requirements for response activities.

2 Oil spill response framework

2.1 Spill Response Levels

Santos WA uses a tiered system of incident response levels consistent with State and National incident response plans including the State Hazard Plan: MEE and NatPlan. Spill Response Levels help to identify the severity of an oil spill incident and the level of response required to manage the incident and mitigate environmental impacts. Incident response levels are outlined within the Santos WA Incident Command and Management Manual (QE-00-ZF-00025) and further detailed in **Table 2-1** below for hydrocarbon spills.

Table 2-1: Santos WA 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 WA IMT or other external assistance.	
Spill is contained within the incident site Spill occurs within immediate site proximity. Discharge in excess of permitted oil in water (OIW) content (15 ppm). Incident can be managed by the Incident Response Team (IRT) and its resources.	Source of spill has been contained. Oil is evaporating quickly and no danger of explosive vapours. Spill likely to naturally dissipate. No media interest/not have an adverse effect on the public.
Level 2	
An incident that cannot be controlled by the use of onsite resources alone and requires external support and resources to combat the situation; or An incident that can be controlled onsite but which may have an adverse effect on the public or the environment.	
Danger of fire or explosion. Possible continuous release. Concentrated oil accumulating in close proximity to the site or vessel. Potential to impact other installations.	Level-1 resources overwhelmed, requiring additional regional resources. Potential impact to sensitive areas and/or local communities. Local/national media attention/may adversely affect the public or the environment.
Level 3	
An incident which has a wide-ranging impact on Santos WA and may require the mobilisation of external state, national or international resources to bring the situation under control.	
Loss of well integrity. Actual or potentially serious threat to life, property, industry. Major spill beyond site vicinity. Significant shoreline environmental impact.	Level-2 resources overwhelmed, requiring international assistance. Level- 3 resources to be mobilised. Significant impact on local communities. International media attention.

2.2 Jurisdictional Authorities and Control Agencies

During a spill response there will be both a Jurisdictional Authority and a Control Agency assigned to the oil spill incident for all Spill Response Levels. The Jurisdictional Authority is the relevant Statutory Authority that has responsibilities for oil pollution in that jurisdiction. The Control Agency is the agency or company assigned by legislation, administrative arrangements or within the relevant contingency plan to control response

activities to an oil pollution emergency. With respect to a hydrocarbon spill from the activity, the relevant Jurisdictional Authority and Control Agency varies dependent upon the location of the spill (Commonwealth or State waters).

2.2.1 Vessel spills in Commonwealth waters

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

Santos WA is required to have adequate preparedness arrangements for spills from vessels undertaking Petroleum Activities within Commonwealth waters under *OPGGS Act 2006* and OPGGS(E)R.

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

2.2.2 Vessel spills in State waters

For a vessel incident originating in State waters the Jurisdictional Authority/Hazard Management Agency is DoT. DoT is also the Control Agency for Level 2/3 vessel spills in State waters under the State Hazard Plan arrangements.

Santos WA is required to have adequate preparedness arrangements for spills from vessels undertaking Petroleum Activities within State Petroleum legislation administered by DMIRS.

Santos WA will be responsible for coordinating a first-strike response to all vessel-based spill until such time as DoT takes over the role as Control Agency, in the event of a Level 2/3 spill, at which time Santos WA would provide all necessary resources (including personnel and equipment) as a Supporting Agency.

2.2.3 Cross-jurisdictional vessel spills

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

2.3 Santos WA incident management structure

The Santos WA IMT (Perth), Crisis Support Team (CST) (Perth) and Crisis Management Team (CMT) (Adelaide) will be activated in the event of a Level 2/3 hydrocarbon spill regardless of the type of spill or jurisdiction. As outlined above, control of the response may be taken over by the relevant Control Agency as the incident progresses. The Santos WA response structure to a major emergency incident is detailed in the Incident Command and Management Manual (ICMM) (QE-00-ZF-00025) and Santos Energy Incident and Crisis Management Bridging Procedure (SQBP). The ICMM and SQBP describes response planning and incident management that would operate under emergency conditions – describing how the Santos WA IMT operates and interfaces with the CST 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, CST and CMT will be dependent on the severity and type of spill and the obligations of Santos WA and other agencies/authorities in the coordinated spill response.

Santos WA's incident response structure relevant to a spill incident from the activity includes:

+ On Scene Commander (on vessel) – either Company Site Representative or Vessel Master;
+ Incident Management Team (IMT) – Perth based to coordinate and execute responses to an oil spill incident;

+ Crisis Support Team (CST) and Crisis Management Team (CMT) - to coordinate and manage threats to the company's reputation and to handle Santos WA's corporate requirements as an operator;
+ Other field-based response and monitoring teams for implementing strategies outlined within the OPEP.

The Santos WA incident response organisational structure is defined in the *Incident Command and Management Manual* (QE-00-ZF-00025), and in **Figure 2-1** for reference.

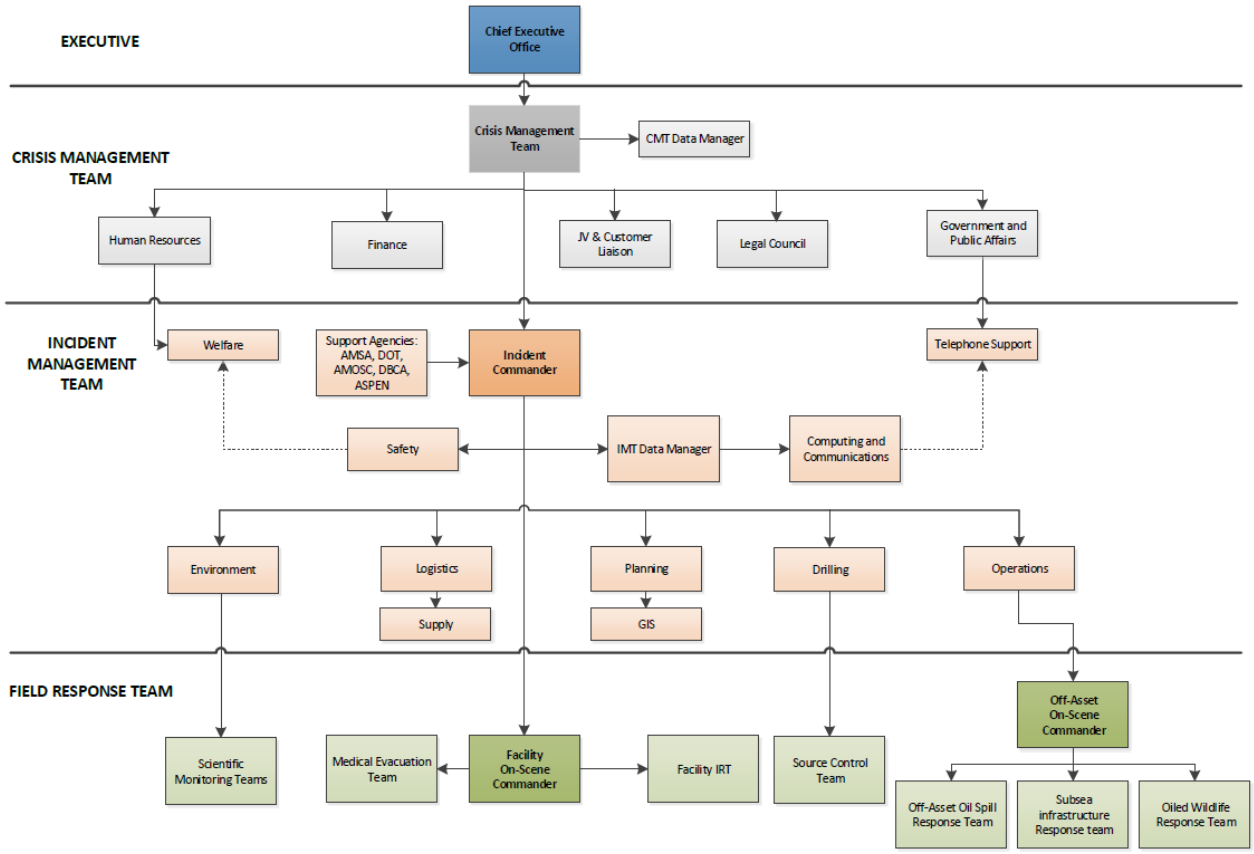

Figure 2-1: Santos WA incident response organisational structure

2.3.1 Roles and responsibilities

The tables below (**Table 2-2** to **Table 2-6**) provide an overview of the responsibilities of the Santos WA CST, IMT, and field-based response team members in responding to an incident.

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

DoT will provide two roles to the Santos WA CST/IMT in a coordinated response. These are also outlined for reference.

Table 2-2: Roles and responsibilities in the Crisis Support Team (CST)

CST Member	Main Responsibilities
CST Leader	Notify Santos Crisis Duty Manager Provide incident briefing and ongoing updates to CMT Identify reputational issues and relevant local stakeholders Set objectives and tasks for CST functional roles
Legal Counsel	Advise CST Leader on on-going legal aspects Manage insurance issues Liaise with CMT Legal & Insurance
Government Relations/Media Advisor	Liaise with Santos CMT GPA Team with respect to overall media strategy Liaise with State government agencies and other local stakeholders Manage messaging to Santos WA employees Activate Santos WA external call centre arrangements Manage release of communications briefs to the external call centre
JV Coordinator / Customer Liaison	Manage all communication between Santos WA and JV partners/ customers Liaise with the GPA to ensure consistent message with JVs and Customers
Finance	Track costs and advise CMT Finance and JV Partners of financial commitments in the response Liaise with CMT Finance Team with respect to access to funds
Human Resource Team Leader	Liaise with CMT HR Team Keep CST updated of personnel activities Validate media and holding statements releasable information with regards to Santos WA personnel matters Work with CST Public Affairs on content of internal statements to staff Put EAP on alert if appropriate Work with Police welfare person or doctors as required Be prepared to accompany police to provide initial company support Arrange Next of Kin (NOK) notifications for affected personnel (excluding Police managed fatalities) Determine NOK assistance required i.e. family travel to hospital, child support, etc Arrange for dedicated management support for families and next-of-kin, if appropriate Arrange EAP counselling at airports and homes where required – HR personnel to attend where possible
CST Data Manager	Ensure CST Centre resources are in place and functional Distribute manuals, contact lists and supporting information to CST personnel Records and collects all information associated with the response to the incident Maintain filing system for incident response

Table 2-3: Roles and responsibilities in the Incident Management Team (IMT)

IMT Member	Main Responsibilities
Incident Commander	Coordinate all support in accordance with the IRP and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan Set the response objectives and strategic direction Oversee the development and implementation of Incident Action Plans Oversee implementation of MoUs and contracted support for 'mutual aid' Ensure co-ordination with external organisations/police, etc. Prepare and review strategic and tactical objectives with the CST Liaise with the CST and provide factual information Set response termination criteria in consultation with regulatory authorities
Planning Team Leader	Collect and document situational awareness information of the incident Develop, document, communicate and implement Incident Action Plans to achieve incident objectives Determine the status of action/s or planned activities under the Incident Action Plans and assess and document performance against the objectives. Assess long term consequences of incident and plan for long term recovery Manage the GIS Team in a response
Operations Team Leader/Drilling Team Leader	Coordinate operational aspects of incident response Provide the key contact for On-Scene Commanders Liaise with contractors or third parties Mobilise additional Santos WA staff and external experts to form Technical Support Team Assist Planning Team Leader with overall general plan preparation and preparation of Incident Action Plans Implement Incident Action Plans Manage field response teams and activities
Logistics Team Leader	Mobilise response equipment, helicopters, vessels, supplies and personnel Provide transport and accommodation for evacuated personnel Oversee the implementation of the Waste Management Plan throughout a Tier 2 or Tier 3 oil spill response. Liaise with the Supply Team to activate supply contracts and arrange procurements Coordinate authorities for search and rescue
Supply Team Leader	Arrange fast track procurement Activate supply contracts as required Implement and maintain Cost Tracking System to enable the tracking of all costs associated to the response of the incident
Environmental Team Leader	Manage notification to Designated Environmental Authorities and liaise as required Assist in the development of Incident Action Plans Advise of the Net Environmental Benefit Analysis of oil spill response strategies and tactics Oversee the implementation of scientific monitoring programs in an oil spill response Provide liaison for implementation of the WA Oiled Wildlife Response Plan in an oil spill response

IMT Member	Main Responsibilities
Welfare Team Leader	Obtain personnel status involved in the incident Review POB lists and clarify accuracy through Safety Team Leader Obtain list of Contactor Companies involved in the incident and obtain 3rd-Party Contractor contact to advise of situation and safety of personnel when appropriate Liaise with 3rd-Party Contractor contact regarding their personnel and organise handover Obtain employee's emergency contact list (NOK) to advise of situation and safety of personnel when appropriate Take instructions from the CST HR Team Leader Work with Logistics Team Leader to arrange transport for affected families to hospitals etc. Assist with arrangements through EAP to support families/employees
Safety Team Leader	Manage notification to Designated Safety Authorities and liaise as required Assist in the development of Incident Action Plans Oversee the development and implementation of incident Safety Management Plans as required. Work with the Welfare Team Leader to support personnel safety
Computing and Communications Leader	Set up computing and communications in the IMT and CST Centres Establish video monitoring between IMT and CST Set up the incident response telephone room upon request
IMT Data Manager	Ensure IMT resources are in place and functional in the ICC Oversee the setting up of communications systems by the Computing and Communications Leader Distribute manuals, contact lists and supporting information to IMT personnel Record and collect all information associated with the response to the incident Maintain filing system for incident response
GIS Support	Manage and keep up-to-date facility and asset drawings, data sets, and photos in the 'GIS in IMT Database'. Manage and keep up-to-date environmental features and sensitivity data sets in the 'GIS in IMT Database'. Manage and keep up-to-date marine maps in the 'GIS in IMT Database'. Provide IMT with quick access to up-to-date drawings and data sets in the ICC. Provide software system to IMT that allows tactical response mapping overlays on facility drawings and area maps.

Table 2-4: Key field-based roles and responsibilities

Field-Based Position	Main Responsibilities
On-Scene Commander*	Commands the onsite response to incidents, including oil spills, using onsite resources Notifies the Perth based Incident Commander of Level 2/3 incidents, including oil spills, requiring offsite support Single point of communications between facility/site and IMT
Off-Asset On-Scene Commander	Coordinates the field response as outlined in the Incident Action Plan developed by the IMT Commands a Forward Operating Base (FOB) for the coordination of resources mobilised to site
Off-Asset Oil Spill Response Teams	Undertake oil spill response activities as defined in Incident Action Plans and Oil Pollution Emergency Plans.
Oiled Wildlife Response Team	Respond to oiled wildlife incidents to minimise the impacts to wildlife Refer to the Western Australia Oiled Wildlife Response Plan for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team
Scientific Monitoring Teams	Monitor the impacts and recovery to sensitive receptors from an oil spill and associated response actions Refer to the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) for detail on Scientific Monitoring Team roles and responsibilities

* The On-Scene Commander is either the Santos Company Representative (if any on board) or the Vessel Master. Detail to be agreed during the activity planning stage.

Table 2-5: Santos WA personnel roles embedded within the State Maritime Environmental Emergency Coordination Centre (MEECC) / Department of Transport (DoT) IMT

Santos Personnel Roles embedded within the State MEECC / DoT IMT	Main Responsibilities
CST Liaison Officer	Provide a direct liaison between the Santos CST and the State Maritime Environmental Emergency Coordination Centre (MEECC) Facilitate effective communications and coordination between the Santos CST Commander and the State Maritime Environmental Emergency Coordinator (SMEEC) Offer advice to SMEEC on matters pertaining to Santos WA crisis management policies and procedures
Deputy Incident Officer	Provide a direct liaison between the DoT IMT and the Santos WA IMT Facilitate effective communications and coordination between the Santos WA Incident Commander and the DoT Incident Controller Offer advice to the DoT Incident Controller on matters pertaining to the Santos WA incident response policies and procedures Offer advice to the Safety Coordinator on matters pertaining to Santos WA safety policies and procedures particularly as they relate to Santos WA employees or contractors operating under the control of the DoT IMT
Intelligence Support Officer	As part of the Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situation and awareness. Facilitate the provision of relevant modelling and predications from the Santos WA IMT. Assist in the interpretation of modelling and predictions originating from the Santos WA IMT. Facilitate the provision of relevant situation and awareness information originating from the DoT IMT to the Santos WA IMT. Facilitate the provision of relevant mapping from the Santos WA IMT. Assist in the interpretation of mapping originating from the Santos WA IMT. Facilitate the provision of relevant mapping originating from the Santos WA IMT.
Deputy Planning Officer	As part of the Planning Team, assist the DoT Planning Officer in the performance of their duties in relation to the interpretation of existing response plans and the development of incident action plans and related sub plans Facilitate the provision of relevant IAP and sub plans from the Santos WA IMT Assist in the interpretation of the Santos WA OPEP from Santos WA Assist in the interpretation of the Santos IAP and sub plans from the Santos WA IMT Facilitate the provision of relevant IAP and sub plans originating from the DoT IMT to the Santos WA IMT Assist in the interpretation of Santos WA's existing resource plans Facilitate the provision of relevant components of the resource sub plan originating from the DoT IMT to the Santos WA IMT (Note this individual must have intimate knowledge of the relevant Santos OPEP and planning processes)

Santos Personnel Roles embedded within the State MEECC / DoT IMT	Main Responsibilities
Environmental Support Officer	As part of the Planning Team, assist the Environmental Officer in the performance of their duties in relation to the provision of environmental support into the planning process. Assist in the interpretation of the Santos WA OPEP and relevant TRP plans Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the Santos WA IMT Facilitate the provision of relevant environmental information and advice originating from the DoT IMT to the Santos WA IMT
Public Information Support & Media Liaison Officer	As part of the Public Information Team, provide a direct liaison between the Santos WA Media team and DoT IMT Media team Facilitate effective communications and coordination between Santos WA and DoT media teams Assist in the release of joint media statements and conduct of joint media briefings Assist in the release of joint information and warnings through the DoT Information & Warnings team Offer advice to the DoT Media Coordinator on matters pertaining to Santos WA media policies and procedures Facilitate effective communications and coordination between Santos WA and DoT Community Liaison teams Assist in the conduct of joint community briefings and events Offer advice to the DoT Community Liaison Coordinator on matters pertaining to Santos WA community liaison policies and procedures Facilitate the effective transfer of relevant information obtained from through the Contact Centre to the Santos WA IMT
Deputy Logistics Officer	As part of the Logistics Team, assist the Logistics Officer in the performance of their duties in relation to the provision of supplies to sustain the response effort Facilitate the acquisition of appropriate supplies through Santos WA's existing OSRL, AMOSC and private contract arrangements Collects Request Forms from DoT to action via the Santos WA IMT (Note this individual must have intimate knowledge of the relevant Santos logistics processes and contracts)
Facilities Support Officer	As part of the Logistics Team, assist the Logistics Officer Supply in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters Facilitate the acquisition of appropriate services and supplies through Santos WA's existing private contract arrangements related to waste management Collects Request Forms from DoT to action via the Santos WA IMT
Deputy Finance Officer	As part of the Logistics Team, assist the Finance Officer in the performance of their duties in relation to the setting up and payment of accounts for those services acquired through Santos' existing OSRL, AMOSC and private contract arrangements. Facilitate the communication of financial monitoring information to Santos WA to allow them to track the overall cost of the response.

Santos Personnel Roles embedded within the State MEECC / DoT IMT	Main Responsibilities
	Assist the Finance Officer in the tracking of financial commitments through the response, including the supply contracts commissioned directly by DoT and to be charged back to Santos
Deputy On-Scene Commander (FOB)	Provide a direct liaison between the Santos WA Forward Operations Base/s (FOB/s) and the DoT FOB Facilitate effective communications and coordination between the Santos WA FOB Operations Commander and the DoT FOB Operations Commander Offer advice to the DoT FOB Operations Commander on matters pertaining to the Santos WA incident response policies and procedures Assist the Senior Safety Officer deployed in the FOB in the performance of their duties, particularly as they relate to Santos WA employees or contractors Offer advice to the Senior Safety Officer deployed in the FOB on matters pertaining to the Santos WA safety policies and procedures

Table 2-6: Department of Transport roles embedded within Santos WA's CST / IMT

DoT roles embedded within Santos WA's CST / IMT	Main Responsibilities
DoT Liaison Officer	Provide a direct liaison between the Santos WA CST and the MEECC Facilitate effective communications between DoT's SMEEC and the Incident Controller and Santos' appointed CST Commander and Incident Controller Provide enhanced situational awareness to DoT of the incident and the potential impact on State waters Assist in the provision of support from DoT to Santos WA Facilitate the provision of technical advice from DoT to Santos WA's Incident Controller as required
Media Liaison Officer	Provide a direct liaison between the Santos WA Media team and DoT IMT Media team Facilitate effective communications and coordination between the Santos WA and DoT media teams Assist in the release of joint media statements and conduct of joint media briefings Assist in the release of joint information and warnings through the DoT Information & Warnings team Offer advice to the Santos WA Media Coordinator on matters pertaining to DoT and wider Government media policies and procedures

2.3.2 Incident Response Authority

During the course of an incident, team members may be required to make technical and financial decisions that exceed those levels set for normal operations.

The IMT Leader has full technical authority to request all Santos WA and contracted resources deemed necessary to manage the incident, and to call in additional resources if required.

The IMT Leader is to request the CST Leader to obtain authority from the CMT for financial commitments to respond to the incident consistent with the level of authorisation required for normal operations.

2.3.3 Training and exercises

2.3.3.1 CST/IMT training and exercises

Santos WA sets training and exercise requirements for IMT/CST personnel to ensure skills and competency requirements are achieved and maintained. Competency is maintained through participation in regular response exercises and workshops. Training and exercise requirements for Santos WA are outlined within the Incident Command and Management Manual (QE-00-ZF-00025) and the Incident and Crisis Management Exercise and Training Plan (QE-92-HG-10001) and are summarised in **Table 2-7**.

Table 2-7: Training and exercise requirements for CST/IMT positions

CST Role	Exercise	Training
CST Leader	1 x Level 3 exercise annually or 3 x Level 3 desktop exercises annually.	+ PMAOMIR320 + AMOSC – Oil Spill Response Familiarisation Training
CST Members: Finance Team Leader GPA Team Leader JV Coordinator/ Legal Team Leader Data Manager		+ PMAOMIR320 + AMOSC – Oil Spill Response Familiarisation Training
IMT Role	**Exercise**	**Training**
Incident Commander Operations/ Drilling Team Leader	1 x Level 2 exercise annually or 3 x Level 2 desktop exercises annually.	+ PMAOMIR320; + PMAOMIR418; and + AMOSC – IMO3 Oil Spill Command & Control;
Planning Team Leader Logistics Team Leader Environmental Team Leader		+ PMAOMIR320; and + AMOSC – IMO2 Oil Spill Management Course

Safety Team Leader Supply Team Leader GIS Team Leader Data Manager HR/ Welfare Team Leader		+ PMAOMIR320; and + AMOSC – Oil Spill Response Familiarisation Training

2.3.3.2 Oil spill responders

Santos has an internal capability of trained oil spill responders that can be deployed in the field in a spill response, and has access to external trained spill responder resources (refer to **Table 2-8**).

Table 2-8: Spill responder personnel resources

Responder	Role	Training	Available Number
Santos AMOSC Core Group Responders	Santos personnel trained and competency assessed by AMOSC as the AMOSC Core Group. Deployed by IMT for spill response operations	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 Oil Spill Operators Course	12
Santos WA Facility Incident Response Teams	Present at Devil Creek, Varanus Island and Ningaloo Vision Facilities for first strike response to incidents	Internal Santos training and exercises as defined in each facility's Incident Response Plan On-scene commander to have AMOSC – Oil Spill Response Familiarisation Training.	One IR team per operational facility per shift.
Santos WA Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircrafts.	AMOSC – Aerial Surveillance Course (refresher training undertaken tri-annually).	6
AMOSC Core Group Oil Spill Responders	Industry personnel as the AMOSC Core Group, available to Santos under the AMOSPlan. For providing incident management (IMT) and operations (field response) assistance.	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 Oil Spill Operators Course and/or IMO2 Oil Spill Management Course	As defined in Core Group Member Reports Min.84 Max. 140 (incl. Santos).
OSRL Oil Spill Response Personnel	Oil Spill Response Ltd professionals, providing	As per OSRL training and competency matrix.	18

Responder	Role	Training	Available Number
	technical, incident management and operational advice and assistance available under Santos-OSRL contract.		
AMOSC Oil Spill Response Specialists	Professionals, providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract.	As per AMOSC training and competency matrix.	8
Oiled Wildlife Response Roles (Level 4)	Refer OPEP Section 15 and Appendix M.		
Monitoring Service Provider: Monitoring Coordination Team (MCT) and SMP Teams	Monitoring Coordination Team (MCT) SMP Teams: Technical Advisers Field Team Leader Field Team Member	As defined in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Capability defined in Monthly Capability Reports. MCT – 5 personnel SMP Teams 12+ per team
Level 1 Oiled Wildlife Responders (Workforce Hire)	Provide oiled wildlife support activities under supervision.	No previous training required; on the job training provided.	Nominally over 1,000.
Shoreline clean-up personnel (Workforce Hire)	Manual clean-up activities under supervision.		

In addition to **Table 2-8**, the following resources are available for spill response and may be activated by the relevant Controlling Agency:

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

In the event of a spill the trained spill responders outlined in **Table 2-8** would be required to undertake various roles in key spill response operations including operational monitoring, shoreline protection, shoreline clean-up, oiled wildlife response and scientific monitoring.

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

2.3.4 Response testing

Oil spill response arrangements are tested annually as outlined within the Incident and Crisis Management Exercise and Training Plan (QE-92-HG-10001). Exercises and workshops clarify and familiarise incident and

crisis management roles with their responsibilities within OPEPs and other Emergency Plans. Santos WA conducts oil spill scenario-based exercises and workshops involving Santos WA's main operating facilities or drilling activities. These exercise and workshops test the chain of command of the Santos WA response system, communications and notification with external parties, communication processes between office and facility, and field response tactics.

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

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

2.3.5 Testing schedule

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

The Incident and Crisis Management Exercise and Training Plan (QE-92-HG-10001) is reviewed and revised annually.

2.3.6 Oil spill response audits

Oil spill response audits will follow the Santos WA Assurance Procedure (QE-91-IQ-10022) and are scheduled as per the annual Assurance Schedule (QE-91-HA-20002). Audits will assist in identifying and addressing any deficiencies in systems and procedures. At the conclusion of the audit any opportunities for improvement and /or corrective actions required (non-conformances) will be formally noted and discussed with corrective actions developed and accepted. In some instances, audits may conclude with potential amendments to the OPEP.

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

The deployment readiness and capability of OSRL's oil spill response equipment and personnel in Singapore is audited every two years. The intent of this audit is to provide assurances to Santos WA's of OSRLs ability to respond to an oil spill incident as per the methods and responsibilities defined in Santos WA's Oil Pollution Emergency Plans and OSRL's Service Level Agreement.

Oil spill response testing arrangements for oil spill response are summarised in **Table 2-9**.

Table 2-9: Oil spill response testing arrangements

Exercise	Objective	Frequency	Recording and review
Communication Test	To test all communication and notification processes to service providers and regulatory agencies defined within the OPEP.	Required for every approved OPEP. When response arrangements have changed. At least annually.	Any results of the test are recorded in a Test Report. Corrections are updated within the Incident Response Telephone Directory (QE-00-ZF-00025.20)
IMT/CST Workshops	To refresh IMT & CST roles and responsibilities and provide familiarisation with	Annually as per Incident and Crisis Management	All workshops undertaken are recorded

Exercise	Objective	Frequency	Recording and review
	OPEP processes and arrangements.	Exercise and Training Plan (QE-92-HG-10001)	in Santos WA's Learning Management System.
OPEP Desktop and Activation Exercises	To familiarise IMT with functions and process, and teste oil spill arrangements, in response to a simulated oil spill scenario	Annually as per Incident and Crisis Management Exercise and Training Plan (QE-92-HG-10001)	All exercises undertaken are recorded in Santos WA's Learning Management System. Key recommendations are recorded are tracked in Santos WA's Action Tracking System.
Response arrangement tests	Tests of response arrangements outlined within the OPEP either as part of desktop/ activation exercises or as standalone desktop tests	Annually as per Incident and Crisis Management Exercise and Training Plan (QE-92-HG-10001)	Test reports are recorded
Equipment deployment exercises/ tests	To focus on Santos WA's deployment capability. To inspect and maintain the condition of the Santos oil spill response equipment. To maintain training of field response personnel.	When new response equipment is added. Annually as per Incident and Crisis Management Exercise and Training Plan (QE-92-HG-10001) The following Santos-owned equipment is inspected, deployed and/or tested Tracker buoys Offshore / nearshore booming equipment Vessel dispersant spray systems	Reports are generated for deployment exercises and recorded in Santos WA's Learning Management System. Key recommendations are recorded are tracked in Santos WA's Action Tracking System. Tracker Buoy tests are recorded.
AMOSC audit	To test deployment readiness and capability of AMOSC.	Every 2 years.	Undertaken by two of AMOSC's participating members and the audit report made available to members.
OSRL Audit	To test deployment readiness and capability of OSRL in Singapore.	Every 2 years.	Undertaken by Santos WA or other member company in collaboration with Santos WA. Recommendations provided to OSRL for action and close-out.

2.3.7 Incident management environmental performance

Table 2-10 indicates the environmental performance outcomes, controls and performance standards for the Santos WA incident management framework.

Table 2-10: Environmental performance outcomes, controls and performance standards for incident management

Environmental Performance Outcome	Manage incident via a systematic planning process		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Incident Management	**Response preparedness**		
	Competent and sufficient Incident Management Team (IMT) and oil spill responder personnel	Maintaining numbers of responder personnel trained as per Santos WA standards and procedures	Training and exercise records
	Incident management facilities	Maintain IMT/CST facilities as per Santos WA standards and procedures	Inspection reports
	Response implementation		
	Net Environmental Benefit Analysis (NEBA)	NEBA undertaken to inform response strategy selection or rejection	Incident Log Incident Action Plan
		NEBA undertaken each operational period to determine if response strategy is continuing to have a net environmental benefit. NEBA included in development of following period Incident Action Plan	Incident Log Incident Action Plan
	Incident Action Plan (IAP)	Incident Action Plan is completed for each operational period and approved by the Incident Commander	Incident Log Incident Action Plan/s
		Monitor effectiveness of response strategies being implemented and use information in the development of IAPs	Incident Log Incident Action Plan/s

2.4 Integration with other organisations

2.4.1 Australian Marine Oil Spill Centre (AMOSC)

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

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

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

2.4.2 Australian Maritime Safety Authority (AMSA)

The Australian Maritime Safety Authority (AMSA) is the designated Control Agency for oil spills from vessels within Commonwealth jurisdiction. Upon notification of an incident involving a ship, AMSA will assume control of the incident and response in accordance with AMSA's Marine Pollution Response Plan. AMSA's Marine Pollution Response Plan is the operational response plan for the management of ship-source incidents. AMSA is to be notified immediately of all ship-source incidents through RCC Australia on +61 2 62306811.

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

AMSA manages the National Plan for Maritime Environmental Emergencies (NatPlan), Australia's key maritime emergency contingency and response plan. All resources under the NatPlan are available to Santos through request to AMSA under the arrangements of the MoU.

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

2.4.3 WA Department of Transport (DoT)

In the event that a Level 2/3 spill arises within, or has potential to enter, State waters, the HMA (DoT Marine Safety General Manager or proxy) will take on the role as the State Maritime Environmental Coordinator (SMEEC) and DoT will take on the role as a Control Agency.

Santos WA will notify the DoT Maritime Environmental Emergency Response (MEER) unit as soon as reasonably practicable (within 2 hours of spill occurring). On notification, the HMA will activate their Maritime Environmental Emergency Coordination Centre (MEECC) and the DoT Incident Management Team (IMT).

Santos WA will work in partnership with DoT during such instances, as outlined within the DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (available online: https://www.transport.wa.gov.au/imarine/oil-spill-contingency-plans.asp). The coordinated response may occur within a single jurisdiction (spill within State waters) or cross-jurisdiction (spill crossing from Commonwealth to State waters).

2.4.3.1 Single jurisdiction arrangements

For Level 2/3 spills originating within State waters, DoT will assume control as the Control Agency with the initial first strike response will be undertaken by Santos WA; formal protocols for the transfer of Control Agency responsibility from Santos WA to DoT are outlined within Section 6.4.2 of DoT's MOP: Response and Consultation Arrangements.

At the request of the SMEEC, Santos WA will be required to provide all necessary resources, including personnel and equipment, to assist the DoT's IMT in performing duties as the Control Agency for State waters

response This includes providing an initial 9x personnel to work within the DoT IMT located at Marine House, Fremantle, no later than 8 am following the day of the request. It also includes providing 1x personnel to serve in DoT's Forward Operating Base no later than 24 hours following formal request by the SMEEC.

Two DoT personnel will be provided from DoT's command structure into Santos WA's CST/IMT as CST / Media Liaison Officers.

The roles and responsibilities of Santos WA activated personnel working within DoT's command structure and DoT personnel working within Santos WA's command structure are provided in **Section 2.3.1**.

In addition to these incident management roles, Santos WA, at the request of the SMEEC, will be required to provide an appropriate number of operational field personnel to assist with field response activities, such as shoreline protection and clean-up and oiled wildlife response, with the required number determined based on the nature and scale of the spill and response requirements. DoT may also stand-up field response capability through the State Response Team and request National Response Team support.

Any matters of contention between Santos WA and DoT, with respect to the partitioning of resources and responsibilities between IMTs will be referred to the SMEEC for resolution.

2.4.3.2 Cross-jurisdictional arrangements

For a large vessel spill (Level 2/3) that crosses Jurisdictions between Commonwealth and State waters, two Jurisdictional Authorities exist (AMSA for Commonwealth waters and DoT for State waters). Control Agency responsibilities will be determined by DoT and AMSA with Santos WA providing all necessary resources (including personnel and equipment) as a Supporting Agency. Support to DoT will be provided by Santos WA as requested by the State Maritime Environmental Coordinator (SMEEC) as a s detailed for Single jurisdiction arrangements.

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

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

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

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

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

2.4.5 Oil Spill Response Limited (OSRL)

Through a direct international subscription, Santos has access to Oil Spill Response Limited (OSRL) based in the UK with offices and equipment at Singapore and at other various locations around the world. OSRL is a member of the Global Response Network (GRN). In the event of a Level 3 response, Santos WA would access OSRL's international holding of Level 3 equipment and resources.

Response equipment and personnel are allocated on a 50% of inventory basis, with the intent, under best efforts, to address any short-fall through the Global Response network (GRN).

2.5 Interface with external plans

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

+ AMOSPlan – Australian Industry Cooperative Spill Response Arrangements

Details the cooperative arrangements for response to oil spills by Australian oil and associated industries.

+ NatPlan - National Plan for Maritime Environmental Emergencies and National Marine Oil Spill Contingency Plan

Sets out national arrangements, policies and principles for the management of maritime environmental emergencies. The Plan provides for a comprehensive response to maritime environmental emergencies regardless of how costs might be attributed or ultimately recovered.

+ Western Australia State Hazard Plan: Maritime Environmental Emergencies

Details the management arrangements for preparation and response to a marine oil pollution incident occurring in State waters.

+ DoT Oil Spill Contingency Plan

Defines the steps required for the management of marine oil pollution responses that are the responsibility of the DoT.

DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (available online: https://www.transport.wa.gov.au/imarine/oil-spill-contingency-plans.asp)

+ Shipboard Oil Pollution Emergency Plans (SOPEP)

Under MARPOL Annex I requirements, all vessels of over 400 gross tonnage are required to have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill including steps taken to contain the source with equipment available onboard the vessel.

+ Western Australia Oiled Wildlife Response Plan (WAOWRP)

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

+ Western Australia State Hazard Plan: Hazardous Materials Emergencies (HAZMAT)

Details the emergency management arrangements for hazardous materials emergencies throughout the State of Western Australia

+ Oil Spill Response Limited (OSRL) Associate Agreement

Defines the activation and mobilisation methods of OSRL spill response personnel and equipment allocated under contract.

+ Australian Government Coordination Arrangements for Maritime Environmental Emergencies

Provides a framework for the coordination of Australian Government departments and agencies in response to maritime environmental emergencies.

2.6 Interface with internal documents

Emergency preparedness and response, including oil spill response, is a key element within Santos WA's Health, Safety and Environment Management System (HSEMS) (QE-91-IF-00001).

In addition to this OPEP, a number of other Santos WA documents provide guidance during preparation and implementation of a spill response, including:

+ Values and Sensitivities of the Marine and Coastal Environment (EA-00-RI-10062);
+ Incident Command & Management Manual (QE-00-ZF-00025);
+ Santos Energy Incident and Crisis Management Bridging Procedure;
+ Incident Response Telephone Directory (QE-00-ZF-00025.020);

+ Environment Incident Notification Guidelines and Matrices (QE-91-HF-10003);
+ Incident Reporting Guideline Environmental Approvals Supporting Information (QE-91-ZF-10003);
+ NWA Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053);
+ Oil Spill Recovery Safety Management Plan (QE-91-RF-10016);
+ Oil Spill Scientific Monitoring Plan (EA-00-RI-10099);
+ Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162);
+ Baseline Data Review document (QE-00-BI-20001); and
+ Incident and Crisis Management Exercise and Training Plan (QE-92-HG-10001).

2.7 Cost recovery

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

3 Spill risk and protection priorities

3.1 Spill risk scenarios

All credible oil spill scenarios, including presentation of detailed modelling results for the activity are detailed in the activity EP (SO-91-RI-20058.

This OPEP outlines strategies, actions and supporting arrangements applicable for all credible oil spill events associated with the activity. However, the greatest level of response required would be associated with the worst case spill event of a rupture and loss of containment of a vessel fuel tank. The response required for this event has been informed by spill modelling of a 329 m^3 release of Marine Diesel Oil (MDO) over a 1 hour period.

3.2 Hydrocarbon characteristics and behaviour

Hydrocarbon characteristics, including weathering and behaviour are further described in **Appendix A: Hydrocarbon Characteristics and Behaviour**.

3.3 Offshore spills (State and Commonwealth waters)

3.3.1 Stochastic modelling

This section presents the spill modelling results for the selected worst-case scenario only; this was modelled using a stochastic approach running multiple simulations across all seasons using a number of unique environmental conditions sampled from historical metocean data.

For the purpose of spill response preparedness, outputs relating to floating oil and oil accumulated on the shoreline are most relevant for the allocation and mobilisation of spill response resources, and therefore these are the results presented in this OPEP.

Concentration thresholds for floating and accumulated oil relevant have been developed for response planning to determine the conditions that response strategies would be effective. These are shown in **Table 3-1.**

Table 3-1: Surface hydrocarbon thresholds for response planning

Hydrocarbon (g/m^2)	Description
>1	Estimated minimum threshold for commencing some scientific monitoring components (refer to **Appendix O: SMP Activation Process**)
100	Estimated minimum shoreline accumulation threshold for shoreline clean-up

Modelling results for dissolved and entrained oil for the worst-case scenarios have not been included given there are limited response strategies that will reduce subsurface impacts. Refer to the Accidental Release of Hydrocarbons in **Section 7** of the EP for further description on selection of impact and operational thresholds.

3.3.2 Modelling results

Table 3-2 below presents the spill modelling results.

Table 3-2: Predicted shoreline contact for a surface release of 329 m^3 of MDO

Receptor contact	Probability (%) of floating oil arriving at shoreline at concentrations >10 g/m^2	Minimum time for floating oil arriving at shoreline at concentrations >10 g/m^2 (days)	Probability (%) of shoreline accumulation at concentrations >100 g/m^2	Minimum time for shoreline accumulation at concentrations >100 g/m^2 (days)	Maximum shoreline accumulation (tonnes) at concentrations >100 g/m^2
Dampier Archipelago	0.8	6.1	-	-	-
Montebello Islands	24.2	0.5	12.5	0.5	221.5
Lowendal Islands	1.7	1.5	1.7	1.5	10.6
Barrow Island	5.8	2.4	4.2	2.4	130.0
Barrow-Montebello Surrounds[1]	20.8	0.3			
Muiron Islands	3.3	6.6	-	-	-
Ningaloo Coast North	0.8	5.2	-	-	-

[1]This receptor is only emergent at lowest astronomical tide therefore accumulation is considered temporary only under these tidal conditions.

3.4 Identification of protection priority areas

3.4.1 Offshore spill

Protection priority areas for spill response, together with key sensitivities are included in **Table 3-3**. For further information on how these were defined refer to **Section 7.5.5** of the EP (SO-91-RI-20058).

Table 3-3: Protection priority areas and key sensitivities

Protection Priority	Values	Relevant key periods
Montebello Islands	Habitats Reefs Algae (40%) Mangroves (globally unique as offshore) Fish habitat Intertidal sand flat communities Turtles Loggerhead and green (significant rookery), hawksbill, flatback turtles. Northwest and Eastern Trimouille Islands (hawksbill) Western Reef and Southern Bay at Northwest Island (green) Seabirds 14 species of migratory and threatened seabirds Significant nesting, foraging and resting areas Whales Pygmy blue whale northern migration Humpback whale migration Socio-Economic Pearling (inactive/pearling zones) Very significant for recreational fishing and charter boat tourism Social amenities and other tourism Nominated place (National heritage)	Coral spawning: Mar & Oct Loggerhead turtle nesting: Dec-Jan Green turtle nesting: Nov- to Apr. Peak period from Jan-Feb Hawksbill turtle nesting: Oct-Jan Flatback turtle nesting: Dec-Jan Birds: Sept-Feb Pygmy blue whale migration: Apr-Aug Humpback whale migration: May-Dec
Lowendal Islands	Habitats Shallow lagoons with seagrass meadows Mangroves Macro algal reefs Reefs Turtles Loggerhead, green and hawksbill nesting turtles. Significant flatback rookery Seabirds 14 species of migratory and threatened seabirds Whales Humpback whale migration	Loggerhead turtle nesting: Dec-Jan Green turtle nesting: Nov- to Apr. Peak period from Jan-Feb Hawksbill turtle nesting: Oct-Jan Flatback turtle nesting: Dec-Jan

Protection Priority	Values	Relevant key periods
		Birds: Sept-Feb Humpback whale migration: May-Dec
Barrow Island	Habitats Bandicoot Bay - conservation area Fisheries Act (benthic fauna/seabird protection), mudflats, rock platforms, mangroves, clay pans Mangroves are in Bandicoot Bay (considered globally unique) Coral reefs (eastern side) - Biggada Reef Biggada Creek Turtles Regionally and nationally significant green turtle (western side) and flatback turtle (eastern side) nesting beaches Turtle Bay north beach North and west coasts- John Wayne Beach also loggerhead and hawksbill turtles. Seabirds Migratory birds (important bird area) 10th of top 147 bird sites. Highest population of migratory birds in BI Nature reserve (south-south east island). Double island important bird nesting (shearwaters, sea eagles). Whales Pygmy blue whale northern migration Socio-Economic Significant for recreational fishing and charter boat tourism Nominated place (National heritage)	Coral spawning: Mar & Oct Green turtle nesting: Nov- to Apr. Peak period from Jan-Feb Hawksbill turtle nesting: Oct-Jan Flatback turtle nesting: Dec-Jan Loggerhead turtle nesting: Dec-Jan Birds: Sept-Feb Humpback whale migration: May-Dec Blue whale migration: Apr-Aug
Barrow-Montebello shallows	The values and relevant key sensitive timings are as described above for Barrow Island and the Montebello Islands.	

4 Response option selection

The response strategies outlined in this OPEP have been developed by Santos WA utilising risk assessments to identify credible worst-case spill scenarios, expected/calculated release rates, known information of hydrocarbon types and behaviour, and expected partitioning of the hydrocarbon within the marine environment . This information has been modelled to give a theoretical spill dispersion extent that is used to identify potential sensitive receptors and response strategies required to reduce the consequences of a spill to ALARP.

The process implemented throughout the response to assess the appropriate response strategies and implement these in a controlled manner to ensure the health and safety of operational personnel and effectiveness in response is the Incident Action Planning (IAP) process.

Incident action planning is the responsibility of the spill Control Agency. It is the responsibility of the Control Agency IMT to evaluate the response strategies provided in this OPEP based on actual and real circumstances. Where Santos WA is not the Control Agency, Santos WA will provide support to the incident action process adopted by the Control Agency through provision of situational awareness information and available resources. Where there is more than one Control Agency (i.e. a cross-jurisdictional response in coordination with DoT), Santos WA will undertake the IAP process as Lead IMT for those spill response activities it is responsible for and provide information and personnel to support DoT's planning function for those activities which DoT assumes control as Lead IMT.

4.1 Evaluation of applicable response strategies

Based on the nature and scale of the credible spill scenarios outlined in **Section 3.1**, the following spill response strategies have been assessed as potentially applicable for combatting a spill (**Table 4-1**). These response strategies have been identified as either primary or secondary options depending on which may result in a net environmental benefit based on the worst-case spill scenarios identified in **Section 3.1**. Primary response strategies are those considered to have net environmental benefit of managing the spill. Secondary response strategies are those that may be used to either supplement primary response options or may be appropriate under specific circumstances.

In the event of an emergency situation where human safety is at significant risk, tasks included in this OPEP may not be implemented, and the International Convention for the Safety of Life at Sea (SOLAS) 1974 may take precedence.

Note: The information contained in **Table 4-1** has been developed by Santos WA for preparedness purposes. Santos WA may not be the Control Agency or Lead IMT for implementing a spill response. For example, for Level 2/3 spills within or entering State waters, DoT will ultimately determine the strategies and controls implemented for most State water activities with Santos WA providing all necessary resources and planning assistance.

Table 4-1: Applicable response strategy operational considerations

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
Source control	Spill kits	1	Relevant for containing spills that may arise on board a vessel.
	Secondary containment	1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel. Bunded areas will contain hydrocarbons reducing the potential for a spill escaping to the surrounding environment and allowing collection of hydrocarbon and contaminated run-off through contaminated drainage systems as applicable.
	Shipboard Oil Pollution Emergency Plan (SOPEP)	1	MARPOL requirement for applicable vessels. In the event a vessel hydrocarbon storage tank is ruptured, applicable strategies for reducing the volume of hydrocarbon releases will be contained within the vessel SOPEP. This may include securing cargo via transfer to another storage area on-board the vessel, transfer to another vessel, or through pumping in water to affected tank to create a water cushion (tank water bottom). Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will aim to minimise the volume of fuel spilt.
	Pumping procedures	1	Provides guidance for supervision and actions required in the event of a hydrocarbon spill during pumping operations for marine diesel.
In-Situ Burning	Controlled burning of oil spill	X	Not applicable to diesel spills due to inability to contain marine diesel making it very difficult to maintain necessary slick thickness for ignition and sustained burning.
Monitor and Evaluate Plan (Operational Monitoring)	Vessel surveillance	1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). Informs implementation of other response strategies. Vessel personnel may not be trained observers. Vessel observers on leaking vessel may not have capacity to observe oil during emergency response procedure implementation. Constrained to daylight. Limited to visual range from the vessel.

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
			Limited capacity to evaluate possible interactions with sensitive receptors.
	Aerial surveillance	1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). May identify environmental sensitivities impacted or at risk of impact (e.g. seabird aggregations, other users such as fishers). Informs implementation of other response strategies.
	Tracking buoys	1	Can be implemented rapidly. Can provide indication of near-surface entrained / dissolved hydrocarbons (most other monitor and evaluate techniques rely on the hydrocarbon being on the surface or shoreline).
	Trajectory Modelling	1	Can be implemented rapidly. Predictive - provides estimate of where the oil may go, which can be used to prepare and implement other responses. No additional field personnel required. Not constrained by weather conditions. Can predict floating, entrained, dissolved and stranded hydrocarbon fractions. May not be accurate. Requires in-field calibration.
	Satellite Imagery	1	Can work under large range of weather conditions (e.g. night time, cloud cover etc) Mobilisation likely to be >24 hours Requires processing May return false-positives
	Operational Water Quality Monitoring	1	Fluorometry surveys are used to determine the location and distribution of the entrained oil and dissolved aromatic hydrocarbon components of the spill and validate the spill fate modelling predictions.

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
	Shoreline and Coastal Habitat Assessment	1	Provides information on shoreline oiling (state of the oil, extent of pollution etc.). Can provide information on amenability of shoreline response options (e.g. clean-up, protect and deflect). Provides information on status of impacts to sensitive receptors. Considerable health & safety considerations. Requires trained observers. Constrained to daylight. Delayed response time.
Chemical Dispersion	Vessel or aerial	X	Marine diesel is not considered a persistent hydrocarbon and has high natural dispersion rates in the marine environment. Chemical dispersant application is not recommended as a beneficial option for marine diesel as it has a low additional benefit of increasing the dispersal rate of the spill while introducing the potential for increased impacts.
Offshore Containment and Recovery	Use of offshore booms/ skimmers or other collection techniques deployed from vessel/s to contain and collect oil.	X	Marine diesel is a low viscosity oil that spreads quickly resulting in thin surface expressions, making recovery via booms and skimmers difficult and ineffective. For these oils offshore containment and recovery is not considered an applicable strategy.
Mechanical Dispersion	Vessel prop-washing	X	Due to the volatile/semi-volatile nature of MGO/MDO creating a hazard for vessels and crew and propensity for this fuel to naturally disperse, mechanical dispersion is not considered an applicable strategy to be taken forward for further planning.
Protection and Deflection	Booming in nearshore waters and at shorelines	2	Use of anchored boom or other barriers (e.g. sand bags, earthworks) to contain/divert oil and/or to protect sensitive receptors in the nearshore environment.

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
			Considered for Level 2/3 spills if operational monitoring shows or predicts spill is predicted to contact sensitive shorelines, although marine diesel has high volatility and low persistence with low potential for shoreline loading. Flushing and bioremediation may provide a greater net benefit than booming operations.
Shoreline clean-up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	2	Various strategies to clean shorelines of oil including: + Mechanical/ manual collection + Low pressure flushing + Sorbent materials + Surf washing + Sand tilling + Bioremediation. Considered if operational monitoring shows or predicts contact to sensitive shorelines. Intrusive activities such as physical removal of waste using manual labour or mechanical aids requires careful site-specific planning in order to reduce secondary impacts of habitat disturbance, erosion and spreading oil beyond shorelines. The majority of the affected coastline is offshore islands, mangroves and tidal flats, most of which has no access by land. Flushing may be considered if the oil enters high priority/slow recovery habitats such as mangroves. Marine diesel has low to no persistence in the environment and therefore prolonged loading of shorelines is not expected. Natural remediation and flushing may be preferred to more intrusive clean-up methods given the nature and low persistence of these hydrocarbons.
Oiled Wildlife Response	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation.	2	Can be used to deter and protect wildlife from contact with oil. Mainly applicable for marine and coastal fauna (e.g. birds) where oil is present at the sea surface or accumulated at coastlines. Potential for onshore releases to impact nesting areas. Surveillance can be carried out as a part of the fauna specific operational monitoring Wildlife may become de-sensitised to hazing method.

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
			Hazing may impact upon animals (e.g. stress, disturb important behaviours such as nesting or foraging) Permitting requirements for hazing and pre-emptive capture.
Scientific Monitoring	The monitoring of environmental receptors to determine the level of impact and recovery form the oil spill and associated response activities.	1	Monitoring activities include: + Water and sediment quality + Biota of shorelines (sandy beaches, rocky shores and intertidal mudflats) + Mangrove monitoring + Benthic habitat monitoring (seagrass, algae, corals) + 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.

4.2 Resource arrangements and demonstration of ALARP

A detailed ALARP assessment on the adequacy of resourcing available to support spill response strategies and control measures is presented in **Table 4-2**.

Table 4-2: ALARP assessment of the resourcing for spill response strategies

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
Monitor and Evaluate - Aerial Surveillance	Helicopter services available through Santos WA's primary contracted supplier based out of Karratha. Initial aerial observation using helicopter pilots will be activated within 3 hours of notification of the spill. Trained Aerial Observers (6) will be available from Day 2 of the incident, following activation (based in Perth and Santos WA facilities).	Given location of potential spill site, mobilisation of helicopters from Karratha (via Varanus Island (VI) if required) is considered adequate for surveillance. Endurance is not considered a limiting factor at this location. Current arrangements can provide for 2 passes (am and pm) of the spill area per day. This has been exercised as part of major spill exercises. Trained Aerial Observers can mobilise to Karratha or Exmouth for Day 2 operations. Day 1 surveillance and recording using helicopter pilots considered adequate for initial situational awareness.	Resource not considered limiting. Primary supplier on contract with additional providers available to provide desired overpass frequency. Santos WA trained observers can be provided on rotation from Day 2.	No additional costs as helicopters are currently contracted for day-to-day operations to and from Santos WA facilities. In the event that additional passes are required due to data gaps, the cost of the additional flights will be added to the cost of the response.	There is no value in increasing dedicated overpasses; therefore, the arrangements are considered ALARP. However, opportunistic aerial surveillance can be provided through the shared use of aircraft deployed for other purposes.
Monitor and Evaluate - Vessel Surveillance	On-hire vessels supporting Santos WA's VI facilities. Vessel of opportunity from other operators. Additional vessels contracted through Santos WA vessel	On-contract vessels performing duties at VI may be available, as well as vessels of opportunity from other petroleum operators. The activity area is central on the North West Shelf and offshore from the major marine base of Dampier. Additional available vessels out of	Based on the close proximity of the activity to VI and the central location of the activity relative to the main marine base of Dampier, dedicated additional vessels for the purpose of oil spill surveillance is not	The current vessel arrangements are considered to provide the required function. Dedicated vessels on standby for vessel surveillance would cost tens of thousands of dollars per day and are	There is no benefit in having additional dedicated surveillance vessels, given surveillance can be performed from any vessel; and these duties will be shared amongst spill response vessels.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	providers out of Dampier. Santos WA has access to automatic identification system live-vessel tracking portal to establish vessel availability. Vessel surveillance will be activated within 90 minutes for available on-site (at VI) vessels.	Dampier can be put on hire through Santos WA's contracted vessel providers; mobilisation times to site can provide additional contracted vessels relatively quickly. This strategy is not designed to perform 'whole of spill' coverage, which is provided by aerial surveillance (i.e., it is a secondary strategy).	considered to be required, given the need is met through vessel sharing. Surveillance will also be conducted through a number of complementary strategies (aerial surveillance, oil spill trajectory modelling, tracker buoys).	not considered required.	
Monitor and Evaluate- Oil Spill fate Modelling	24/7 standby Oil Spill Trajectory Modelling (OSTM) service provider OSTM provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill. Spill modelling to be initiated within 24 hours. Upon activation, OSTM provider will provide trajectory models within: 2 hours for OILMAP model for offshore and open ocean; and	OSTM provider 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. Operational surveillance data (aerial, vessel, tracker buoys) will be provided to OSTM provider to verify and adjust fate predictions of the spill and improve predictive accuracy.	Predictive oil spill modelling will be used to forecast (using real-time data) the trajectory and fate of the spill. Resource is not considered limiting with no environmental benefit from dedicating additional modelling capability.	Santos WA pays for the provision of the service OSTM provider. This is considered to provide the required function.	There is no benefit in having additional modelling capability given that OSTM provider have staff based across Australia and can provide 24/7 coverage.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	4 hours for OILMAP operation for near-shore.				
Monitor and Evaluate - Tracker Buoys	Up to 12 Santos WA tracker buoys (at different Santos WA facilities); typically 4 are immediately available on VI, and deployment can be at a staggered rate determined by the need to track oil heading towards sensitive receptors. Subscription to tracker buoy tracking website. Santos WA on-hire vessels and vessels of opportunity for buoy deployment. Subject to weather and vessel availability, the tracker buoys can be mobilised within 2 hours upon request from the IMT or on-scene commander.	In addition to aerial surveillance, tracker buoys are an additional strategy to provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance). 12 buoys are sufficient to enable timely retrieval and redeployment. Four are available on VI. Vessels for buoy deployment will be Santos WA on-hire vessels and other operators of vessels of opportunity. Vessels can be shared across this and other tasks (e.g., surveillance and tracker buoy deployment).	Additional buoys are available through secondary suppliers (e.g., AMOSC, OSRL and AMSA – more than 20 buoys available) if required. Dedicated vessels are not required given that the need is met through vessel sharing.	Santos WA has 12 buoys linked to a satellite-tracking website designed for first strike deployment across its operational facilities. No additional buoys need to be purchased by Santos WA given secondary availability through AMSA, AMOSC, OSRL within days. There is no additional upfront cost for accessing these secondary buoys.	The number of buoys immediately available and the availability of secondary buoys within days is sufficient to cover tracking of oil fronts, especially given the spread of oil will be limited within the initial days of the spill. Therefore, no additional requirements and the response is considered ALARP.
Monitor and Evaluate-	Contract in place with third party provider to enable access and	Suitable imagery can be accessed through existing contracts with AMOSC and OSRL. The most appropriate	Satellite imagery is considered a supplementary source of information that can		The current satellite imagery arrangements are considered

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
Satellite Imagery	analysis of satellite imagery	images for purchase will depend on the extent and location of the spill. Frequency of reporting is subject to satellite overflight schedule.	improve awareness but is not critical to the response and usage is at the discretion of the IMT. Given the adequate provision of satellite imagery and analysis through a third-party provider there is no requirement for additional resources.		adequate to provide the required function.
Monitor and Evaluate-Water Quality Monitoring (operational and scientific)	CTD (conductivity, temperature, and depth) meters, including fluorometry and dissolved oxygen sensors. Water sampling equipment (e.g., Niskin bottles, jars). Water quality monitoring personnel. Dedicated vessels for towed fluorometers, CTD meter deployment, water sampling. Oil sample collected using a vessel of opportunity and	CTD meters with fluorometers and water sampling equipment available locally and to be arranged through Santos WA's contracted scientific monitoring provider. Contractual standby arrangements are in place for rapid activation, planning and deployment of operational water quality monitoring personnel. CTD meters provide discrete 'single point' readings over a depth profile. Water quality sampling at discrete locations. Discrete water sampling will target sites positioned to validate modelling predictions.	There are locally available subsea gliders and access to towed fluorometers. Water sampling equipment and CTD meters are also available locally. Water sampling equipment is not considered a bottleneck to deployment. Given multiple access avenues to equipment, dedicated equipment (i.e., purchased or standby on-hire equipment) is not considered required.	Santos WA can access subsea gliders with fluorometers through Blue Ocean Monitoring and towed fluorometers through OSRL. Santos WA's contracted scientific monitoring provider is on an existing standby footing in Perth with mobilisation time of personnel to site within 72 hours following approved monitoring action plan based on incident specifics. An enhanced standby with vessels, equipment	The existing arrangements are considered sufficient to provide targeted 'first strike' operational water quality monitoring to priority sites as identified through oil spill modelling and surveillance.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	analysed on VI or in Perth.		Deployment personnel will initially be provided through Santos WA's contracted monitoring provider.	and personnel all prepositioned for immediate deployment would cost in the order of tens of thousands of dollars per day.	
Monitor and Evaluate – Shoreline and Coastal Habitat Assessment	Spill response teams (Santos WA and AMOSC core group, State Response Team) Santos WA GIS resources Santos WA contracted vessels and vehicles available as required for shoreline access	Shoreline Assessment strategies will be implemented under the direction of DoT as the HMA. AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders. Santos WA will make available AMOSC Core Group Responders for shoreline and coastal habitat assessment positions. Existing information on shoreline character can be obtained from Santos WA's GIS, including habitat/fauna distribution layers and aerial imagery. First-strike deployment arrangements would come from personnel and equipment based at VI. This includes Santos WA AMOSC Core Group personnel, and IRT members. Santos WA maintain the capability to implement a	Personnel and equipment for shoreline and coastal habitat assessment is not considered limiting. However, the time for deployment may exceed predicted times to minimum shoreline contact. This is particularly relevant given that sites for assessment cannot be confirmed until oil spill fate modelling and aerial/vessel surveillance data has been analysed.		The existing arrangements are considered sufficient to provide a first strike shoreline and coastal habitat assessment in addition to supporting DoT.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
		first strike shoreline and coastal habitat assessment within the first 24 hours of a spill notification.			
Monitor and Evaluate – Wildlife Reconnaissance	Spill response teams (Santos WA and AMOSC core group, State Response Team) Santos WA contracted helicopters, vessels and vehicles available as required. Third party Scientific Monitoring Wildlife aerial observers	First strike wildlife reconnaissance will rely on personnel conducting monitor and evaluate activities (aerial and vessel surveillance) with all wildlife sightings reported (including wildlife contacted with hydrocarbons or at risk of contact) in or near the spill trajectory and during shoreline and coastal habitat assessments. All reports will be reported to the IMT within 2 hours of detection. Access to experienced fauna aerial observers and targeted fauna surveys will occur through activation of the third-party scientific monitoring provider.	Having experienced fauna observers and dedicated helicopters and vessels on standby for targeted fauna surveys from the very start of the spill could result in improving the quality of data initially received.	The cost of personnel, helicopters and vessels on standby for this purpose would cost in the order of tens of thousands of dollars per day.	The current arrangements in terms of using monitory and evaluate surveillance to provide the initial wildlife surveillance, followed by targeted fauna surveys with experienced fauna observers as part of the scientific monitoring program, are considered adequate. The cost of having dedicated personnel and helicopter(s)/vessels at an enhanced standby footing is considered grossly disproportionate to the environmental benefit gained.
Protection and Deflection	Shoreline and nearshore booms plus ancillary equipment (Santos WA – VI; AMOSC – Exmouth,	Shoreline and nearshore booms provided by Santos WA or through AMOSC or AMSA are available from Exmouth, VI and Dampier within close	Boom equipment is not considered limiting. However, the time for deployment may exceed predicted times	The cost of booms, vessels and personnel on an enhanced standby footing or prepositioned booms is	The cost of having dedicated personnel and equipment on an enhanced standby footing or prepositioned

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	Fremantle and Geelong; AMSA – Fremantle and Dampier). Boom tow-vessels. Spill response teams (Santos WA and AMOSC core group, State Response Team). Tactical response plans in place for the deployment of booms at offshore island locations (Montebello Islands).	proximity to shorelines potentially contacted as predicted by modelling. Combined, multiple kilometres of boom are available from these locations. Mutual aid arrangements through AMOSC also provide access to additional booms from other operators (e.g. Chevron equipment based at Barrow Island). Regular deployment exercises conducted by VI AMOSC Core Group and IRT personnel of spill response equipment have demonstrated the ability of loading of VI field support vessels within relatively short timeframes (<4 hours). Santos WA maintain the capability to implement first strike protection and deflection strategies within the first 24 hours of a spill notification, taking into consideration the need for oil spill modelling, surveillance and an operation NEBA to guide such a response. Given the proximity of the potential spill to the shoreline or due to weather conditions, it may not be possible to	to shoreline contact. This is particularly relevant given that boom deployment locations cannot be confirmed until oil spill fate modelling and aerial/vessel surveillance data has been analysed. Prepositioning or having personnel and equipment at an enhanced standby footing would reduce deployment time. However, pre-deploying boom at sensitive locations creates potential for impacts which weighed against the uncertainty of an oil spill reaching the location are deemed to be unacceptable.	in the order of tens of thousands of dollars per day and considered to be of limited value based on the timeframes needed to undertake oil spill modelling /surveillance activities and a NEBA in order to establish the areas to be protected by boom.	is considered grossly disproportionate to the environmental benefit gained.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
		implement strategies prior to the minimum modelled contact times. For such instances, protection and deflection could still have environmental benefit once implemented.			
Shoreline Clean-up	Manual clean-up and flushing equipment (Santos WA, AMOSC, AMSA, hardware supplies). Staging infrastructure. Clean-up team leaders. (Santos WA, AMOSC core group, AMSA). Clean-up labour personnel (labour hire as required). Vessels for transport (Santos WA contracted vessel providers). Equipment is prepositioned on VI so readily available.	Shoreline clean up strategies will be implemented under the direction of DoT as the HMA. Existing Santos WA equipment and that available through AMOSC/AMSA arrangements is considered to be sufficient given stockpile locations at Dampier, Exmouth and VI. Further equipment can be provided through additional Australian stockpile locations. First strike deployment arrangements would come from personnel and equipment based at VI. Santos WA maintain the capability to implement first strike shoreline clean-up strategies within the first 24 hours of a spill notification. Santos WA has developed Tactical Response Plans to guide nearshore and shoreline operations at Montebello Islands.	The main limitation of undertaking a shoreline clean-up response is based around access for plant and personnel to remote offshore island locations. VI can accommodate a maximum of 160 personnel outside of cyclone season. Barrow Island also has resident personnel associated with Chevron's operations. Provision of additional clean-up resources such as spill kits, sorbents, brooms, shovels, buckets etc are not considered to provide an environmental benefit unless additional personnel can be mobilised.	During a spill event, the cost of additional resources is not considered to be a limiting factor. Mobilising additional personnel to undertake shoreline clean-up via vessel to remote offshore locations presents increased associated health and safety risks. Mobilising personnel via helicopter is limited to 10 passengers per trip. Once at the locations, there is a need to provide adequate facilities, which may be difficult given the limited numbers of beds available on VI and in other offshore locations.	The current level of resources available are considered to be appropriate. The outcome of oil spill modelling/surveillance and a NEBA would be used to identify priorities for protection at specific locations given the time of year e.g. during turtle nesting season, where shoreline clean-up efforts would be directed at nesting beaches.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
		A sustained clean-up would involve large numbers of bulk clean-up personnel through labour-hire arrangements, led by clean-up team leaders. Given the light/volatile nature of marine diesel and the relatively low volumes predicted to arrive at shorelines under worst case conditions, intrusive and labour-intensive methods are unlikely to be favoured or required.			
Waste Management	Assorted waste receptacles and trucks. Waste personnel – project manager, local responsible personnel and operations personnel. Vessels for waste transport from offshore islands. Dedicated spill equipment container available on VI with equipment to establish waste storage areas during shoreline clean-up (e.g., collapsible bunds, absorbent rolls, drain covers, temporary fencing).	Santos WA's waste service is contracted to provide first-strike and ongoing waste storage, transport and disposal requirements commensurate with a worst-case spill across Santos WA's operations. These resources are over and above those required for the worst case scenarios described in this OPEP.	Waste contractor has access to sufficient resources for the worst-case waste requirements associated with the activity; there is no benefit to acquiring additional resources specifically for the activity. Additional equipment to manage shoreline clean-up waste on offshore islands can be accessed and replenished from the mainland during an ongoing response.	Contracted resources are considered greater than required to respond to a worst-case scenario.	Resources are considered to be adequate based on worst-case modelled waste requirements.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
Oiled Wildlife Response	Oiled wildlife response kits and containers available from AMOSC, AMSA, DBCA, or DoT in Darwin, Broome, Exmouth, Karratha, Fremantle, or Kensington. Oiled Wildlife Response personnel Level 2 to 4 as per the WA Oiled Wildlife Response Plan (AMOSC, AMOSC-activated Oiled Wildlife Response contractors, Industry Mutual Aid, DBCA, OSRL-activated Oiled Wildlife Response contractors, "Sea Alarm"). VI HSE Advisors with fauna handling training Untrained resources (level 1) through personnel-hire arrangements Level of escalation of the oiled wildlife response is under authority of the DoT	If a spill occurs in or crosses into State waters an OWR will be implemented under the direction of DoT as the HMA and Santos WA will assist the response. An operational NEBA would direct efforts for maximum effectiveness and ensure the response effort itself does not cause more harm. Santos WA will provide all necessary resources to assist DoT, mainly, and initially, through its access to AMOSC oiled wildlife resources. In the event of large-scale OWR, further specialised OWR equipment and personnel will be accessed through AMOSC and OSRL. Equipment and personnel required for the development and operation of staging areas/ treatment facilities can be provided locally. The Pilbara Region OWR Plan provide detail of local organisations and suppliers for personnel and equipment. Labour hire agencies would be used to provide large numbers of level 1 responders that would	Prehire and/or prepositioning of staging areas and responders may enhance response times and hence the overall success of an OWR. As any OWR would be in consultation with DBCA upon completion of a NEBA, the timeframe for this to occur would exceed the time to mobilise an OWR (equipment and personnel) from one of the locations on the WA mainland. As Santos WA has access to OWR kits through 3rd party agreements that can be mobilised in a timely manner, it is not considered to be necessary to increase equipment. The available OWR kits are strategically positioned within WA enabling flexibility on locations for staging	The cost of personnel (Level 1 responders) on standby is $1,500 per person per day as per existing arrangements through recruiting agencies. This is a guaranteed cost regardless of whether a spill occurs or not. Given that personnel on this level can be arranged within relatively short timeframes there is not considered sufficient environmental value in having dedicated OWR responders on standby. This is further supported by OWR being undertaken in consultation with relevant agencies (e.g. DoT, DBCA and DoEE) which is expected to be more of a limiting factor with regards to time than mobilising additional resources.	The cost of setting up staging areas and having responders on standby is considered grossly disproportionate to the environmental benefit gained. The overall OWR capability Santos WA can access through AMOSC, OSRL/Sea Alarm and through Santos WA Workforce hire are considered adequate. Santos WA is committed to improving their first strike OWR capability through the development of a Varanus Island Oiled Wildlife First Strike Plan prior to the end of 2020.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	incident controller with technical input from the DBCA – Oiled Wildlife Advisor.	undergo an induction and basic training. Mobilisation of OWR personnel and equipment to site will start to occur in 24-48 hours following notification of actual or imminent impact to wildlife. This will occur through access to AMOSC oiled wildlife resources.	areas to be established. The ability to increase the OWR effort relies on having adequate numbers of trained personnel available to undertake the response rather than having access to extra OWR kits. The first strike capability of Santos WA, prior to the arrival of OWR/wildlife specialists, would be enhanced through the development of a VI Oiled Wildlife First Strike Plan.		

4.3 Net Environmental Benefit Analysis (NEBA)

The Control Agency IMT use the NEBA process to inform the development and refinement of incident response strategies and tactics, so the most effective response strategies and tactics with the least detrimental environmental impacts can be identified, documented and executed.

Within Santos WA's IMT, the Environmental Team Lead is responsible for reviewing the priority receptors identified within the EP and this OPEP and coordinating the Operational NEBA to identify which response options are preferred for the situation, oil type and behaviour, environmental conditions, direction of plume and priorities for protection.

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

Strategic NEBAs have been developed for all response strategies identified as applicable to credible worst-case spills identified in this OPEP, with the benefit or potential impact to each sensitivity identified within the Environment that May Be Affected (EMBA). Although not all spill response activities included in the strategic NEBA would not be under the control of Santos WA during a spill incident, they have however been included to assist in planning conducted by DoT.

In the event of a spill, NEBA is applied with supporting information from situational awareness and information collected as part of the Monitor and Evaluate Plan (**Section 9**) to achieve the following:

+ Identify sensitivities within the area potentially affected by a spill at that time of the year (noting that the sensitivity of some key receptors, such as birdlife and turtles, varies seasonally);
+ Assist in prioritising and allocating resources to sensitivities with a higher ranking; and
+ Assist in determining appropriate response strategies with support of real time metocean conditions, oil spill tracking and fate modelling.

When a spill occurs, NEBA is applied to the current situation, or operationalised, using the Operational NEBA Form (**Appendix B**). To complete the NEBA:

+ All ecological and socioeconomic sensitivities identified within the spill trajectory area are inserted; and
+ Potential effects of response strategies on each sensitivity are assessed and assigned a positive, negative or no change rating.

The Operational NEBA Form documents the decisions behind the recommendation to the IMT Leader on which resources at risk to prioritise, and the positives and negatives of response strategies to deploy. The Operational NEBA provides guidance to the IAPs and is revisited each Operational Period.

Table 4-3 shows an impact assessment of different response strategies on each of the protection priorities.

Table 4-3: Impact of spill response strategies on the environmental values of the protection priorities following worst-case spill of 329 m^3 of MDO in Commonwealth or State waters

Key environmental sensitivities	Relevant Key Sensitive Periods	No Controls	Source Control	Monitor and Evaluate	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Montebello Islands								
Turtle nesting – Northwest and Eastern Trimouille Islands (hawksbills), Western Reef and Southern Bay and Northwest Island (green)	Loggerhead turtle nesting: Dec-Jan Green turtle nesting: Nov- to Apr. Peak period from Jan-Feb Hawksbill turtle nesting: Oct-Jan Flatback turtle nesting: Dec-Jan							
Mangroves – particularly Stephenson Channel							N/A	
Coral and other subsea benthic primary producers	Coral spawning: Mar & Oct				N/A	N/A	N/A	
Seabird nesting	Sept-Feb							
Migratory shorebirds	Sept-Feb							
Humpback/ Pygmy blue whale migration	Pygmy blue whale migration: Apr-Aug Humpback whale migration: May-Dec				N/A	N/A		
Fishing/ charter boat tourism								

Key environmental sensitivities	Relevant Key Sensitive Periods	No Controls	Source Control	Monitor and Evaluate	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Barrow Island								
Turtle nesting – particularly flatback (western side) and green turtles (eastern side)	Green turtle nesting: Nov- to Apr. Peak period from Jan-Feb Hawksbill turtle nesting: Oct-Jan Flatback turtle nesting: Dec-Jan Loggerhead turtle nesting: Dec-Jan							
Mangroves and mudflats (shorebird foraging) – Bandicoot Bay							N/A	
Coral and other subsea benthic primary producers – incl. Biggada Reef	Coral spawning: Mar & Oct				N/A	N/A	N/A	
Seabird nesting - incl. Double Island	Sept-Feb							
Migratory shorebirds - particularly Bandicoot Bay	Pygmy blue whale migration: Apr-Aug Humpback whale migration: May-Dec							
Aboriginal listed sites incl. pearling camps	Sept-Feb						N/A	N/A
Lowendal Islands								

Key environmental sensitivities	Relevant Key Sensitive Periods	No Controls	Source Control	Monitor and Evaluate	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Turtles nesting- Important hawksbill (Beacon, Parakeelya, Kaia and Pipeline), Loggerhead and green turtle nesting (minor) Varanus pipeline, Harriet and Andersons),	Loggerhead turtle nesting: Dec-Jan Green turtle nesting: Nov- to Apr. Peak period from Jan-Feb Hawksbill turtle nesting: Oct-Jan Flatback turtle nesting: Dec-Jan							
Mangroves- mangrove stands on Varanus Island on the west coast in discrete patches at South Mangrove Beach also on Bridled Island							N/A	
Coral and other subsea benthic primary producers	Coral spawning: Mar & Oct				N/A	N/A	N/A	
Seabird nesting	Sept-Feb							
Migratory shorebirds	Sept-Feb							
Dugongs- Seagrass beds around the Lowendal islands thought to provide valuable food source					N/A	N/A		
Humpback whale migration	May-Dec				N/A	N/A		

Key environmental sensitivities	Relevant Key Sensitive Periods	No Controls	Source Control	Monitor and Evaluate	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Aboriginal listed sites incl. pearling camps							N/A	N/A

Legend	
	Beneficial impact
	Possible beneficial impact dependent upon the situation (e.g. Timeframes and metocean conditions to dilute entrained oil)
	Negative impact
N/A	Not applicable for the environmental value

5 Initial response (first strike activations)

The initial response actions to a vessel oil spill will be in accordance with the vessel SOPEP.

Further response information contained within this OPEP is concerned primarily when the Santos WA IMT is engaged for support.

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

Position	Type of communication	Timeframe	To Whom
On-Scene Commander	Verbal	Within 30 minutes of incident having been identified or as soon as additional resources are required	Incident Commander via Duty Manager

First strike activations required for the credible oil spill incidents identified in this plan are outlined in **Sections 5.1** and **5.2** below.

5.1 Level 1 spills

Level 1 activations are based on spills which will not have an adverse effect on the public or the environment and can be controlled by the use of resources available onsite, without the need to mobilise additional resources for combatting the spill. First strike actions for level 1 offshore spills are detailed below (**Table 5-1**).

Table 5-1: First strike activations for Level 1 vessel spills

When	Actions	Who
Immediate	Manage the safety of personnel on vessel	Vessel Master
Immediate	Control the source using available onsite resources Refer: Source Control Plan – go to **Section 7**	Vessel Master
30 minutes	Report incidents where spill has reached marine environment to Incident Commander via on-call Duty Manager	Vessel Master/ CSR
60 minutes	Initiate regulatory notifications as per Notifications Plan (refer to **Section 6.1**)	Vessel Master/ CSR Incident Commander or delegate
60 minutes	If spill has reached marine waters gain further situational awareness by undertaking surveillance of the spill from vessel (refer to **Section 9.1**)	Vessel Master/ CSR
Ongoing	Provide updates and incident reporting in accordance with Notifications Plan – go to **Section 6.1**.	Vessel Master/ CSR Incident Commander or delegate

5.2 Level 2 and 3 spills

Level 2 activations are based on spills that cannot be controlled by the use of vessel resources alone or spills that may be able to be controlled using on-site resources, but which will have an adverse effect on the public or the environment.

For Level 2 and 3 spills from vessels, AMSA is the Control Agency for Commonwealth water spills and DoT the Control Agency for State waters spills. Santos WA will provide first strike response and then support DoT or AMSA in their role as Control Agencies through provision of resources.

Table 5-2: First strike activations for Level 2 and 3 vessel spills

When	Actions	Who
Immediate	Manage the safety of personnel on the vessel	Vessel Master
Immediate	Control the source using available onsite resources as per vessel SOPEP Refer: Source Control Plan – go to **Section 7**	Vessel Master
Within 30 minutes	Notify Incident Commander	Vessel Master/ CSR
As soon as practical but within 60 minutes	Make initial notifications Activate the Notifications Plan - go to **Section 4.2** Including notifications to relevant Control Agency (DoT or AMSA)	Vessel Master/ CSR IMT – (Environment/ Safety)
Within 90 minutes of notification	Gain situational awareness by initiating Operational Monitoring– go to **Section 9**	Vessel Master/ CSR IMT (Ops, Logs, Planning, Env)
If/when initiated (refer **Section 10)**	Prepare for initiation of Shoreline Protection and Deflection - go to **Section 10**	IMT (Ops, Logs, Planning, Env)
If/when initiated (refer **Section 11.2)**	Prepare for initiation Shoreline Clean-up Plan - go to **Section 11.2**	IMT (Ops, Logs, Planning, Env)
If/when initiated (refer **Section 12)**	Prepare for initiation Oiled Wildlife Response as applicable – go to **Section 12**	IMT (Ops, Logs, Planning, Env)
If/when initiated (refer **Section 14)**	Prepare for initiation of scientific monitoring as per Scientific Monitoring Plans where applicable – go to **Section 14**	IMT Environment Team Leader
Day 1	Initiate the development of a Safety Management Plan/s Refer Oil Spill Recovery Safety Management Plan (QE-91-RF-10016)	IMT Safety Team Leader
Ongoing	Following notification of a Level 2/3 spill, AMSA or DoT, as the legislated Control Agency, will assume control of	

When	Actions	Who
	the spill response and provide direction to those activities already commenced by Santos WA. Santos WA will provide resources as a Support Agency	

6 Notification and reporting plan

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

6.1 Regulatory notification and reporting

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

Contact details for the Regulatory agencies outlined in **Table 6-1** and **Table 6-2** are provided within the Incident Response Telephone Directory (QE-00-ZF-00025.020)

Table 6-1 and **Table 6-2** outline the external regulatory reporting requirements specifically for oil spill incidents outlined within this OPEP in Commonwealth and State jurisdictions, noting that regulatory reporting may apply to smaller Level 1 spills that can be responded to using onsite resources as well as larger Level 2/3 spills.

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

Table 6-1 outlines Santos WA oil spill reporting requirements associated with carrying out a Petroleum Activity in State and Commonwealth waters. There are also additional requirements for Vessel Masters to report oil spills from their vessels under relevant marine oil pollution legislation (e.g. MARPOL). This includes, where relevant, reporting oil spills to AMSA (Rescue Coordination Centre) and WA DoT (MEER unit).

Table 6-1: External notification and reporting requirements (Commonwealth and State waters)

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
NOPSEMA Reporting Requirements for Commonwealth water spills					
NOPSEMA (Incident Notification Office)	Verbal notification within 2 hours Written report as soon as practicable, but no later than 3 days	*Petroleum and Greenhouse Gas Storage Act 2006* Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009 (as amended 2014)	A spill associated with the activity in Commonwealth waters that has the potential to cause moderate to significant environmental damage[1]	Notification by IMT Environmental Team Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
NOPTA (National Offshore Petroleum Titles Administrator) & DMIRS (WA Department of Mines, Industry Regulation and Safety)	Written report to NOPTA and DMIRS within 7 days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by IMT Environmental Team Leader (or delegate)	Provide same written report as provided to NOPSEMA
DMIRS Reporting Requirements for State water spills					
WA Department of Mines, Industry Regulation and Safety (DMIRS)	Verbal phone call within 2 hours of incident being identified Follow up written notification within 3 days	Guidance Note on Environmental Non-compliance and Incident Reporting	A spill incident associated with the activity in State waters that has the potential to cause an environmental impact that is categorised as moderate or more serious than moderate[1]	Notification by IMT Environmental Team Leader (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Environment/Environment-reports-and-6133.aspx

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

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
Department of Biodiversity Conservation and Attractions (Pilbara Regional Office)	Verbal notification within 2 hours	DBCA consultation	Santos WA to notify AMSA of any marine pollution incident[1] Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Department of Biodiversity Conservation and Attractions (State Duty Officer and Pilbara Regional Office)	Verbal notification within 2 hours	Western Australian Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Parks Australia (24-hour Marine Compliance Duty Officer)	Verbal notification as soon as practicable	Environment Protection and Biodiversity Conservation Act 1999	An oil spill which occurs within a marine park or are likely to impact on an Australian Marine Park	Notification by IMT Environmental Team Leader (or delegate)	Not applicable, but the following information should be provided: Titleholder's details Time and location of the incident (including name of marine park likely to be affected) Proposed response arrangements as per the OPEP Details of the relevant contact person in the IMT

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
Department of Primary Industry and Regional Development (DPIRD) - Fisheries	Verbal phone call notification within 24 of incident	As per consultation with DPIRD Fisheries	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Australian Fisheries Management Authority	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

1- For clarity and consistency across Santos WA regulatory reporting requirements Santos WA will meet the requirement of reporting a marine oil pollution incident by reporting oil spills assessed to have an environmental consequence of moderate or higher in accordance with Santos WA's environmental impact and risk assessment process outlined in **Section 5** of the EPs.

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

6.2 Level 2/3 spill response support notifications

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 response providers that have pre-established roles in assisting Santos WA in an oil spill response. It is not an exhaustive list of all providers that Santos WA may use for assisting an oil spill response. The Company Incident Response Telephone Directory (QE-00-ZF-0025.02) contains a more detailed list and contact details for incident response support and is updated every 6 months with up-to-date revisions available within the Company Incident Control room and online (intranet procedures and emergency response pages).

Table 6-2: List of spill response support notifications

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for notification/ activating
AMOSC, AMOSC Duty Manager	As soon as possible	Verbal Service Contract	Santos is a Participating Company in AMOSC and can call upon AMOSC personnel and equipment (including oiled wildlife). Under the AMOSPlan, Santos can also call upon mutual aid from other trained industry company personnel and response equipment AMOSC's stockpiles of equipment include dispersant, containment, recovery, cleaning,	**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. Santos WA Duty Managers/ Incident Commanders are designated call-out authorities.	Incident Commander or delegate (typically Environment Team Leader) can notify. Call-out authorities only (Santos WA Duty Managers/ Incident Commanders) are authorised to mobilise AMOSC.

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for notification/ activating
			absorbent, oiled wildlife and communications equipment. Equipment is located in Geelong, Fremantle, Exmouth and Broome		
Oil Spill Response Limited (OSRL), OSRL Duty Manager	If spill requires additional resources or technical expertise	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. 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. **Step 4.** Authorise mobilisation of resources through completion of OSRL mobilisation form. Call-out authorities only (Santos WA Duty Managers/ Incident Commanders) are authorised to mobilise OSRL.	Incident Commander or delegate (typically Environment Team Leader) can notify. Call-out authorities only (Santos WA Duty Managers/ Incident Commanders) are authorised to mobilise OSRL.

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for notification/ activating
Babcock Helicopters	Within 2 hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place.	**Phone call**	IMT Logistics Team Leader (or delegate)
Exmouth Freight & Logistics	When equipment from movements are required in Exmouth and Dampier	Verbal	Assistance with mobilising equipment and loading vessels	**Phone call**	IMT Logistics Team Leader (or delegate)
North West Alliance – Waste	When Shoreline Clean-up is activated (**Section 11**)	Verbal	Santos has contract arrangements in place with North West Alliance to take overall responsibility to transport and dispose of waste material generated through clean-up activities.	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	IMT Logistics Team Leader (or delegate)
Astron	Scientific Monitoring Plan initiation criteria	Verbal and written	Astron has been contracted by Santos to provide Standby	**Step 1.** Obtain approval from Incident Commander to activate Astron for Scientific Monitoring	IMT Environment

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for notification/ activating
	are met (**Section 14**)		Services for Scientific Monitoring Plans (SMPs) 1-11. This includes provision of personnel and equipment. Aston annually reviews the SMPs for continual improvement.	**Step 2.** Verbally notify Astron followed by the submission of an Activation Form (Environment Team Leader Folder) via email **Step 3.** Provide additional details as requested by the Astron Monitoring Coordinator on call-back **Step 4.** Astron initiates Scientific Monitoring Activation and Response Process	Team Leader (or delegate)
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When characterisation of oil is activated (**Section 9.7**)	Verbal	Oil analysis including GC/MS fingerprinting and Ecotoxicology	**Phone call**	IMT Environment Team Leader (or delegate)
Ecotox Services Australasia (NSW)	When characterisation of oil is activated (**Section 9.7**)	Verbal	Ecotoxicology	**Phone call**	IMT Environment Team Leader (or delegate)
RPS Group	Within 2 hours	Verbal and written	Santos has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill	Contact RPS Group Duty Officer	IMT EUL (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for notification/ activating
			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		

7 Incident Action Plan (IAP)

Santos WA incident response personnel use the incident action planning process to develop Incident Action Plans (IAPs). All stakeholders involved in the incident achieve unity of effort through application of the disciplined planning process.

The incident action planning process is built on the following phases:

1. Understand the situation;
2. Establish incident objectives;
3. Develop the plan;
4. Prepare and disseminate the plan; and
5. Execute, evaluate and revise the plan.

The Santos WA IMT will use the IAP process to determine and document the appropriate strategies as more information becomes available during an incident response. The IAP is to be used by the IMT for each operational period following the initial first-strike assessments, notifications, and activations undertaken by Santos WA.

The Santos WA IAP process is built on the phases described in **Figure 7-1**.

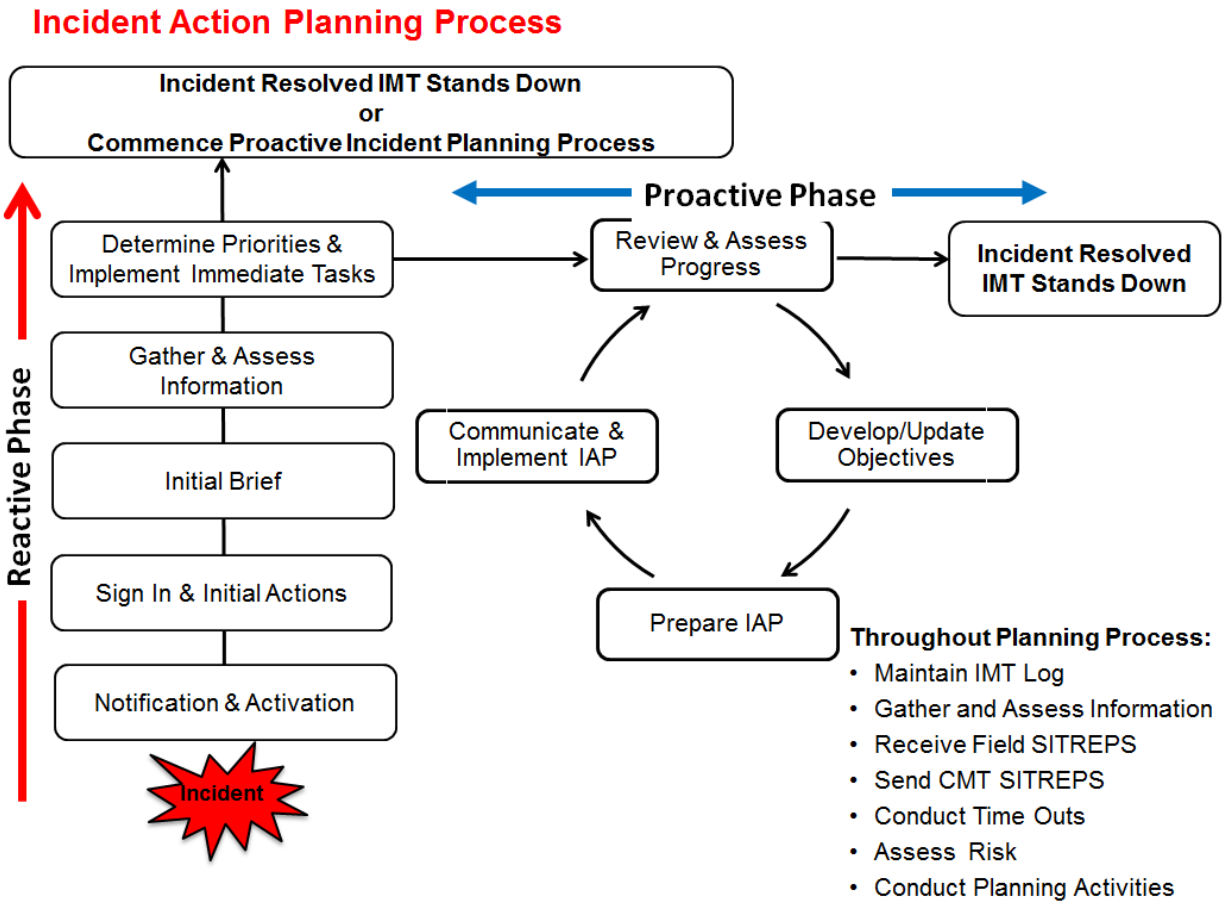

Figure 7-1: Incident Action Plan process

The IAP process facilitates the determination of appropriate strategies as more information becomes available during a spill event. The IAP is used for each operational period following the initial incident response actions defined in **Section 5**. An operational period is defined as the period scheduled for execution of actions specified

in the IAP. The IAP is refreshed when conditions change. There can be multiple objectives and action plans occurring simultaneously within an IAP.

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 WA's response to the incident for regulatory and legal investigations that will follow the termination of the incident.

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

Gain situational awareness

In order to review the applicability of the contingency response strategies contained within this OPEP to the actual and real incident characteristics, and assess the response strategies using NEBA to achieve impacts that are ALARP, the IMT must first gain situational awareness by obtaining answers to the following:

+ What type of hydrocarbon has been spilt?
+ What is the expected behaviour of the hydrocarbon that has been spilt?
+ How much has been spilt?
+ Is the source under control?
+ Where is the hydrocarbon going?
+ Is there anything in the path of the predicted hydrocarbon travel zones?
+ Can the hydrocarbon be approached or are there safety concerns?
+ Can the hydrocarbon be contained?
+ Can the hydrocarbon be dispersed?
+ Will shoreline impact occur and clean-up be required?
+ Can wildlife be affected and require response?

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

8 Source control

The initial and highest priority response to an oil spill incident, following the safety of personnel, is to prevent or limit further oil loss into the marine environment; however, this will only be attempted if safe to do so. In most circumstances, the net benefit of source control outweighs impacts of further oil being released into the marine environment. Further risks may arise due to increased vessels and the associated increased health and safety risks for the team involved in the response.

Small spills to deck (eg from 25 litre containers) of lube oils, cleaning products and hydraulic fluids are possible on the vessel. These are unlikely to reach the marine environment.

These scenarios do not include vessel fuel/cargo tank rupture, covered in **Section 8.1**.

The environmental performance outcome, initiation and termination criteria and the implementation guide for vessel releases are provided in **Table 8-1** and **Table 8-2**.

Table 8-1: Vessel releases – environmental performance outcome, initiation criteria and termination criteria

Vessel Releases (small containers)		
Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.	
Initiation criteria	Notification of spill.	
Applicable hydrocarbons	**Lube oil/ hydraulic fluids**	**Marine Diesel**
	✔	✔
Termination criterion	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbon.	

Table 8-2: Vessel releases implementation guide

Vessel Releases (small containers)				
Activation time		Immediately upon notification of a vessel release.		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	In the event of a spill from the vessel, refer to vessel SOPEP		*Vessel Master*	❑
	Spill response	In all situations, consider the following: + Where drainage is open to the marine environment, drainage is to be isolated as soon as practicable following the spill to prevent discharge to the ocean (the Vessel Master will confirm that the drainage network is closed on the vessel before washing down the deck after excess oil has been cleaned up); + Use of onsite spill kit resources (i.e. sorbent material) to clean-up spills; + Recovery of dropped container where practicable; + Disposal of contaminated waste to licensed waste contractor; and + Isolation and repair of damaged, leaking equipment.	*Vessel Master*	❑
			Vessel Master	❑
Resources			**Location**	
Equipment		Refer to vessel and activity specific procedures for details of equipment available.	Refer to vessel and activity specific procedures for details of equipment locations.	
Personnel		Refer to vessel and activity specific procedures for details of personnel.	Refer to vessel and activity specific procedures for details of personnel.	

Vessel Releases (small containers)			
Activation time	Immediately upon notification of a vessel release.		
Action	**Consideration**	**Responsibility**	**Complete**
Maintenance of response	Spills of this nature are expected to be handled by the resources available at the spill location due to the relatively small credible release volumes and hydrocarbon types. The resources on hand are expected to be sufficient to maintain the response until the termination criteria are reached. If required, Santos has access to additional resources internally and through service providers to maintain this response.		

8.1 Vessel tank rupture

Credible vessel tank ruptures during the activity include marine diesel releases from survey vessel collision and release of marine diesel.

Diesel tank ruptures are credible within State and Commonwealth waters.

Through the implementation of these controls, the amount of hydrocarbons released to the marine environment may be reduced. However, there are several influencing factors that would result in delay or failure to implement controls, potentially resulting in a full discharge of a fuel tank compartment; such as a high sea state, a significantly large rupture, or injuries to personnel.

The environmental performance outcome, initiation and termination criteria and the implementation guide for vessel tank ruptures are provided in **Table 8-3** and **Table 8-4** respectively.

Table 8-3: Vessel tank rupture – environmental performance outcome, initiation criteria and termination criteria

Vessel Tank Rupture	
Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.
Initiation criteria	Notification of incident/spill.
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	The cargo in the ruptured fuel or storage tank is secured and release to the marine environment stopped.

Table 8-4: Vessel tank rupture implementation guide

Vessel Tank Rupture				
Activation time		Immediately upon notification of a vessel tank rupture.		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	The vessel's Shipboard Oil Pollution Emergency Plan (SOPEP), as applicable under MARPOL, or procedure for responding to a ruptured tank will be followed as applicable	Notwithstanding vessel specific procedures for source control, the following activities would be immediately evaluated for implementation providing safe to do so: + Reduce the head of cargo 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 cargo loss; + If the affected tank is not easily identified, reduce the level of the cargo in the tanks in the vicinity of the suspected area if stability of the vessel will not be compromised; + Evaluate the transfer of cargo to other vessels; + Trimming or lightening the vessel to avoid further damage to intact tanks; and/or + Attempt repair and plugging of hole or rupture.	*Vessel Master*	❑
Resources			**Location**	
Equipment		Refer to vessel specific procedures for details of equipment available.	Refer to vessel specific procedures for details of equipment locations.	
Personnel		Refer to vessel specific procedures for details of personnel.	Refer to vessel specific procedures for details of personnel.	
Maintenance of response		Source control measures on vessels are typically contained in the vessel-specific SOPEP and/or Emergency Response		

Vessel Tank Rupture			
Activation time	Immediately upon notification of a vessel tank rupture.		
Action	**Consideration**	**Responsibility**	**Complete**
	Plan (ERP). The need for additional resources to support vessels undertaking source control measures will be specific for each spill. Santos has a range of potential resources (e.g. support vessels with capacity to store liquids) available through its VI Hub operations.		

8.2 Source control plan environmental performance

Table 8-5 indicates the environmental performance outcomes, controls and performance standards for the Source Control response strategy.

Table 8-5: Source Control Performance Standards and Measurement Criteria

Environmental Performance Outcome		
Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Control Measures	**Performance Standards**	**Measurement Criteria**
Vessel Spill Response Plan (SOPEP/SMPEP)	Support vessels have a shipboard oil pollution emergency plan (SOPEP) or shipboard marine pollution emergency plan (SMPEP) that outlines steps taken to combat spills	Audit records. Inspection records
As per the vessel SOPEP	Actions to control vessel tank rupture followed in accordance with SOPEP.	Vessel logs
	SOPEP source control measures will be undertaken to contain and clean up oil spills on vessels.	Incident log Vessel logs
	Clean-up waste will be stored in bunded or sealed area for onshore disposal.	Incident log Vessel logs
	In the event of a hydrocarbon release from a fuel tank rupture, vessel master is to follow procedures outlined with the vessel's SOPEP.	Incident log Vessel logs
	Response terminated when end-point criteria is met.	Incident log

9 Monitor and evaluate plan (operational monitoring)

Operational monitoring is key to gaining situational awareness of an oil spill and in helping to identify, assess and adapt spill response strategies such that environmental impacts are reduced to ALARP. Operational monitoring provides information that can be used to answer the following questions:

+ How much hydrocarbon has been spilt?
+ Is the source under control?
+ Where is the hydrocarbon going?
+ What are the chemical and physical properties of the hydrocarbon?
+ What is the observed and expected behaviour of the hydrocarbon that has been spilt?
+ Is there anything in the path of the predicted hydrocarbon travel zones?
+ Can the hydrocarbon be approached or are there safety concerns?
+ Will shoreline contact occur and protection/clean-up be required?
+ Will wildlife be affected and require response?
+ Are the current response strategies effectively meeting the response objectives?

The sections below outline the operational monitoring strategies considered applicable to worst case spill events identified for the activity.

9.1 Vessel surveillance

Direct observations from the vessel can be used to assess the location and visible extent of an oil spill, aid with the verification of spill trajectory modelling and inform the application and effectiveness of response strategies. Due to the proximity of observers to the water's surface vessel, surveillance is limited in its coverage in comparison to aerial surveillance and may also be compromised in rough sea state conditions or where fresh hydrocarbons at surface poses safety risks.

The environmental performance outcome, initiation and termination criteria, the implementation guide and the performance standards and measurement criteria for vessel surveillance are provided in **Table 9-1** and **Table 9-2** respectively. Environmental performance is described in **Table 9-3.**

Table 9-1: Vessel surveillance – environmental performance outcome, initiation criteria and termination criteria

Vessel Surveillance	
Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.
Initiation criteria	Level 2 or 3 spills. May be deployed for a Level 1 spill if deemed beneficial by the On-scene Commander or Incident Commander.
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	Vessel-based surveillance is undertaken at scheduled intervals during daylight hours, and continues for 24 hours after the source is under control

Vessel Surveillance	
	and a surface sheen is no longer observable, or no net environmental benefit being achieved. Vessel surveillance will terminate if there are unacceptable safety risks associated with gas and VOCs at the sea surface.

Table 9-2: Vessel surveillance implementation guide

Vessel Surveillance				
Activation time		Within 90 minutes for available onsite vessels		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	Request Vessel Master of nearest available Support Vessel to commence surveillance – direct to spill location	Current Santos WA on hire vessels or Vessels of Opportunity (VOO) can be used. AIS vessel tracking is available through ER intranet page.	On-Scene Commander Operations TL	❑
	Source additional contracted vessels if possible need for assistance.		Logistics Team Leader	❑
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms, located in **Appendix G: Aerial** Surveillance Surface Slick Monitoring Template **Surveillance Observer Log**.	Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by IMT.	Vessel Crew	❑
	Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick to the IMT within 60 minutes of completing vessel surveillance	Initial reports to the IMT may be verbal (followed by written transmission) if the vessel is out of range or has no facilities for transmitting forms.	Vessel Master and/or On-Scene Commander	❑
Resources			**Location**	
Equipment		Santos WA Contracted Support Vessel Vessels of Opportunity	Santos WA Operational Areas Dampier port	
Personnel		Support Vessel Crew	With vessel	
Systems		AIS vessel tracking software	Santos WA ER intranet	

Documentation	Bonn Code of Oil Appearance	Santos WA Procedures Index
Maintenance of response	This response will be maintained through Santos WA's existing contractual arrangements with vessel suppliers, which will ensure that sufficient surveillance can be maintained. Regular rotations of vessel crews and refuelling runs will be timed with other surveillance vessels to maintain the response.	

9.2 Aerial surveillance

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

Santos WA maintains a trained pool of Aerial Observers comprising both field staff and office staff. Aerial Observers based in Perth can be mobilised to the airbase the day following activation. In the absence of Aerial Observers, untrained observers (e.g. pilots) can perform initial surveillance of the spill to gain situational awareness.

Helicopter support can be provided by Santos WA on-contract helicopters based at Karratha. Flying time to offshore facility locations is up to 45 minutes.

Time onsite for the purpose of observations will depend on the location of the spill, the airbase of departure, the endurance of the aircraft and the number of personnel onboard.

The environmental performance outcome, initiation and termination criteria, the implementation guide and the performance standards and measurement criteria for aerial surveillance are provided in **Table 9-3**, **Table 9-4** and **Table 9-19** respectively.

Table 9-3: Aerial surveillance – environmental performance outcome, initiation criteria and termination criteria

Aerial Surveillance	
Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.
Initiation criteria	Notification of a Level 2/3 spill. May be deployed for a Level 1 spill if deemed beneficial by the On-scene Commander.
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	Aerial surveillance undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable, or no net environmental benefit being achieved.

Table 9-4: Aerial surveillance implementation guide

Aerial Surveillance				
Activation time		Within 3 hours from notification		
Action		**Consideration**	**Responsibility**	
Initial Actions	Contact contracted helicopter provider – provide details of incident location and request aerial surveillance	Untrained oil observers (e.g. pilots) can perform initial surveillance of the spill to gain situational awareness - recording extent and appearance of oil (including using photos where possible)	Operations TL Logistics TL	❑
	Identify available Santos WA Aerial Observers and deploy them to flight departure location	Santos WA maintains a record of current trained Aerial Observers comprising both field staff and office staff. Aerial Observers based in Perth can be mobilised to the airbase the day following activation. Field based observers may be available same day as notification.	Logistics TL	❑
	Develop flight plan (frequency and flight path) to meet IMT expectations. Expected that 2 overpasses per day of the spill area completed.	Flight plan to confirm with On-Scene Commander that aircraft are permitted in the vicinity of the spill. Flights are only to occur during daylight and in weather conditions that do not pose significant safety risks.	Operations Team Leader / Aviation Superintendent	❑
	Determine the spill extent by completing Aerial Surveillance Log (**Appendix F: Aerial Surveillance Observer Log**) and Aerial Surveillance Surface Slick Monitoring Template. Calculate volume of oil (**Appendix G: Aerial Surveillance Surface Slick Monitoring Template**). Take still and/or video images of the slick. Thickness estimates are to be based on the Bonn Agreement Code		Aerial Observer	❑

Aerial Surveillance				
Activation time		Within 3 hours from notification		
Action		**Consideration**	**Responsibility**	
	(Santos WA Procedure Index)			
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix H: Aerial Surveillance Marine Fauna Sighting Record**)		Aerial Observer	❑
	Record shoreline habitat type and degree of oiling by completing the Shoreline Aerial Reconnaissance Log (**Appendix I: Aerial Surveillance Shoreline Observation Log**)	Thickness estimates are to be based on the Bonn Agreement Code (Santos WA Procedure Index)	Aerial Observer	❑
	Relay all surveillance records: logs, forms, photographic images, video footage to the IMT (Operations/Planning TLs) following completion of survey (nominally 2 reports per day)	Where possible, a verbal report via radio/telephone en route providing relevant information should be considered if the aircraft has long transits from the spill location to base	Aerial Observer	❑
Resources			**Location**	
Equipment		Helicopters through Santos WA contracted aircraft suppliers.	Karratha	
		Aerial Observer Kits (GPS, camera, forms)	Perth, Varanus Island	
Personnel		Santos WA Trained Aerial Observers, Industry Aerial Observers through AMOSPlan Mutual Aid	Perth, NWS various	
Document		Bonn Agreement Code	Santos WA Procedure Index	
Maintenance of response		Aerial surveillance will be maintained through continual procurement of additional aircraft as required from Perth, the Pilbara regions and interstate. Trained Aerial Observers will be rotated on a roster throughout the response.		

9.3 Tracking buoys

Santos WA maintains a minimum of 12 spill tracking buoys across their North West Shelf operations available for deployment in the event of a spill. These are located on Santos WA facilities, contracted drilling rigs and support vessels.

The environmental performance outcome, initiation and termination criteria, the implementation guide and the performance standards and measurement criteria for tracking buoys are provided in **Table 9-5**, **Table 9-6** and **Table 9-19** respectively.

Table 9-5: Tracking buoys – environmental performance outcome, initiation criteria and termination criteria

Tracking Buoys	
Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.
Initiation criteria	Notification of a Level 2 or 3 spill. May be deployed for a Level 1 spill if deemed beneficial by the On-scene Commander
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	Tracking buoy deployment will continue for 24 hours after the source is under control and a surface sheen is no longer observable or Net Environmental Benefit is no longer being achieved.

Table 9-6: Tracking buoys implementation guide

Tracking Buoys				
Activation time		Mobilisation within 2 hours upon request from IMT or On-Scene Commander (deployment time subject to vessel locations and weather conditions)		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	Organise vessel to mobilise tracking buoys from Varanus Island or Santos WA Dampier logistics yard to the spill site.	Current Santos WA on hire vessels or Vessels of Opportunity (VOO) can be used. AIS vessel tracking is available through ER intranet page.	On-scene Supervisor/ Operations Team Leader	❑
	Deploy tracking buoys at leading edge of plume	Note deployment details and weather conditions in incident log	Vessel Master	❑
	Monitor movement of tracking buoys	Refer login details of tracking buoy monitoring website on Santos WA ER intranet site	On-Scene Commander and/or IMT Planning Team Leader/GIS	❑
	Use tracking buoy data to integrate into Common Operating Picture		IMT Planning Team Leader/GIS	❑
	Relay information to spill fate modelling supplier for calibration of trajectory modelling		Environmental Team Leader	❑
Escalation and Ongoing Response Actions	Mobilise additional tracking buoys if required from other Santos WA operations (Santos WA presently has 12 Tracker Buoys located on the NWS). Develop plan for rolling recovery and deployment of buoys if there is a continuous release.		Logistics Team Leader Operations Team Leader	❑
Resources			**Location**	
Equipment		Santos WA Contracted Support Vessel Vessels of Opportunity	Santos WA Operational Areas Dampier Port	
		Tracking buoys (12 in total)	Various	

	Additional tracking buoys	AMOSC/ AMSA/ OSRL
Personnel	Vessel crew	With vessel
Systems	AIS vessel tracking software	Santos WA ER intranet
	Tracking buoy tracking software	Santos WA ER intranet
Maintenance of response	Additional tracking buoys will be procured as required during the response through existing contracts with service providers.	

9.4 Spill fate modelling

A spill modelling service provider will be used to provide forecast spill fate modelling to assess the direction, speed, and potential impacts of the spill. At the time of OPEP preparation, Santos WA has engaged RPS to provide forecast spill fate modelling. RPS use SIMAP and OILMAP modelling systems that comply with *ASTM Standard F2067 "Standard Practice for Development and Use of Oil Spill Models"*. RPS also provide the capacity for forecast air quality monitoring to enable an assessment of potential health and safety risks associated with VOCs released from a surface slick.

The spill fate modelling service is to be initiated by the submission of the RPS trajectory modelling request form by the IMT. RPS 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. Operational surveillance data (aerial, vessel, tracker buoys) is to be provided to RPS to verify and adjust fate predictions of the spill and improve predictive accuracy.

The environmental performance outcome, initiation and termination criteria, the implementation guide and the performance standards and measurement criteria for spill fate modelling are provided in **Table 9-7**, **Table 9-8** and **Table 9-19** respectively.

Table 9-7: Spill fate modelling – environmental performance outcome, initiation criteria and termination criteria

Spill Fate Modelling	
Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.
Initiation criteria	Notification of a Level 2 or 3 spill. May be deployed for a Level 1 spill if deemed beneficial by the On-scene Commander.
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	Spill fate modelling will continue for 24 hours after the source is under control and surface sheens or in-situ hydrocarbons are no longer detectable, or until no longer beneficial to predict spill trajectory and concentrations.

Table 9-8: Spill fate modelling implementation guide

Spill Fate Modelling				
Activation time		Oil Spill Modelling provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill. As per contractual agreements with the modelling service provider RPS, upon activation and when requested by Santos WA, will provide trajectory models with the following minimum delay (or otherwise agreed with Santos WA on a case-by-case basis); Within 2 hours for OILMAP model for offshore and open ocean Within 4 hours for OILMAP operation for near-shore		
Action		**Consideration**	**Responsibility**	**Complete**
Initial Actions	Initiate spill modelling by submission of a trajectory modelling request form (Santos WA Procedure Index) to RPS. Request for 3 day forecast trajectory modelling		Environmental Team Leader	❑
	Determine requirement for gas/VOC modelling and request initiation from RPS	This to be considered for any tactics that monitor/recover oil – especially at close proximity to release site.	Safety Team Leader Environmental Team Leader	❑
	Any operational surveillance data (aerial, vessel, tracker buoys) to be provided to RPS to verify and adjust fate predictions of the spill and improve predictive accuracy		Environment Team Leader Planning Team Leader	❑
	Login to the RPS data sharing website and maintain connection. Access RPS portal and download modelling results and report to GIS Support (refer Santos WA Procedure Index)		Planning Team Leader GIS Support	❑
	Display RPS modelling data within IMT Room		GIS Support	❑

	Update IMT on spill trajectory.	Spill trajectory modelling is key data that will identify environmental sensitivities at risk, guide response strategies and objectives and help determine relevant jurisdictional spill response arrangements.	Planning TL	❑

Resources		**Location**
Equipment	Modelling provided by service provider (e.g. RPS).	Perth
Personnel	Modellers	RPS
Documentation	Trajectory Modelling Request Form and Login Instructions	Santos WA Procedures Index
Maintenance of response	This response will be maintained through contracts with suppliers to maintain spill trajectory modelling services to Santos WA. Modelling service providers have a 24 hr, 7-day capability.	

9.5 Satellite imagery

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

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

Requests for satellite imagery through OSRL can be made through the OSRL notification and mobilisation form (http://www.oilspillresponse.com/activate-us/activation-procedure/) and actioned by the OSRL Duty Manager.

The environmental performance outcome, initiation and termination criteria, the implementation guide and the performance standards and measurement criteria for spill fate modelling are provided in **Table 9-9**, **Table 9-10** and **Table 9-19** respectively.

Table 9-9: Satellite imagery – environmental performance outcome, initiation criteria and termination criteria

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

Table 9-10: Satellite imagery implementation guide

Satellite Imagery				
Activation time		*3-4 hours*		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	Assess requirement for satellite imagery		Planning Team Leader	❑
	Notify AMOSC and OSRL Duty Officer to initiate request for available satellite imagery		Incident Commander Planning Team Leader	❑
	Assess suitability and order imagery		Planning Team Leader	❑
	Integrate satellite imagery into common operating picture and provide to trajectory modelling provider for model validation		GIS Team Leader Planning Team Leader	❑
Resources			**Location**	
Equipment		Satellite access provided by service providers (AMOSC and OSRL)	Provided by AMOSC and OSRL	
Personnel		Provided by service providers (AMOSC and OSRL)	Provided by AMOSC and OSRL	
Maintenance of response		This response will be maintained through contracts with suppliers to maintain satellite imagery services to Santos WA.		

9.6 Initial oil characterisation

The environmental performance outcome, initiation and termination criteria, the implementation guide and the performance standards and measurement criteria for initial oil characterisation are provided in **Table 9-11, Table 9-12** and **Table 9-19** respectively.

Table 9-11: Initial oil characterisation – environmental performance outcome, initiation criteria and termination criteria

Initial Oil Characterisation	
Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.

Initial Oil Characterisation	
Initiation criteria	Level 2 or 3 spills. May be deployed for a Level 1 spill if deemed beneficial by the On-scene Commander
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	Oil sample and analysis to occur to terminate once enough data has been collected to profile the oil behaviour throughout weathering and to provide oil for toxicity testing. As directed by the relevant Control Agency. NB: Vessel surveillance will terminate if there are unacceptable safety risks associated with volatile hydrocarbons at the sea surface.

Table 9-12: Initial oil characterisation implementation guide

Initial Oil Characterisation				
Activation time		Source and spilled oil samples collected with 24 hrs of activation of initial oil characterisation response tactic		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	Source available vessels (on hire or VOO) for oil sampling.	Can be multi-tasked – e.g. for vessel surveillance or tracking buoy deployment	Operations Team Leader Logistics Team Leader	❑
	Confirm suitable equipment onboard for sampling. Confirm sampling methodology Confirm laboratory for sample analysis Develop H&S requirements/ controls	Appendix A and D of CSIRO Oil Spill Monitoring Handbook provide suitable procedure PPE and gas/VOC monitoring to be considered in context of release scenario	Environment TL Safety TL	❑
	Vessel directed to sampling location	Sampling of oil at thickest part of slick – typically leading edge	Operations Team Leader Environment TL	❑
	Vessel crew to undertake sampling and delivery of samples to VI or Dampier for dispatch to laboratory. Environmental TL to confirm analysis of oil with lab	Varanus Island Hub and/or Dampier Supply Base personnel to assist with logistics of sending oil samples to laboratory for analysis.	Operations Team Leader Environmental TL Logistics TL	❑

	Continue sample collection for 14-day post release where oil is available	Initial monitoring by crew of available vessels – Once mobilised to site Santos WA scientific monitoring provider to continue sampling of oil in conjunction with operational water quality monitoring once mobilised to site.	Operations Team Leader Environment Team Leader Logistics Team Leader	❑
Resources			**Location**	
Equipment		Hydrocarbon sampling equipment	Opportunistically with vessel or source locally (in first instance). Varanus island lab is a source of basic sampling equipment. Provided through Monitoring Service Provider (once activated)	
		Nominated laboratories (Intertek Geotech / ESA or suitable alternatives).	Australia	
		Vessels of opportunity and contracted vessels	Within area of operations	
Personnel		Vessel crew Monitoring Service Provider	With vessel Perth, WA	
Documentation		Appendix A and D of CSIRO Oil Spill Monitoring Handbook	Santos WA Procedure Index	
Maintenance of response		Given the frequency and nature of hydrocarbon fingerprinting analysis, any of the analytical laboratories in area capable of sustaining hydrocarbon fingerprinting throughout a response.		

Given marine diesel is a common fuel type with known general properties, the general physical and chemical characteristics of this hydrocarbon is known and is been presented in **Appendix A**. Nevertheless, sampling and analysis of the released hydrocarbon will provide the most accurate information on the hydrocarbon properties at the time of release, as well as providing information on the effect of natural weathering at sea on these properties over time.

Using onsite vessels of opportunity, oil samples (3 x samples per location up to 2L per sample) are to be taken daily where possible from fresh oil, and from the weathered oil locations and dispatched to Laboratory for analysis. Where possible, larger volumes of oil (6-10L) required for ecotoxicity testing can be recovered. Appendix A and D of CSIRO Oil Spill Monitoring Handbook provide suitable procedure. Samples are to be collected for 14 days post release where oil is available for sampling.

Laboratory analysis of the chemical and physical properties of the recovered oil, including gas chromatography/ mass spectrometry (GC/ MS) for the purpose of fingerprinting the oil constituents, is to be undertaken following the initial assessment as part of operational water quality monitoring studies

(refer to **Section 9.7**). Forensic fingerprinting of the released hydrocarbon potentially allows contamination to be traced back to the source where this is otherwise unclear on in dispute.

Sampling of the released hydrocarbon is also to undertaken as part of operational water quality monitoring to provide samples for use in ecotoxicology analysis allowing the toxicity of different concentrations of the hydrocarbon to marine organisms to be assessed experimentally.

Sampling and analysis will allow for forensic fingerprinting of the released hydrocarbon, potentially allowing contamination to be traced back to the source where this is otherwise unclear on in dispute.

Sampling of the released hydrocarbon will also provide samples for use in ecotoxicology analysis allowing the toxicity of different concentrations of the hydrocarbon to marine organisms to be assessed experimentally.

If sample volume allows, ecotoxicology assessment of the oil will also be conducted at an ecotoxicology laboratory following the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). The quantity of oil required for analysis will be confirmed by the laboratory but is expected to be in the order of 6-10 L of oil. Testing results will provide the concentrations at which toxicity endpoints consistent with ANZG (2018) are met for each test. Overall species protection concentrations, including 90%, 95% and 99% species protection trigger levels are then to be generated using a species sensitivity distribution (SSD) fitted to the data (e.g. by using the Burrlioz software program). These species protection trigger levels will be used to aid interpretation of spill trajectory modelling outputs and inform the NEBA process.

9.7 Operational water quality monitoring

Operational sampling of oil and oil in water will be undertaken at discrete locations, providing visual observations, real time fluorometry/ dissolved oxygen readings and providing oil and water samples for laboratory analysis.

This monitoring is complimentary to scientific water quality monitoring (SMP1) delivered through the Oil Spill Scientific Monitoring Plan in terms of methodology and required skillset and can be provided through Santos WA's Scientific Monitoring Provider (**Section 14**).

Key aspects of this monitoring program are provided below. The environmental performance outcome, initiation and termination criteria, the implementation guide and the performance standards and measurement criteria for operational water sampling and analysis are provided in **Table 9-13**, **Table 9-14** and **Table 9-19,** respectively.

Table 9-13: Operational water sampling and analysis – environmental performance outcome, initiation criteria and termination criteria

Operational Water Sampling and Analysis	
Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.
Initiation criteria	Notification of a Level 2/3 spill. May be deployed for a Level 1 spill if deemed beneficial by the On-scene Commander.
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	Operational water sampling and analysis will continue for 24 hours following control of the source provided oil is no longer detectable.

	Vessel surveillance will terminate if there are unacceptable safety risks associated with volatile hydrocarbons at the sea surface.

Table 9-14: Operational water quality sampling and analysis implementation guide

Operational Water Quality Sampling and Analysis				
Activation time		Activation is to follow that for mobilising water quality sampling personnel and equipment for the Water Quality Scientific Monitoring Plan (SMP1).		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	Activate Santos WA Monitoring Service Provider for Operational Water Quality Monitoring		Environment Team Leader	❑
	Obtain spill trajectory modelling and provide to Monitoring Service Provider		Environment Team Leader Planning Team Leader GIS Support	❑
	Develop Monitoring Action Plan (Including Sampling and Analysis Plan) for operational water quality monitoring. Plan to also consider oil characterisation sampling – Monitoring Service Provider to take over this sampling once mobilised.	Sites to be selected using oil spill trajectory modelling and distribution of oil from surveillance tactics. Refer **Table 9-15** for considerations for Sampling and Analysis Plan	Monitoring Service Provider Environment Team Leader	❑
	Develop health and safety plan including potential exposure to volatile gases/VOCs when sampling marine diesel spills	Refer Oil Spill Response Safety Management Manual (QE-91-RF-10016)	Monitoring Service Provider Safety Team Leader	❑
	Source vessels for monitoring meeting Monitoring Service provider requirements	Monitoring Service provider to outline requirements in resource request form	Logistics Team Leader	❑
	Monitoring Service Provider to assemble team/s and water quality monitoring equipment		Logistics Team Leader	❑
	Organise Vessels, accommodation and transport requirements to		Logistics Team Leader	❑

	mobilise monitoring team/s to site			
	Sampling and analysis undertaken. Daily communication and confirmation of sampling plan with On-scene commander and IMT. Daily activity/data reports provided to IMT. Oil/water samples dispatched to nominated laboratories for analysis.		Monitoring Service Provider On-scene Commander Operations Team Leader Environment Team Leader Logistics Team Leader	❑
	Monitoring results to be conveyed to IMT through common operating picture and provided to spill trajectory modeller to validate predictions.		Planning Team Leader GIS Support Environment Team Leader	❑

Resources		**Location**
Equipment	Water sampling equipment to be provide through Monitoring Service Provider (MSP)	Perth, WA
	Vessels of Opportunity, Santos WA contracted vessels	In the area of Operations
Personnel	Monitoring Service Providers (MSPs), vessel crew	Perth, WA, in the area of operations,
Maintenance of response	Response to be maintained through rotation of monitoring teams/vessel crew as required with monitoring action plan reviewed and assessed each operational period as part of IAP revision.	

Table 9-15: 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. The sampling will occur within the predicted or observed position of the spill on surface or the underwater plume. The positioning of water quality locations will be informed by other operational monitoring inputs (for example spill fate modelling, aerial surveillance).

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

9.8 Shoreline and coastal habitat assessment

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

DoT are the designated Control Agency for shoreline response for all marine spills identified in this OPEP and will direct resources provided through Santos WA for the purposes of on-ground shoreline assessments and shoreline response activities. Santos WA will provide additional information on shoreline character and oiling collected as part of aerial surveillance activities carried out under its control (refer to **Section 9.2**).

The information provided below is included for planning purposes and represents how Santos WA would approach shoreline assessments. In the event of a spill with the potential for shoreline contact, the actual survey objectives, methodology, deployment locations and resource allocation will be controlled by DoT, as the Control Agency (with Santos WA acting as a Supporting Agency).

DoT provides guidance on shoreline assessments within their 2015 Oil Spill Contingency Plan.

The environmental performance outcome, initiation and termination criteria, the implementation guide and the performance standards and measurement criteria for shoreline and coastal habitat assessment are provided in **Table 9-16**, **Table 9-17** and **Table 9-19** respectively. This table also provides a list of resources that may be used to implement this tactic. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 9-16: Shoreline and coastal habitat assessment – environmental performance outcome, initiation criteria and termination criteria

Shoreline and coastal habitat assessment	
Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.
Initiation criteria	Operational monitoring predicts or observes shoreline contact from surface oil; or As directed by DoT
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	As directed by DoT

Table 9-17: Shoreline and coastal habitat assessment implementation guide

Shoreline and coastal habitat assessment				
Activation time		Within 24 hours of request by IMT. Deployment within 5 days of activation.		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	Ensure initial notifications to WA DoT have been made	Refer to **Section 6** for reporting requirements	Environment Team Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for assistance in identification of protection priority areas and NEBA.		Environment Team Leader Planning Team Leader	❑
	Mobilising the AMOSC core group responders.		Incident Commander Operations Team Leader Logistics Team Leader	❑
	Actions below are indicative only and are at the final determination of DoT as the Control Agency			
	Assessment of shoreline character, habitats and fauna.	Assessment includes: shoreline structured biotic habitats distribution of fauna shoreline energy and processes (e.g. wave energy, tidal flows) shoreline substrate (e.g. mud, sand, pebble, rock) shoreline form (e.g. width, shape and gradient) access/ safety constraints	AMOSC Core group and DOT	❑
	Assessment of shoreline oiling (if present).	Assessment includes: surface distribution and cover subsurface distribution oil type, thickness, concentration and physical character sampling of oil for laboratory analysis	AMOSC Core group and DOT	❑

	Recommendations for response strategies.	Considerations include: applicable strategies based on oil type and habitat potential access, safety and environmental constraints likely resourcing (personnel and equipment) requirements	AMOSC Core group and DOT	❑

Resources		**Location**
Equipment	Santos WA contracted vessels and vehicles as required for shoreline access.	At the protection priority areas detailed in **Section 3**
	Santos WA aerial surveillance reports	Aerial surveillance monitor and evaluate tactic
Personnel	Shoreline clean-up specialists and other trained oil spill responders	Perth, WA
	AMOSC Core Group	Provided by AMOSC
	DoT State Response Team	Provided by DoT
	AMSA National Response Team	Provided by AMSA
Maintenance of response	Santos maintains internal resources, and has contracts with external service providers, by which shoreline and coastal habitat assessment can be maintained for the duration of a spill response. Assessment teams will be supported by Santos' existing logistics and supply arrangements (e.g. vessel providers, freight etc.)	

9.9 Operational monitoring data collection and frequency

Table 9-18 outlines details of operational monitoring data that will be collected. This includes details on frequency of collection and reporting/data transfer back to the IMT. Operational monitoring informs situational awareness, which feeds into the Incident Action Planning/NEBA process carried out for each operational period. This is typically on a daily basis during the initial stages of incident response where information is changing rapidly and response strategies are being initiated. **Section 7** provides further detail on how situational awareness information is used through the IAP process.

Table 9-18: Details of operational monitoring data collection and transfer

Strategy	Initiation	Method	Data Provided	Tools	Field Personnel	IMT Reporting Contact	Frequency
Vessel surveillance	Within 90 minutes of spill	Santos WA contracted support vessels Vessels of opportunity	Spill location Weather conditions Slick appearance Marine fauna presence	Digital imagery GPS Vessel surveillance forms Bonn agreement code	Vessel crew Company site representative	Operations Team Leader Planning Team Leader	Collection: Minimum daily while surveillance is undertaken Reporting: minimum daily while surveillance is undertaken
Aerial surveillance	Initiated within 3 hours of notification of Level 2/3 spill Mobilisation at discretion of On-scene Commander for Level 1 spill	Santos WA contracted helicopter provider	Spill location Slick appearance Marine fauna presence	Imagery and video GPS Aerial surveillance forms and map templates Bonn agreement code	Pilots Trained Aerial Observers	Operations Team Leader Planning Team Leader	Deployment: 2 overpasses per day (am/pm) while surveillance is undertaken Reporting: 2 reports per day (am/pm) while surveillance is undertaken
Tracking buoys	Mobilisation within 2 hours of notification of Level 2/3 spill Mobilisation at discretion of On-scene Commander for Level 1 spill	Santos WA contracted support vessel	Current direction/ spill front movement	Satellite tracking buoys Satellite tracking website	Vessel crew	Operations Team Leader Planning Team Leader	Deployment: As required – nominally up to 4 per day Reporting: Position updates every 30 minutes
Spill trajectory modelling	Level 2/3 spill Mobilisation at discretion of On-scene Commander for Level 1 spill	N/A – office based	Spill trajectory predictions Oil weathering predictions Shoreline loading predictions	Trajectory modelling request form Modelling provider data portal	N/A – office based	Environment Team Leader Planning Team Leader	Reporting: minimum daily updates Trajectory modelling to be provided within 2 hours of initial request.
Satellite imagery	Level 2/3 spill	Satellites	Spill size and location	Satellite imagery data portal	N/A – office based	Environmental Team Leader Planning Team Leader	Reporting: Subject to satellite overflight schedule
Initial oil characterisation	Level 2/3 spill Mobilisation at discretion of On-scene Commander for Level 1 spill	Vessels of opportunity Santos WA contracted vessels	Oil physical and chemical characteristics Oil ecotoxicity	Digital imagery GPS Oil sampling equipment Ecotoxicology and oil analysis laboratories	Monitoring provider Vessel crew	Operations Team Leader Planning Team Leader Environment Team Leader	Oil collection: Daily for 14 days if possible (physical and chemical characteristics) Field reports: Daily Lab reporting: As results available
Operational water sampling and analysis	Initiated on Level 2/3 spill Mobilisation within 72 hours of accepted SoW Mobilisation at discretion of On-scene Commander for Level 1 spill	Santos WA contracted vessels	Water quality samples (surface and at depth) – oil detection and related parameters Real-time CTD readings - oil detection and related parameters	Water sampling equipment CTDs GPS WQ analysis laboratories	Monitoring provider Vessel crew	Operations Team Leader Planning Team Leader Environment Team Leader	Sampling: Daily Field reports: Daily Lab reporting: As results available
Shoreline and coastal habitat assessments	Operational monitoring predicts or observes shoreline contact from surface oil; or As directed by DoT	Vehicles Santos WA contracted vessels By foot	Shoreline character Access constraints Distribution flora and fauna Degree of oiling	Shoreline survey forms Digital imagery and video GIS mapping	AMOSC core group responders State and National Response Teams	Operations Team Leader Planning Team Leader	Field reports: Daily

9.10 Monitor and evaluate plan environmental performance

Table 9-19 indicates the environmental performance outcomes, controls and performance standards for the Monitor and Evaluate response strategy.

Table 9-19: Monitor and evaluate performance standards and measurement criteria

Environmental Performance Outcome	**Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.**		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Monitor and Evaluate	**Surveillance**	**Response preparedness**	
	Maintenance of MSAs with multiple vessel providers	Santos WA maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	MSA with aircraft supplier	Master Services Agreement (MSA) in place with helicopter provider throughout activity	MSA with aircraft suppliers
	Santos WA trained Aerial Observers	Santos WA maintains a pool of trained aerial observers	Exercise Records Training Records
	AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	AMOSC Participating Member Contract
	Surveillance	**Response implementation**	
	Vessel Surveillance	Vessel Surveillance strategy initiated within 90 minutes following request from IMT (i.e. begin to source vessels for surveillance)	Incident log
		Daily observation reports submitted to IMT until termination criteria is met	Incident log
	Aerial Surveillance	Aerial Surveillance initiated within 3 hours following request from IMT	Incident log

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		Following initiation two passes per day of spill area by observation aircraft provided	Incident log
		Trained Aerial Observers supplied from Day 2 of response	Incident log
		Flight schedules are maintained throughout response	Incident Action Plan
		Observers completed aerial surveillance observer log following completion of flight	Aerial Observer Logs
		Aerial surveillance continues until termination criteria are met	Incident log
	Tracking Buoys	**Response preparedness**	
	Tracking Buoys available	Maintenance of 12 tracker buoys throughout the activity	Computer tracking software Tracker buoy tests
		Response implementation	
		Tracking buoys mobilisation within 2 hours of request from On-Scene Commander or Operations Team Leader	Incident log
		Tracking buoys utilised until termination criteria met	Incident log
	Oil Spill Modelling	**Response preparedness**	
	Maintenance of contract for emergency response modelling	Maintenance of contract for forecast spill trajectory modelling services throughout activity	Modelling services contract

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Oil Spill Modelling	**Response implementation**	
	Oil Spill Modelling available	Oil Spill Modelling provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill	Incident Log
		Modelling delivered to IMT within 2 hours of request to service provider	Incident Log
		Modelling continues until termination criteria are met	Incident Log
	Satellite Imagery	**Response preparedness**	
	Satellite imagery available	Contract in place with third party provider to enable access and analysis of satellite imagery	Contract with service provider
	Satellite Imagery	**Response implementation**	
	Satellite imagery available	Data incorporated into common operating picture and provided to spill modelling provider	Incident Log and Incident Action Plan
	Oil and Oil in Water Monitoring	**Response preparedness**	
	Maintenance of Monitoring Service Provider contract for water quality monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Oil and Oil in Water Monitoring	**Response implementation**	

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Initial Oil Characterisation	Oil samples collected and sent to NATA accredited laboratory for physico-chemical analysis, including fingerprinting.	Incident Log
		Where sample size allows, oil samples collected and sent to laboratory for ecotoxicity testing as per ANZG 2018 guidelines	Incident Log
		90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results within 24 hours of receiving all results	Incident Log
	Operational Oil and Oil in Water Monitoring	Scientific Monitoring provider activated for operational water quality monitoring for Level 2/3 spill	Incident Log
		Operational water sampling and analysis surveys mobilised within 72 hours of approval	Incident Log
		Daily operational water quality reports provided to IMT	Incident Log
	Shoreline Assessment	**Response preparedness**	
	AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders	AMOSC Participating Member Contract
	Shoreline Assessment	**Response implementation**	

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Shoreline assessment	Shoreline Assessment strategies will be implemented under the direction of DoT as the HMA	Incident Log
		Santos WA will make available AMOSC Core Group Responders for shoreline and coastal habitat assessment positions to the Control Agency	Incident Log
		Shoreline assessment reports provided to the IMT daily detailing the assessed areas to maximise effective utilisation of resources	Incident Log
	Use of shallow draft vessels for shoreline and nearshore operations	Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency (i.e. DoT).	Vessel specification documentation contained in IAP.
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Conduct shoreline/nearshore habitat/bathymetry assessment	Unless directed otherwise by the designated Control Agency (i.e. DoT) a shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities.	IAP records assessment records
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird	Unless directed otherwise by the designated Control Agency (i.e. DoT) demarcation zones are	IAP demonstrates requirement is met.

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	nesting/roosting areas and turtle nesting habitat.	mapped out in sensitive habitat areas.	
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	Unless directed otherwise by the designated Control Agency (i.e. DoT) action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met.

10 Shoreline Protection Plan

Booms can be used to create physical barriers on the water surface to protect sensitive receptors in intertidal and nearshore environments with the intent of taking the oil plume off its trajectory path. Booms can also be used to deflect the oil spill to locations easier for shoreline clean-up, for example moving oil from rocky shorelines to sandy shorelines.

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 are parts of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Control Agency. Santos WA will undertake first-strike protection and deflection activities as required. Upon assumption of Control Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos WA for the purposes of shoreline protection. Santos WA will provide all relevant information on shoreline character and oiling collected as part of surveillance activities carried out under its control (refer to **Section 9**).

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

Table 10-1, Table 10-2 and Table 10-3 provide the environmental performance outcome, initiation criteria and termination criteria, implementation actions and performance standards, measurement criteria for this strategy. The On-Scene Commander and/or Incident Commander are 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: Shoreline protection – environmental performance outcome, initiation criteria and termination criteria

Shoreline Protection	
Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.
Initiation criteria	Monitor and evaluate activities predict potential contact to from surface oil key sensitive receptors; or As directed by DoT
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	Oil no longer posing a risk to sensitive receptors; or Booming operations are no longer effective; or As directed by DoT

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

Shoreline protection and deflection techniques include:

+ The utilisation of earthen booming and sandbags where needed to prevent ingress of oil into tidal creeks;

- Nearshore booming using vessel-based operations while the spill remains on a predicted shoreline impact trajectory; and
- Placement of shoreline boom around areas to protect and to deflect the oil back to ocean or to easier locations for shoreline clean-up.

The effectiveness of these techniques will be dependent on local bathymetry, sea state, current and wind conditions. The Shoreline Protection Plan activation process is provided in **Table 10-2** below.

Table 10-2: Shoreline protection implementation guide

Shoreline Protection				
Activation time		Where monitor and evaluate activities predict potential contact to key sensitive receptors as risk from surface oil; or As directed by DoT		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	Ensure initial notifications to WA DoT have been made	Refer to **Section 6** for reporting requirements	Environment Team Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to identify protection priority areas		Environment Team Leader Planning Team Leader	❑
	Actions below are indicative only and are at the final determination of DoT if they have assumed status as Control Agency			
	Conduct operational NEBA to determine if protection and deflection is likely to result in a net environmental benefit		Environment Team Leader	❑

	If NEBA indicates that there is an overall environmental benefit, develop a Shoreline Protection Plan (IAP Sub-Plan) for each deployment area using information from shoreline assessments and the Montebello Islands Tactical Response Plans, as applicable, on the Santos WA ER Intranet	Shoreline Protection Plan may include (but not be limited to): + 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 No access zones (to minimise disturbance to sensitive receptors)	Operations Team Leader Planning Team Leader	❑
	Identify resources for shoreline protection activities based on nominated deployment locations.		Operations Team Leader	❑

	Mobilise protection and deflection equipment to designated location for deployment	Potentially contacted locations include (>5% probability, at or above 100 g/m^2 accumulation concentration) Montebello Islands	Logistics Team Leader	❑
	Identify vessels with relevant capabilities (e.g. shallow draught) for equipment deployment in consultation with Control Agency.	Ensure vessels have shallow draft and/or a suitable tender (with adequate towing capacity and tie-points) if they are required to access shorelines	Operations Team Leader Logistics Team Leader	❑
	Deploy shoreline protection response teams to each shoreline location selected and implement response.	If passive recovery and/or non-oiled debris removal has been selected as a tactic, ensure deployment activities prioritise their implementation prior to hydrocarbon contact	Operations Team Leader On-scene Commander	❑
	Response teams to conduct daily inspections and maintenance of boom arrays		Operations Team Leader	❑
	Report to the Operations Team Leader on the effectiveness of the boom arrays		Shoreline Response Team Leader – AMOSC core group responder	❑

Resources		**Location**
Equipment	Sea Curtain, Near-shore and Beach Guard Booms and associated equipment	AMOSC Santos WA (VI) Other Operators through AMOSC mutual aid
	General purpose containment boom; inflatable general-purpose boom	AMSA (Dampier)
	Vessels	Santos WA Operational sites
Personnel	Santos WA Facility Incident Response Team members AMOSC Core Group Responders	Santos WA Operational sites
	AMOSC Core Group Responders	Mobilised through AMOSC

	Logistics personnel	Exmouth Freight & Logistics
	National Response Team (NRT)	Mobilised through AMSA
	State Response Team (SRT)	Mobilised through DoT
	Tactical Response Plans	Santos WA Procedures Index
Maintenance of response	Conduct daily re-evaluation of NEBA to assess varying net benefits and impacts of continuing to conduct shoreline protection and deflection activities. Shoreline protection efforts will be maintained through the forward operation(s) facilities setup at mainland locations under direction of DoT. Equipment will be installed and maintained by response crews who will be rotated on a roster basis from the forward operations centres, with new personal procured on an as-need basis from existing human resource suppliers. The protection and auxiliary equipment (dinghies, tools etc.) will be maintained and replaced, if necessary, through existing suppliers of this equipment or through supplies from existing stockpiles.	

10.1 Equipment and personnel

Shoreline protection equipment available for use by Santos WA is a combination of Santos WA owned, AMOSC, AMSA, DoT and OSRL equipment as well as other operator resources available through the AMOSPlan mutual aid arrangements.

Shoreline personnel available to Santos WA are a combination of Santos WA Facility Incident Response Team members, AMOSC Core Group Responders (comprising AMOSC trained Santos WA and Industry personnel), State Response Team members and National Response Team members.

The level of deployment of equipment and personnel for shoreline protection will be commensurate to the spatial extent of shoreline contact, and the nature of the shoreline contacted, in terms of sensitivities to be protected. Once activated as Control Agency, deployment will be under the direction of DoT and the advice of shoreline specialists from AMOSC/ AMOSC Core Group and National/State response teams. Shoreline Assessments (**Section 9**) and existing Tactical Response Plans will provide information to guide the strategy and deployment of resources.

10.2 Deployment locations

Pre-planning has identified shoreline protection priority areas which have high environmental value and which modelling indicates could receive floating oil and shoreline loading with greater than 5% probability:

+ Montebello Islands.

Shoreline sensitivity and mapping data provided in the following data sources will be used to assist in evaluation of protection priority areas for response:

+ Santos WA GIS;
+ DoT Oil Spill Response Atlas –Web Map Application (OSRA WMA);
+ Pilbara Region Oiled Wildlife Response Plan;
+ Aerial Surveillance and Shoreline Assessment records where available; and

+ The EP.

Santos WA GIS and the OSRA WMA, provides detailed information on shoreline features, sensitive receptors, and potential spill response equipment mobilisation locations in the North West Shelf region.

10.3 Protection and Deflection Plan environmental performance

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

Table 10-3: Shoreline protection – environmental performance

Environmental Performance Outcome	**Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.**		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Protection and Deflection	**Response preparedness**		
	Access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan and OSRL	Maintenance of access to protection and deflection 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
	Varanus Island shoreline protection equipment and trained Incident Response Team	A Varanus Island spill response exercise involving IRT held annually	Training and exercise records
	Response implementation		
	Shoreline Protection and Deflection Plan	Santos WA IMT to confirm protection priorities in consultation with DoT	IAP/Incident Log
		Prepare operational NEBA to determine if shoreline protection and deflection activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to shoreline protection and deflection activities commencing
		IAP Shoreline Protection and Deflection Sub-plan developed to provide oversight and management of shoreline protection and deflection operation	Records indicate IAP Shoreline Protection and Deflection Sub-plan prepared prior to shoreline protection and deflection operations commencing

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

11 Shoreline Clean-Up Plan

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Control Agency. Santos WA will undertake first-strike activations as triggered (refer below), until such time as DoT assume control. Upon assumption of Control Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos WA for the purposes of shoreline clean-up. The information obtained from Operational Monitoring (refer to **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 determined as opposed to natural attenuation for sensitive sites. Selection of the shoreline clean-up methods and controls to prevent further damage from the clean-up activities are to be undertaken in consultation with the HMA and selected based on NEBA.

Spill modelling indicates loading of hydrocarbons onto shorelines could occur from spills during the activity operations and therefore clean-up of shorelines may be required.

Marine diesel may load onto shorelines from credible spills in State and Commonwealth waters.

Marine diesel is likely to be difficult to handle for removal given its light nature and is readily washed from sediments by wave and tidal flushing; contaminated sand and debris are the likely waste products from a shoreline response.

Table 11-1, **Table 11-2** and **Table 11-3** provide the environmental performance outcome, initiation criteria and termination criteria, implementation actions and performance standards and measurement criteria for this strategy. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 11-1: Shoreline clean-up – objectives, initiation criteria and termination criteria

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

Table 11-2: Shoreline clean-up implementation guide

Shoreline Clean-up				
Activation time		+ Level 2 or Level 3 spills where shorelines with identified or potential protection priorities that will be, or have been, contacted; + NEBA indicates shoreline clean-up will benefit receptors; and + Approval has been obtained from DoT IC or delegate (as the Control Agency) to initiate response strategy		
	Action	**Consideration**	**Responsibility**	**Complete**
Initial Actions	Undertake shoreline assessment as outlined in **Section 9.8**		Refer to **Section 9.8**	❑
	Identify resources for shoreline clean-up activities based on nominated deployment locations, recommendations from shoreline assessments and requests from the Control Agency. Equipment stockpile information accessed through Santos WA Emergency Response Intranet Site	Equipment list to support forward operational areas, decontamination systems, welfare infrastructure, and operation deployments are located in **Appendix J: Shoreline Clean-up Equipment**. These are for reference for procurement plans and must be modified to suit actual deployment numbers and locations, which will be dependent on incident specific circumstances. Tactical Response Plans also contain information outlining shoreline clean-up resources for some protection priority areas.	Operations Team Leader	❑
	In consultation with the Control Agency identify vessel requirements for transferring personnel, equipment, and waste to/from offshore islands		Operations Team Leader Logistics Team Leader Deputy Logistics Officer (DoT 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.		Logistics Team Leader Supply Team Leader Deputy Logistics Officer (DoT IMT)	❑

	Deploy shoreline clean-up response teams to each shoreline location selected to begin operations under direction of the Control Agency.		Operations Team Leader Logistics Team Leader Deputy Logistics Officer (DoT IMT)	❑
	Monitor progress of clean-up efforts and report to the Control Agency		Operations Team Leader On-Scene Commander Deputy On-Scene Commander (DoT FOB)	❑

Resources		**Location**
Equipment	Mobile plant (if required)	Karratha/ Exmouth/ Perth
	Vessels for personnel, equipment and waste transfer to/from offshore islands	Santos WA contracted vessel providers
	Shoreline Clean-up Equipment (Decontamination, Beach Wash Down, Beach Clean-up kits and Temporary Waste Storage)	Santos WA (Varanus Island)/ AMOSC / AMSA/ OSRL / Spot purchase from various suppliers
	Waste skips and associated waste equipment (as defined in **Section 13**)	North West Alliance
	Beach Clean-up equipment and PPE	Perth Petroleum Services/ PPE specialists/ Hardware stores
Personnel	Shoreline Clean-up specialists	AMOSC, NRT (AMSA), SRT (DoT), OSRL
	Santos WA AMOSC Core Group and IRT Personnel	Santos WA Facilities
	Logistics personnel	Exmouth Freight & Logistics
	Waste handling and transportation personnel	Through North West Alliance contract
	Manual clean-up personnel	Santos WA labour hire
Maintenance of response	This response will be maintained through Santos WA's existing contractual arrangements with equipment and personnel suppliers, which will ensure that clean-up activities can be maintained. Santos WA maintains waste management arrangements that can be scaled dynamically to accommodate potential wastes generated during the clean-up.	

11.1 Equipment and personnel

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

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

Once activated as Control Agency, deployment will be under the direction of DoT and the advice of shoreline clean-up specialists from AMOSC Core Group and National/State response teams. Shoreline Assessments (**Section 9.8**) and NEBA process will provide information to guide the clean-up tactics and deployment of resources.

The level of deployment of equipment and personnel for clean-up will be commensurate to the spatial extent of shoreline contact, the volume of oil arriving and the sensitivity and access constraints of the shoreline in question. Physical removal of marine diesel may not be possible or recommended due to the degree of infiltration into sediments that could occur.

Spill modelling indicates that shoreline loading of up to ~220 tonnes could occur on shorelines of the Montebello islands (refer to **Table 3-2**). Approximately 130 tonnes could occur on the shoreline of Barrow Island.

A bulking factor of 10x is considered appropriate to account for addition of sand and debris, therefore up to 2,200 tonnes of oily waste could be required to be removed in a worst-case scenario. An estimate of required resources for clean-up can be made by applying a removal rate of 1 tonne per person per day for manual removal. For example, 30 small teams consisting of 6 personnel (including one trained responder per team) could theoretically remove a loading of 2,200 tonnes of oily waste in roughly 15 days. This assumes oil is accessible for removal (i.e. on accessible sections of coastline) and there would be a net benefit in removing all oil.

11.2 Clean-up activities

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

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

11.2.1 Shoreline clean-up decision guides

A number of shoreline types are found within the area potentially contacted by a spill during the activity, including:

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

To assist with planning purposes, guidance for the selection of appropriate shoreline response strategies based on the type of shoreline sensitivities is provided within **Appendix K**.

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

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

11.2.2 Onsite waste management

Waste consolidation and storage at forward operations areas is an important aspect of the shoreline clean-up response and will have implications for the management of waste by the Waste Service Provider (WSP). DoT as the Control Agency for shoreline response is responsible for overseeing the consolidation and storage of collected waste prior to collection of the waste by the WSP.

The DoT Waste Management Sub-Plan to the DoT OSCP (2015) provides guidelines to assist DoT with preparing site-specific waste management plans for clean-up activities controlled by DoT.

Santos WA will provide a contracted WSP for the collection, treatment and disposal of waste from an oil spill response as detailed in **Section 13**.

11.3 Deployment locations

Pre-planning has identified shoreline protection priority areas which have high environmental value and which modelling indicates shoreline loading meets or exceeds the actionable oil threshold concentration of 100 g/m^2, above 5% probability, are:

- Montebello Islands.

Monitor and Evaluate information and NEBA will help prioritise shoreline sites for clean-up operations. Shoreline sensitivity and mapping data provided in the following data sources will be used to assist in evaluation of protection priority areas for response:

- Santos WA GIS;
- DoT Oil Spill Response Atlas –Web Map Application (OSRA WMA);
- Pilbara Region Oiled Wildlife Response Plan;
- Spill trajectory modelling;
- Aerial Surveillance and Shoreline Assessment records where available; and
- the EP.

Santos WA GIS and the OSRA WMA, provides detailed information on shoreline features, sensitive receptors, and potential spill response equipment mobilisation locations in the North West Shelf region.

In all areas, the primary shoreline protection priorities are mangrove environments and shorelines identified as important for turtle nesting and hatching and shorebird/seabird nesting, roosting or foraging. Key areas for these shoreline sensitivities are outlined in **Section 3.4**.

11.4 Shoreline clean-up environmental performance

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

Table 11-3: Shoreline clean-up – environmental performance

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Clean-Up	**Response preparedness**		
	Access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL	Maintenance of access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Response implementation		
	Shoreline Clean-Up Plan	Clean-up strategies will be implemented under the direction of DoT as the HMA.	Incident Log
		Santos WA will make available AMOSC Core Group Responders for shoreline clean-up team positions to the Control Agency	Incident Log
		Santos WA will make available to the Control Agency equipment from Santos WA, AMOSC and OSRL stockpiles	Incident Log
		NEBA undertaken every operational period by the relevant Control Agency to determine if response strategy is having a net environmental benefit. NEBA included in development of following period Incident Action Plan.	IAP/Incident Log
		Shoreline clean-up response continues until termination criteria is met, as outlined within the Shoreline Clean-up Plan.	Incident Log
	Prioritise use of existing roads and tracts	Unless directed otherwise by the designated Control Agency (i.e. DoT) access plans for shoreline	IAP demonstrates requirement is met.

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

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		deployment of resources to townships and marine/coastal areas	

12 Oiled Wildlife Response Plan

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

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

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

Note: For Spill contained solely in Commonwealth waters, Santos WA is the Control Agency for OWR. DoT is the Control Agency and Department of DBCA is the Jurisdictional Authority for OWR within State waters. DoT is also the lead IMT for Oiled Wildlife Response where the spill covers both Commonwealth and State waters. The OWR environmental performance outcome, initiation and termination criteria are found in **Table 12-1**.

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

Oiled Wildlife Response	
Environmental Performance Outcome	Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife
Initiation criteria	Operational monitoring shows that wildlife is contacted or predicted to be contacted by a spill
Applicable hydrocarbons	**Marine Diesel**
	✔

Oiled Wildlife Response	
Termination criterion	+ Oiling of wildlife have not been observed over a 48-hour period; + Oiled wildlife has been successfully rehabilitated; and + Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response.

12.1 OWR stages of response

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

Table 12-2: Oiled wildlife response stages (adapted from WAOWRP)

Stage	Description
Stage 1: Initial wildlife assessment and notifications	Gather situational awareness on whether an OWR impact has occurred or is imminent and complete notifications to Jurisdictional Authorities and external support agencies
Stage 2: Mobilisation of wildlife resources	Mobilise initial preventative measures and/or mobilisation of resources to deal with incident in early stages of development.
Stage 3: Wildlife reconnaissance	Wildlife reconnaissance for the OWR should occur as part of the implementation of monitor and evaluate tactics (**Section 9**) to aid planning and decision making for executing spill response or clean-up operations. Wildlife reconnaissance will be required for the duration of the wildlife response operations
Stage 4: IAP Wildlife Response Sub-plan development	The Wildlife Response Sub-plan should include the following operational components (relevant to the scale of the OWR): + Wildlife impact assessment; + Reconnaissance and monitoring; + Search and collection; + Carcass collection and necropsy storage; + Field stabilisation; + Wildlife transport; + Wildlife processing/admission; + Wildlife intake and triage; + Wildlife cleaning; + Rehabilitation/conditioning; + Release; + Post-release monitoring; and + OWR termination and demobilisation. (It should be noted that separate strategies and protocols may be required for different species groups).
Stage 5: Wildlife rescue and staging	This includes commencing actions such as hazing, pre-emptive capture, administering first-aid and holding and/or transportation of wildlife to oiled wildlife facilities. If oiled birds or non–avian wildlife were to be observed at sea, on-water collection should be considered for the effective capture of oiled animals

Stage	Description
	before they become so debilitated that their chance of survival is severely affected (IPIECA, 2004)
Stage 6: Establishment of an oiled wildlife facility	Treatment facilities would be required for the cleaning and rehabilitation of affected animals. A vessel-based 'on-water' facility would likely need to be established to enable stabilisation of oiled wildlife before transport to a suitable treatment facility
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping, release and post-release monitoring
Stage 8: Oiled wildlife response termination	Demobilisation of the OWR should be undertaken in accordance with parameters or endpoints established in the IAP and supplementary Wildlife Response Sub-plan. This decision will be made in consultation with the relevant jurisdictional authorities and support agencies

12.2 OWR levels and resourcing

An impact assessment threshold of 10 g/m^2 for impacts on fauna from floating hydrocarbons is provided in the in the EP. This conservative threshold is broadly accepted as being the minimal thickness of surface hydrocarbons that may result in adverse impacts to seabirds through adhesion to feathers and secondary effects (French et al., 1996; French-McCay 2009) and is also considered appropriate for turtles, sea snakes and marine mammals (NRDAMCME, 1997).

Review of the worst-case spill modelling indicates that floating diesel concentrations above 10g/m^2 have a >5% probability of extending up to approximately 50 km for the release site, including the Montebello Islands. Surveys at the Montebello Islands have recorded 70 bird species, including 12 species of seabird and 14 species of migratory shorebirds (Burbidge et al. 2000). These islands also include both major and minor nesting areas for green, hawksbill, and flatback turtles (Commonwealth of Australia, 2017), with hundreds of turtles nesting annually. Offshore of the Montebello Islands, dugong and migrating pygmy blue whales are known to occur.

In reality the degree of potential wildlife exposure would be highly season and location dependent. It is however anticipated to be low given the worst-case spill scenario of 329 m^3 of marine diesel and the likelihood that the oil would only be on the water surface for a short period, the degree of predicted shoreline loading, and the low amount of residual oil on the shoreline following weathering through evaporation and dispersion from wave and tidal movements. For further detail on the weathering of marine diesel refer to **Appendix A.**

Conservative estimates for OWR planning predict a worst-case OWR for this activity will be an OWR Level 3, as defined in the WAOWRP (2014) (**Table 12-3**).

For a Level 3 response, it is expected that up to 59 personnel will be required, with a range of skill levels (**Table 12-4** – OWR 1 = basic training to OWR 4 = OWR Advisor; Information drawn from WAOWRP). Personnel at skill levels OWR 2 - 4 and those with specialised skills (e.g. vets) are expected to be sourced through AMOSC, OSRL, DBCA, Universities and contractors.

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

Table 12-3: Indicative oiled wildlife response level (adapted from WA OWRP, 2014)

OWR Level	Indicative personnel numbers	Indicative duration	Indicative number of birds (non-threatened species)	Indicative number of birds (threatened species)	Turtles (hatchlings, juveniles, adults)	Cetaceans	Pinnipeds	Dugongs
Level 1	6	< 3 days	1–2/day < 5 total	None	None	None	None	None
Level 2	26	> 4–14 days	1–5/day < 20 total	None	< 20 hatchlings No juv/adults	None	None	None
Level 3	59	> 4–14 days	5–10/day	1–5/day < 10 total	< 5 juv/adults < 50 hatchlings	None	< 5	None
Level 4	77	> 4–14 days	5–10/day < 200 total	5–10/day	< 20 juv/adults < 500 hatchlings	< 5, or known habitats affected	5–50	Habitat affected only
Level 5	116	> 4–14 days	10–100/day > 200 total	10–50/day	> 20 juv/adults > 500 hatchlings	< 5 dolphins	> 50	Dugongs oiled
Level 6	122	> 4–14 days	> 100/day	10–50/day	> 20 juv/adults > 500 hatchlings	> 5 dolphins	> 50	Dugongs oiled

Table 12-4: Oiled wildlife response level and personnel numbers

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

12.3 Implementation guidance

Oiled wildlife response activities can be resource intensive and require additional personnel to be positioned within the IMT. The oiled wildlife response team will be managed according to the Wildlife Division outlined in the WAOWRP. The wildlife operations unit will contain all the field staff and activities, including oiled wildlife reconnaissance, who will work in close consultation with personnel undertaking relevant monitor and evaluate activities. The IAP Wildlife Response Sub-plan as outlined in **Table 12-2** will form the key management system which will provide control and oversight over the response.

Table 12-5 provides guidance to the IMT on the actions and responsibilities that should be considered when implementing OWR. These actions are provided as a guide and should be read in conjunction with the WAOWRP. In some cases, the Implementation Guidance (**Table 12-5**) will provide additional detail to the WAOWRP and has greater linkages to other aspects of the response operation and this OPEP (e.g. NEBA and aerial surveillance).

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

Information on resource capability for this strategy is shown in **Table 12-6** and **Appendix M: Oiled Wildlife Response Personnel and Equipment**.

Table 12-5: Implementation guidance – oiled wildlife response

	Action	Consideration	Responsibility	Complete
Stage 1: Initial wildlife assessment and notifications				
Initial Actions	Personnel conducting monitor and evaluate activities shall report wildlife sightings in or near the spill trajectory (including those contacted with hydrocarbons or at risk of contact) and report them to the IMT within 2 hours of detection	Record all reports of wildlife potentially impacted and impacted by spill. Record reports on: + Location; + Access; + Number; + Species; and + Condition of impacted animals (if available).	Surveillance personnel	❑
	If wildlife is sighted and are at risk of contact (or have been contacted), initiate oiled wildlife response by contacting AMOSC Duty Manager and DCBA State Duty Officer (who will then activate their respective Oiled Wildlife Advisors)	Obtain approval from IC prior to activating AMOSC Oiled Wildlife Advisor (OWA) and/or DCBA OWR as outlined in **Section 6.2** DoT will be the Control Agency for OWR in State waters	Environmental Team Leader	❑
	Notify DoEE if there is a risk of death or injury to a protected species (including Matters of National Environmental Significance (MNES))	Refer to **Section 6.1** for reporting requirements. A list of MNES is provided in the Existing Environment Section of the EP	Environmental Team Leader	❑
	Review all wildlife reports from surveillance or opportunistic activities and contact personnel who made the reports (if possible) to confirm information collected		Environmental Team Leader Wildlife Division Coordinator	❑
	Use information from initial assessments to prepare an Operational NEBA. Use this information to help determine: + Initial OWR Response Level (1-6), as defined in the WA OWRP + If OWR activities are likely to result in a net environmental benefit	Oiled wildlife response activities can cause additional stress and mortality on individuals than oil pollution alone. The Environmental Team Leader and Wildlife Division Coordinator will determine via an Operational NEBA whether capture and cleaning of oiled wildlife will result in a net environmental benefit. This may be done in consultation with the DCBA and AMOSC Oiled Wildlife Advisors, and any	Environmental Team Leader Wildlife Division Coordinator	❑

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

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

Action	Consideration	Responsibility	Complete
	containers can be requested via the IAP to AMSA	AMOSC OWA DBCA OWA OWR field personnel Operations Team Leader	
Stage 7: Wildlife rehabilitation			
Implement Wildlife Response Sub-plan for rehabilitation	Animals need to be stable to withstand stress of washing. Oiled animals, particularly birds, cannot thermoregulate and need to be kept indoors in a temperature-controlled room. The room needs to be well ventilated to disperse the hydrocarbon fumes	Wildlife Division Coordinator Wildlife Veterinarian Wildlife Rehabilitation Officer AMOSC OWA DBCA OWA OWR field personnel Operations Team Leader	❑
Stage 8: Oiled wildlife response termination			
Liaise with Jurisdictional Authorities regarding OWR termination, using endpoints established in the IAP and supplementary Wildlife Response Sub-plan (Termination and Demobilisation section)		Wildlife Division Coordinator AMOSC OWA DBCA OWA Incident Commander	❑

Table 12-6: Oiled wildlife response - resource capability

Service Provider Capability	Location	Activation Time
WA Oiled Wildlife Response Plan Pilbara Region OWR Plan	N/A	N/A
1. AMOSC oiled wildlife response container and kit (includes wash facility that may treat up to 150 OWR units) 2. AMSA OWR container and kits 3. DBCA OWR container and kit 4. OSRL equipment 5. Vessels via call off contracts	1. Fremantle, plus various locations around Australia (Refer to **Appendix M: Oiled Wildlife Response Personnel and Equipment**) 2. Various locations around Australia (Refer to **Appendix M: Oiled Wildlife**	1. 24 hours from Fremantle to Dampier 2. AMSA OWR container positioned in Dampier. 3. 24 hours from Kensington to Dampier

Service Provider Capability	Location	Activation Time
	Response Personnel and Equipment) 3. Kensington and Karratha 4. Various locations internationally (Refer to Appendix L) 5. NW Australia	4. 48-72 hours from Singapore to Dampier. 5. 24 + hours
Santos WA is a participating member of AMOSC with access to Mutual aid arrangements. AMSA MoU and OSRL contracts enable access to national and international oiled wildlife expertise (Refer to **Appendix M: Oiled Wildlife Response Personnel and Equipment**)	Various locations around Australia and internationally (Refer to **Appendix M: Oiled Wildlife Response Personnel and Equipment**)	AMOSC Mutual Aid OWR Industry Team can be available within 3 days
Santos WA Capability	**Location**	**Santos WA Activation Time**
5 Santos WA trained Oiled Wildlife Responders	Perth	24 hours
Santos WA HSE Advisors with fauna handling training	Varanus Island	Imminent or actual impact to wildlife
Untrained resources through personnel-hire arrangements	Perth	~72 hours

12.4 Oiled Wildlife Response Plan environmental performance

Table 12-7 indicates the environmental performance outcomes, controls and performance standards for the Oiled Wildlife Response strategy.

Table 12-7: Environmental performance outcomes, controls and performance standards for the Oiled Wildlife Response strategy.

Environmental Performance Outcome	Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Oiled Wildlife Response	**Response preparedness**		
	Maintenance of access to oiled wildlife response equipment and personnel	Maintenance of access to oiled wildlife response equipment and personnel through AMOSC, AMSA National Plan and Oil spill Response Limited (OSRL) throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Response implementation		
		Prepare operational NEBA to help classify OWR level and determine if OWR activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to OWR operations commencing
		IAP Wildlife Response Sub-plan developed to provide oversight and management of OWR operation	Records indicate IAP Wildlife Response Sub-plan prepared prior to OWR operations commencing

13 Waste Management Plan

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

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

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

Where DoT is the Control Agency, Santos WA will provide a Facilities Support Officer to the DoT IMT Logistics Unit to support the DoT IMT in coordinating waste management services. The environmental performance outcome, initiation and termination criteria are found in **Table 13-1**.

Table 13-1: Waste management – environmental performance outcome, initiation criteria and termination criteria

Waste Management	
Environmental Performance Outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible
Initiation criteria	Response activities that will be generating oily waste have been initiated. 2 hours for IMT to activate Waste Service Provider
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	All waste generated from the oil spill response has been stored, transported and disposed as per the regulatory requirements; and Agreement is reached with Jurisdictional Authorities to terminate the response

13.1 Waste approvals

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

13.2 Waste service provider capability

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

Key responsibilities of the waste service provider include:

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

13.2.1 Waste management resources

Santos WA has access to capacity to deliver storage receptacles, remove, transport and dispose of all waste material from oil spill response activities to predetermined disposal points. Stochastic modelling conducted for a worst case hydrocarbon release shows that the highest shoreline loading was approximately 220 tonnes at the Montebello Islands. Lesser amounts were modelled as potentially arriving at Barrow Island (130 tonnes) and the Lowendal Islands (11 tonnes), noting that these worst case loadings come from different model simulations. Conservatively assuming all loaded hydrocarbon are required to be removed from shorelines with a bulking factor of 10x to account for contaminated waste (sediments and organics) collected with the oil, worst case waste storage and transport requirements would be in the order of 2,200 tonnes. **Table 13-2** provides waste service provider capability for waste removal and storage, which is in excess of the waste management requirements for spill response activities associated with this OPEP, and has been developed based on a significant loss of well control event.

Table 13-2: Waste service provider vehicle and equipment availability

Plant and Equipment	Capacity	Functionality	Uses per week	Indicative waste stored/shifted per week (m3)	Mobilisation schedule to meet estimated capacity			
					No. Sourced locally	No. Sourced State-wide and Nationally		
Waste removal					**48 hours**	**1 week**	**2 weeks**	**1 month**
12x Skip Lift Trucks	Lift up to 10 Tonnes	Servicing of skip Bins	7	840	4	3	3	2
10x Front Lift Trucks	28 m^3 Body	Servicing of Front lift bins	7	1960	4	3	2	1
10x Side Loading Truck	18 m^3 Body	Servicing of MGB's	7	1260	1	2	4	3
7x Hook Lift Truck	12 Tonne rated	Servicing of hook lift bins	7	588	3	2	2	N/A
12x Flat Bed Truck	22 pallet spaces	Servicing of bins	7	840	3	6	4	N/A
Waste storage					**48 hours**	**1 week**	**2 weeks**	**1 month**
500x MGB's	240 litres	Mobile bins	2	48	200	300	N/A	N/A
2x Offshore 8 pack Lifting Cradle (MGB's)	16 x 240 litre MGB'S	Able to remove 16 x 240L MGB'S simultaneously	continuous		0	2	N/A	N/A
Waste storage					**48 hours**	**1 week**	**2 weeks**	**1 month**
6x Lidded Bins	1,100 litres	contain various waste streams	2	13	6	N/A	N/A	N/A
50x Front Lift Bins	3 m^3	various waste streams	2	300	20	30	N/A	N/A

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

Table 13-3: Implementation guidance – waste management

	Action	Consideration	Responsibility	Complete
Initial Actions	Contact WSP (Primary or Secondary Contact Person) and activate Waste Project Manager. Arrange for personnel to attend Emergency Control Centre	Refer to Incident Response Contacts Directory (QE-00-ZF-00025.20) for contact details	Logistics Team Leader (or delegate)	❑
	Provide briefing to WSP personnel once positioned in IMT		Logistics Team Leader (or delegate)	❑
	Using most recent monitor and evaluate data, estimate expected waste volumes to be generated by selected response strategies	It is better to overestimate volumes and scale back resources then to underestimate waste volumes	Logistics Team Leader (or delegate) Planning Team Leader	❑
	Using most recent monitor and evaluate data and any existing and future response activities, determine most suitable locations for waste receptacles to be positioned and for temporary storage locations to be established	Consideration would be given to positioning receptacles and locating temporary storage sites to ensure secondary contamination of sensitive receptors is avoided or minimised. The approval of temporary storage sites would be given through DWER	Logistics Team Leader (or delegate) Planning Team Leader Environmental Team Leader	❑
	For each receival location indicate the anticipated: + Material types; + Material generation rates; + Material generation quantities; + Commencement date/time; + Anticipated clean-up duration; + Receptacle types required;	Consider facilities for waste segregation at source	Logistics Team Leader Planning Team Leader Deputy Logistics Officer	❑

	Action	Consideration	Responsibility	Complete
	+ Logistical support requirements; + Any approvals required from Ports, Local Governments, Landowners, State Government Agencies (Refer to Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053)).			
	Once the above information is obtained, ensure all necessary waste management information is included in the IAP	Waste management should be conducted in accordance with Santos' Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan Refer to Cedre (2016) for technical guidance on waste management techniques	Logistics Team Leader (or delegate) Facilities Support Officer (DoT IMT) Planning Team Leader WSP Location Responsible Person or Operations Supervisor	❑
	Mobilise waste management resources and services to agreed priority locations		WSP Location Responsible Person or Operations Supervisor Logistics Team Leader (or delegate) Facilities Support Officer (DoT IMT)	❑
Ongoing Actions	Provide ongoing point of contact between IMT and WSP	If DoT is the Control Agency, the Facilities Support Officer shall be the point of contact between DoT and the WSP	Facilities Support Officer (DoT IMT) Logistics Team Leader	❑

	Action	Consideration	Responsibility	Complete
	Ensure all waste handling, transport and disposal practices comply with legislative requirements	Alert Logistics Team Leader (or delegate)/ Deputy Logistics Officer (if DoT is the Control Agency) if any non-compliance is anticipated or detected	WSP Location Responsible Person or Operations Supervisor	❑
	Ensure records are maintained for all waste management activities, including but not limited to: + Waste movements (including types of receptacles, receival points, temporary storage points, final disposal locations); + Volumes generated at each site (including total volume and generation rates); + Types of waste generated at each site; + Approvals obtained (as required).		WSP Location Responsible Person or Operations Supervisor	❑

Table 13-4: Waste management – resource capability

Service Provider Capability	Location	Service Provider Activation Time
Processes		
Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053)	N/A	N/A
Equipment		
Refer to **Table 13-2** NWA Waste handling and transfer depot	N/A Karratha	48 hours
Personnel		
2 x Project Manager 2 x Operations Supervisor	Perth Karratha	Within 24 hours of activation
Santos WA Capability	**Location**	**Santos WA Activation Time**
Processes		
Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053)	N/A	N/A
Personnel		
Logistics Team Leader or delegate	Perth	On IMT activation
Facility Support Officer		By 8 am of the day following DoT request

13.3 Waste Management Plan environmental performance

Table 13-5 indicates the environmental performance outcomes, controls and performance standards for the Waste Management Response strategy.

Table 13-5: Environmental performance outcomes, controls and performance standards for waste management

Environmental Performance Outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Waste Management	**Response preparedness**		
	Maintain access to waste management equipment, personnel, transport and disposal facilities	Maintain access to waste management equipment, personnel, transport and disposal facilities throughout activity	Contract with Waste Service Provider for emergency response services
	Response implementation		
	Implement Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053)	Waste Service Provider to appoint a Project Manager within 24 hours of activation	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
		Waste Service Provider shall track all wastes from point of generation to final destination	Waste tracking records
		Waste Service Provider to provide monthly waste management reports and more regular situation reports during the response until termination criteria are met	Waste reports
		Waste management to be conducted in accordance with Santos' Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan	Waste reports

14 Scientific Monitoring Plans

The overarching objective of Santos WA's Scientific Monitoring Plans (SMPs) is to provide guidance to staff, consultants and contractors in developing monitoring programs for detecting impacts and recovery to environmentally sensitive receptors contacted by a spill.

Receptor specific SMPs have different objectives as outlined in **Appendix N: Scientific Monitoring Plans**.

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

Santos WA will activate and implement scientific monitoring in State and Commonwealth waters for Level 2/3 spills in line with its SMP unless directed otherwise by the relevant Control Agency/s.

Table 14-1: Scientific monitoring - environmental performance outcome, initiation criteria and termination criteria

Scientific Monitoring	
Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by a spill response.
Initiation criteria	Refer to individual SMPs – Appendix N. Monitoring Provider activated within 2 hours of notification from IMT
Applicable hydrocarbons	**Marine Diesel**
	✔
Termination criterion	Refer to individual SMPs – **Appendix N: Scientific Monitoring Plans**

14.1 Scope

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

14.2 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 Scientific Monitoring Plan.

14.3 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 VI Hub Operations (**Table 14-2**). These are detailed further in **Appendix N: 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 DoT methodology, termination criteria and analysis/reporting requirements may differ.

Table 14-2: Oil Spill Scientific Monitoring Plans relevant to VI Hub operations

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 (including Whale Sharks)
SMP9	Marine Reptiles
SMP10	Seafood Quality
SMP11	Fish, Fisheries and Aquaculture
SMP12	Whale Sharks

14.4 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.

There are scientific monitoring components that are suited to pre-impact baseline monitoring. 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. Understanding priority areas for reactive pre-impact baseline monitoring is important. **Section 3** uses stochastic modelling to indicate receptors likely to be contacted at certain thresholds within a specified timeframe. **Section 3** also uses this information to help determine protection priority areas, which would provide an initial focus for reactive pre-impact monitoring.

Santos WA periodically review the status, availability and suitability of existing baseline data sources related to high biodiversity value receptors in their EMBA (for the findings of the latest baseline review refer to **Appendix P**).

In addition to the baseline review, Santos WA is a participant in the Industry-Government Environmental Metadata (I-GEM) Project. The project is a collaborative approach between industry and government to share metadata on quantitative ecological data for key receptors in the mid to north-west of WA.

14.5 Monitoring service providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos WA by a contracted Monitoring Service Provider (MSPs) and applies to the implementation of SMPs 1-11.

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

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

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

Appendix P provides an overview of Santos WA's MSP capability to implement SMPs 1-11. The MSP also provides monthly capability statements outlining availability of resources to implement SMPs. Capability statements are reviewed and filed within the IMT Environment Team Leader folder set and are accessed via the Emergency Response intranet page.

14.6 Activation

In the event that one or more SMPs are activated, as per the initiation criteria for each, the Activation Process outlined in **Appendix O: SMP Activation Process** and **Appendix N: Scientific Monitoring Plans** will be followed, including the completion of an Activation Form found on the Santos WA Procedures Index.

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

This process will identify monitoring operational objectives and resourcing/ mobilisation requirements which the Environment Team Leader will feed back to the IMT for approval.

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

14.7 Scientific Monitoring Plan environmental performance

Table 14-3 indicates the environmental performance outcomes, controls and performance standards for the Scientific Monitoring program.

Table 14-3: Environmental performance outcomes, controls and performance standards for scientific monitoring

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Scientific Monitoring	**Response preparedness**		
	Maintenance of Monitoring Service Provider contract for scientific monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Conduct periodical review of existing baseline data sources across the Santos WA combined EMBA	Undertake a review of the status, availability and suitability of existing baseline data sources every 2 years	Baseline data review report
	Response implementation		
	Activate Scientific Monitoring Plans	Initiation criteria of SMPs will be reviewed during the preparation of the initial Incident Action Plan (IAPs) and subsequent IAPs; and if any criteria are met, relevant SMPs will be activated	Incident Action Plan and Incident Log
		If any SMPs are activated, the subsequent activation of Monitoring Service Provider is to follow the process outlined in Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Incident Log
		Monitoring Service Provider shall commence activation process within 30 mins of initial notification form being received from Santos WA	Monitoring Service Provider records

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		Santos WA personnel to support Monitoring Service Provider in finalising monitoring study design, monitoring locations and field methodologies based on operational monitoring information, relative location of sensitive receptors to the spill and the timing of the spill with respect to seasonality of sensitive receptors	Incident Log and Monitoring Service Provider records

15 Forward Operations Plan

The CST and IMT operate from Perth within the Santos WA CST and IMT rooms. These rooms are equipped and subject to regular checks as per Incident Command and Management Manual (QE-00-ZF-00025).

15.1 Forward Operating Base (FOB)

For a significant Level 2/3 response requiring coordination of resources deployed to the field, Santos WA will set up a Forward Operating Base (FOB). For a level 2/3 spill in State waters or a level 2/3 spill crossing from Commonwealth to state waters (cross-jurisdictional spills) DoT will establish a FOB. **Section 2.4.3** details requirements for Santos WA providing personnel to a DoT FOB.

For the initial stages of a response to spills where personnel and resources from Varanus Island are deployed the Varanus Island Central Control Room (CCR) may be used as the FOB.

For an ongoing response, a FOB would likely be set-up in Santos WA's Dampier facilities leased from Toll Energy. These facilities are located in Toll Energy's Yard 1 and Yard 2 on Streckfuus Road Dampier; the facilities consist of a conference room and multiple offices that could be used as break-out rooms.

The VI CCR and the Toll Energy Dampier facilities are already connected to the Santos WA internet and telephone system. These facilities are also available to the DoT to establish a FOB for State based response.

15.2 Local facilities

Table 15-1 lists the local facilities around Dampier/Karratha that may potentially be utilised for response uses.

Table 15-1: Dampier facilities with operational value for response

Facility	Owner / Operator	Potential Uses
Dampier Cargo Wharf	Pilbara Ports Authority	Staging area for vessel loading for spill response equipment and waste management Storage of oil spill response equipment Vessel loading for spill response equipment and waste management Office facilities for Marine-based Command Centre
Toll Dampier Supply Base	Toll Energy Logistics Pty Ltd	Staging area for vessel loading for spill response equipment and waste management
Karratha Airport	City of Karratha	Air freight spill response equipment.
Devil Creek accommodation Searipple Village	Santos WA/Sodexo Searipple Karratha	Spill responders and IMT accommodation Accommodation & messing for clean-up crew
Toll Energy Yard	Toll Energy Logistics Pty Ltd	Transfer yard for truck-based equipment deliveries and waste management, Boom Maintenance and Cleaning Facility Materials consolidation Marine equipment storage, staging & repairs Oiled wildlife response centre Laydown / storage area Bunded washing facility for oil booms

Facility	Owner / Operator	Potential Uses
Local boat ramp at Dampier Yacht Club	Leased to Dampier Yacht Club	Load out for near-shore marine based operations Boat launching

15.3 Staging areas

Staging areas for shoreline operations will be set up at shoreline response locations under the direction of the DoT as the Control Agency for shoreline response activities.

15.4 Wildlife holding facility

In the event that handling and rehabilitation of oiled wildlife is required (e.g. birdlife), local facilities will be used in conjunction with mobile oiled wildlife response equipment provided through spill response providers (refer to **Section 12**). The Pilbara Region Oiled Wildlife Response Plan details potentially applicable facilities to be used for oiled wildlife response. Based on the potential area of the response and the likely use of Dampier as the closest port for vessel based operations, facilities in the Dampier/Karratha region would be the primary options.

15.5 Freight movement

The transportation of all equipment and service will be through Santos WA's third party logistics providers.

15.6 Transport

Transportation on shoreline locations will be supported by 4x4 vehicles and all-terrain vehicles. These can be supplied by locally and nationally through hire/purchase 3rd parties.

15.7 Mobile plant

Mobile plant and equipment for mechanical clean-up in initial response can be provided from suppliers in Karratha, Exmouth, Port Hedland, Broome or directly from Perth as required.

15.8 Decontamination

Decontamination areas (HDPE lining provided through the provider of PPE) will be constructed for maintaining the integrity of the 'Zones' at shoreline Staging areas, location and terrain permitting and as directed by the DoT as Control Agency for the shoreline response. Contaminated water from the decontamination areas will be regularly pumped out. All contaminated waste water will be decanted into suitable transportable medium provided by Santos WA's WSP for removal.

15.9 Ablutions

Staging areas may be supported by toilet / ablution solutions; these solutions will be dictated by the location and terrain of the clean-up operations. Available facilities include:

+ Portable toilets;
+ Trailer mounted toilets; and
+ Transportable toilets.

These solutions are chemical and fresh water based, and supported by weekly/fortnightly flushing servicing. The requirement of the situation will dictate if this service is supplied out of Karratha or Perth. Santos WA's WSP can provide disposal as required of wastewater from ablutions.

15.10 Security

To ensure that staging areas are secure, Santos WA can provide temporary fencing to contain operations / equipment during the clean-up; suppliers of temporary fencing are available in Karratha, or larger quantities may need to be sourced from Perth. If required, the specialist services of security providers will be engaged.

15.11 Messing

Messing and catering facilities can be provided through one of Santos WA's current service providers, under local arrangements as determined by capacity and facilities geographically available.

15.12 Cleaning and repair

Cleaning and repair of booms and other operational equipment this can be carried out in bunded areas at the supply base facilities.

15.13 Suppliers

All material, associated equipment and services will be sourced, where possible, through existing Santos WA suppliers. Service Orders will be raised if other/new suppliers are to be engaged to provide services etc. in the event of an oil spill.

15.14 Accommodation

Accommodation options for field responders and FOB personnel will be dictated by proximity to their respective activity areas, to ensure maximum utilisation of the shift time available.

VI has limited accommodation facilities and accommodation may also be available on Barrow Island (Chevron facilities) under a request through AMOSC Mutual Aid arrangements.

Mainland accommodation is available at Dampier/ Karratha, Onslow and Exmouth. Santos WA's Devil Creek accommodation close to Karratha may also be used.

Where possible local facilities will be utilised to accommodate response personnel, however transportable accommodation and messing facilities can be supplied through contract suppliers if required.

Santos WA has access to transportable accommodation and messing facilities supplied through Sodexo and its subcontractors.

Transportation to respective work sites would be facilitated via modal and multimodal transport solutions, dictated by the geographical constraints of each site. Under current contractual arrangements, Santos WA has access to transportation providers for Land, Air and Marine operations. In general, from accommodation locations to operational areas transport would be via road using the services of a third party supplier. Should additional services be required to meet the demand, this would be engaged under a Service Agreement as determined and authorised by the IMT.

15.15 Providoring

Providoring arrangements when utilising local facilities would be covered under Service Orders / Purchase Order Terms and Conditions. Santos WA has existing contracts with local supplies in Karratha who could be used for additional support for providoring. These supplies would be transported to the respective spill response staging area by one of Santos WA's third party logistics providers.

15.16 PPE

Santos WA would utilise the services of specialist providers of PPE for clean-up operations. All PPE would be sourced in Perth and transported by one of Santos WA's third party logistics providers to the forward operating centres.

In the event of a spill incident Santos WA would engage the services of a third party to provide and maintain inventory for the duration of oil spill operations.

The disposal of contaminated PPE is provided by Santos WA's WSP.

PPE requirements for spill responders is detailed in the Santos WA Oil Spill Recovery Safety Management Plan (QE-91-RF-10016).

15.17 Response personnel clean-up crew

Santos WA can provide an initial clean-up workforce from existing Santos WA and AMOSC staff and contractors. This could provide up to 150 personnel immediately from Varanus Island, Dampier Supply Base, Karratha and Perth office, and AMOSC core group responders from around Australia.

Santos WA would access labour hire arrangements for untrained work force required for low skill labour intensive operations, including shoreline clean-up and roles within an oiled wildlife facility. On the job training and inductions would be provided to enable personnel to perform their functions safely and effectively.

15.18 Radio communications

Santos WA would utilise the services of a specialist communication provider, mutual aid arrangements, or control agency arrangements to access hand-held and vehicle mounted UHF radios to support response and clean-up personnel. Portable deployed repeater stations (battery or mains powered) can be positioned along the shoreline to provide a 'voting' system for transmitting and receiving during the clean-up operation.

16 Spill response termination

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

+ The efficacy and benefit of current response options;
+ Any potential for additional pollution;
+ Any potential for additional environmental damage caused by further clean-up efforts; and
+ An assessment of prevailing weather conditions that can increase risk to response teams or increase the efficacy in weathering hydrocarbon.

A NEBA will be conducted to inform the decision-making process. Termination criteria are defined within each section of contingency response activities defined within the OPEP.

Upon conclusion of the spill response activity, Santos WA will complete the following tasks:

+ Prepare detailed reports and collate all documents;
+ Report on the performance objectives of each individual spill response that was mobilised;
+ Undertake an inventory of consumables and prepare accounts;
+ Arrange for the return of equipment;
+ Arrange for the refurbishment of consumed equipment;
+ Conduct an investigation into the cause of the incident and report to relevant authorities; and
+ Assess long-term environmental monitoring requirements.

17 OPEP administration

17.1 Document review and revision

In line with regulatory requirements, this document shall be reviewed, updated and submitted to NOPSEMA and DMIRS, in accordance with the Santos WA Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to one or more of the following:

+ When major changes have occurred 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 are identified; or
+ 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 State and Commonwealth regulations, i.e. the OPGGS (E) Regulations, P(SL)(E) Regulations.

17.2 OPEP custodian

The custodian of the OPEP is Santos WA Senior Oil Spill Advisor:

Position:	Senior Spill Response Advisor
Location	Santos WA Perth Office

18 References

AMSA (2015). Technical guidelines for preparing contingency plans for marine and coastal facilities. Prepared by the Australian Maritime Safety Authority, January 2015.

AMSA (2017). Australian Government Coordination Arrangements for Maritime Environmental Emergencies. Prepared by the Australian Maritime Safety Authority, October 2017.

AMOSC (2011). Oil pollution emergency plan: guidelines for the Australian marine petroleum exploration and production industry. Prepared by the Australian Marine Oil Spill Centre, November 2011.

ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

APASA (2013a). Memorandum: Advice on the properties of Lube and hydraulic oils. Asia-Pacific Applied Science Associates (APASA) for Apache Energy Ltd. November 2013.

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French-McCay, D.P. (2009). 'State-of-the-art and research needs for oil spill impact assessment modelling', Proceedings of the 32nd Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Environment Canada, Ottawa, pp. 601–653.

ITOPF (2011). ITOPF Members Handbook 2011/12. Prepared by the International Tanker Owners Pollution Federation Ltd. http://www.itopf.com/news-and-events/documents/itopfhandbook2011.pdf (Accessed: 2 December 2011).

NOAA (2013). Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments.
https://response.restoration.noaa.gov/sites/default/files/Characteristics_Response_Strategies.pdf

NOPSEMA (2012). Preparation of Oil Spill Contingency Plans. Guidance Note – Consultation Draft. Prepared by the National Offshore Petroleum Safety and Environmental Management Authority. N-04700-GN0940 Rev 1, March 2012.

NRDAMCME (1997). The CERCLA Type A Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAMCME) Technical Documentation Vol 4, 14 -42. http://www/doi.gov/oepc/oepcbb.html.

Appendix A: Hydrocarbon Characteristics and Behaviour

During the activity, the following hydrocarbons may be unintentionally released to the onshore or marine environment: oily water, hydraulic/ lube oils, petrol and marine diesel. The following sub-sections summarise the characteristics of key hydrocarbons of concern and their weathering behaviour when spilt to the marine environment.

Marine diesel oil

ITOPF (and Australian Maritime Oil Spill Centre-AMOSC (2011)) categorises marine diesel as a light group II hydrocarbon. In the marine environment, a 5% residual of the total quantity of marine diesel spilt will remain after the volatilisation and solubilisation processes associated with weathering (**Table A-18-1**).

Table A-18-1: Characteristics of marine diesel

Hydrocarbon	Initial density (kg/m3)	Viscosity (cP) @ 25oC	Component	Volatiles (%)	Semi-volatiles (%)	Low volatility (%)	Residual (%)
			Boiling Points (oC)	<180	180–265	265–380	>380
Diesel	836.8	4.0	% of total	6	34.6	54.4	<5

In the marine environment marine diesel will behave as follows:

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

For more details relating to the environmental impacts and risks from marine diesel, see the Yoorn-1 Geophysical Survey Environment Plan (EP) (SO-91-RI-20058).

Hydraulic and lube oils

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

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

Appendix B: Operational NEBA Worksheet

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**NEBA - General**												
2	**Section 1**	**Time Period**											
3	**1. Incident**												
4	**2. Date**												
5	**3. Season**												
6	**4. Operational Period**												
7	**5. Time**												
8	**6. Compiled By**												
9													
10	**Section 2**	**Data Gathering**											
11	**A. Situational Awareness**												
12	**1. Location *(lat/longs)***												
13	**2. Source**												
14	**3.Oil type and behaviour**												
15	*a. HC type*												
16	*b. Group*												
17	*c. Pour point*												
18	*d. Viscosity*												
19	*e. Flash Point*												
20	*f. Wax content*												
21	*g. Ashphaltene content*												
22	*h. Specific gravity/density*												
23	**4. Status *(available from ICT)***												
24	**5. Volume *(available from ICT)***												
25	**6. Weather (forecasted) *(available from BOM)***												
26	*a. Ocean current speed/direction (knots)*												
27	*b. Wind speed/direction*												
28	*c. Ambient sea temp*												
29	*d. Ambient air temp*												
30	*e. Wave height*												
31	**7. Spill trajectory**												

	A	B	C	D	E	F	G	H	I	J	K	L	M
32	**8. Water depth**												
33	**9. Safety issues?**												
34	**10. Jurisdiction**												
35													
36													
37	**B. High priority resources at risk from oiling *(data from A and B, EP/OSCP, EUL, HMA and ESC)***	**1. Priority level**	**2. Presence/Absence**	**3. Time to Impact**	**4. Vulnerability**	**5. Sensitivity**	**6. Recoverability**	**7. Intervention recommended**	**8. Accessibility**	**9. Comments**			
38													
39													
40													
41													
42													
43													
44	**C. Identify appropriate response strategies**	**1. Source control**	**2. Monitor and Evaluate**	**3. Containment and Recovery**	**4. Shoreline Deflection**	**5. Shoreline Protection**	**6. Shoreline Cleanup**	**7. Oiled Wildlife Response**	**8. Dispersants**	**9. In-situ Burning**	**10. Waste**	**11. Vulnerability to strategy**	**12. Comments**
45	**Priority Resources at Risk (list)**												
46													
47													
48													
49													
50													
51													
52	**D. Advice to ICT**												
53	**Protection Priorities**	**Primary Response Strategy**	**Primary Response Strategy**	**Primary Response Strategy**	**Primary Response Strategy**	**Secondary Response Strategy**	**Secondary Response Strategy**	**Secondary Response Strategy**	**Secondary Response Strategy**				
54													
55													
56													
57													
58													
59													
60													
61	**Environment Team Lead**	**Name: Signature:**											
62	**Planning Team Lead**	**Name: Signature:**											
63	**Operations Team Lead**	**Name: Signature:**											
64	**Oil Spill Coordinator**	**Name: Signature:**											
65	**HMA**	**Name: Signature:**											

Appendix C: POLREP

Department of **Transport**

Marine Pollution Report (POLREP)

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

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

INCIDENT DETAILS

Date of Incident: _____ Time of Incident *(24 hr format)*: _____

Location name/description: _____

Incident Coordinates Latitude of spill _____ Longitude of spill _____

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

Description of Incident: _____

POLLUTION SOURCE

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

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

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

POLLUTANT

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

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

☐ **Garbage** Details/description: _____

☐ **Packaged** Details/description: _____

☐ **Sewage** Details/description: _____

☐ **Other** Details/description: _____

EXTENT

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

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

Has the discharge stopped? ☐ Yes ☐ No ☐ Unknown

Weather conditions at site: _____

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

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

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

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

ADDITIONAL INFORMATION

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

Equipment used? ☐ AMSA ☐ State / NT ☐ Industry

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

ORIGINAL REPORT SOURCE

Name:_____ Position: _____ Phone: _____

Combat agency:_____ Statutory agency: _____

SENDER DETAILS

Name:_____ Agency: _____ Date:_____

Phone: _____ Fax: _____ Email:_____

PRIVACY STATEMENT

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

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

POST Reset Form

Appendix D: SITREP

Marine Pollution Situation Report (SITREP)

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

MARINE POLLUTION SITUATION REPORT (SITREP)

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

This form is transmitted to all relevant agencies including:

- Jurisdictional Authority
- Support Agencies

Incident Name:_____ **Ref. No.** _____

Priority ☐ Urgent ☐ Immediate ☐ Standard

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

Date:_____ **Time:**_____

POLREP Reference: _____

Incident location Latitude_____ Longitude_____

Brief description of incident and impact:

Overall weather conditions:

Summary of response actions to date:

Current Strategies:

Summary of resources available/deployed:

Expected developments:

Other Information:

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

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

POST

RESET

Appendix E: Vessel Surveillance Observer Log

Santos

Vessel Surveillance Observer Log – Oil Spill

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

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

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

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Timeline of observations:

Time	Description

Appendix F: Aerial Surveillance Observer Log

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Aerial Surveillance Observer Log – Oil Spill

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

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

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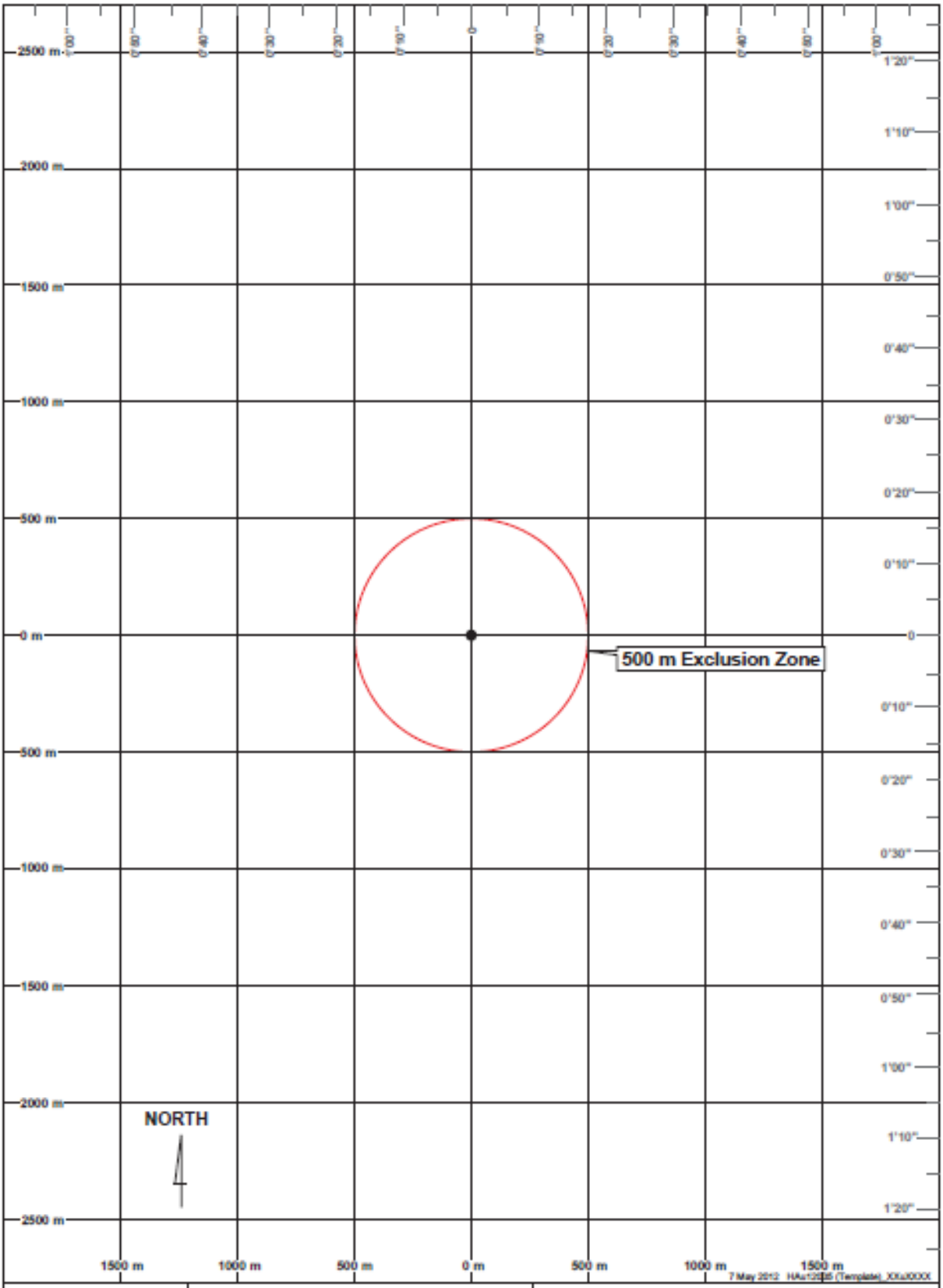
Slick Details											
Slick grid parameters (lat/long)				Slick grid parameters (air speed)		Slick grid dimensions					
Length Axis		Width Axis		Length Axis		Width Axis	Length	nm			
Start Latitude		Start Latitude		Time (seconds)		Time (seconds)	Width	nm			
Start Longitude		Start Longitude					Length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

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

Appendix G: Aerial Surveillance Surface Slick Monitoring Template

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



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

Appendix H: Aerial Surveillance Marine Fauna Sighting Record

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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

Appendix I: Aerial Surveillance Shoreline Observation Log

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Aerial Surveillance Reconnaissance Log – Oil Spill

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

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

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

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

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

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

Appendix J: Shoreline Clean-up Equipment

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

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

	Inflatable Tent 9 square metres	1

Equipment list for a decontamination unit for Beach Clean Up Team

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

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

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

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

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

Appendix K: Shoreline Response Strategy Guidance

Shoreline Response Strategy Guidelines

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

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

Table 1 Strategy Guidance for shoreline response at coastal sensitivities

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

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

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

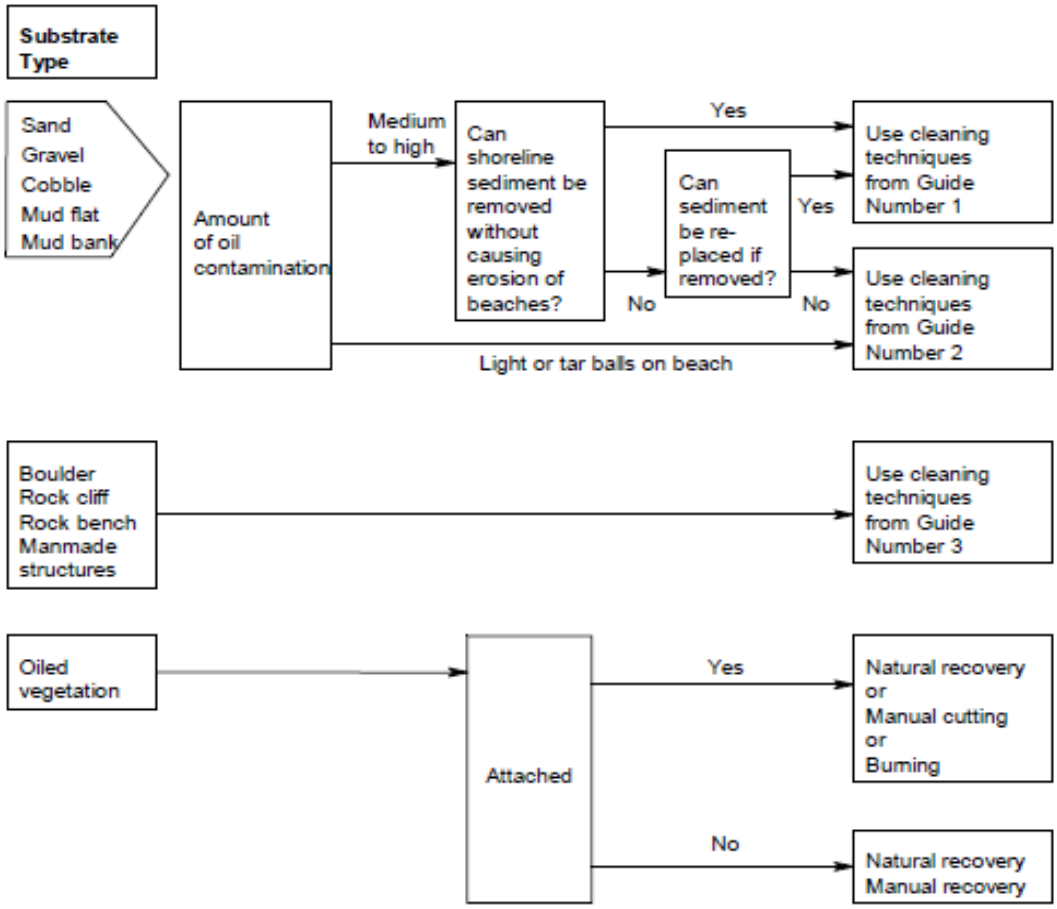

Figure 1: Shoreline Clean-up Master Decision Guide

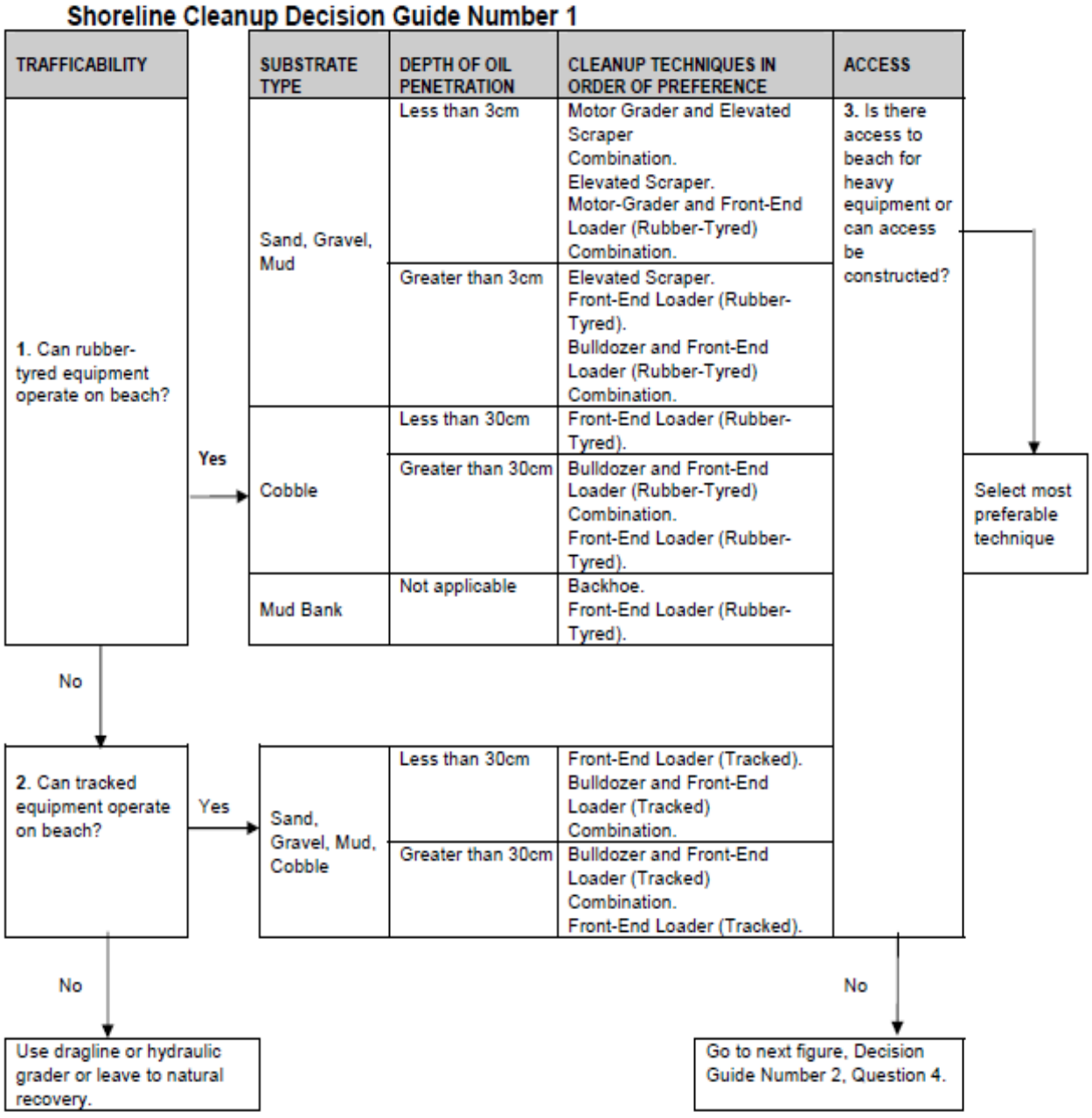

Figure 2: Shoreline Clean-Up Decision Guide 1

Shoreline Cleanup Decision Guide Number 2

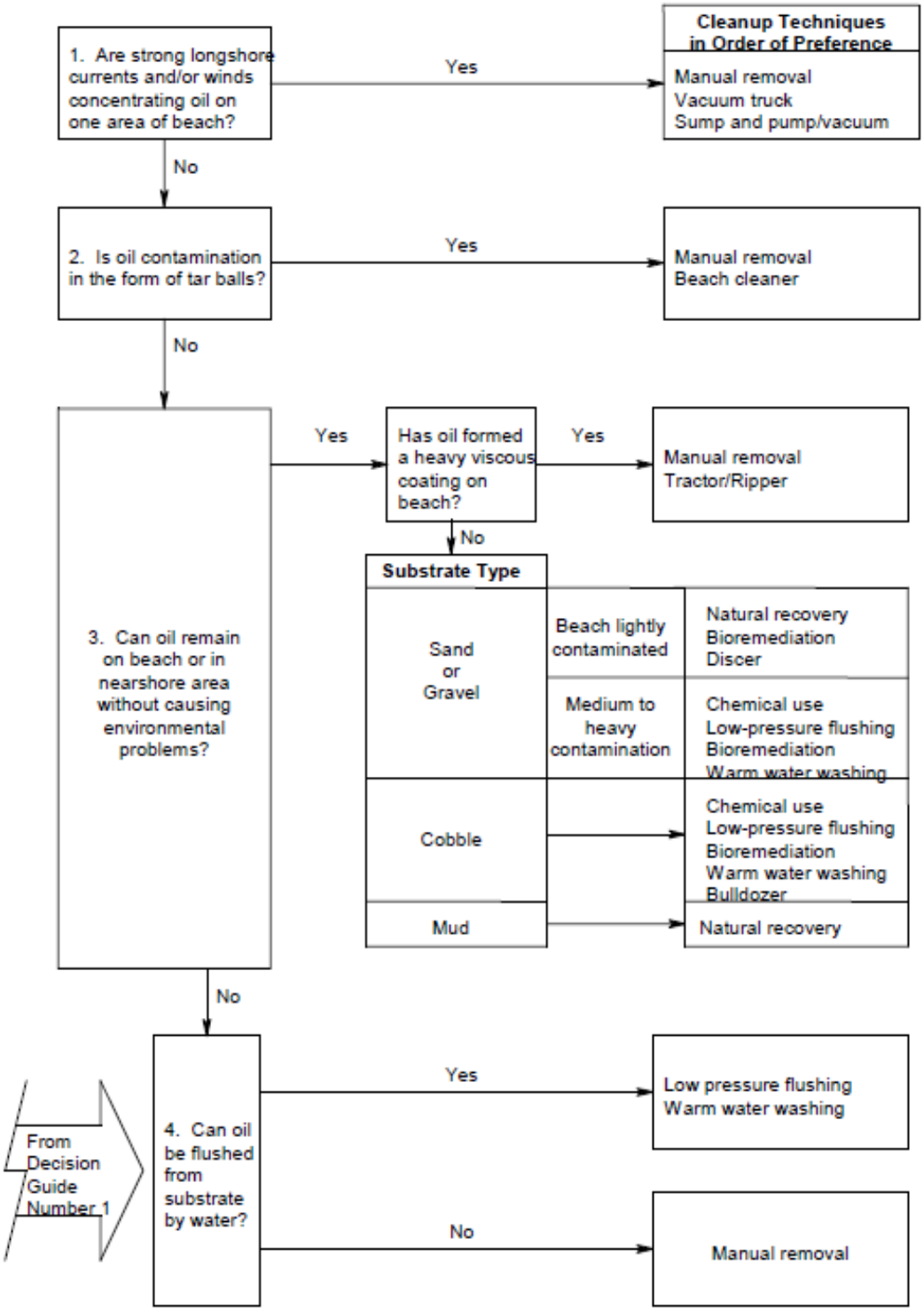

Figure 3: Shoreline Clean-Up Decision Guide 2

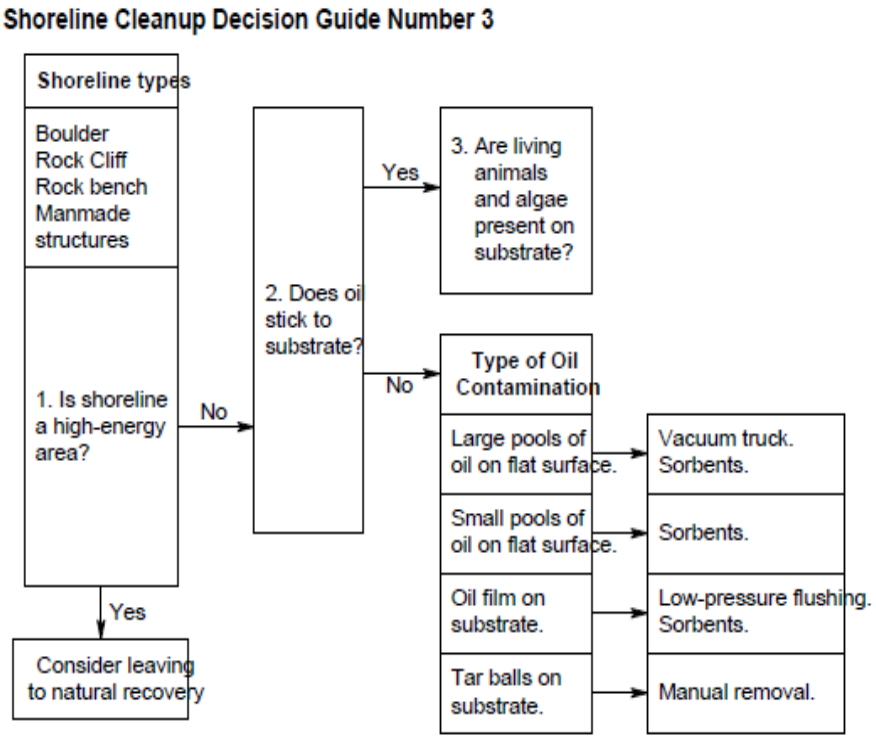

Figure 4: Shoreline Clean-Up decision Guide 3

Appendix L: Operational Guidelines for Shoreline Response

Operational Guidelines for Shoreline Clean-up activities

1.1.1 Worksite preparation guidelines

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

Organisation and worksite set-up

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

These specific areas are:

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

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

Preparation

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

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

PRIMARY STORAGE OF WASTE

A primary storage site is:

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

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

The return of the site to its original condition implies:

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

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

Primary waste storage sites should meet certain criteria:

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

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

BASE CAMP/REST AREA

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

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

At base camp, operators must be provided with:

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

Selection of the rest area must meet certain criteria:

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

Equipment

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

STORAGE AREA FOR EQUIPMENT AND MACHINERY

This area consists of and equipped repair and maintenance site.

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

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

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

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

Equipment

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

1.1.2 Manual clean-up guidelines

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

Conditions of use

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

Equipment

Basic Equipment:

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

Extra Equipment:

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

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

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

Impact

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

Performance

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

1.1.3 Mechanical clean-up guidelines

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

Conditions of use

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

Equipment

Basic equipment:

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

PPE: At least suitable for heavy machinery operation

Impact

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

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

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

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

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

1.1.5 Shoreline vessel access guidelines

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

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

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

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

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

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

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

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

Appendix M: Oiled Wildlife Response Personnel and Equipment

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

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

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

Table 1: Sources of oiled wildlife response personnel

AMOSC / INDUSTRY RESPONDERS	Activated through	Capability
AMOSC Technical Advisor – Oiled Wildlife – assistant in IMT (as industry OWA if required)	AMOSC Duty Officer	1*
AMOSC OWR Industry Team– Level 2-4 responders (DBCA training)		18*
WA Petroleum Industry Personnel – 20 Trained in OWR management by Massey University through AMOSC		20
WA Petroleum industry personnel – Trained by individual petroleum industry companies – activated via mutual aid		~50*
AUSTRALIAN OWR EXPERTISE	Activated through	Capability
Blue Planet Marine (ACT and WA) – Oiled Wildlife Responders	AMOSC Duty Officer	10-20*
Phillip Island National Parks (VIC) – Oiled Wildlife Responders		~70 staff ~45 volunteers*
NatPlan Mutual Aid		50-100*
Wildlife care and		

Perth Zoo – Duty Veterinarian	rehabilitation advice, expertise and management	Personnel potentially available to petroleum industry (currently there is no formal arrangement)	
	Links to wildlife rehabilitation networks		
OWA		DBCA State Duty Officer –	1 per shift
Personnel			
DBCA staff with wildlife and emergency management skill set who currently operate in fire preparedness and response			
INTERNATIONAL OWR EXPERTISE		Activated through	Capability
DwyerTECH NZ - Facilities Management Personnel Call-off contract)		AMOSC Duty Officer	2*
Wild base, Massey University (NZ) - Oiled Wildlife Responders			4-6*
International Bird Rescue (USA)- Oiled Wildlife Responders			4*
Sea Alarm (Belgium) – Expert assistance with organisational set-up and global OWR resourcing		OSRL Duty Officer	2/3** (Sea Alarm) + additional OWR responders accessed through global network

* As per AMOSC Capacity Statement 28 Feb 2019

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

Table 2: First Strike Deployment-Ready OWR Equipment

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

1 x Wildlife Rehabilitation Unit		Fort Lauderdale, USA

* As per AMOSC Capacity Statement 28 Feb 2019

** As per OSRL Mobilisation Fact File. NB: 50% of equipment available to members.

Appendix N: Scientific Monitoring Plans

1 Scientific Monitoring Principles

1.1 Monitoring Design

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

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

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

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

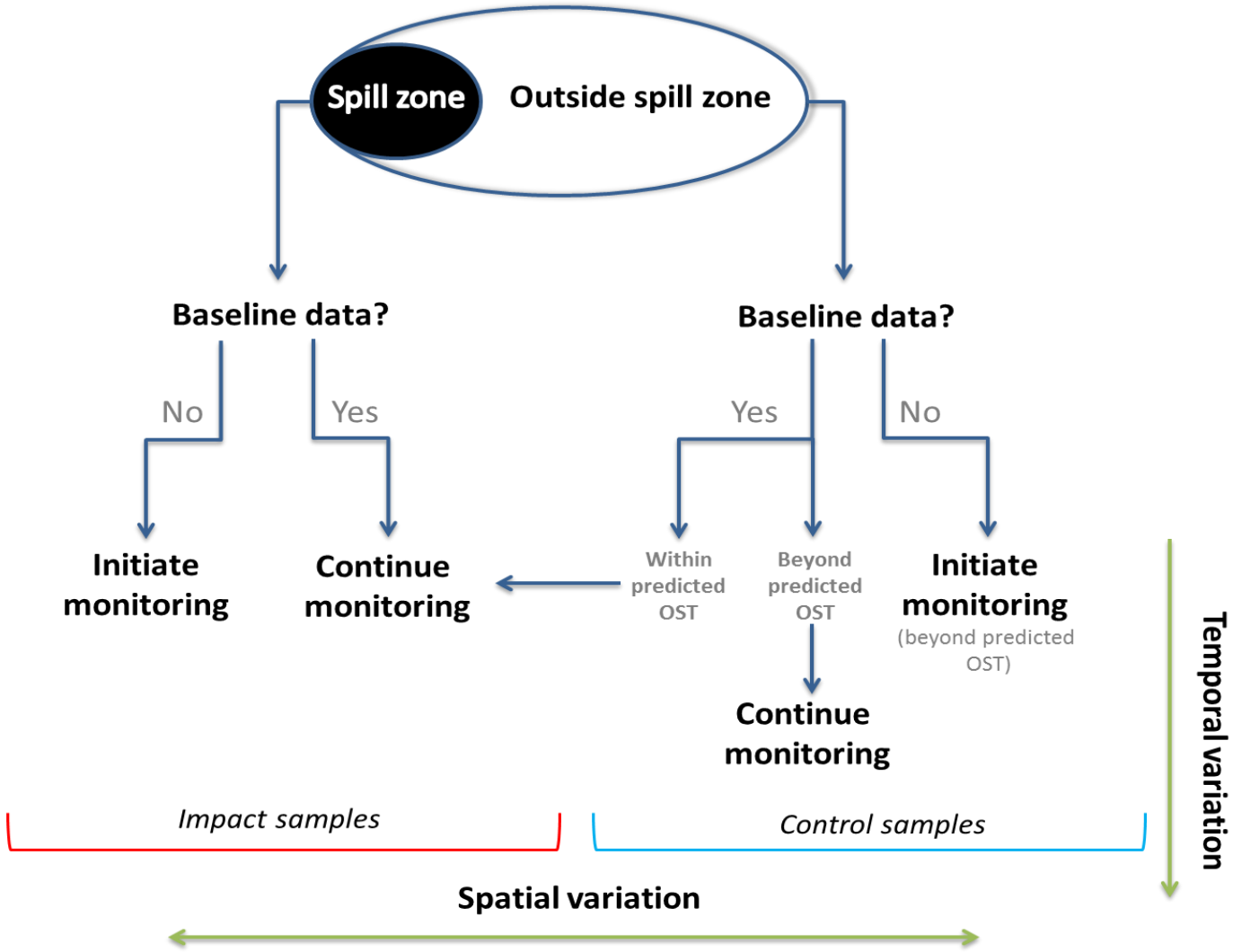

Figure 1: Structured decision making process based on Gregory et al. (2012) in reference to monitoring programs, the availability of baseline data, and oil spill trajectory. In an ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

1.2 Data Analysis

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

Table 2: Summary of data analysis techniques.

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

2 Scientific Monitoring Plans by Receptor

2.1 SMP1 Marine Water Quality

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

SMP1 – Marine Water Quality	
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): 4. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied; 5. If insufficient long-term baseline data is available, where appropriately matched baseline data sites are impacted and non-impacted, a before-after-control-impact (BACI) approach to monitoring will be applied; 6. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See Figure 1 for detailed description of these approaches. The selection of potentially impacted and non-impacted sites will be informed by Operational Monitoring, including operational water quality monitoring and spill trajectory modelling. Sampling frequency will be dictated by the spatial extent of the spill, the number and location of sampling sites and the philosophy of the sampling design. <u>Water profiles</u> A water quality probe will be used to measure conductivity (to derive salinity), temperature and depth (CTD), dissolved oxygen (% and mg/L), turbidity, total dissolved solids and fluorometry along a depth profile. Sampling methods will be aligned with the recommended standard operating procedures for the use of sensors for oil spill monitoring found in Appendix F of the Oil Spill Monitoring Handbook (Hook et al. 2016). <u>Water quality</u> Water quality samples will be taken along a similar depth profile as the CTD measures using a Niskin bottle, Van Dorn water sampler, rosette sampler or equivalent instrument. The laboratory(ies) will inform and supply the appropriate sample containers, storage requirements, holding times, detection limits/limit of reporting for required analytes and the analysis required for each sample. Water samples shall be analysed for key contaminants of concern including polycyclic aromatic hydrocarbons (PAHs), monocyclic aromatic hydrocarbons (including benzene, toluene, ethylbenzene, xylene), and nutrients, metals and chlorophyll-a. At each site, replicate water samples (at least three samples) will be collected to allow appropriate statistical analyses to be made including samples for quality assurance and quality control (QA/QC) purposes (i.e. split sample, triplicate sample, field blanks, transport blanks). Water sample collection and handling will align with Standard operating procedures found in the Oil Spill Monitoring Handbook (Hook et al., 2016), specifically the following sections: • Appendix A & B hydrocarbon analysis; • Appendix C Volatile Organic Compounds Analysis; and • Appendix D Surface Oil Analysis. Environmental DNA (eDNA) will also be collected to detect for the presence of marine species in the water column. Water samples will be collected in Nalgene bottles and sent to an appropriate laboratory for analysis. Sample processing will depend on holding times required (<8 hours ideal) and may involve filtering and freezing of each sample (Grochowsi and Stat 2017).
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.

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

2.2 SMP2 Sediment Quality

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

SMP2 - Sediment Quality	
Termination criteria	Concentrations of hydrocarbons in marine benthic and shoreline sediments, attributable to the released hydrocarbon, are not significantly higher than baseline or similar non-impact sites. In the absence of baseline or similar non-impact sites data, concentrations are below marine sediment quality interim guideline levels within the ANZG (2018), or the relevant regulatory site-specific trigger level (where these exist), if this is lower. For infauna assemblages, abundance and species diversity/richness/composition are not significantly different from baseline (where baseline data exists) or are not statistically significantly different from comparable non-impacted benthic infauna assemblages. Forensic fingerprinting of the released hydrocarbon and sediment quality samples by way of GC/MS may be used to determine the source of contaminants where this is not otherwise clear from operational monitoring.
Receptor impact	Impact to sediment quality is measured through change in hydrocarbon content and concentration. Change to sediment quality is also reflected by changes to infaunal assemblages. Potential impact to infaunal assemblages are measured through change(s) in: • Taxonomic diversity • Assemblage composition • Abundance of indicator species. Other pressures to these states are: • Discharge of other toxicants • Physical disturbance including dredging • Sedimentation • Introduction of marine pests • Shading from marine infrastructure • Climate change

SMP2 - Sediment Quality	
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): 7. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied; 8. 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; 9. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See Figure 1 for detailed description of these approaches. The selection of potentially impacted and non-impacted sites will be informed by Operational Monitoring, including operational water quality monitoring and spill trajectory modelling. Sampling frequency will be dictated by the spatial extent of the spill, the number and location of sampling sites and the philosophy of the sampling design <u>Sediment quality</u> Operational Monitoring (including spill trajectory modelling) and the results of SMP1 Marine Water Quality monitoring will be used to inform the location of potentially impacted sediment sites. Sediment monitoring sites in nearshore and shoreline locations will also consider and align where practicable, with sites selected for habitat monitoring (i.e. SMP3, 4, 5 and 6). Sampling frequency will be dictated by the spatial extend of the spill, the number and location of sampling sites and the philosophy of the sampling design. At each site, replicate sediment samples will be taken including those for QA/QC purposes. Sediment grab (i.e. Van Veen or Box corer) or coring equipment will be selected based on water depth (offshore, inshore or shoreline) and sample size requirements. Sediment sample collection and handling will align with Standard operating procedures found in the Oil Spill Monitoring Handbook (Hook et al. 2016), specifically the following sections according to sampling equipment utilised: • Appendix G hydrocarbon analysis (Grab samplers) • Appendix H hydrocarbon analysis (Ship borne corer) • Appendix H Manual push corer, and • Appendix O Sediment infauna. The laboratory(ies) will inform and supply the appropriate sample containers, storage requirements, holding times, detection limits/limit of reporting for required analytes and the analysis required for each sediment sample. Sediment samples shall be analysed for key contaminants of concern including metals, hydrocarbons, nutrients, particle size distribution, and nutrients. <u>Infauna samples</u> A subset of the sediment sample shall be sieved in the field (if time permits) with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of infauna to lowest taxonomic resolution possible. eDNA will also be collected to detect for the presence of marine infauna species in sediments. Sediment will be removed from the surface of a subset of the sediment sample and sent to an appropriate laboratory for analysis.

SMP2 - Sediment Quality	
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.
Implementation	Service provider to be capable of mobilising within 72 hours of the SoW having been approved by Santos. Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.
Analysis and reporting	Sediment samples analysed by NATA-accredited laboratories for presence and concentrations of hydrocarbons associated with the spill including full suite PAHs and total organic carbon. A government endorsed laboratory for forensic fingerprinting (GC/MS) will be used. Infauna samples sorted and identified by qualified marine invertebrate specialist to acceptable taxonomic groups. Data will be entered to spatially explicit database and analysed statistically in order to detect significant differences among sites. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.3 SMP3 Sandy Beaches and Rocky Shores

SMP3 - Sandy Beaches and Rocky Shores	
Rationale	Contact of entrained oil and stranded floating oil of shoreline habitats may occur on sandy beaches and rocky shores. Rocky and sandy shores provide habitat for a variety of intertidal organisms, which in turn provide food for shorebirds. Large tides tend to create a large degree of horizontal zonation amongst taxa. Rocky and sandy shores are included within the one receptor as they are often spatially mixed and both represent high energy regions.
Aim	To monitor changes in biota of sandy and rocky shoreline habitats in relation to an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM shall be reviewed for applicable rocky shoreline and sandy beach biota baseline data. Minimal baseline data currently exists for rocky shorelines and sandy beaches.
Initiation criteria	Operational monitoring, SMP1 or SMP2 indicates that rocky and/or sandy shorelines are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP3 - Sandy Beaches and Rocky Shores	
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.

SMP3 - Sandy Beaches and Rocky Shores	
Methodological approach	Monitoring will be designed as follows: • Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved, a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied. Owing to potentially high spatial variation in assemblage structure, post-spill pre-impact monitoring will be a priority where no baseline data exists. If this opportunity is not available, a gradient approach to monitoring will be applied. Sampling frequency will be dictated by the number and location of sampling sites and the philosophy of the sampling design. Rocky shoreline intertidal assemblages (fauna and flora) will be monitored using a quadrat/transect approach, with the positioning of quadrats/transects accounting for any natural variation in assemblage structure along a seaward-landward gradient. Assemblage structure to be recorded through in-situ counts of fauna and flora or still images taken for further analysis. Sandy shoreline infauna will be sampled by way of replicated grab/core samples. Sampling sites within impacted and non-impacted areas to consider any cross-shore gradient in assemblage structure that may exist. Where baseline data exists, the methodology will be adapted to available data so that results are comparable. Samples to be sieved with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of fauna to lowest taxonomic resolution possible. Process to follow that for baseline data where this pre-exists. Biomonitoring of hydrocarbon concentrations in shoreline invertebrates will occur through collection of replicated tissue samples from representative, and preferably widely available species, across impact and non-impacted locations. The laboratory(ies) will supply and inform the appropriate method for collection, storage and holding times of tissue samples for required laboratory analysis and to avoid cross-contamination among samples. Where limitations in the distribution and abundance of representative invertebrate species preclude collection of sufficient samples for analysis, in-situ biomonitoring using a locally available species (e.g. the use of caged oysters) shall be considered for assessing spatial and temporal changes in bioaccumulation of hydrocarbon concentrations in invertebrates across impact and reference sites.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
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.

SMP3 - Sandy Beaches and Rocky Shores	
Analysis and reporting	Specimens not identified in situ (in the field) will be processed and identified in the laboratory by appropriately qualified scientists. Biota tissue samples (if collected) analysed for hydrocarbon contaminants by NATA-accredited laboratories. Data will be entered to spatially explicit database and analysed in order to test for significant difference between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.4 SMP4 Mangrove Communities

SMP4 - Shorelines and Coastal Habitats – Mangroves	
Rationale	In the event of Tier 2 or 3 spill, mangroves may be contacted by floating or entrained oil. Mangrove health may be adversely affected due to increased concentration of hydrocarbons in sediments and coating due to surface oil, which in turn can lead to leaf-loss, mortality and a reduction in areal extent of mangrove habitat. This plan's focus is mangrove vegetation. Associated monitoring of sediment quality and mudflat fauna is described in SMP2 and SMP5, respectively.
Aim	To monitor changes to mangrove extent and health in relation to an oil spill and associated activities.
Baseline	On-ground monitoring is ongoing at several locations , refer Baseline Data Review (QE-00-BI-20001). Santos holds long term data from field mangrove health surveys at Varanus Island/ Bridled Island (Lowendal Group). Baseline extent and of mangroves is monitored by remote sensing in several regions, and further historical and post-impact data for mangrove health and extent can be obtained as remotely sensed imagery (e.g., Sentinel, Landsat and Worldview).
Initiation criteria	Operational Monitoring, SMP1 or SMP2 indicates that mangroves are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Mangrove extent and health are not significantly different from their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted mangroves; AND Sediment quality monitoring (SMP2) at the site has been terminated; AND Shoreline response at the site has been completed.

SMP4 - Shorelines and Coastal Habitats – Mangroves	
Receptor impact	Impact to mangroves from pressures including hydrocarbons is measured through change in: • Tree health • Aerial extent. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Litter • Introduction of marine pests • Dust • Sedimentation from human activities • Climate change.
Methodological approach	Remote sensing data will be accessed for the purpose of detecting change in aerial cover and change in canopy health through and index of plant health (e.g., NDVI or MSAVI) (Astron Environmental Services 2013). Where long term on-ground baseline monitoring has occurred, further post impact onground monitoring should be carried out to complement any analysis of remote sensing. Analysis of long-term onground monitoring data will be as follows: • Where long-term baseline data sites (only) are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied (See Figure 1). On-ground monitoring of mangroves will aim to detect change in mangrove health, including canopy cover and plant/leaf health indices. Field methodology will follow the routine monitoring techniques currently employed for Santos at Varanus Island (Quadrant Energy Australia Limited 2018), adapting where required to align with pre-existing baseline field data, where available. Sampling of sediments as per SMP2 will occur at mangrove health assessment sites to allow any changes in mangrove health to be related to sediment hydrocarbon levels. In-field mangrove health sampling frequency will be dictated by the number and location of sampling sites and the sampling design applied.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	On-ground monitoring will only occur where long-term baseline data has been collected, and hence no post-spill pre-impact data collection will be required. On-ground post-spill data will be collected at an appropriate time as guided by the analysis of remote sensing imagery, and potential on-ground assessment.
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to test statistically significant change to parameters associated with hydrocarbon spill. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.5 SMP5 Intertidal Mudflats

SMP5 - Shorelines and Coastal Habitats – Intertidal Mudflats	
Rationale	Intertidal mudflat communities are primary producer habitats which support invertebrate fauna, which in turn provides a valuable food source for shorebirds. High diversity of infauna (particularly molluscs) occur within these habitats and may be affected by penetrating oil. At high tide, these habitats become foraging grounds for vertebrates such as rays and sharks. While there is some localised disturbance, most of the communities in the area of interest are generally in an undisturbed condition. These habitats are at high risk of impact as the sheltered environments promote high faunal diversity combined with low-energy wave action.
Aim	To monitor changes in intertidal mudflat communities associated with an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) . In addition, the IGEM shall be reviewed for applicable intertidal mudflat infauna baseline data.
Initiation criteria	Operational Monitoring, SMP1 or SMP2 indicates that mudflat habitats are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Mudflat infaunal assemblages are not significantly different from their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages; AND SMP2 Sediment Quality monitoring at the site has been terminated; AND Clean-up of the shoreline site has been completed.
Receptor impact	Impact to mudflat epifauna and infauna from pressures, including hydrocarbons, is measured through change in: • Species diversity • Assemblage composition • Abundance of indicator taxa. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Overfishing (bait collecting) • Introduction of marine pests • Climate change.

SMP5 - Shorelines and Coastal Habitats – Intertidal Mudflats	
Methodological approach	Monitoring will be designed as follows: • Where long-term baseline data sites (e.g., Roebuck Bay) are contacted, a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied (See Figure 1). Owing to potentially high spatial variation in assemblage structure, post-spill pre-impact monitoring will be a priority if baseline data are not available. If this opportunity is not available, a gradient approach to monitoring will be applied. Mudflat infauna will be sampled by way of replicated grab/core samples. Sampling sites within impacted and non-impacted areas to consider any cross-shore gradient in assemblage structure that may exist. Where baseline data exists methodology to adapt to available data such that results are comparable. Sites selected for mudflat infauna sampling to be concurrently sampled for sediment quality as per SMP2. Sampling frequency will be dictated by the number and location of sampling sites and the philosophy of the sampling design. Samples to be sieved with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of fauna to lowest taxonomic resolution possible. Process to follow that for baseline data where this pre-exists.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	With the purpose of collecting post spill pre-impact data, service provider able to mobilise within 72 hours of the scope of work having been provided to them (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilization time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.6 SMP6 Benthic Habitats

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 which also provide habitat, refuge areas and food for fish, turtles, dugongs and invertebrates. Seagrass and macroalgae also increase structural diversity and stabilise soft substrates. Non-coral benthic filter feeders, which include sponges, molluscs, sea whips and gorgonians, are considered indicators of disturbance due to their immobility and long living. Corals are important primary producers that provide food, substrate and shelter for a diversity of marine life, including invertebrates and fish. They also protect coastlines from wave erosion and provide important substrate for algae. Undisturbed intertidal and subtidal coral reefs occur in several locations throughout the EMBA and are generally considered to be in good condition.
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 Baseline Data Review (QE-00-BI-20001) In addition, the IGEM will be reviewed for applicable benthic habitat and coral health and reproduction baseline data. Remote sensing data, satellite and aerial imagery previously acquired (for example Hyperspectral imagery along the Ningaloo lagoon) (Kobryn et al. 2013) may also be applicable for shallow clear-water benthic habitats to detect changes in benthic habitat cover and composition. Pollution-induced change to benthic habitat cover and composition may take some time to be detected. Therefore post-spill, pre-impact benthic survey data will be collected when required to have a baseline state following initial oil contact.
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. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP6 - Benthic Habitats	
Termination criteria	<u>Benthic habitat cover and composition</u> Cover and composition of benthic habitats are not statistically significantly different from that of their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages. <u>Coral health and reproduction</u> Hydrocarbon concentration in corals, reproductive state and settlement indices are not statistically different from the baseline state (where baseline data exists) or from comparable non-impacted assemblages.
Receptor impact	Impact to benthic habitats from pressures including hydrocarbons is measured through change in: • Species diversity • Assemblage composition • Percent cover. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Introduction of marine pests • Shading • Climate change.

SMP6 - Benthic Habitats	
Methodological approach	Monitoring design will be as follows: • Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. <u>Benthic Habitat Cover and Composition</u> Field survey methodology will be based upon acquiring repeat digital imagery (video or still images) of benthic habitats along fixed transects (preferable), using a stratified sampling approach at each site to target different habitat types and depths where clear gradients in these conditions exist. Site selection and image acquisition methodology will aim to align applicable baseline studies where these exist, such that imagery is comparable. The number of sites and frequency of sampling will depend upon the sampling design philosophy. Divers, towed video or remotely operated vehicles (ROVs) will be employed to collect imagery considering safety aspects and the depth of water at survey locations. Where divers are employed, fish species will also be recorded where practicable (for example following methodologies employed by Babcock et al. (2008) to contribute to SMP11. <u>Coral Health and Reproduction</u> Using divers, selected coral colonies will have tissue samples removed for the purpose of laboratory analysis of the concentration of accumulated hydrocarbons and for determining reproductive state, noting sampling for reproductive state will be dependent upon the timing of coral spawning. Reproductive state will be determined from measures of gamete size, stage and fecundity determined from in-field examination and laboratory analysis of histological samples. In addition to the standard suite of ecotoxicology testing done on the released hydrocarbon as part of the Operational Monitoring Program, ecotox testing of the released hydrocarbon on the larval competency of representative coral species will be conducted. Settlement plates will be deployed to monitor settlement of coral recruits following spawning periods to ascertain the level of coral recruitment at impacted and non-impacted sites.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider is to be able to mobilise within 72 hours of the SoW being approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.

SMP6 - Benthic Habitats	
Analysis and reporting	Digital imagery will be analysed using a point-count technique (using software such as AVTAS, Coral Point Count with Excel extensions (CPCe) or TransectMeasure (SeaGIS)) to estimate the percentage cover of biotic and abiotic categories (in line with the CATAMI classification scheme) comprising the benthic habitat. Biotic categories to include the following as applicable: corals; macroalgae and seagrass; and non-coral benthic filter feeders. Live, dead and bleached coral cover shall be recorded. The imagery collected will allow for the determination of percent cover, abundance, measurement of size (if scaling lasers are included in the image) and a visual assessment of health (Kohler and Gill 2006). NATA accredited laboratory analysis to determine the concentration of hydrocarbons within coral tissue. Reproductive output to be determined by complementary means, including in-field and laboratory analysis of gametes, including microscopic examination of histological samples preserved in the field. Coral larval competency tests to be conducted by ecotox laboratory in addition to standard suite of ecotox tests using released hydrocarbon. Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card provided as part of report. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.7 SMP7 Seabirds and Shorebirds

SMP7 - Seabirds and Shorebirds	
Rationale	The region supports around 25 species of migratory shorebirds, 20 species of resident shorebirds, and approximately 30 species of seabirds. Shorebird foraging is most highly concentrated on tidal mudflats, while seabirds tend to nest on offshore islands. Impacts to seabirds and shorebirds due to the presence of surface, entrained and dissolved hydrocarbons may include behavioural (e.g. deviation from migratory routes), physiological (e.g. disruption to digestion) or physical (e.g. matting of feathers, inability to fly). These effects may ultimately lead to death or failed breeding. For the purposes of this document, seabirds and shorebirds are defined as: • shorebirds – those birds that inhabit and feed in the intertidal zone and adjacent areas and are resident or migratory, using the area principally during the austral summer • seabirds – those birds associated with the sea and deriving most of their food from it, and typically breeding colonially, including the marine raptors osprey and white-bellied sea eagle.
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 Baseline Data Review (QE-00-BI-20001) The Oil Spill Response Atlas (Department of Transport (DoT)) and National Conservation Values Atlas (Department of the Environment and Energy - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) should also be consulted. Long-term seabird monitoring has been conducted on Lowendal, Airlie and Serrurier Islands by Santos as part of seabird and shearwater monitoring programs.
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. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Detectable levels of hydrocarbons attributable to the hydrocarbon spill are not present in seabird and shorebird tissues; AND measured variables are not statistically significantly different from their baseline or pre-spill state (where these data exist) or from measured variables at non-impacted sites; AND Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).

SMP7 - Seabirds and Shorebirds	
Receptor impact	Impact to sea and shore birds from pressures including hydrocarbons is measured through change in: • Species diversity • Bird abundance • Health/condition • Breeding success (resident species only). Other pressures to these states are: • Physical disturbance of foraging and nesting habitat • Accidental chemical spillage • Entanglement in litter • Displacement by less favourable species (e.g. Silver Gull) • Predation • Climate change.
Methodological approach	Monitoring design will be as follows: • Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. Given the ease of survey establishment, post-spill pre-impact monitoring will be attempted wherever practicable in order to established pre-impact state. • Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied. Monitoring for seabirds and shorebirds will measure abundance and diversity in key foraging/roosting areas with the timing of surveys to coincide with seasonal peaks in abundance. The seabird and shorebird roost count monitoring will follow current accepted survey methodology conducted in the area, such as Bamford and Moro (2011) at Barrow Island, and survey guidelines standardised by the Department of the Environment and Energy (2017). Monitoring of seabirds to focus on nesting (burrow) density, breeding participation and breeding success, taking measurements of the number of adults, eggs and chicks with the timing of surveys to allow assessments immediately after egg laying and immediately prior to chick fledging. Bird mortality to be recorded during monitoring of seabirds and shorebirds with tissue samples taken from dead birds for hydrocarbon analysis in the laboratory. Necroscopies will follow the process of Gagnon and Rawson (2010).
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been provided to them (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.

SMP7 - Seabirds and Shorebirds	
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Draft annual report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.8 SMP8 Marine Megafauna

SMP8 - Marine Megafauna	
Rationale	Thirty-eight species of marine mammals are known to occur within the region. These include cetaceans (whales and dolphin) and sirenians (dugong). The whale shark (*Rhincodon typus*) is also included within this plan. Effects to marine megafauna due to presence of surface oil, entrained oil and dissolved aromatic hydrocarbons may include behavioural (e.g. deviation from migratory routes), physiological (e.g. disruption to digestion) or physical effects. Given large spatial variation in occurrence and broad scale movement, population estimates and associated change are not often available. This plan will focus on assessing the extent of impacts to animals within the region, and where possible, the level of recovery. This will then be used to deduce potential impacts at a population level.
Aim	To monitor short and long-term environmental effects on marine mammals and whale sharks that may have resulted from the hydrocarbon spill and associated response.
Baseline	Refer Baseline Data Review (QE-00-BI-20001)
Initiation criteria	Operational monitoring indicates that marine megafauna are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP8 - Marine Megafauna	
Termination criteria	Restoration or resumption of key biological processes (e.g. abundance, distribution, breeding) necessary to ensure post-impact recovery is demonstrated. Specific criteria to be developed by Marine Scientist(s) with expertise in marine mammals in the north-west of Western Australia; AND No further instances of dead marine megafauna with detectable levels of hydrocarbons attributable to the hydrocarbon spill; AND Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).
Receptor impact	Impact to marine mammals and whale sharks from pressures including hydrocarbons is measured through observed injury and mortality. Other pressures to these states are: • Physical disturbance • Entanglement in fishing gear and litter • Accidental chemical spillage • Climate change • Over-exploitation.
Methodological approach	Aerial and marine surveys will be implemented to identify individuals in proximity of the spill and to quantify damage: • Aerial surveys will follow the protocols of Hedley et al. (2011) • Marine surveys will follow the protocols of Watson et al. (2009) Tissue sampling of dead or injured animals will follow the protocols of: • Department of Environment and Heritage (DEH) (2006) (Cetaceans) • Eros et al. (2000) (Dugongs).
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP8 - Marine Megafauna	
Analysis and reporting	Data will be entered to spatially explicit database. Data and conclusions will be summarised in an environmental report card. Statistical power related to these receptors is likely to be low, due to observational data and small sample sizes. Therefore, the assessment of quantified impacts will be corroborated with marine scientist(s) with expertise in relevant fauna in the north west of Western Australia. Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.9 SMP9 Marine Reptiles

SMP9 - Marine Reptiles	
Rationale	Six species of marine turtle, 22 species of sea snake and one species of estuarine crocodile are considered to occur within the region. Impacts to marine reptiles due to presence of surface oil, entrained oil and dissolved aromatic hydrocarbons may include behavioural, physiological (e.g. disruption to digestion) or physical effects. This plan is primarily focussed on marine turtles, while assessing other reptiles where encountered.
Aim	To observe and quantify the presence of marine reptiles in the spill and response areas, and broader regional areas. To assess and quantify lethal impacts or sub-lethal impacts of this exposure or interactions. To monitor changes in turtle populations in relation to an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) The Oil Spill Response Atlas (Department of Transport (DoT)) and National Conservation Values Atlas (Department of the Environment and Energy - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) should also be consulted.

SMP9 - Marine Reptiles	
Initiation criteria	Operational monitoring indicates that marine reptiles or nesting sites are contacted or likely to be contacted by a hydrocarbon spill; OR Operational monitoring indicates that marine reptiles are contacted, or are predicted to be contacted, by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Detectable levels of hydrocarbons attributable to the hydrocarbon spill are no longer present in marine reptile tissues collected from live or dead individuals; AND In the event that an impact attributable to the hydrocarbon spill is detected on marine reptiles, the measured parameters are not statistically significantly different from their baseline or pre-spill state (where these data exist) or from measured parameters at non impacted sites; AND Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).
Receptor impact	Impact to marine turtles from pressures including hydrocarbons is measured through change in: • Abundance • Health/condition • Nesting success. Impact to other marine reptiles from pressures including hydrocarbons is measured through change in observed injury and condition. Other pressures to these states are: • Lighting and flares causing disorientation (turtles) • Vessel strike • Physical disturbance of nesting sites • Predation • Entanglement in fishing gear and litter • Accidental chemical spillage • Habitat loss or change due to dredging • Climate change • Over-exploitation.

SMP9 - Marine Reptiles	
Methodological approach	**Abundance** In-water impacts – aerial surveys. Shoreline impacts – ground surveys (either rapid track census survey or tagging program). **Health/condition** In-water impacts – vessel surveys (collecting observations on animal condition and collection of tissue samples or dead specimens for analysis). Shoreline impacts – ground surveys (collecting observations on animal condition and collection of tissue samples or dead specimens for analysis). Dead reptiles will be collected for autopsy following Gagnon (2009) **Reproductive success** Shoreline impacts – ground surveys (detailed tagging and/or nesting success studies). Design of ground surveys for turtles will be applied as follows: • Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved, and timing allows, a post spill pre-impact approach will be attempted • If a post-spill pre-impact approach is not practicable, a gradient approach to quantifying impacts will be applied
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP9 - Marine Reptiles	
Analysis and reporting	Data will be entered to spatially explicit database. Turtle data will be analysed in order to test for significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Owing to their observational nature and potentially low sample size, observed impacts to other reptile fauna will be corroborated with marine scientist(s) with expertise in relevant fauna in the north-west of Western Australia. Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.10 SMP10 Seafood Quality

SMP10 - Seafood Quality	
Rationale	Exposure of commercial and recreationally targeted demersal and pelagic fish species to entrained and dissolved aromatic hydrocarbons can cause flesh tainting and increase the levels of toxicants above human consumption guidelines. Aromatic hydrocarbons are carcinogenic to humans. This scope includes finfish, sharks and invertebrates (principally crustacea).
Aim	To identify potential human health risks due to the presence of hydrocarbon concentrations in the flesh of targeted seafood species for consumption.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) Human health benchmarks relating to the exposure of PAHs shall be used to determine health effects as per Yender et al. (2002). Flesh samples from non-impacted sites to be used as baseline for olfactory analysis for flesh taint.
Initiation criteria	Operational monitoring and results from SMP1 predicts or observes contact of oil to target species for consumption. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP10 - Seafood Quality	
Termination criteria	Hydrocarbon concentrations in the tissues of seafood are not above levels considered a human health risk from consumption; AND Flesh taint is not detected from olfactory testing of seafood samples; AND Target species are no longer exposed to hydrocarbons in the water column.
Receptor impact	Impact to seafood quality from hydrocarbons is measured through change in: • Toxicity indicators • Olfactory taint. Other pressures to these states are: • Accidental chemical spillage • Disease.
Methodological approach	Target fish species determined from water quality monitoring results and relevant and available commercial and recreational-fished species. Sampling of target species will follow a gradient design (Gagnon and Rawson 2012) ranging from impacted to non-impacted (or non-suspect) catches using commercial and recreational fishing techniques undertaken by commercial and recreational fishers. Sampling method (netting, trawling, baited fish traps, spear fishing, line fishing) will be determined by habitat, target species and spill location. If more than one target species is affected, replicate samples of each species shall be collected, with a minimum of five replicate samples. Olfactory testing will follow Rawson et al. (Rawson et al. 2011), following the duo-trio method (Standards Australia 2005).
Scope of works	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP10 - Seafood Quality	
Analysis and reporting	Laboratories will be NATA-accredited for food standards analyses. Data will be stored in spatially explicit database and analysed in order to test for significant differences between impacted and non-impacted seafood. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.11 SMP11 Fish, Fisheries and Aquaculture

SMP11- Fish, Fisheries and Aquaculture	
Rationale	Impacts to fisheries species due to presence of entrained hydrocarbons may include lethal and sub-lethal physiological effects (e.g. reduced growth) and physical effects. The region comprises the Indo-West Pacific area which consists of a high diversity of fish species and assemblages and provides important spawning and nursery grounds for several fisheries species. Fish are concentrated in a number of biodiversity hotspots. The environment is also conducive to aquaculture including pearl production. Fisheries species that spawn or inhabit near shore areas face a greater risk to an oil spill than finfish found in deeper waters.
Aim	To monitor changes in structure and distribution of fish assemblages in relation to an oil spill and associated activities. To monitor the effect of hydrocarbon exposure and physiological condition on fisheries and aquaculture species.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM shall to be reviewed for applicable baseline data.
Initiation criteria	Operational monitoring indicates fish, fisheries or aquaculture are contacted or likely to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Fish assemblages are not statistically significantly different than those of baseline or similar non-impacted assemblages; AND Hydrocarbon concentrations, physiological condition indices, and biomarker levels in affected fish and aquaculture species are not statistically significantly different from those of non-impacted samples; AND Termination of monitoring is done in consultation with the Department of Primary Industries and Regional Development (DPIRD).

SMP11- Fish, Fisheries and Aquaculture	
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 • Over fishing • 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). Fish assemblages will be randomly sampled within discrete habitats at cross-shelf impact areas and non-impact areas. Sampling design for fish assemblages will be as follows: • Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • If baseline data is not available, a gradient approach to quantifying impacts will be applied (See Figure 1). Where relevant, data available from DPIRD, including catch/effort data, will be assessed to determine potential changes from baseline levels in fishing grounds potentially affected by an oil spill compared to after the event. For fish and aquaculture species potentially exposed to an oil spill, species will be sampled across the contamination gradient as per Gagnon and Rawson (2012). Hydrocarbon concentrations (particularly PAH) within tissues of fish and aquaculture species will be determined. Exposure to hydrocarbons on fish health will also be determine through analysis of physiological indices and biochemical markers following Gagnon and Rawson (2012). If fish kills are observed, whole specimens will be obtained and preserved (frozen) for necropsy to determine the cause of death.
Scope of works	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP11- Fish, Fisheries and Aquaculture	
Analysis and reporting	BRUV imagery will be processed using EventMeasure (SeaGIS) software. NATA-accredited laboratories will be employed for health analyses. Data will be entered to spatially explicit database and analysed to test for statistically significant differences between non-impacted and impacted fish assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.12 SMP12 Whale Shark

SMP12- Whale Shark	
Rationale	Whale sharks inhabit most of the Western Australian coast and seasonally aggregate at Ningaloo Reef in the austral autumn and winter, coinciding with a pulse of productivity following mass coral spawning in early autumn, with the population during this period dominated by juveniles (Bradley et al. 2016). In addition to the monitoring that will be undertaken as part of SMP8 Marine Megafauna, additional scientific monitoring of whale sharks along the Ningaloo Coast will be undertaken (SMP12). Santos has historically and currently supported research on the behaviour, demography and migration patterns of whale sharks at Ningaloo Reef. In the event of a spill that could impact whale sharks, Santos will leverage off this long term research program to assess potential impacts to whale sharks at, and migrating to-and-from, Ningaloo Reef. SMP12 is regarded as complementary to SMP8 which will detect potential impacts to whale sharks from visual surveys of whale sharks wherever they may occur in relation to a spill.
Aim	To quantify impacts of an oil spill on whale sharks at the Ningaloo Coast

Baseline	Baseline monitoring information of whale sharks includes: 1) Aerial survey. Monthly surveys funded by Woodside Energy were completed from 2000 to 2002. DEC undertook monthly surveys of Ningaloo Reef during the whale shark season from 2006 to 2010. The results of work funded by Woodside were published by Sleeman *et al*. (2010). Because whale sharks are not constrained to visit the surface in the same way as marine mammals, both surveys recorded relatively few whale sharks. Analysis of the DEC survey data by Professor Helene Marsh of James Cook University concluded its surveys did not account for problems of availability and perception errors and that due to the relatively low numbers of sharks available to be counted in the Ningaloo region, aerial survey was probably not an appropriate means to census these sharks (DEC pers. comm.). Note that while aerial survey techniques have shortfalls for determining abundance patterns, they are still useful for identifying aggregation sites of whale sharks in the Exmouth sub-basin. 2) Photo-identification databases. Two databases of whale sharks sighted at Ningaloo Reef are available although there is likely to be considerable overlap in their content. The first of these is held by AIMS and uses open-source software to compare and match images of sharks. Access to this database is not restricted. The second is held by Ecocean and requires user-access agreements to deposit, match and retrieve images or access metadata. The software used by Ecocean to compare images is proprietary. In the case of the AIMS database, images are available from 1992 to the present day with most of them provided by ecotourism operators at the end of each whale shark season. As part of licence agreements with DBCA, videographers working with each tourist operator must surrender footage of each shark encountered by the operator. DBCA staff then download id-images from these videos. Metadata and id-images are provided to both Ecocean and AIMS databases. These databases can be used in mark-recapture modelling frameworks to examine trends in the composition and abundance of whale sharks at Ningaloo, but outputs must be considered in the light of the caveats mentioned earlier (i.e. representativeness, sampling protocol etc.). 3) Operator and researcher trip logs. Each time a whale shark is encountered by a tourist and research vessel, or by a spotter plane, a record is kept of the location, size and sex (where possible) of the animal and the date and time. These records now exist from 1994 to the present day. These data suffer from the same caveats applicable to photo-id databases (e.g. representativeness of sampling of the entire population within the Exmouth region). Furthermore, planes do not search for animals in any formally structured manner, but rather fly up and down the reef at varying distances from the reef crest until a whale shark is sighted. If animals are sighted early in the day and all operators have completed tourist swims with sharks, then searches are terminated and the plane returns to base. Conversely, if whale sharks are difficult to find the area of search is widened and the plane will search for longer. Thus, the area and duration of searches can be highly variable. There have been changes in the format of reporting (written logs to GPS records) of encounters both by the boats and the planes through time. Finally, at times when there are few whale sharks, encounters with the same shark may be shared among tourist vessels, so that there is the possibility of double (or even triple) counting of the same shark in the database. Despite these problems, analysis of tourist industry databases have returned valuable insights into physical drivers of whale shark abundance at Ningaloo Reef (e.g. Sleeman *et al*., 2010) Other relevant baseline datasets include: 4) Sightings by the oil and gas industry. Occasional sightings of whale sharks either from the decks of oil rigs or by remotely operated vehicles (ROVs) around oil platforms and deepwater facilities have been compiled by AIMS for the past six years. No formal sampling program exists and these sightings occur largely by

SMP12- Whale Shark	
	chance, although they do indicate the presence of these animals around oil and gas facilities offshore and in deep water on the shelf. 5) Tagging data. Satellite telemetry has been used to describe the movement patterns of whale sharks along the Ningaloo coast and extending into the Timor Sea and south-east Indian Ocean. This data cannot be used to estimate patterns of abundance, but does provide important insights into the feeding, residency and migratory behaviours of sharks under 'normal' oceanographic conditions within the Exmouth sub-basin. Much of this data has been gathered by tag deployments led or assisted by AIMS. Researchers from other institutions have also deployed tags on whale sharks at Ningaloo at tracked movement, including a recent study by Ecocean/University of QLD (Reynolds et al., 2017). 6) Food chain studies. Surveys of euphausiids (a major food item of whale sharks at Ningaloo; Jarman and Wilson, 2004) and other mesoplankton in the region of Ningaloo Reef have been published by Wilson et al. (2001; 2003). Preliminary work on the food chains leading to the prey of whale sharks is underway (Marcus et al., 2016, 2019). This ongoing research may identify the physical and biological factors correlated with whale shark abundance at Ningaloo and thus result in a better understanding of variability in the ecosystem. Such information is essential if the effects of an oil spill or development are to be discerned against a background of natural changes in distribution and abundance of whale sharks.
Initiation criteria	Operational monitoring indicates that Ningaloo Coast whale shark aggregations are contacted or predicted to be contacted by oil. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	The termination criteria for this monitoring program are: • Measured parameters of whale shark abundance and distribution are not significantly different to baseline levels ; **AND** • The water quality at feeding/ aggregation sites has been measured as not significantly different to baseline levels.
Methodological approach	During spill activities may require the following surveys and sampling: • Aerial surveys • Satellite tagging • Toxicology • Food chain studies • Photo-identification • Vessel and plane logs • Acoustic tagging The methodologies adopted will follow the approaches of those baseline studies identified allowing consistency of data from baseline to impact and recovery phases.
Scope of works	Prepared within 24 hours of this SMP being activated
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been approved
Analysis and reporting	Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

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Appendix O: SMP Activation Process

Oil Spill Scientific Monitoring Activation and Response Process

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
Phase 1 – Activation					
1	Santos IMT (Environmental Team Leader (ETL))	Astron Monitoring Coordinator notified of incident.	On approval from Santos Incident Commander	Astron oil spill response phone number and answering service	
2	Astron Monitoring Coordinator (MC)	Call back client for further details, request *Activation Form* if not received.	Within 30 minutes of receiving initial notification	Activation Form	
3	Astron MC	Call Planning & Logistics Officer to advise of incident.	Immediately following Step 2	n/a	
4	Santos IMT (ETL)	Complete *Activation Form* and submit to Astron via email.	Within one hour following initial notification (Step 2)	Activation Form	
5	Astron Planning & Logistics Officer (PLO)	Notify MCT, Technical Advisors and key subcontractors via SMS Global.	Within 30 minutes of Step 3	SMS Global Guidance	
6	Astron PLO	Notify all staff of incident via SMS Global.	Within one hour of receiving Activation Form	SMS Global Guidance	
Phase 2 – Response Planning					
7	Astron MC	Maintain verbal communication with Santos IMT (ETL).	At least twice daily (0800 and 1700)	n/a	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
8	Astron MC Astron Operations Officer Astron PLO	Maintain Functional Log.	Daily	Functional Log	
9	Astron PLO	Set up Command Room.	Within 4 hours of activation (Step 5)	Command Room Resource Checklist	
10	Astron MC, PLO and BMT Oceanica Operations Officer	Attend Santos incident briefing and relay information to MCT.	As advised by the Santos IMT (ETL)	n/a	
11	Astron Operations Officer	MCT and Technical Advisors to meet at Royal St office, review personnel and equipment resource status.	Within 6 hours of activation (Step 5)	Capability report Training matrix Resource chart	
12	Astron PLO	Confirm availability of additional personnel and equipment resources.	Within 16 hours of activation (Step 5)	External Supplier Details Requisition Request Form	
13	Santos IMT (ETL)	Provide spill trajectory modelling and sensitive receptor information to Astron.	When available	APASA modelling Department of Transport database Santos GIS Mapping	
14	Astron MC in consultation with Santos ETL	Define the scale of response - identify which SMPs are activated. Identify if operational water quality monitoring is required.	Within 2 hours of receiving spill and receptor information (Step 13).	Scientific Monitoring Plan* Relevant OPEP Spill trajectory modelling Operational monitoring results	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
15	Astron Technical Advisors in consultation with Santos ETL	**Determine monitoring locations for activated SMPs:** • Identify monitoring locations in order of priority for activated SMPs based on: o nature of hydrocarbon spill o spill trajectory modelling and time to shoreline impacts o sensitive receptors impacted or potentially at risk of being impacted o state of current baseline data o current environmental conditions o current results of operational monitoring. • Determine if post-spill pre-impact data is required to be collected from any locations. See SMP Work Method Statements for decision making process when considering availability of baseline data.	Within 6 hrs of relevant SMP activation (Step 14).	Relevant SMPs Information from Astron: • baseline information for relevant receptors. Information from Santos IMT: • sensitive receptor information from relevant EP, Santos GIS mapping and online resources (DoT oil spill response atlas, DoE conservation values atlas) • oil spill trajectory modelling • response strategies and priority protection areas • results from OMPs currently activated • baseline information for relevant receptors as reference in the relevant SMP.	
16	Astron Technical Advisors in consultation with Santos ETL	Submit Department of Parks and Wildlife Licence applications	Within 12 hrs of relevant SMP activation (Step 14)	• Proposed monitoring locations • SMP methods	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
17	Astron Operations Officer, PLO & Technical Advisors in consultation with Santos ETL	**Determine personnel requirements:** • Identify number and competencies of personnel required for monitoring teams for each SMP based on: o activated SMPs o number of locations to be monitored o number of locations where pre-spill baseline data needs to be collected o timing of hydrocarbon spill and overlap with sensitive receptors in activated SMPs o logistical and equipment resource constraints. • Arrange additional personnel if required.	Within 12 hrs of activation if pre-impact data is needed.**	Information from Astron: • Capability report • Training matrix • Resource chart • relevant SMPs and WMS. Information from Santos IMT: • sensitive receptor information • oil spill trajectory modelling • response strategies and priority protection areas • equipment (i.e. vessels, aircraft) availability • logistics (availability of flights, accommodation, etc).	
18	Astron Operations Officer, PLO & Technical Advisors in consultation with Santos ETL	**Determine equipment requirements:** • Identify number and competencies of equipment required for each SMP based on: o activated SMPs o number of locations to be monitored o number of field teams and timing of mobilisation to the field o logistical and equipment resource constraints. • Arrange additional equipment resources if required.	Within 12 hrs of activation if pre-impact data is needed.**	Information from Astron: • Resource chart • relevant SMPs and WMS. Information from Santos IMT: • equipment (i.e. vessels, aircraft) availability • logistics (availability of flights, accommodation, etc).	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
19	Astron MC, Operations Officer, PLO & Technical Advisors	**Prepare and submit Monitoring Action Plan** (mission, objectives, strategies, tactics, tasks), including scope of works. **Prepare and submit cost estimate.** **Prepare and submit logistics request:** • Allocate personnel and equipment resources to field teams for relevant SMPs. • Submit SOW and logistics request for each activated SMP to Santos IMT for approval.	Within 24hrs of request for SoW (Step 15) for relevant SMP if pre-impact data is needed.**	Information from Astron: • Resource chart • relevant SMPs and WMS • agreed monitoring locations • Mobilisation and Logistics Form (incorporating SOW) • Monitoring Action Plan. Information from Santos IMT: • request for SoW • agreed monitoring locations.	
20	Santos IMT (ETL)	Santos to approve SOW, provide purchase order and initiate logistical arrangements.	Within 24 hours of SOW submission (Step 19).	Astron Mobilisation and Logistics Request	
21	Astron MC	Advise field personnel by email meeting invite, or phone if not in office.	Within 24 hours of SOW approval (Step 20).	Field team allocation	
22	Astron	Conduct incident briefing with all available Astron personnel.	Within 24 hours of SOW approval (Step 22).	Briefing template Monitoring Action Plan	
Phase 3 – Mobilisation					
24	Astron PLO	GIS and device preparation requests (field maps, data capture) submitted, and discussed with Geospatial team.	Within 24 hours of SOW approval (Step 22).	https://voyager/	
25	Astron Operations Officer	Conduct field team overview briefing, allocate tasks.	Within 36 hours of SOW approval (Step 22).	Briefing Template	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
26	Field Team Leaders	Compile SMP grab packs, GIS information, field equipment, and prepare and submit HSE documentation to Santos IMT.	Within 48 hours of SOW approval (Step 22).	Information from Astron • SoW • Grab packs, SMP WMS and HSE documentation • GIS information/field maps • field equipment. Information from Santos IMT: • booking and logistics confirmations.	
27	Astron Technical Advisors	Conduct scope specific pre-mobilisation briefings.	Prior to mobilisation.	Pre-mob Briefing Template	
28	Santos ETL	Santos to approve HSE plan.	Within 24 hours of receiving HSE Plan.	Mobilisation and Logistics Form HSE plan	
29	Astron PLO	Personnel mobilised to site.	Within 72 hrs of SOW approval (Step 22) if pre-impact data is needed.**	Approved SOW	
Phase 4 – Response Operations					
30	Astron MC	Conduct Monitoring Action Plan review with MCT and Technical Advisors and communicate to Santos IMT (ETL).	Daily	Monitoring Action Plan template	
31	Astron PLO	Hold post-demobilisation debrief with field teams.	Within 3 days of demobilisation.	Demob Meeting Template	
32	Santos ETL	Santos to arrange approval of Monitoring Action Plan revisions and any additional mobilisation/logistics requirements.	Daily or as required	Monitoring Action Plan Mobilisation and Logistics Form	
33	Astron Field Team Leaders	Provide activity reports to Santos ETL.	Daily	Daily Activity Report Template	

[#] Timeframes are indicative and may be require adjustment where activities are dependent on information availability or affected by logistical constraints

*The Scientific Monitoring Plan (EA-00-RI-10099) provides the most up to date list of SMPs and activation criteria. Refer to the OPEP for operational water quality monitoring requirements.

**If post-spill, pre-impact data is not required then timeframes will be specific to each SMP. The lead times for resourcing, preparation of SoW and mobilisation of field teams may be longer depending on the timing of the spill, likely trajectory and life stages of receptors present or likely to be impacted.

For example, in SMP4 if post-spill, pre-impact data collection is not required then mangrove decline is likely to take several weeks to occur and there is lower priority for mobilisation of field teams for this SMP within the 72 hr timeframe. In this case, mobilisation within 30 days may be more appropriate.

Abbreviations

EMBA – Environment that May Be Affected
IMT – Incident Management Team
OMP – Operational Monitoring Program
OPEP – Oil Pollution Emergency Plan
Santos – Santos Energy Australia Limited
SMP – Scientific Monitoring Plan/Program
SoW – Scope of Works
WMS – Work Method Statement

Appendix P: Scientific Monitoring Capability

Scientific Monitoring Assurance and Capability Assessment

1.1 Assurance arrangements

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

Assurance on the continued maintenance of capability is provided through the delivery of monthly capability reports. These reports are generated by the Astron and BMT Planning and Logistics Officers and delivered to the Santos Spill Response Adviser along with a summary of any changes in resourcing or, and if required, how gaps in resourcing have been managed. Since the establishment of the scientific monitoring contract in 2015 Astron has always demonstrated through this process that it has the required capability to meet first strike resourcing as per the standby services contract.

Santos ensures that Astron/BMT standby arrangements are adequate through its exercise and auditing program. Santos regularly conducts exercises and tests with Astron and BMT to ensure that Santos IMT roles and Astron/BMT monitoring roles are familiar with the SMP activation arrangements while providing spot checks on resource availability. Santo WA has also 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.

1.2 Continuous improvement

Santos WA is committed to further improving its oil spill scientific monitoring capability. To that end, Santos is participating in a Joint Industry Operational and Scientific Monitoring Plans (OSMP) project, governed through an APPEA-Industry Steering Committee. This project, being progressed throughout 2020, 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.

1.3 Baseline Data and Capability Assessment

Santos WA is currently committed to undertaking a review of the status, availability, currency and suitability of existing baseline data for oil spill scientific monitoring sources every 2 years. The latest review was undertaken in March 2019 by Astron (Baseline Data Review document QE-00-BI-20001) and looked at all high biodiversity value receptors in the Santos WA EMBA. Following this an additional assessment was undertaken in September 2019 (DC-40-RI-20017) to determine whether existing baseline data is sufficient and accessible for sensitive receptors that could be impacted from worst case Commonwealth waters spills scenarios associated with operational activities at or around Devil Creek pipeline/Reindeer platform, Varanus Island and Ningaloo Vision facilities. This study concentrated on sensitive receptor areas with minimum hydrocarbon contact times of less than seven days as indicated by stochastic spill modelling; it is considered that contact within seven days would require an enhanced understanding of available baseline data to ensure a timely response.

The assessment of baseline data included:

1. A review of the following parameters for each program identified:
    - IMCRA

- Custodian- contact point for data
- Spatial extent
- Variables available for monitoring
- Methods applied to monitoring
- Year of most recent data capture
- Total duration of monitoring program
- Data completeness (number of years monitored as proportion of program duration)
- How often data is captured
- Appropriateness of variables (Judgement as to whether variables are appropriate for future oil spill monitoring)
- Is there any clear indication that the monitoring will continue?

2. The quality of the following parameters were then ranked as high, medium, low or unknown:
    I. Year of most recent capture:
        - 2015-2018 (if a single data capture has occurred in the last two years, then the overall program can be considered of high quality) = high
        - 2009-2014 = medium
        - <2009 = low
    II. Duration:
        - >4 years = high
        - 2-4 years = medium
        - 1 year = low
    III. Data completeness:
        - 100% = high
        - 75-99% = medium
        - <75% = low
    IV. Frequency of capture
        - Annually = high
        - Bi-annually = medium
        - <Bi-annually = low
    V. Appropriateness of parameters
        - High/medium/low

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

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

The above assessment process was also performed across monitoring programs which specified at least one of the priority target areas within their monitoring sites. For Priority target areas, the above assessment was then used to determine if 1) the baseline data available could be used to detect change in the state in the event of a significant impact - Classified as "good" in the above assessment (ie., 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 (ie., the data was dated, infrequent, of limited duration and/or relied on inappropriate methodologies). Following this assessment a Protection Priority Area by SMP matrix summarising recommendations on baseline data status and recommendations for further action was developed (Table 1) based on three categories:

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

The assessment determined for the majority of sensitive receptors within the target areas (Montebello Islands, Barrow Island, Lowendal Islands, Ningaloo, Muiron Islands and Dampier Archipelago) post-spill pre-impact monitoring should be prioritised, noting that alternative approaches exist for detecting impacts where it is not feasible to conduct first-strike pre-impact baseline surveys, for example, impact versus multiple control sites and/or a gradient approach. These experimental design approaches are described within the Oil Spill Scientific Monitoring Plan (EA-00-RI-10099).

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

SMP	Priority target areas					
	Montebello Islands	Barrow Island	Lowendal Islands	Ningaloo	Muiron Islands	Dampier Archipelago
Water Quality (SMP1)	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
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Mangroves (SMP4)	Survey	Survey	Survey	Survey	Not applicable	Survey
Intertidal Mudflats (SMP5)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Benthic Habitats (SMP6)	Priority survey	Survey	Priority survey	Survey	Survey	Priority survey
Seabirds/ shorebirds (SMP7)	Priority survey	Survey	Survey	Survey	Survey	Priority survey
Marine mammals (SMP8)	Survey	Not applicable	Priority survey	Survey	Not applicable	Survey
Marine reptiles (SMP9)	Priority survey	Survey	Survey	Survey	Survey	Survey
Seafood Quality (SMP10)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Fish, Fisheries & Aquaculture (SMP11)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Whale sharks (SMP12)	Not applicable	Not applicable	Not applicable	Survey	Not applicable	Not applicable

Based on the assessment of priority survey areas/receptors outlined in **Table 1** a capability assessment was undertaken to understand whether existing scientific monitoring capability would be sufficient to mount a first-strike monitoring program to gather baseline data within a short-timeframe (<7 days), noting that in the event of very short contact timeframes mobilisation of scientific monitoring teams to priority receptor sites may not be possible within contact timeframes and experimental designs not relying on pre-impact baseline would have to be employed.

Given that **Table 1** lists Protection Priority areas that could be contacted within 7 days based on stochastic modelling data (i.e. the outcomes of 100s of spill modelling simulations rather than a single spill event) it was not considered appropriate or credible that baseline monitoring would have to occur at all areas over this timeframe. For the purposes of the assessment it was considered credible that only one of the three broad regions: 1) Barrow/ Montebello/ Lowendal Islands; 2) Ningaloo Coast/ Muiron Islands or; 3) Dampier Archipelago would potentially require priority baseline monitoring within the 7 day time period.

The results of the capability assessment for each of the three broad regions is provided in **Table 2** to **Table 4,** outlining the required capability vs actual availability from Astron/BMT to provide personnel. The capability to overlap teams across SMPs within the same region has been identified where possible. Based on this analysis the current availability through Santos' contracted monitoring providers is considered sufficient to collect baseline data at priority areas as part of a first-strike response.

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

Table 2: Scenario 1 capability assessment for rapid sampling of Montebello/Barrow/Lowendal Islands area within seven days.

Receptors	Priority target areas			Required capability for rapid response	Actual capability
	Montebello Islands	Barrow Island	Lowendal Islands		
Water Quality (SMP1)	Priority survey	Priority survey	Priority survey	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	19 potential field team members (all Field Team Leader (FTL) capable)
Sediment Quality (SMP2)	Priority survey	Priority survey	Priority survey		
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	Priority survey	Priority survey	2 teams of 2 personnel • at least one team member with experience in shoreline macrofauna/infauna assessment	19 potential field team members (9 FTL, 4 Moderate Experience, 4 Low Experience, 2 Relevant Experience)
Intertidal Mudflats (SMP5)	Priority survey	Priority survey	Priority survey		
Mangroves (SMP4)	Survey	Survey	Survey	Not required[3]	Not required
Benthic Habitats (SMP6)	Priority survey	Survey	Priority survey	2 teams of 2 personnel • at least one team member with experience in benthic habitat assessment • ROV operator or divers	19 potential field team members (15 FTLs, 4 Moderate Experience)
Seabirds/ shorebirds (SMP7)	Priority survey	Survey	Survey	1 ground-based survey team of 2 personnel[2] • at least one member be experienced ornithologist	10 potential field team members (4 FTLs (experienced ornithologists), 4 Moderate Experience, 2 Low Experience)
Marine mammals (SMP8)	Survey	Not applicable	Priority survey	1 aerial survey team of 2 personnel[1] • both to be experienced wildlife observers 1 vessel-based survey team of 2 personnel[1] both to be experienced wildlife observers	9 potential field team members (7 FTLs (experienced wildlife observers), 2 Relevant Experience)

Receptors	Priority target areas			Required capability for rapid response	Actual capability
	Montebello Islands	Barrow Island	Lowendal Islands		
Marine reptiles (SMP9)	Priority survey	Survey	Survey	1 aerial survey team of two personnel[1] • both to be experienced wildlife observers 1 vessel-based survey team of two personnel[1] • both to be experienced wildlife observers 1 ground-based survey team of 2 personnel[2] • at least one member with experience in turtle survey techniques	14 potential field team members (9 FTLs (7 experienced wildlife observers and 2 turtle survey experience), 5 Relevant Experience)
Seafood Quality (SMP10)	Priority survey	Priority survey	Priority survey	2 teams of 3 personnel • at least one member to have experience in fish identification and necropsy • at least one member to have BRUV experience	19 potential field team members (3 FTLs, 12 Moderate Experience and 4 Low Experience) plus subcontractor support where required (up to 5 FTLS available for field)
Fish, Fisheries & Aquaculture (SMP11)	Priority survey	Priority survey	Priority survey		
Whale sharks (SMP12)	Not applicable	Not applicable	Not applicable	Not required	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 at Montebello Islands 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.

Table 3: Scenario 2 capability assessment for rapid sampling of Ningaloo coast and Muiron Islands area within seven days.

Receptors	Priority target areas		Required capability for rapid response	Actual capability
	Ningaloo	Muiron Islands		
Water Quality (SMP1)	Priority survey	Priority survey	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	19 potential field team members (all Field Team Leader (FTL) capable)
Sediment Quality (SMP2)	Priority survey	Priority survey		
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	Priority survey	2 teams of 2 personnel • at least one team member with experience in shoreline macrofauna/infauna assessment	19 potential field team members (9 FTL, 4 Moderate Experience, 4 Low Experience, 2 Relevant Experience)
Intertidal Mudflats (SMP5)	Priority survey	Priority survey		
Mangroves (SMP4)	Survey	Survey	Not required[1]	Not required
Benthic Habitats (SMP6)	Survey	Survey	2 teams of 2 personnel • at least one team member with experience in benthic habitat assessment • ROV operator or divers	19 potential field team members (15 FTLs, 4 Moderate Experience)
Seabirds/ shorebirds (SMP7)	Survey	Survey	Rapid priority response not required	Not required
Marine mammals (SMP8)	Survey	Not applicable	Rapid priority response not required	Not required
Marine reptiles (SMP9)	Survey	Survey	Rapid priority response not required	Not required
Seafood Quality (SMP10)	Priority survey	Priority survey	2 teams of 3 personnel • at least one member to have experience in fish identification and necropsy • at least one member to have BRUV experience	19 potential field team members (3 FTLs, 12 Moderate Experience and 4 Low Experience) plus subcontractor support where required (up to 5 FTLS available for field)
Fish, Fisheries & Aquaculture (SMP11)	Priority survey	Priority survey		
Whale sharks (SMP12)	Survey	Not applicable	Rapid priority response not required	Not required

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

Table 4: Scenario 2 capability assessment for rapid sampling of Dampier Archipelago area within seven days.

Receptors	Priority target area	Required capability for rapid response	Actual capability
	Ningaloo		
Water Quality (SMP1)	Priority survey	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	19 potential field team members (all Field Team Leader (FTL) capable)
Sediment Quality (SMP2)	Priority survey		
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	2 teams of 2 personnel • at least one team member with experience in shoreline macrofauna/infauna assessment	19 potential field team members (9 FTL, 4 Moderate Experience, 4 Low Experience, 2 Relevant Experience)
Intertidal Mudflats (SMP5)	Priority survey		
Mangroves (SMP4)	Survey	Not required[1]	Not required
Benthic Habitats (SMP6)	Priority survey	2 teams of 2 personnel • at least one team member with experience in benthic habitat assessment • ROV operator or divers	19 potential field team members (15 FTLs, 4 Moderate Experience)
Seabirds/ shorebirds (SMP7)	Priority survey	1 ground-based survey team of 2 personnel • at least one member be experienced ornithologist	10 potential field team members (4 FTLs (experienced ornithologists), 4 Moderate Experience, 2 Low Experience)
Marine mammals (SMP8)	Survey	Rapid priority response not required	Not required
Marine reptiles (SMP9)	Survey	Rapid priority response not required	Not required
Seafood Quality (SMP10)	Priority survey	2 teams of 3 personnel • at least one member to have experience in fish identification and necropsy • at least one member to have BRUV experience	19 potential field team members (3 FTLs, 12 Moderate Experience and 4 Low Experience) plus subcontractor support where required (up to 5 FTLS available for field)
Fish, Fisheries & Aquaculture (SMP11)	Priority survey		
Whale sharks (SMP12)	Not applicable	Not required	Not required

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