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Oil Spill Preparedness and Response Mitigation Assessment for Scarborough Seabed Intervention and Trunkline Installation

Security & Emergency Management
Hydrocarbon Spill Preparedness

December 2021
Revision 0

TABLE OF CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

Woodside Energy Scarborough Pty Ltd (Woodside) has developed its oil spill preparedness and response position for the Scarborough Seabed Intervention and Trunkline Installation, hereafter known as the Petroleum Activities Program (PAP) techniques. This document demonstrates that the risks and impacts from an unplanned hydrocarbon release, and the associated response operations, are controlled to As Low as Reasonably Practicable (ALARP) and Acceptable levels. It achieves this by evaluating response options to address the potential environmental impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the Environment Plan (EP).

This document then outlines Woodside's decisions and techniques for responding to a hydrocarbon release event and the process for determining its level of hydrocarbon spill preparedness. A summary of the key facts and references to additional detail within this document are presented below.

Table 0-1: Summary of the key details for assessment

<table>
<tr><th>Key details of assessment</th><th colspan="2">Summary</th><th>Reference to additional detail</th></tr>
<tr><td>Worst Case Credible Scenario</td><td colspan="2">Credible Scenario-01 (CS-01): A short-term (instantaneous) surface release of 2000 m^3 of marine diesel from a vessel collision outside Mermaid Sound.
Credible Scenario-02 (CS-02): A short-term (instantaneous) surface release of 2000 m^3 of marine diesel from a vessel collision within Montebello Marine Park.
Credible Scenario-03 (CS-03): A short-term (instantaneous) surface release of 2000 m^3 of marine diesel from a vessel collision in the Scarborough field (at the proposed Floating Production Unit (FPU) location).</td><td>Section 2.2</td></tr>
<tr><td>Hydrocarbon Properties</td><td colspan="2">Under constant 5 kn wind conditions approximately 45% of the oil is predicted to evaporate within 24 hours. The majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes.
Under variable wind conditions where winds are of a greater strength, more entrainment of oil into the water column is predicted (about 45% after 24 hours). A further 35% is forecast to evaporate, leaving only a small proportion of the oil floating on the water surface (<1%).</td><td>Section 6.7.2 of the EP

Appendix A of the First Strike Plan</td></tr>
<tr><td rowspan="5">Modelling Results</td><td colspan="2">A quantitative, stochastic assessment has been undertaken for credible spill scenarios to help assess the environmental risk of a hydrocarbon spill.
A total of 100-200 replicate simulations were completed for the scenarios to test for trends and variations in the trajectory and weathering of the spilled oil, with an even number of replicates completed using samples of metocean data that commenced within each calendar quarter.
Deterministic modelling was conducted for CS-01 and CS-02 following assessment of stochastic modelling. Shoreline contact above 100 g/m^2 was not predicted from stochastic modelling of CS-02 or CS-03.</td><td>Section 2.3</td></tr>
<tr><td colspan="2">Deterministic Modelling Results</td><td rowspan="4"></td></tr>
<tr><td colspan="2">CS-01 (Outside Mermaid Sound)</td></tr>
<tr><td>Minimum time to shoreline contact (above 100 g/m^2)</td><td>Dampier Archipelago – 53 hours (2.2 days)</td></tr>
<tr><td>Largest volume ashore at any single Response</td><td>Dampier Archipelago – 3 m^3</td></tr>
</table>

	Priority Area (RPA) (above 100 g/m^2)		
	Largest total shoreline accumulation (above 100 g/m^2) all shorelines	Dampier Archipelago – 156 g/m^2	
Net Environmental Benefit Analysis	Identified as potentially having a net environmental benefit (dependent on the actual spill scenario) and carried forward for further assessment are: • Monitor and evaluate • Shoreline clean-up • Source control via vessel SOPEP (Ship Oil Pollution Emergency Plan) • Oiled wildlife response • Shoreline protection and deflection • Scientific monitoring programs		**Section 4**
ALARP evaluation of selected response techniques	The evaluation of the selected response techniques shows the proposed controls reduced the risk to an ALARP and acceptable level for the risk are presented in **Section 2**, without the implementation of considered additional, alternative or improved control measures.		**Section 6**

1 INTRODUCTION

1.1 Overview

Woodside Energy Scarborough Pty Ltd (Woodside) has developed its oil spill preparedness and response position for the Scarborough Seabed Intervention and Trunkline Installation activity, hereafter known as the Petroleum Activities Program (PAP). This document outlines Woodside's decisions and techniques for responding to a hydrocarbon loss of containment event and the process for determining its level of hydrocarbon spill preparedness.

1.2 Purpose

This document, together with the documents listed below, meet the requirements of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS Environment Regulations) relating to hydrocarbon spill response arrangements.

- The Scarborough Seabed Intervention and Trunkline Installation Environment Plan (EP)
- Oil Pollution Emergency Arrangements (OPEA) (Australia)
- The Scarborough Seabed Intervention and Trunkline Installation Oil Pollution Emergency Plan (OPEP) including
  - First Strike Response Plan
  - Relevant Operations Plans
  - Relevant Tactical Response Plans (TRPs, also see ANNEX E)
  - Relevant Supporting Plans
  - Data Directory

The purpose of this document is to demonstrate that the risks and impacts from an unplanned hydrocarbon release and the associated response operations are controlled to As Low as Reasonably Practicable (ALARP) and Acceptable levels.

1.3 Scope

This document demonstrates that the risks and impacts from an unplanned hydrocarbon release, and the associated response operations, are controlled to ALARP and Acceptable levels. It achieves this by evaluating response options to address the potential environmental risks and impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the EP. This content of this document then outlines Woodside's decisions and techniques for responding to a hydrocarbon release event and the process for determining its level of hydrocarbon spill preparedness. It should be read in conjunction with the documents listed in Table 1-1. The location of the Petroleum Activity Program (PAP) is shown in Figure 3-2 of the EP.

1.4 Oil spill response document overview

The documents outlined in Table 1-1 and Figure 1-1 are collectively used to manage the preparedness and response for a hydrocarbon release.

The Oil Pollution First Strike Plan (FSP) contains a pre-operational Net Environmental Benefit Analysis (NEBA) summary, outlining the selected response techniques for this PAP. Relevant Operational Plans to be initiated for associated response techniques are identified in the FSP and relevant forms to initiate a response are appended to the FSP.

The process to develop an Incident Action Plan (IAP) begins once the Oil Pollution FSP is underway. The IAP includes inputs from the Monitor and Evaluate (ME) operations and the operational NEBA

(Section 4). Planning, coordination and resource management are initiated by the Incident Management Team (IMT). In some instances, technical specialists may be utilised to provide expert advice. The planning may also involve liaison officers from supporting government agencies.

During each operational period, field reports are continually reviewed to evaluate the effectiveness of response operations. In addition, the operational NEBA is continually reviewed and updated to ensure the response techniques implemented continue to result in a net environmental benefit (see **Section 4**).

The response will continue as described in **Section 5** until the response termination criteria have been met, as set out in ANNEX B: Operational Monitoring Activation and Termination Criteria.

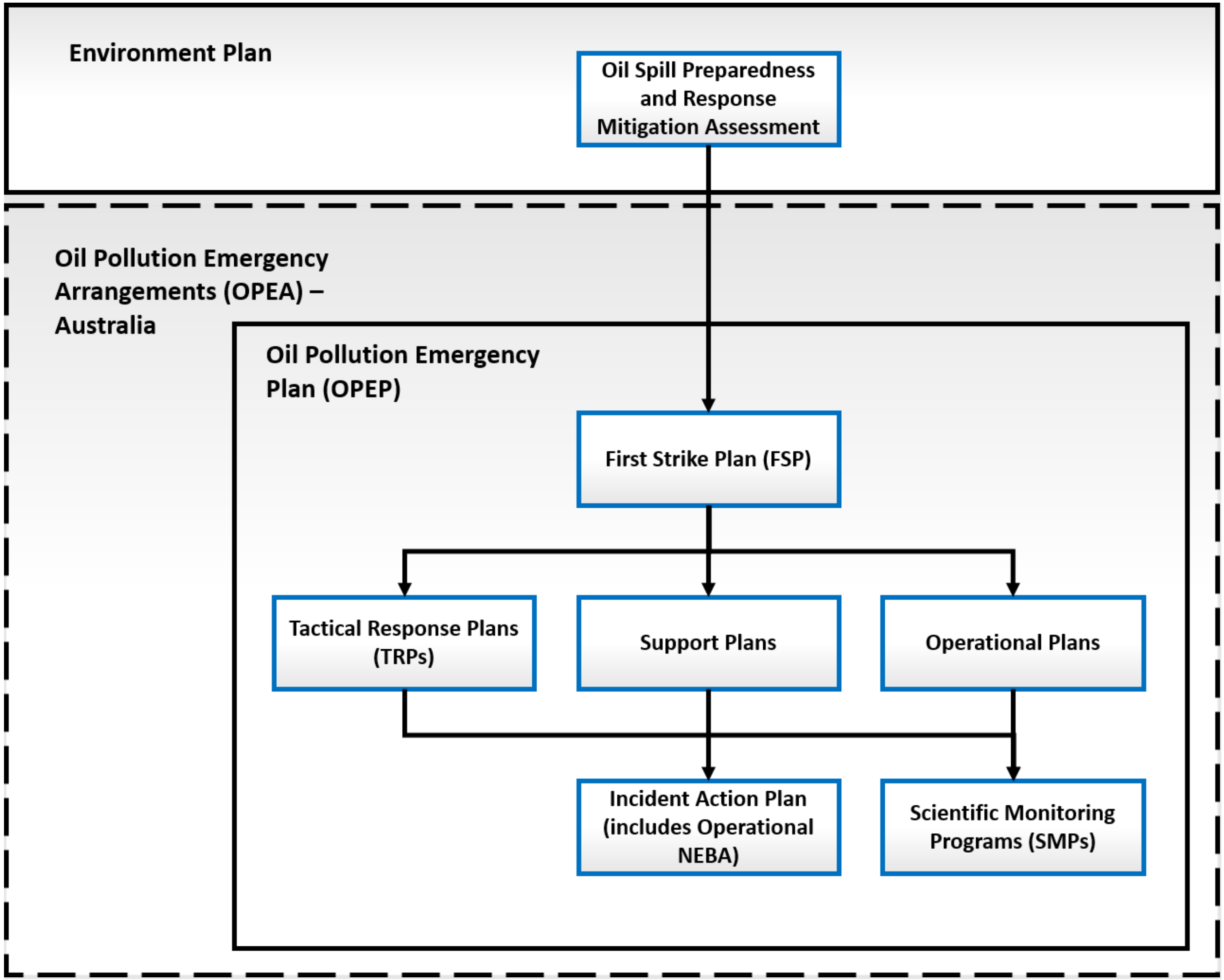


Figure 1-1: Example of Woodside hydrocarbon spill document structure

Table 1-1: Hydrocarbon Spill preparedness and response – document references

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
Scarborough Seabed Intervention and Trunkline Installation Environment Plan (EP)	Demonstrates that potential adverse impacts on the environment associated with the Scarborough Seabed Intervention and Trunkline Installation (during both routine and non-routine operations) are	NOPS EMA Woodside internal	EP Section 6 (Identification and evaluation of environmental risks and impacts, including credible spill scenarios) EP Section 7 (Implementation strategy) including: EP Section 7.9 – (Emergency preparedness	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	mitigated and managed to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level.		and response) EP Section 7.8 (Reporting and compliance) EP Section 7.9 (Performance outcomes, standards and measurement criteria)	
Oil Pollution Emergency Arrangements (OPEA) Australia	Describes the arrangements and processes adopted by Woodside when responding to	Regulatory agencies Woodside internal	All	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	a hydrocarbon spill from a petroleum activity.			
Oil Spill Preparedness and Response Mitigation Assessment for the Scarborough Seabed Intervention and Trunkline Installation (this document)	Evaluates response options to address the potential environmental impacts resulting from an unplanned loss of hydrocarbon containment associated with the	Regulatory agencies Corporate Incident Control Centre (CICC): Control function in an ongoing spill response for activity-specific response information.	All Performance outcomes, standards and measurement criteria related to hydrocarbon spill preparedness and response are included in this document.	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	PAP described in the EP.			

Scarborough Seabed Intervention and Trunkline Installation Oil Pollution First Strike Response Plan	Facility specific document providing details and tasks required to mobilise a first strike response. Primarily applied to the first 24 hours of a response until a full Incident Action Plan (IAP) specific to the event is developed. Oil Pollution First	Site-based IMT for initial response, activation and notification. CICC for initial response, activation and notification. CICC: Control function in an ongoing spill response for activity-specific response information.	Initial notifications and reporting required within the first 24 hours of a spill event. Relevant spill response options that could be initiated for mobilisation in the event of a spill. Recommended pre-planned tactics. Details and forms for use in immediate response. Activatio	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	Strike Response Plans are intended to be the first document used to provide immediate guidance to the responding Incident Management Team (IMT).		n process for oil spill trajectory modelling (OSTM), aerial surveillance and oil spill tracking buoy details.	
Operational Plans	Lists the actions required to activate, mobilise and deploy personnel and	CICC: Operations and Logistics functions for first strike activities.	Locations from where resources may be mobilised. How resources will be	Operational monitoring plan Protection and deflection Shoreline clean-up Oiled wildlife Scientific monitoring

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	resources to commence response operations. Includes details on access to equipment and personnel (available immediately) and steps to mobilise additional resources depending on the nature and	CICC: Planning Function to help inform the IAP on resources available.	mobilised. Details of where resources may be mobilised to and what facilities are required once the resources arrive. Details on how to use resources to undertake a response.	

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
	scale of a release. Relevant operational plans will be initially selected based on the Oil Pollution First Strike Plan; additional operational plans will be activated depending on the nature and scale of the release.			

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
Tactical Response Plans	Provides options for response techniques in selected RPAs. Provides site, access and deployment information to support a response at the location.	CICC: Planning Function to help develop IAPs, and Logistics Function to assist with determining resources required.	Indicative response techniques. Access requirements and/or permissions. Relevant information for undertaking a response at that site. Where applicable, may include equipment deployment locations and site layouts.	For full list of relevant Tactical Plans for the Scarborough Development oil spill response, refer to References AAM (2014) RapidEye satellite images were captured along the coastline of Central/ Northern, Western Australia in between September 2011 to April 2014. Advisian (2021) Northwest Marine Region Seabird and Shorebird Baseline and Threats Review. Report to Woodside. Advisian (2019) Montebello Marine Park Benthic Habitat Survey ROV Analysis of the Scarborough Pipeline Route. Report Prepared for Woodside Energy Ltd. 183 pp. Abdul Wahab, M, A., Radford, B., Cappo, C., Colquhoun, J., Stowar, M., Depczynski, M., Miller, K and Heyward, A. (2018). Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems. *Coral Reefs*. Vol. 37, Issue 2, pp. 327-343. https://doi.org/10.1007/s00338-017-1655-9 AIMS (2010) Reefs: Ningaloo Reef Biodiversity Expeditions (2008-2010). http://www.aims.gov.au/creefs AIMS (2014a). AIMS 2013 Biodiversity Survey of Glomar Shoal and Rankin Bank. Report prepared by the Australian Institute of Marine Science for Woodside Energy Ltd. Australian Institute of Marine Science, Townsville. October 2014 Rev 1,153pp. AIMS (2014b). AIMS 2014 Extended Benthic Models and Habitat Maps of Rankin Bank. Report prepared by the Australian Institute of Marine Science for Woodside Energy Ltd. Australian Institute of Marine Science, Townsville. December 2014 Rev 0 (43pp.). AIMS (2015). Ningaloo and Outer Shark Bay Baseline Survey 2014. AIMS Field Report for Woodside. 21 pp. Co-funded Baseline Surveys (November-December 2014). AIMS (2017) Juvenile fish recruitment surveys, Ningaloo Reef, Western Australia (WAMSI Node 3 Project 3.1.2). https://data.gov.au/dataset/juvenile-fish-recruitment-surveys-ningaloo-reef-western-australia-wamsi-node-3-project-3-1-2 AMOSC/DPAW (2014). Inter-Company Oil Spill Wildlife Response Plan – Pilbara region. pp. 272 http://www.dpaw.wa.gov.au/images/documents/conservation-management/marine/wildlife/PROWRP_20141103.pdf

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Astron Environmental Service (2014). Exmouth Islands Turtle Monitoring Program January 2014 Field Survey. Report prepared on behalf of Apache Energy/Quadrant Energy (now Santos). Babcock R, Donovan A, Collin S and Ochieng-Erftemeijer C (2017). Pilbara Marine Conservation Partnership – Final Report – Volume 2 (Part III: Coral Reef Health). CSIRO Oceans & Atmosphere, Published Brisbane. https://research.csiro.au/pmcp/pmcp-publications/ Bancroft, K.P. (2009). Establishing long-term coral community monitoring sites in the Montebello/ Barrow Islands marine protected areas: data collected in December 2006. Marine Science Program Data Report Series MSPDR4. January 2009. Marine Science Program, Science Division, Department of Environment and Conservation, Perth, Western Australia. 68p. Bamford M.J. (2004). Gorgon Development on Barrow Island. Technical Report: Avifauna Bamford and Moro (2011). Barrow Island as an important bird area for migratory waders in the East Asian – Australasian Flyway. Stilt 60: 46–55 BirdLife Australia (2018) Seabird and Shorebird Baseline Studies, Ningaloo Region – Report on January 2018 bird surveys. Interim Report for Woodside Energy Ltd. BirdLife Australia (2017) Shorebirds 2020 programme – Data Extraction (1993-2017). http://www.birdlife.org.au/projects/shorebirds-2020 Cannell B, Hamilton S and Driessen (2019). Wedge-tailed Shearwater foraging behaviour in the Exmouth Region. Final Report. Report prepared for Woodside Energy Limited. The University of Western Australia and BirdLife, pp.36. Cassata, L. and L.B. Collins (2008). Coral reef communities, habitats and substrates in and near Sanctuary Zones of Ningaloo Marine Park. Journal of Coastal Research Vol. 24 (1): 139-51. Chevron Australia (2010). Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report: Domestic Gas Pipeline. Document Number: G1-NT-REPX0002750 http://www.chevronaustralia.com/Libraries/Chevron_Documents/Gorgon_Project_Coastal_and_Marine_Baseline_State_and_Environmental_Impact_Report_Domestic_Gas_Pipeline.pdf.sflb.ashx

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Chevron Australia (2011). Gorgon Gas Development and Jansz Feed Gas Pipeline: Dredging and spoil disposal Management and Monitoring Plan, Document number: G1-NT-PLNX0000373. Pp. 255. https://www.chevronaustralia.com/docs/default-source/default-documentlibrary/gorgon-emp-dredging-and-spoil-disposal-plan.pdf?sfvrsn=2 Chevron Australia (2013). Wheatstone Project, Oil Spill Operational Scientific Monitoring Program-OPS 5 Shorebird and Seabird Rapid Assessment. Document Number: WS0-0000-HESRPT-CVX-000-00144-000. https://www.chevronaustralia.com/docs/default source/defaultdocument-library/wheatstone-ops5-shorebird-and-seabird-rapid-assessment.pdf?sfvrsn=2 Chevron Australia (2014). Gorgon Gas Development and Jansz Feed Gas Pipeline: Post-Development Coastal and Marine State and Environment Impact Survey Report, Year 2:2012-2013. Document number G1-NT-REPX0005152. Pp. 362 https://www.chevronaustralia.com/docs/default-source/default-document-library/gorgon-emp-post-development-coastal-and-marine-state-and-environmental-impact-survey.pdf?sfvrsn=4 Colquhoun J and Heyward A. (eds) (2008). WAMSI Node 3 Project 1 Subproject 3.1.1 Deepwater Communities at Ningaloo Marine Park: Ningaloo Reef Marine Park Deepwater Benthic Biodiversity Survey Annual Report 2007. 209 pp. http://www.wamsi.org.au/sites/default/files/Node%203.1.1%20Ningaloo%20Reef%20Marine%20Park.pdf CSIRO (2020). Highlights Report – Ningaloo Outlook Program. https://research.csiro.au/ningaloo/outlook/shallow-reefs/shallow-reefs-research-2015-2020/ Currey-Randall L, Wakeford M, Colquhoun J, Cappo M, Stowar M, Birt M, Cure K, Vaughan B, Case M, Fisher R and Miller KJ (2019) Temporal trends in benthic communities and demersal fishes at Rankin Bank and Glomar Shoal. Report prepared for Woodside Energy Ltd. Australian Institute of Marine Science, Perth. 59 pp. Department of Biodiversity, Conservation and Attractions (DBCA) (2021). High Resolution Photogrammetry Surveys for marine turtle nesting beaches of the Dampier Archipelago during peak nesting season 2019-2020.

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Department of Environment and Conservation (DEC), 2007, Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007-2017, Marine Management Plan No. 55, DEC, Perth, WA. Depczynski M, Heyward A, Wilson S, Holmes T, Case M, Colquhoun J, O'Leary RA, Radford B (2011). Methods of monitoring the health of benthic communities at Ningaloo – Coral & Fish recruitment. WAMSI Node 3 Project 3.1.2. Final Report to the Western Australian Marine Science Institution, Perth. 101 pp. http://www.wamsi.org.au/research-ningaloo/node-3-reports EOMAP. (2017). Atmospheric correction and land cover classification, NW Cape. Report prepared for Woodside Energy Ltd. Fitzpatrick B.M., Harvey E.S., Heyward A.J., Twiggs E.J. and Colquhoun J. (2012). Habitat Specialization in Tropical Continental Shelf Demersal Fish Assemblages. PLoS ONE 7(6): e39634. doi:10.1371/journal.pone.0039634 http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0039634 Hutchins, J.B. (2004). Fishes of the Dampier Archipelago, Western Australia. *Records of the Western Australian Museum* Supplement No. 66: 343-398. Johnstone R.E, Burbidge A. H, Darnell J.C. (2013). Birds of the Pilbara Region, including seas and offshore islands, Western Australia: distribution, status and historical changes. Records of the Western Australian Museum, Supplement 78: 343-441. http://museum.wa.gov.au/sites/default/files/WAM_Supp78(B)_JOHNSTONEetal%20pp343-441_0.pdf Joint Carnarvon Basin Operators (2012). Draft Joint Carnarvon Basin Operators North West Cape Sensitivity Mapping. Part A. (Apache Energy Ltd, Woodside Energy Ltd, BHP Billiton and the Australian Marine Oil Spill Centre Pty Ltd (AMOSC). Keesing, J., K. (2019). Benthic habitats and biodiversity of the Dampier Archipelago and Montebello Australian Marine Parks. Report of the Director of Nationals Parks. CSIRO, Australia Keulen, M. Vand Langdon, M.W. (2011) Ningaloo Collaboration Cluster: Biodiversity and ecology of the Ningaloo Reef lagoon. Final Report No. 1c.

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				http://www.ningaloo.org.au/www/en/NingalooResearchProgram/Publications/Cluster-finalreports.html Kobryn, H.T., Wouters, K., Beckley, L.E. and T. Heege (2013). Ningaloo Reef: Shallow marine habitats mapped using a Hyperspectral sensor. PLoS ONE 8(7): e70105. doi:10.1371/journal.pone.0070105. http://dx.plos.org/10.1371/journal.pone.0070105 Le Noahic, M., Cornwall, M. E., Comeau, S., McCulloch, M. T. and Schoepf, V. (2017). Marine heatwave causes unprecedented regional mass bleaching of thermally resistant corals in northwestern Australia. *Scientific Reports,* vol. 7, doi: 10.1038/s41598-017-14794-y McLean, D., Taylor M., Vaughan B. (2019) Marine Communities of the Pluto Trunkline within the Montebello Marine Park. Report prepared for Woodside Energy Ltd. Australian Institute of Marine Science, Perth. 45 pp. Pendoley Environment (2005). Proposed Gorgon Development: Sea turtle Monitoring program results November 2004 to February 2005. Report for Chevron Australia. Pendoley, K. (2009). Marine Turtle Beach Survey. Onslow Mainland Area and Nearby Islands. Report to URS for the Chevron Wheatstone Project Team, 91 pp. https://www.chevronaustralia.com/Files/PDF/Wheatstone%20Draft%20EIS_ERMP%20Technical%20Appendices%20O8%20to%20O12%20and.pdf Pitcher, C.R., Miller, M., Morello, E., Fry, G., Strzelecki, J., McLeod, I., Slawinski, D., Ellis, N., Thomson, D., Bearham, D., Keesing, J., Donovan, A., Mortimer, N. Babcock, R., Fromont, J, Gomez, O., Hosie, A., Hara, A., Moore, G., Morrison, S., Kirkendale, L., Whisson, C., Richards, Z., Bryce, M., Marsh, L., Naughton, K., O'Loughlin, M., O'Hara, T., Boddington, D., Huisman, J. (2016) Environmental Pressures: Regional Biodiversity — Pilbara Seabed Biodiversity Mapping & Characterisation. Final report, CSIRO Oceans & Atmosphere, Published Brisbane, March 2016, 62 pages Quadrant Energy - Seabird Monitoring - Lowendal, Airlie, Serrurier islands - 1994 to present. Industry-Government Environmental Meta-database (IGEM). UUID: bdd428fe-cf24-4596-a822-cd578695ee16. Accessed June 2017

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Rob D, Barnes P, Whiting S, Fossette S, Tucker T and Mongan T (2019) Turtle activity and nesting on the Muiron Islands and Ningaloo Coast: Final Report 2018, Ningaloo Turtle Program. Report prepared for Woodside Energy Limited. Department of Biodiversity, Conservation and Attractions, Exmouth, pp.51. RPS-Bowman Bishaw Gorham (2005). Gorgon Development on Barrow Island, Technical Report, Marine Benthic Habitats. Prepared for Chevron Australia. https://www.chevronaustralia.com/docs/default-source/default-document-library/c8_marine_benthic_habitats.pdf?sfvrsn=0 RPS (2012). Pipeline Corridor Biological Seabed Survey: Apache Julimar Development Project – Field Report. Prepared for Apache Energy Limited, October 2011. Stevens, J.D., Last, P.R., White, W.T., McAuley, R.B., Meekan, M.G. (2009) Diversity, abundance and habitat utilisation of sharks and rays. CSIRO Marine and Atmospheric Research. Final report to Western Australian Marine Science Institute Surman CA and Nicholson LW (2015). Exmouth Sub basin Marine Avifauna Monitoring Program: Final Report. Unpublished report prepared for Apache Energy Ltd. by Halfmoon Biosciences. 188 pp. Surman CA and Nicholson LW (2012) Monitoring of annual variation in seabird breeding colonies throughout the Lowendal Group of islands: 2012 Annual Report. Unpublished report prepared for Apache Energy Ltd. by Halfmoon Biosciences. Tucker T, Fossette S, Whiting S, Rob, D and Barnes P (2019) Spatial and temporal use of inter-nesting habitat by sea turtles along the Muiron Islands and Ningaloo Coast. Final Report. Report prepared for Woodside Energy Limited. Department of Biodiversity, Conservation and Attractions, Kensington, pp.77. URS Australia Pty Ltd (2010). Biota of Subtidal Habitats in Pilbara Mangroves with Particular Reference to the Ashburton Delta and Hooley Creek, Technical Appendix N13. In: Technical Appendices N11 to N15 and O1 to O7. Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Project. July 2010, pp 124-245 https://www.chevronaustralia.com/Files/PDF/Wheatstone%20Draft%20EIS_ERMP%20Tech

Document	Document overview	Stakeholders	Relevant information	Document Details (where relevant)
				Watson, D.L., Harvey, E.S., Fitzpatrick, B.M. et al. Mar Biology (2010) Assessing reef fish assemblage structure: how do different stereo-video techniques ANNEX E: Tactical Response Plans (or here).
Support Plans	Support Plans detail Woodside's approach to resourcing and the provision of services during a hydrocarbon spill response.	CICC: Operations, Logistics and Planning functions.	Technique for mobilising and managing additional resources outside of Woodside's immediate preparedness arrangements.	Marine Logistics People & Global Capability Surge Labour Requirement Plan Health & Safety Aviation IT (First Strike Response) IT (Extended Response) Communications (First Strike Response) Communications (Extended Response) Stakeholder Engagement Accommodation & Catering Waste Management Guidance for Oil Spill Claims Management (Land based) Hydrocarbon Spill Responder Health Monitoring Guideline

2 RESPONSE PLANNING PROCESS

This document details Woodside's process for identifying potential response options for the hydrocarbon release scenarios, identified in the EP. Figure 2-1 outlines the interaction between Woodside's response, planning/preparedness and selection process.

This structure has been used because it shows how the planning and preparedness activities inform a response and provides indicative guidance on what activities would be undertaken, in sequential order, if a real event were to occur. The process also evaluates alternative, additional and/or improved control measures specific to the PAP.

The Scarborough Seabed Intervention and Trunkline Installation First Strike Response Plan then summarises the outcome of the response planning process and provides initial response guidance and a summary of ongoing response activities, if an incident were to occur.

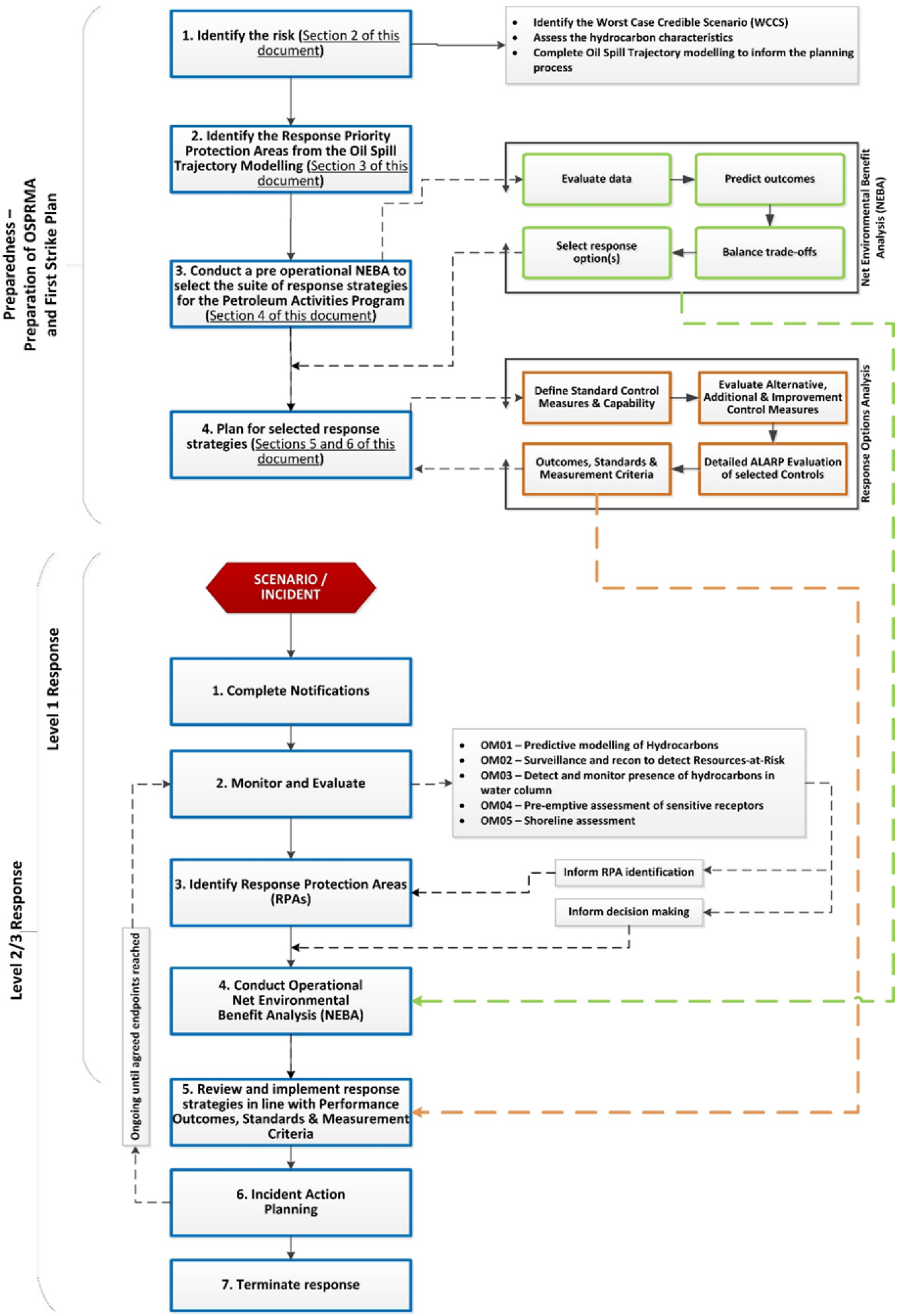


Figure 2-1: Response planning and selection process

2.1 Response planning process outline

This document is expanded below to provide additional context on the key steps in determining capability, evaluating ALARP and hydrocarbon spill response requirements.

Section 1. INTRODUCTION

Section 2. RESPONSE PLANNING PROCESS

- Identification of worst-case credible scenario(s) (WCCS)
- Spill modelling for WCCS.

Section 3. IDENTIFY RESPONSE PROTECTION AREAS (RPAs)

- Areas predicted to be contacted at concentration >100 g/m^2 [1].

Section 4. NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA)

- Pre-operational NEBA (during planning/ALARP evaluation): this must be reviewed during the initial response to an incident to ensure its accuracy
- Selected response techniques prioritised and carried forward for ALARP assessment.

Section 5. HYDROCARBON SPILL ALARP PROCESS

- Determines the response need based on predicted consequence parameters.
- Details the environmental performance of the selected response options based on the need.
- Sets the environmental performance outcomes, environmental performance standards and measurement criteria.

Section 6. ALARP EVALUATION

- Evaluates alternative, additional, and improved options for each response technique to demonstrate the risk has been reduced to ALARP.
- Provides a detailed ALARP assessment of selected control measure options against:
  - predicted cost associated with implementing the option
  - predicted change to environmental benefit
  - predicted effectiveness / feasibility of the control measure.

Section 7. ENVIRONMENTAL RISK ASSESSMENT OF SELECTED RESPONSE TECHNIQUES

- Evaluation of impacts and risks from implementing selected response options.

Section 8. ALARP CONCLUSION

Section 9. ACCEPTABILITY CONCLUSION

[1] This represents the threshold that could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat.

2.1.1 Response planning assumptions – timing, resourcing and effectiveness

IMT Call-out/ Notification	Contract Activation	Response Option Mobilisation	Response Option Deployment	Response Option Effectiveness
This is the time taken from call-out to mobilise the IMT to the designated Incident Control Centre	This is the time taken once the IMT has been mobilised to activate specific contracts for resources (SFRT, FWADC, AMOSC, AMSA, OSRL, etc)	This is the time taken to mobilise resources from home location to laydown/staging area (expected to be airport or sea port) close to response area	This is the time taken to deploy resources from laydown/staging area (expected to be airport or sea port) to response area/field	This relates to the performance of equipment/response option as well as required personnel resourcing (Specialists/Supervisors + support personnel)
Approx 2-4 hours	Approx 2-4 hours	Response Technique specific	Field/Location specific	Response Strategy specific

Figure 2-2: Response Planning Assumptions – Timing, Resourcing and Effectiveness

2.2 Environment plan risk assessment (credible spill scenarios)

Potential hydrocarbon release scenarios from the PAP have been identified during the risk assessment process (Section 6 of the EP). Further descriptions of risk, impacts and mitigation measures (which are not related to hydrocarbon preparedness and response) are provided in Section 6 of the EP. Three unplanned events or credible spill scenarios for the PAP have been selected as representative across types, sources and incident/response levels, up to and including the WCCS.

Table 2-1 presents the credible scenarios for the PAP. The WCCS for the activity is then used for response planning purposes, as all other scenarios are of a lesser scale and extent. By demonstrating capability to manage the response to the WCCS, Woodside assumes other scenarios that are smaller in nature and scale can also be managed by the same capability. Response performance measures have been defined based on a response to the WCCS.

Stochastic modelling has been completed for a worst case spill scenario of an instantaneous surface release of 2000 m^3 of marine diesel, the volume of the largest single fuel tank. The modelling results are representing loss of vessel fuel tank integrity after a collision, at three locations: outside Mermaid Sound (CS-01), within Montebello Marine Park (CS-02) and at the proposed Floating Production Unit (FPU) location in the Scarborough field (CS-03). The surface release of marine diesel caused by vessel collision (CS-01, CS-02 or CS-03) has been considered for response planning purposes, given the large volume released instantaneously. Marine fuel loss during bunkering (CS-04) has a significantly smaller marine diesel release volume of a maximum of 55 m^3, based on a 15 min delay to shut off pumps and a maximum transfer rate of 220 m^3/h, Hydraulic fluid loss of up to 8 m^3 from hydraulically actuated equipment (Scenario 5) is also considered credible. Both a 55 m^3 bunkering spill and 8 m^3 hydraulic fluid spill are considered to be within the risk profile and spill response capability requirements of CS-01, CS-02 or CS-03.

Table 2-1: Petroleum Activities Program credible spill scenarios

Scenario	Scenario selected for planning purposes	Scenario description	Maximum credible volume released (liquid m³)	Incident Level	Hydrocarbon (HC) type	Residual proportion	Residual volume (liquid m³)
CS-01	Yes	Short-term (instantaneous) surface release of marine diesel after a vessel collision outside Mermaid Sound.	2000	2	Marine Diesel	5.0 %	100
CS-02	Yes	Short-term (instantaneous) surface release of marine diesel after a vessel collision within Montebello Marine Park.	2000	2	Marine Diesel	5.0 %	100
CS-03	Yes	Short-term (instantaneous) surface release of marine diesel after a vessel collision at the FPU location in the Scarborough field.	2000	2	Marine Diesel	5.0 %	100
CS-04	No	Marine fuel loss during bunkering: Short-term (instantaneous) release of marine diesel	55	1	Marine Diesel	5.0 %	2.75
CS-05	No	Loss of containment from hydraulic systems of hydraulically actuated equipment	8	1	Hydraulic Fluid	5.0 %	0.4

2.2.1 Hydrocarbon characteristics

Marine Diesel (API 37.2 by the American Petroleum Institute)

Marine Diesel Oil is typically classed as an International Tanker Owners Federation (ITOPF) Group I/II oil.

Marine diesel is a mixture of volatile and persistent hydrocarbons with low proportions of highly volatile and residual components. Under constant 5 kn wind conditions, approximately 45% of the oil is predicted to evaporate within 24 hours. Under these calm conditions the majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes. Under variable wind conditions where winds are of a greater strength, more entrainment of oil into the water column is predicted (about 45% after 24 hours). A further 35% is forecast to evaporate, leaving only a small proportion of the oil floating on the water surface (<1%).

The heavier (low volatility) components of the oil have a tendency to entrain into the upper water column due to wind-generated waves but can subsequently resurface if wind-waves abate. Therefore, the heavier components of this oil can remain entrained or on the sea surface for an extended period, with associated potential for dissolution of the soluble aromatic fraction.

2.3 Hydrocarbon spill modelling

Oil spill trajectory modelling tools are used for environmental impact assessment and during response planning to understand spatial scale and timeframes for response operations. Woodside recognises that there is a degree of uncertainty related to the use of modelling data and has subsequently utilised conservative approaches to volumes, weathering, spatial areas, timing and response effectiveness to scale capability to need.

The Oil Spill Model and Response System (OILMAP) and Integrated Oil Spill Impact Model System (Spill Impact Mapping and Analysis Program, SIMAP) models are both used for stochastic and deterministic trajectory modelling. They have been developed over three decades of planning, exercises, actual responses, several peer reviews, and validation studies. OILMAP was originally derived from the United States Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Type A model (French et al. 1996), for assessing marine transport, biological impact and economic impact that was also used under the United States Oil Pollution Act 1990 Natural Resource Damage Assessment (NRDA) regulations. Notable spills where the model has been used and validated against actual field observations include, Exxon Valdez (French McCay 2004), North Cape Oil Spill (French McCay 2003), along with an assessment of 20 other spills (French McCay and Rowe, 2004). In addition, test spills designed to verify fate, weathering and movement algorithms have been conducted regularly and in a range of climate conditions (French and Rines 1997; French et al. 1997; Payne et al. 2007; French McCay et al. 2007).

Further to this, the algorithms have been updated using the latest findings from the Macondo/Deepwater Horizon well blowout in the Gulf of Mexico and validated according to the Deepwater Horizon (DWH) oil spill in support of the Natural Resource Damage Assessment (NRDA) (Spaulding et al. 2015; French McCay et al. 2015, 2016).

Finally, the OILMAP and SIMAP models have been used extensively in Australia to prosecute pollution offences, predict discharge locations and likely spill volumes based on weathering and surveillance observations, and has been used as expert witness evidence in Australian court proceedings, aiding the prosecution to determine spill quantum estimates.

2.3.1 Stochastic modelling

Stochastic modelling has been completed for the following scenarios outlined in **Table 2-1**. CS-01: A short-term (instantaneous) surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision outside Mermaid Sound, CS-02: A short-term (instantaneous) surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision within Montebello Marine Park (MP) and CS-03: A short-term (instantaneous) surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision at the FPU location in the Scarborough field. A quantitative, stochastic assessment has been undertaken for credible spill scenarios to help assess the environmental consequences of a hydrocarbon spill.

Numerous simulations (100-200) were completed to test for trends and variations in the trajectory and weathering of the spilled oil, with an even number of replicates completed using samples of metocean data that commenced within each calendar quarter. Further details relating to the assessments for the scenario can be found in Section 6 of the EP.

2.3.1.1 Environmental impact thresholds – EMBA and hydrocarbon exposure

The outputs of the stochastic spill modelling are used to assess the potential environmental impact from the credible scenarios. The stochastic modelling results are used to delineate areas of the marine and shoreline environment that could be exposed to hydrocarbon levels exceeding environmental impact threshold concentrations. The summary of all the locations where hydrocarbon thresholds could be exceeded by any of the simulations modelled is defined as Environment that May Be Affected (EMBA) and is discussed further in Section 6 of the EP. As the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean mechanism of transportation, a different EMBA is presented for each fate within the EP.

A conservative approach – adopting accepted contact thresholds for impacts on the marine environment – is used to define the EMBA. These hydrocarbon thresholds are presented in **Table 2-2** below and described in Section 6 of the EP.

Table 2-2: Summary of thresholds applied to the stochastic hydrocarbon spill modelling to determine the EMBA and environmental impacts

Threshold Scarborough Seabed Intervention and Trunkline Installation	Description
10 g/m^2	Surface hydrocarbon
100 ppb	Entrained hydrocarbon (ppb)
50 ppb	Dissolved aromatic hydrocarbon (ppb)
100 g/m^2	Shoreline accumulation

2.3.2 Deterministic modelling

Woodside uses deterministic modelling results to evaluate risks and impacts and response capability requirements. These results are provided in both shapefile and data table format with each row of the data table representing a 1 km^2 cell. This cell size has been used as it represents the approximate area that a single containment and recovery operation or surface dispersant operation (single sortie or vessel spraying) can effectively treat in one ten (10) hour day. Smaller cell sizes have been considered but would not change the response need as the potential distance between cells would not allow multiple cells to be treated per day by response operations. Additionally, a 1km^2 cell is expected to allow averaging of threshold concentrations and mass across the spatial extent to represent a conservative approach (patches of oil and windrows) to response planning that simulates operational monitoring feedback in a real event.

The deterministic modelling data provides an indication of the response need by displaying the potential surface area and volume that may be treated or recovered by response operations. Existing capability is reviewed to approximate the surface area and volumes that can be treated or removed and a range of alternate, improved and additional options to reduce risks and impacts to as low as reasonably practical (ALARP) are considered.

Woodside recognises that no single response technique will treat all available subsea or surface oil and that a combination of response techniques will be required for the identified scenario. Even with the significant resources available to Woodside through existing capability and third-party resources, the primary offshore response techniques of surface dispersant application and containment and recovery will only treat or recover a minor proportion (<30%) of the available surface hydrocarbons based on previous response experience.

Woodside is committed to a realistic, scalable response capability that is commensurate to the level of risk and able to be practically implemented and feasibly sustained.

2.3.3 Response planning thresholds for surface and shoreline hydrocarbon exposure

Thresholds to determine the EMBA are used to predict and assess environmental impacts and inform the scientific monitoring program (SMP), however, they do not appropriately represent the thresholds at which an effective response can be implemented. Additional response thresholds are used for response planning and to determine areas where response techniques would be most effective. The deterministic modelling is then used to assess the nature and scale of a response.

In the event of an actual response, existing deterministic modelling would be reviewed for suitability and additional modelling would be conducted using real-time data and field information to inform Incident Management Team decisions.

The deterministic spill modelling outputs are presented at response planning thresholds for surface hydrocarbons for the WCCS. Surface spill concentrations are expressed as grams per square metre (g/m^2) (Section 2.2). The thresholds used are derived from oil spill response planning literature and industry guidance and are summarised below.

2.3.4 Surface hydrocarbon concentrations

Table 2-3: Surface hydrocarbon thresholds for response planning

Surface hydrocarbon concentration (g/m^2)	Description	Bonn Agreement Oil Appearance Code (BAOAC)	Mass per area (g/m^2)
>10	Predicted minimum threshold for commencing operational monitoring [2]	Code 3 – Dull metallic colour	5 to 50
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [3]	Code 4 – Discontinuous true oil colour	50 to 200
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application	Code 5 – Continuous true oil colour	>200
Shoreline hydrocarbon concentration (g/m^2)	**Description**	**National Plan Guidance on Oil Contaminated Foreshores**	**Mass per area (g/m^2)**
100	Predicted minimum shoreline accumulation threshold for shoreline assessment operations	Stain	>100
250	Predicted minimum threshold for commencing shoreline clean-up operations	Level 3 - Thin Coating	200 to 1000

The surface thickness of oil at which dispersants are typically effective is approximately 100 g/m^2. However, substantial variations occur in the thickness of the oil within the slick, and most fresh crude oils spread within a few hours, so that overall the average thickness is 0.1 mm (or approx. 100 g/m^2) (International Tanker Owners Pollution Federation [ITOPF] 2011). Additionally, the recommended rate of application for surface dispersant is typically 1-part dispersant to 20 or 25 parts of spilled oil. These figures assume a 0.1 mm slick thickness, averaged over the thickest part of the spill, to calculate a litres/hectare application rate from vessels and aircraft. In practice, this can be difficult to achieve as it is not possible to accurately assess the thickness of the floating oil.

Some degree of localised over-dosage and under-dosage is inevitable in dispersant response. An average oil layer thickness of 0.1 mm is often assumed, although the actual thickness can vary over a wide range (from less than 0.0001 mm to more than 1 mm) over short distances (International Petroleum Industry Environment Conservation Association [IPIECA] 2015).

Guidance from Australian Maritime Safety Authority (AMSA, 2015) indicates that spreading of spills of Group II or III products will rapidly decrease slick thickness over the first 24 hours of a spill resulting

[2] Operational monitoring will be undertaken from the outset of a spill whether or not the minimum threshold has been reached. This is needed to assess the nature of the spill and track its location. This will then inform the need for any additional monitoring and/or response techniques.

[3] At 50 g/m^2, containment and recovery and surface dispersant application operations are not expected to be particularly effective. This threshold represents a conservative approach to planning response capability and containing the spread of surface oil.

in the potential requirement of up to a ten (10) fold increase in capability on day 2 to achieve the same level of performance.

Further guidance from the European Maritime Safety Authority (EMSA) states that spraying the ‘metallic’ looking area of an oil slick (Bonn Agreement Oil Appearance Code [BAOAC] 3, approx. 5 – 50 µm) with dispersant from spraying gear designed to treat an oil layer 0.1 mm (100 µm) thick, will inevitably cause dispersant over-treatment by a factor of 2 to 20 times (EMSA 2012).

Therefore, dispersant application should be concentrated on the thickest areas of an oil slick and Woodside intends on applying surface dispersants to only BAOAC 4 and 5. Spraying areas of oil designated as BAOAC Code 4 (Discontinuous true oil colour) with dispersant will, on average, deliver approximately the recommended treatment rate of dispersant.

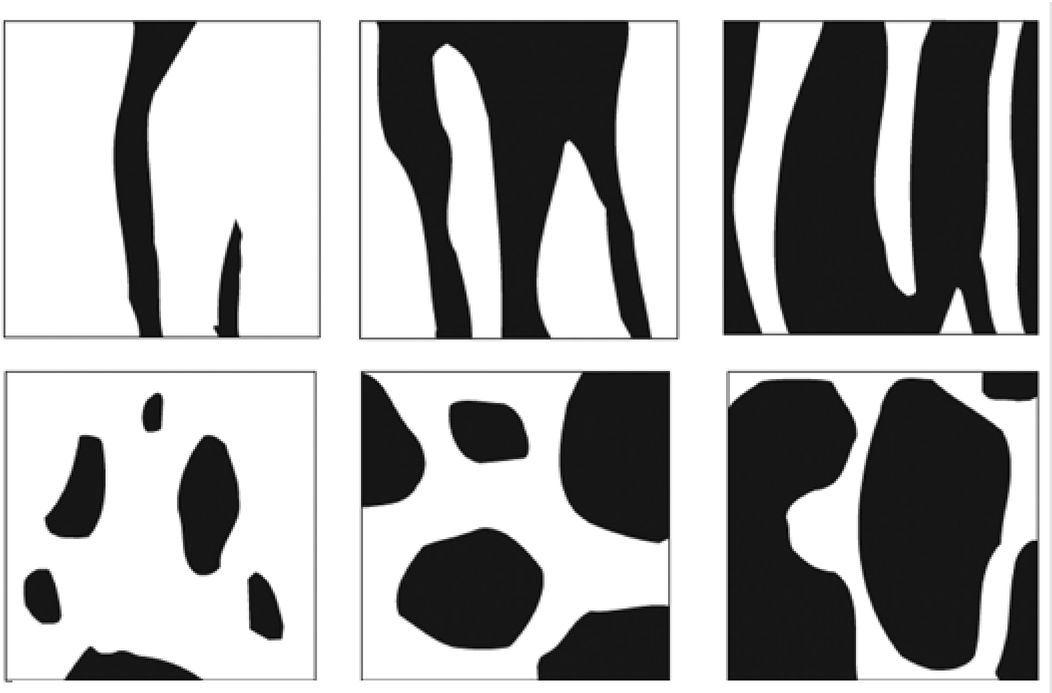
Spraying areas of oil designated as BAOAC Code 5 with dispersant (Continuous true oil colour and more than 0.2 mm thick) will, on average, deliver approximately half the recommended treatment rate of dispersant. Repeated application of these areas of thicker oil, or increased dosage ratios, will be required to achieve the recommended treatment rate of dispersant (EMSA 2012).

Guidance from the National Oceanic and Atmospheric Administration (NOAA) in the United States is found in the document: *Characteristics of Response Techniques: A Guide for Spill Response Planning in Marine Environments 2013 (NOAA 2013).*

This guide outlines advice for response planning across all common techniques, including surface dispersant spraying and containment and recovery. It states that oil thickness can vary by orders of magnitude within distinct areas of a slick, thus the actual slick thickness and oil distribution of target areas are crucial for determining response method feasibility. Further to this, ITOPF also states that in terms of oil spill response, sheen can be disregarded as it represents a negligible quantity of oil, cannot be recovered or otherwise dealt with to a significant degree by existing response techniques, and is likely to dissipate readily and naturally (ITOPF, 2014).

Figure 2-3 below from AMSA’s Identification of Oil on Water – Aerial Observation and Identification Guide (AMSA, 2014) shows expected percent coverage of surface hydrocarbons as a proportion of total surface area. Wind-rows, heavy oil patches and tar balls, for example, must be considered, as they influence oil encounter rates, chemical dosages and ignition potential. Each method has different thickness thresholds for effective response.

From this information and other relevant sources (Allen and Dale, 1996, EMSA, 2012, Spence, 2018) the surface threshold of 50 g/m^2 was chosen as an average / equilibrium thickness (50 g/m^2 is an average is 50% coverage of 0.1 mm Bonn Agreement Code 4 - discontinuous true oil colour, or 25% coverage of 0.2 mm Bonn Agreement Code 5 – continuous true oil colour which would represent small patches of thick oil or wind-rows.



25% 50% 75%

Figure 2-3: Proportion of total area coverage (AMSA, 2014)

Figure 2-4 illustrates the general relationships between on-water response techniques and slick thickness. Windrows, heavy oil patches and tar balls, for example, must be considered, as they influence oil encounter rates, chemical dosages and ignition potential. Each method has different thickness thresholds for effective response.

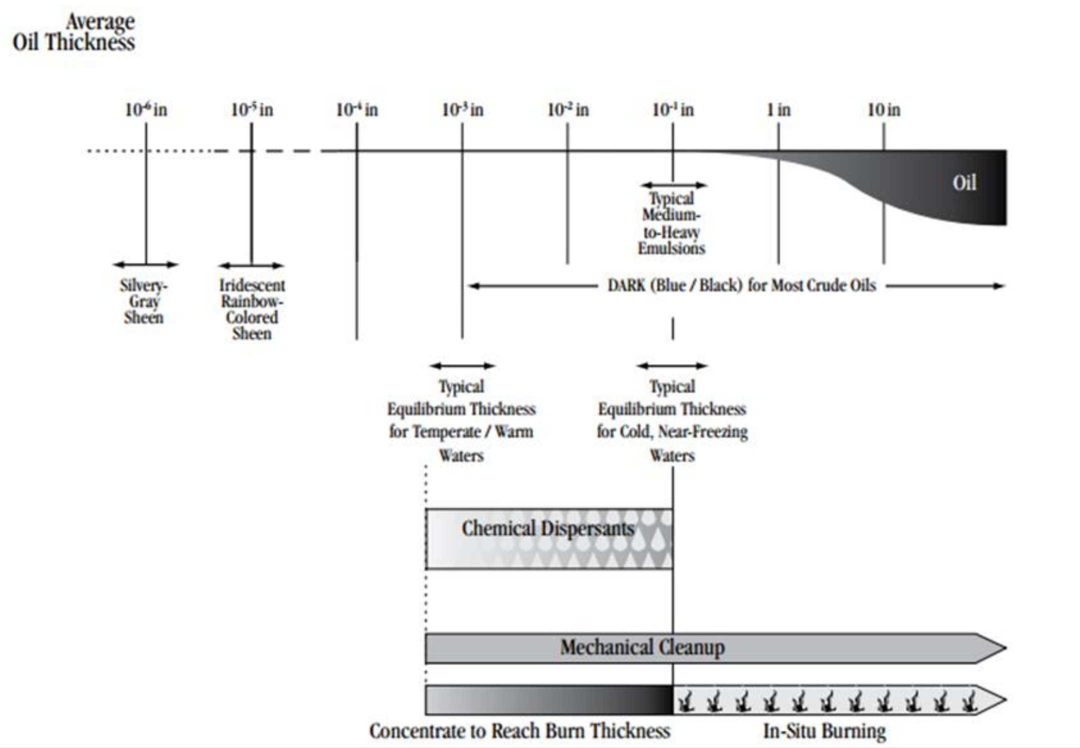


Figure 2-4: Oil thickness versus potential response options (from Allen & Dale 1996)

Wind and waves influence the feasibility of mechanical clean-up operations, dropping the effectiveness significantly because of entrainment and/or splash-over as short period waves develop beyond two to three feet (0.6–0.9 m) in height. Waves and wind can also be limiting factors for the safe operation of vessels and aircraft. There is also potential secondary contamination of unimpacted areas and waste issues associated with mechanical dispersion of slicks (**Table 4-3** and **Section 4.2.3.3**).

2.3.4.1 Surface hydrocarbon viscosity

Table 2-4: Surface hydrocarbon viscosity thresholds

Surface viscosity (cSt)	Description	European Maritime Safety Authority (EMSA)	Viscosity at sea temperature (cSt)
5,000	Predicted optimum viscosity for surface dispersant operations	Generally possible to disperse	500-5000
10,000	Predicted maximum viscosity for effective surface dispersant operations	Sometimes possible to disperse	5,000-10,000

Further to the required thickness for surface dispersant application and containment and recovery to be deployed effectively as outlined above, changes to viscosity will also limit the treatment of offshore response techniques. As outlined in the EMSA Manual on the Applicability of Oil Spill Dispersants (EMSA, 2012), guidance around changes to viscosity and likely effectiveness of surface dispersant application is provided.

This includes the following statements;" It has been known for many years that it is more difficult to disperse a high viscosity oil than a low or medium viscosity oil. Laboratory testing had shown that the effectiveness of dispersants is related to oil viscosity, being highest for modern "Concentrate, UK Type 2/3" dispersants at an oil viscosity of about 1000 or 2000 mPa.s (1000 – 2000 cSt) and then declining to a low level with an oil viscosity of 10,000 mPa.s (10,000 cSt). It was considered that some generally applicable viscosity limit, such as 2000 or 5000 mPa.s (2000 – 5000 cSt), could be applied to all oils."

However, modern oil spill dispersants are generally effective up to an oil viscosity of 5000 mPa.s (5000 cSt) or more, and their performance gradually decreases with increasing viscosity; oils with a viscosity of more than 10,000 are, in most cases, no longer dispersible. Guidance from the Centre of Documentation, Research and Experimentation (CEDRE; EMSA, 2012) also indicates that products with a range of 500 – 5000 cSt at sea temperature are generally possible to disperse, while 5000 – 10,000 cSt at sea temperature above pour point are sometimes possible to disperse, with products beyond 10,000 cSt at sea temperature below pour point are generally impossible to disperse. The potential use of dispersants is evaluated in **Table 4-3**.

To support decision making and response planning, a threshold of 10,000 cSt at sea temperature was chosen as a conservative estimate of maximum viscosity for surface dispersant spraying operations.

The thresholds described above are compared with the modelling results for the WCCS (**Table 2-5**).

2.3.5 Spill modelling results

Details of the credible scenarios and modelling inputs are included along with deterministic results in **Table 2-5**. Modelling was conducted for all scenarios with three different model outputs being used to determine the worst-case credible parameters. CS-01 provided the WCCS for the shortest time for any oil to drift from the source to both the offshore boundary of a sensitive receptor and to the receptor shoreline, relative to the commencement of the spill.

The selected deterministic runs used to represent the WCCS are:

- Fastest time to shoreline contact (above 100 g/m^2);

- Largest volume ashore at any single RPA (above 100 g/m^2); and
- Largest volume ashore on all shorelines from a single model run (above 100 g/m^2).

Both stochastic and deterministic modelling were completed for CS-01 and CS-02 (although no shoreline contact is predicted for CS-02). Stochastic modelling only was undertaken for CS-03. The deterministic modelling results presented below are therefore derived from the deterministic modelling for CS-01.

Table 2-5: Worst case credible scenario modelling results

Response parameter	Modelled result
	Marine diesel release caused by vessel collision
Maximum instantaneous liquid hydrocarbon release rate and duration	Worst case spill scenario of an instantaneous surface release of 2000 m^3 of marine diesel, representing loss of vessel fuel tank integrity after a collision: – Outside Mermaid Sound (Scenario 1) – Within Montebello Marine Park (Scenario 2) – In the Scarborough Field (FPU location) (Scenario 3)
Maximum residual surface hydrocarbon after weathering	100 m^3
Deterministic Modelling results	
Minimum time to commencement of hydrocarbon accumulation at any shoreline receptor (at a threshold of 100 g/m^2)	Surface release of Marine Diesel (CS-01) 2.2 days (53 hours) at Dampier Archipelago
Minimum time to floating hydrocarbon contact with the offshore edge(s) of any shoreline receptor polygon (at a threshold of 10 g/m^2)	Surface release of Marine Diesel (CS-01) 1.1 (27 hours) days at Dampier Archipelago
Maximum cumulative hydrocarbon volume accumulated at any individual shoreline receptor	Surface release of Marine Diesel (CS-01) 3 m^3 at Dampier Archipelago
Maximum cumulative hydrocarbon volume accumulated across all shoreline receptors contacted by accumulated hydrocarbons (including those contacted at <100 g/m^2 accumulation concentration)	Surface release of Marine Diesel (CS-01) 156 g/m^2 at Dampier Archipelago
Minimum time to entrained/dissolved hydrocarbon contact with the offshore edges of any receptor polygon (at a threshold of 100 ppb)	1 hour at Montebello Marine Park (CS-02)[4]

From the above deterministic modelling results, the volumes and timeframes have been considered as the basis for response planning and are included in **Section 4.2**. Further stochastic modelling results for the three credible spill scenarios are summarised below.

CS-01 (outside Mermaid Sound):

- Surface hydrocarbon concentrations greater than 10 g/m^2 may occur up to 18 km from the release location.
- Floating oil at the 10 g/m^2 threshold is predicted to arrive at the surface waters of the Montebello MP with a probability of 100% after 1 hour, at the Dampier Archipelago receptor with a probability of 2% after 27 hours, at Dampier MP with a probability of 2% after 37 hours and at Gascoyne MP with a probability of 1% after 64 hours.

[4] From stochastic modelling

- Potential for accumulation of oil on shorelines is predicted to be low, with a maximum accumulated volume and concentration of 3 m^3 and 156 g/m^2, respectively, forecast at the Dampier Archipelago.
- Shorelines accumulation greater than the 100 g/m^2 threshold is predicted to occur at Dampier Archipelago after 2.2 days with a maximum shoreline accumulation of 156 g/m^2.
- The Dampier Archipelago is predicted to be exposed to entrained hydrocarbons greater than 100 ppb within 14 days.
- No other shoreline location exposed to entrained hydrocarbons greater than 100 ppb over timescales longer than 14 days are predicted to accumulate hydrocarbons >100 g/m^2.
- Numerous islands, banks, shoals and mainland locations may be exposed to entrained hydrocarbons greater than 100 ppb within 14 days.
- Spreading and weathering of the surface oil occurs rapidly due to the loss of light, volatile components and the spreading. Dispersant application and containment and recovery are not appropriate for use on spills of marine diesel due to these weathering characteristics.

CS-02 (Within Montebello MP):

- Surface hydrocarbons greater than the 10 g/m^2 threshold could potentially be found up to 39 km from the spill site. Given that this spill location lies within the Montebello AMP receptor area, floating oil at concentrations equal to or greater than 100 g/m^2 are forecast with a probability of 100%. Probabilities of floating oil contact at the 10 g/m^2 threshold not predicted for other receptors.
- Entrained oil at concentrations equal to or greater than the 100 ppb threshold is predicted to be found up to around 630 km from the spill site. The following receptors are predicted to receive entrained oil concentrations at the 100 ppb threshold with probabilities in parenthesis: Montebello Marine Park (78%), Muiron Islands Marine Management Area – World Heritage Area (MMA-WHA, 13%), Argo-Rowley Terrace MP (1%), Barrow Island (5%), Montebello Islands (8%), Ningaloo Coast (Middle, Middle WHA, North, North WHA, max. 12%), Ningaloo RUZ (12%), Pilbara Islands – Southern Island Group (5%), Rankin Bank (1%), Shark Bay (Open Coast and WHA, 1% and 1%, respectively), Bernier & Dorre Islands (1%), Lowendal Islands (1%), Montebello State Marine Park (13%), Muiron Islands (11%), Gascoyne Marine Park (11%) and WA Coastline (10%). The maximum entrained oil concentration is forecast as 156,954 ppb within the Montebello Marine Park.
- Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be found up to around 216 km from the spill site. Barrow Island (probability 1%), Montebello Islands (probability 1%), Rankin Bank (probability 1%), Montebello Marine Park (probability 49%), Montebello State Marine Park (probability 1%) and the WA Coastline (probability 1%) are receptors predicted to receive dissolved aromatic hydrocarbon concentrations at the 50 ppb threshold. The maximum dissolved aromatic hydrocarbon concentration is forecast as 1990 ppb within the Montebello Marine Park.
- Accumulated hydrocarbons above threshold concentrations (≥100 g/m^2) were not predicted by the modelling to occur.

CS-03 (In Scarborough field (FPU location)):

- Surface hydrocarbons equal to or greater than the 10 g/m^2 threshold could potentially be found up to 113 km from the spill site. No shoreline receptors are predicted to be contacted by surface hydrocarbons concentrations. Floating oil at the 10 g/m^2 threshold is predicted to arrive at the surface waters of the Gascoyne Marine Park receptor with a probability of 1% after 64 hours.

- Entrained oil at concentrations equal to or greater than the 100 ppb threshold is predicted to be found up to around 918 km from the spill site. The Gascoyne Marine Park, Carnarvon Canyon Marine Park and Abrolhos Islands Marine Park receptors are predicted to receive entrained oil concentrations at the 100 ppb threshold with a probability of 10%, 1% and 1%, respectively. The maximum entrained oil concentration is forecast as 7236 ppb within the Gascoyne Marine Park.
- Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be found up to around 244 km from the spill site. The Gascoyne Marine Park is the only receptor predicted to receive dissolved aromatic hydrocarbon concentrations at the 50 ppb threshold with a probability of 3%. The maximum dissolved aromatic hydrocarbon concentration is forecast as 462 ppb within the Gascoyne Marine Park.
- Accumulated hydrocarbons above threshold concentrations (≥100 g/m²) were not predicted by the modelling to occur.

3 IDENTIFY RESPONSE PROTECTION AREAS (RPAs)

In a response, operational monitoring programs – including trajectory modelling and vessel/aerial observations – would be used to predict RPAs that may be impacted. For the purposes of planning and appropriately scaling a response, modelling has been used to identify RPAs as outlined below in **Figure 3-1**.

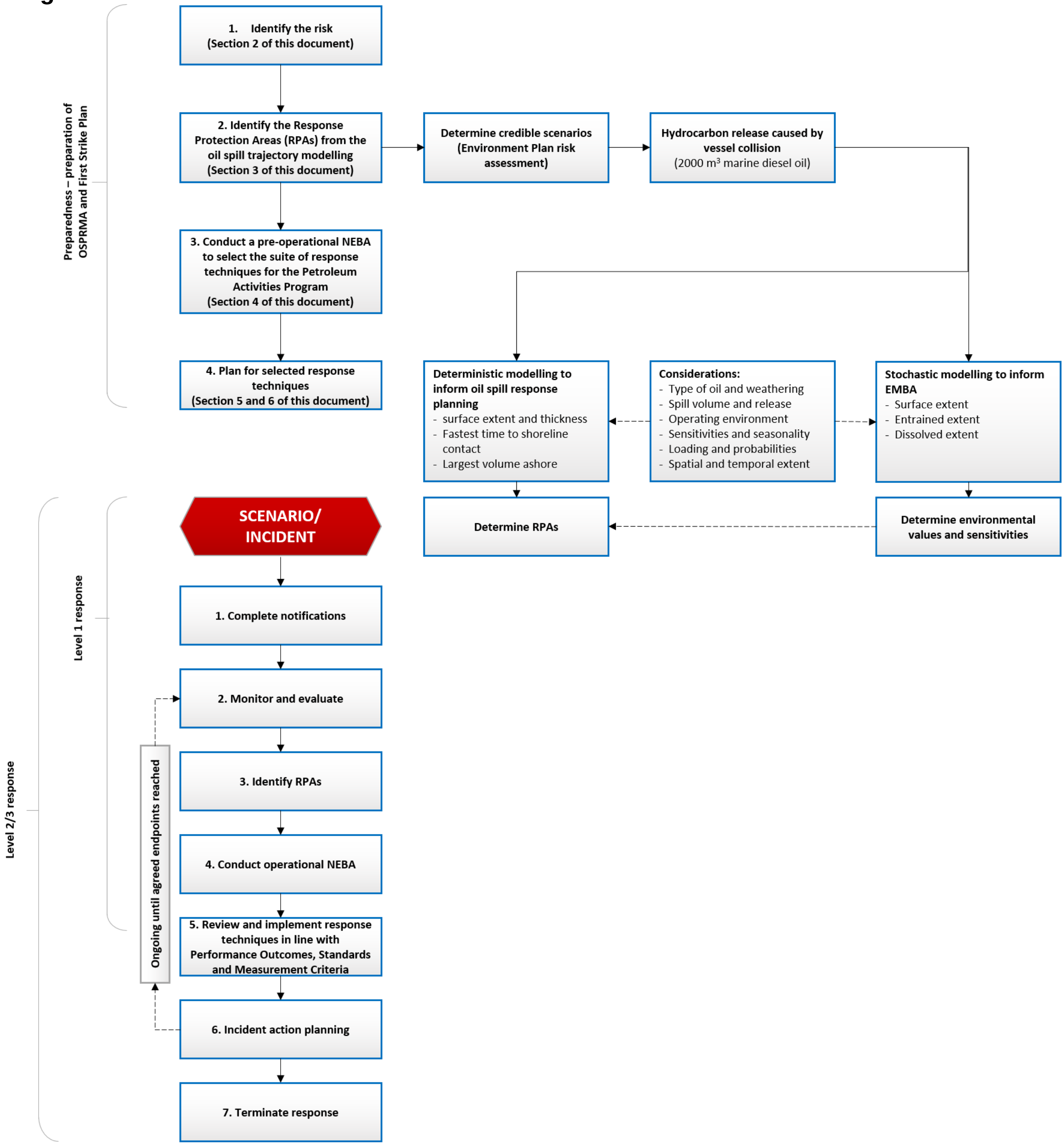


Figure 3-1: Identify Response Protection Areas (RPAs) flowchart

3.1 Identified sensitive receptor locations

Section 6 of the EP includes sensitive receptor locations have been identified by stochastic modelling as meeting the requirements outlined below:

- Receptors with the potential to incur surface, entrained or shoreline accumulation contact above environmental impact thresholds
- Receptors within the EMBA which meet the following:
  - A number of priority protection criteria/categories
  - International Union of Conservation of Nature (IUCN) marine protected area categories
  - High conservation value habitat and species
  - Important socio-economic/heritage value.

3.2 Identify Response Protection Areas (RPAs)

From the identified sensitive receptors described in Section 6 of the EP, only those for which a shoreline response could feasibly be conducted (accumulation > 100 g/m^2 for shoreline assessment and/or contact with surface slicks >10 g/m^2 for operational monitoring[5]) have been selected for response planning purposes.

3.2.1 Response Protection Areas (RPAs)

Response Protection Areas (RPAs) have been selected on the basis of their environmental ecological, social, economic, cultural and heritage values and sensitivities and the ability to conduct a response based on the minimum response thresholds (**Section 2.3.3**). It is important to note that the RPAs are determined from the combined results of the individual worst-case runs and do not indicate a single worst case credible scenario (where the timings and volumes are all expected from one release).

The only RPA identified for the PAP is the Dampier Archipelago.

During a spill event, operational monitoring (OM) techniques (OM01, OM02, OM03, OM04 and OM05) would be deployed from the outset of the spill to track the spill trajectory and deduce if any RPAs are at risk of impact. TRPs will be drafted in advance for any RPAs with a contact time of <14 days.

Any additional sensitive receptors are presented in the existing environment description (Section 4 of the EP) and impact assessment section (Section 6 of the EP) for the spill scenario. The pre-operational NEBA (**Section 4**) considers the results from the stochastic modelling to ensure all feasible response techniques are considered in the planning phase, therefore additional receptors are also included in the pre-operational NEBA.

[5] Operational monitoring will be undertaken from the outset of a spill whether or not this threshold has been reached. Monitoring is needed throughout the response to assess the nature of the spill, track its location and inform the need for any additional monitoring and/or response techniques. It also informs when the spill has entered State Waters and/or control of the incident passes to statutory authorities e.g. WA DoT or AMSA.

Table 3-1: Response Protection Areas (RPAs)

Areas of coastline contacted	Conservation status	IUCN protection category	CS-01 Minimum time to shoreline contact (above 10 g/m^2) in days (6)	CS-01 Maximum shoreline accumulation (above 10 g/m^2) in m^3 (7)	CS-02 Minimum time to shoreline contact (above 10 g/m^2) in days (5)	CS-02 Maximum shoreline accumulation (above 10 g/m^2) in m^3 (6)	CS-03 Minimum time to shoreline contact (above 10 g/m^2) in days (5)	CS-03 Maximum shoreline accumulation (above 10 g/m^2) in m^3 (6)
Dampier Archipelago	National Heritage Property	N/A	2.2 days	3 m^3	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted	No shoreline contact above threshold predicted

[6] This volume and time represent the first time to contact on defined shoreline polygon and the maximum volume ashore for that 24 hour period.
[7] This volume and time represent the maximum volume ashore on defined shoreline polygon for any 24 hour time period

4 NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA)

A Net Environmental Benefit Analysis (NEBA) is a structured process to consider which response techniques are likely to provide the greatest net environmental benefit. The NEBA process typically involves four key steps outlined in **Figure 4-1**: evaluate data, predict outcomes, balance trade-offs, and select response options. These steps are followed in the planning/preparedness process and would also be followed in a response.

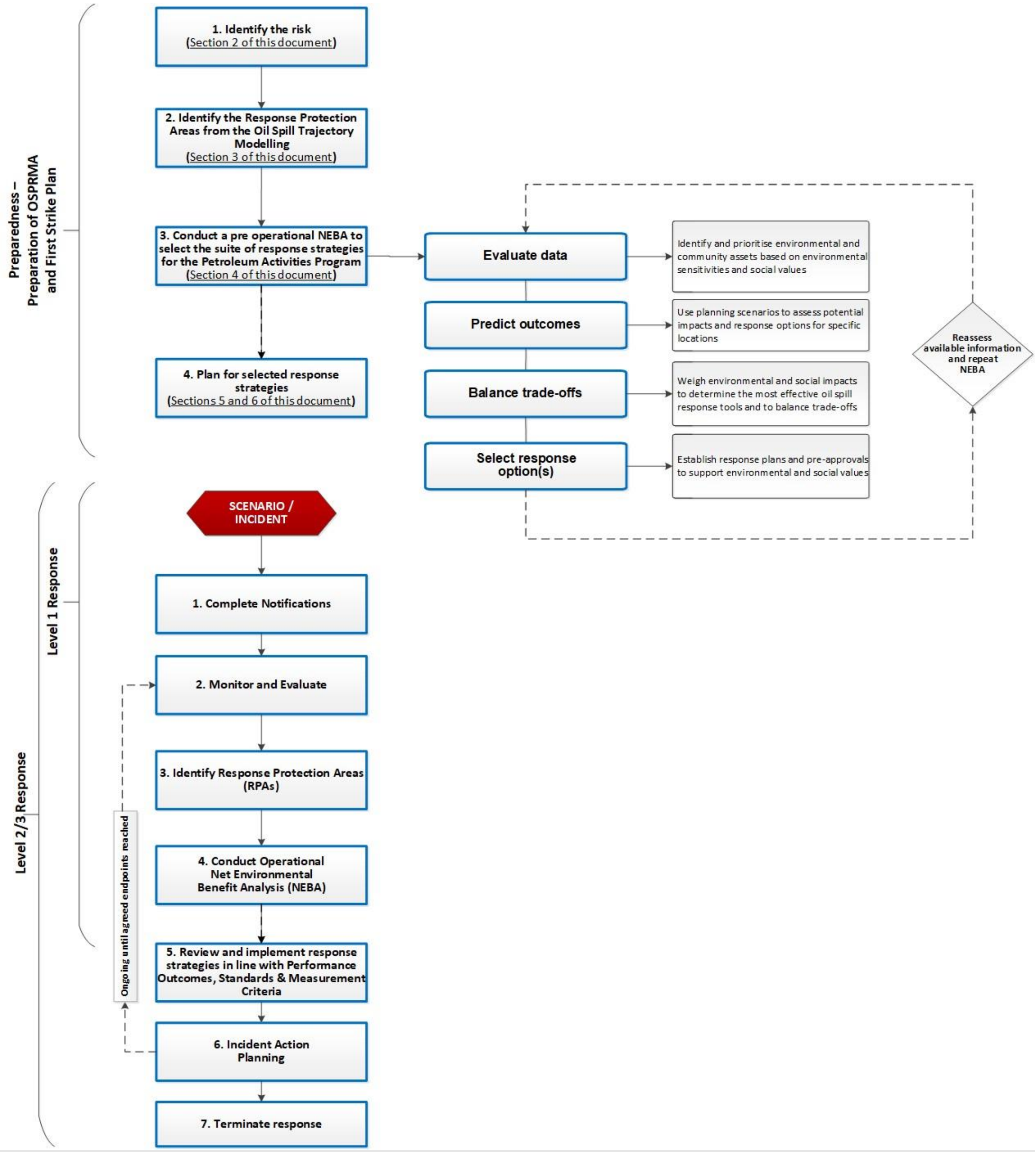


Figure 4-1: Net Environmental Benefit Analysis (NEBA) flowchart

4.1 Pre-operational / Strategic NEBA

The pre-operational NEBA identifies positive and negative impacts to sensitive receptors from implementing the response techniques. Feasibility is considered by assessing the receptors potentially impacted above response thresholds (**Section 2.3.3**) and the surface concentrations (**Section 2.3.4**) from the deterministic modelling.

Completing a pre-operational NEBA is a key response planning control that reduces the environmental risks and impacts of implementing the selected response techniques. The pre-operational NEBA for this PAP is in **ANNEX A**: Net Environmental Benefit Analysis detailed outcomes.

4.2 Stage 1: Evaluate data

Woodside identifies and prioritises environmental and community assets based on environmental sensitivities and social values, informed through the use of trajectory modelling. Interpretation of stochastic oil spill modelling determines the EMBA for the release, which defines the spatial area that may be potentially impacted by the PAP activities.

4.2.1 Define the scenario(s)

Woodside uses scenarios identified from the risk assessment in the EP to assess potential impacts and response options for specific locations. The WCCS is then selected for deterministic modelling and is used for this pre-operational NEBA. Outlier locations with potential environmental impacts, selected from the stochastic modelling may also be included for assessment. Response thresholds and deterministic modelling are then used to assess the feasibility/effectiveness and scale of the response.

Table 4-1: Scenario summary information (WCCS, CS-01, CS-02 and CS-03)

Scenario summary information	
Scenario	Surface release of vessel fuel tank due to a vessel collision
Locations	CS-01: 20° 21' 3.28" S, 116° 42' 5.58" E (outside Mermaid Sound)
	CS-02: 20° 03' 1.44" S, 115° 31' 35.04" E (within Montebello MP)
	CS-03: 19° 53' 54.72" S, 113° 14' 19.56" E (in Scarborough Field, FPU location)
Oil Type	Marine Diesel
Fate and Weathering	Refer to **Section 2.2.1**
Volume and duration of release	2000 m^3 instantaneous

4.2.1.1 Hydrocarbon characteristics

Marine Diesel

Marine Diesel is typically classed as an International Tanker Owners Pollution Federation (ITOPF) Group I/II oil.

Marine diesel is a mixture of volatile and persistent hydrocarbons with low proportions of highly volatile and residual components. Under constant 5 kn wind conditions, about 6% of the oil mass is predicted to evaporate within the first 12 hours (BP < 180 °C); a further 35% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 54% should evaporate over several days (265 °C < BP < 380 °C). Approximately 5% of the oil is shown to be persistent. The aromatic content of the oil is approximately 3%. Under variable wind conditions where winds are of a greater strength, more entrainment of oil into the water column is predicted (about 45% after 24 hours). A further 35% is forecast to evaporate, leaving only a small proportion of the oil floating on the water surface (<1%).

The heavier (low volatility) components of the oil have a tendency to entrain into the upper water column due to wind-generated waves but can subsequently resurface if wind-waves abate. Therefore, the heavier components of this oil can remain entrained or on the sea surface for an extended period, with associated potential for dissolution of the soluble aromatic fraction.

Table 4-2: Oil fate, behaviour and impacts

Deterministic modelling results (CS-01 – outside Mermaid Sound)	
Minimum time to shoreline contact (above 100 g/m^2)	53 hours (2.2 days) at the Dampier Archipelago
Largest volume ashore at any single RPA (above 100 g/m^2)	3 m^3 at the Dampier Archipelago
Largest total shoreline accumulation (above 100 g/m^2)	156 g/m^2 at the Dampier Archipelago
Stochastic modelling results (CS-02 – within Montebello MP)	
Minimum time to shoreline contact (above 100 g/m^2)	No contact at threshold
Largest volume ashore at any single RPA (above 100 g/m^2)	No contact at threshold
Largest total shoreline accumulation (above 100 g/m^2)	No contact at threshold
Stochastic modelling results (CS-03 – Scarborough field, FPU location)	
Minimum time to shoreline contact (above 100 g/m^2)	No contact at threshold
Largest volume ashore at any single RPA (above 100 g/m^2)	No contact at threshold
Largest total shoreline accumulation (above 100 g/m^2)	No contact at threshold

4.2.2 Determining potential response options

The available response techniques based on current technology can be summarised under the following headings:

- Monitor and evaluate (including operational monitoring)
- Source control (via vessel SOPEP)
- Containment and recovery
- In situ burning
- Surface dispersant application:
  - aerial dispersant application
  - vessel dispersant application
- Shoreline protection and deflection
- Shoreline clean-up:
  - Phase 1 – Mechanical clean-up

  - Phase 2 – Manual clean-up
  - Phase 3 – Final polishing
- Oiled wildlife response (including hazing)
- Waste management
- Post spill monitoring/scientific monitoring

An assessment of which response options are feasible for the scenarios is included below in **Table 4-3**. These options were evaluated against each scenario's parameters including oil type, volume and characteristics, prevailing weather conditions, logistical support, and resource availability to determine their deployment feasibility.

A shortlist of the feasible response options is then carried forward for the ALARP assessment with a justification for the exclusion of other response techniques included in **Section 4.2.3**. This assessment will typically result in a range of available options, that are deployed at different areas (at-source, offshore, nearshore and onshore) and times through the response. The NEBA process assists in prioritising which options to use where and when and timings throughout the response.

Table 4-3: Response technique evaluation – Surface Release

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Marine Diesel				
Monitor and Evaluate	Will be effective in tracking the location of the spill, predicting potential impacts and triggering further monitoring and response techniques as required. Operational monitoring (OM) techniques include: • OM01 Predictive modelling of hydrocarbons – used throughout release. 'Ground-truthed' using the outputs of all other monitoring techniques. • OM02 Surveillance and reconnaissance to detect hydrocarbons and resources at risk – from outset of release. • OM03 Monitoring of hydrocarbon presence, properties, behaviour and weathering in water – from outset of release. • OM04 Pre-emptive assessment of sensitive receptors at risk – triggered once OM01, OM02 and OM03 inform likely RPAs at risk. • OM05 Shoreline assessment – once OM02, OM03 and OM04 inform which RPAs have been impacted.	Monitoring of a diesel release is a feasible response technique and outputs can be used to guide decision making on the use of other response techniques and providing information to regulatory agencies including AMSA and Western Australia's Department of Transport (WA DoT).	**Yes**	Monitoring the release will be necessary to: • Validate trajectory and weathering models • Determine the behaviour of the oil in water • Determine the location and weathering condition of the slick • Provide forecasts of spill trajectory • Determine appropriate response techniques • Determine effectiveness of response techniques • Confirm impact pathways to receptors
Source Control (via vessel SOPEP)	Controlling the spill of diesel at source would be the most effective way to limit the quantity of hydrocarbon entering the marine environment.	A spill of diesel from a vessel collision will be instantaneous and source control will be limited to what the vessel or facility can achieve whilst responding to the incident.	**Yes**	Ability to stop the spill at source will be dependent upon the specific spill circumstances and whether or not it is safe for response personnel to access/isolate the source of the spill.
Surface Dispersant Application	Dispersants are not considered effective when applied on thin surface films such as diesel. The dispersant droplets tend to pass through the surface films without binding to the hydrocarbon.	Marine diesel has a high portion of non-persistent (light-ends) component and is prone to rapid spreading and evaporation thus the use of dispersant would be deemed an unnecessary response technique. Furthermore, the volatile nature of Marine Diesel is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon thus this response technique is deemed inappropriate.	**No**	The application of dispersant to marine diesel is unnecessary as the diesel will rapidly evaporate and would thus unnecessarily introduce additional chemical substances to the marine environment. The additional entrainment would also increase exposure of subsea species and habitats to hydrocarbons.
Containment and Recovery	Containment and recovery have an effective recovery rate of 5-10% when a hydrocarbon encounter rate of 25-50% is achieved at BAOAC 4 and 5. Containment and recovery requires a spill to be BAOAC 4 or 5 with a 50-100% coverage at a thickness of 100 g/m^2 (or 0.1 mm) to 200 g/m^2.	The rate at which diesel would spread in the warm waters off the North West Shelf mean that this strategy would not be feasible. Furthermore, the volatile nature of Marine Diesel is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon thus this response technique is deemed inappropriate.	**No**	Containment and recovery would be an inappropriate response technique as the coverage requirements would not be achieved by a marine diesel spill. In addition, most of the spilled diesel would have been subject to rapid evaporation and entrainment prior to the commencement of containment and recovery operations.
In situ Burning	In situ burning is only effective where minimum slick thickness can be achieved.	Use of in situ burning as a response technique for marine diesel is unfeasible as the minimum slick thickness cannot be attained due to rapid spreading. In addition, there is a limited window of opportunity in which this technique can be applied (prior to evaporation of the volatiles) which is unlikely to be achieved. Furthermore, entering a volatile environment to undertake this technique would be unsafe for response personnel.	**No**	Diesel characteristics are not appropriate for the use of in situ burning as the minimum thickness will not be attained due to rapid spreading. Furthermore, it would unnecessarily cause an increase in the release of atmospheric pollutants.

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Marine Diesel				
Mechanical Dispersion	Mechanical dispersion involves the use of a vessel's prop wash and/or fire hose to target surface hydrocarbons to achieve dispersion into the water column. However, this technique is of limited benefit in an open ocean environment where wind and wave action are likely to deliver similar advantages.	Although the technique is feasible, highly volatile hydrocarbons are likely to weather, spread and evaporate quickly. The volatile nature of the oil is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon. Additionally, any vessel used for mechanical dispersion activities would be contaminated by the hydrocarbon and could potentially cause secondary contamination of unimpacted areas when exiting the spill area. The decontamination of a vessel used for mechanical dispersion activities would result in additional quantities of oily waste requiring appropriate handling and treatment.	**No**	Given the limited benefit of mechanical dispersion over natural wind and wave action, secondary contamination and waste issues, and the associated safety risk of implementing the response for this activity, this strategy is deemed unsuitable.
Shoreline Protection and Deflection	This strategy is deployed at highly sensitive sites to prevent ingress of hydrocarbon or to increase concentrations in an area more suitable for shoreline clean-up.	Given the minimum time to shoreline contact is 2.2 days, use of shoreline protection and deflection for a spill of marine diesel may provide some environmental benefit and could prevent shoreline accumulation occurring (although maximum concentration of shoreline loading is predicted to be 3 m^3). Operational monitoring will be deployed from the outset of a spill to track the spill location and fate in real-time. Due to potentially high levels of volatiles from a spill of marine diesel, shoreline protection and deflection would only be undertaken if safe for response personnel.	**Yes**	Protection and deflection may be deployed to prevent contamination of sensitive resources. RPAs predicted to be contacted are based on modelling outputs and thus may differ under the prevailing conditions of a real event, as the locations of oiling and the volume ashore may vary.
Shoreline Clean up	Shoreline clean-up is an effective means of hydrocarbon removal from contaminated shorelines where coverage is at an optimum level of 250 g/m^2.	Potential for accumulation of oil on shorelines is predicted to be low. This strategy can reduce or prevent impact on sensitive receptors and helps prevent remobilisation of hydrocarbons. Although the concentrations are lower than optimal some shoreline clean-up may be possible at natural collection points on the coastline.	**Yes**	Shoreline clean-up may be undertaken if sensitive receptors are impacted at levels that would permit an effective response and only if volatile levels are safe for responders. Low concentrations for manual clean up however there may be isolated higher concentrations in sheltered areas that could be manually recovered
Oiled Wildlife	Oiled wildlife response is an effective response technique for reducing the overall impact of a release on wildlife. This is mostly achieved through hazing to prevent additional fauna from being contaminated and through rehabilitation of fauna already subject to contamination. Air-breathing fauna such as marine mammals are most at risk from surface exposures due to the high volatile components. Marine mammals that have direct physical contact with surface, entrained or dissolved aromatic hydrocarbons may suffer surface fouling, ingest hydrocarbons and inhale toxic vapours.	Due to the likely volatile atmospheric conditions surrounding a diesel spill, response options would be limited to hazing to ensure the safety of response personnel. In addition, any rehabilitation could only be undertaken by trained specialists.	**Yes**	In the event that wildlife are at risk of contamination, oiled wildlife response will be undertaken as and where required.

4.2.3 Exclusion of response techniques

Response techniques that are not feasible for the worst case scenario for the PAP are detailed in the subsections below and are excluded from further assessment within this document.

4.2.3.1 Containment and recovery

Marine diesel is prone to rapid spreading and evaporation thus reducing the feasibility of containment and recovery as a response technique. Furthermore, entering a volatile environment to undertake this technique would be unsafe for response personnel. Although this scenario results in surface oil of BAOAC 4, this only occurs within the first few hours during which time volatile levels would be very high and unsafe for response personnel.

4.2.3.2 Surface dispersant application

Marine diesel is prone to rapid spreading and evaporation thus the use of dispersant would be deemed an unnecessary response technique. The application of dispersant to marine diesel is unnecessary as the diesel will rapidly evaporate and would thus unnecessarily introduce additional chemical substances to the marine environment. The additional entrainment would also increase exposure of subsea species and habitats to hydrocarbons.

4.2.3.3 Mechanical dispersion

Mechanical dispersion involves the use of a vessel’s prop wash and/or fire hose to target surface hydrocarbons to achieve dispersion into the water column. However, this technique is of limited benefit in an open ocean environment where wind and wave action are likely to deliver similar advantages. The volatile nature of the oil is likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon. There are also secondary contamination and waste issues to consider.

4.2.3.4 In situ burning

This technique requires calm sea state conditions as is required for containment and recovery operations, which limits its feasibility in the offshore waters of the Operational Area. Optimum weather conditions are <20 knot wind speed and waves <1 to 1.5 m with oil collected to a minimum 3mm thick layer. Due to the conditions in Operational Area it is expected that the ability to contain oil may be limited as the sea state may exceed the optimum conditions. It is preferable that oil is fresh and does not emulsify to maximise burn efficiency and reduce residue thickness.

There are health and safety risks for response personnel associated with the containment and subsequent burning of hydrocarbons. It is also suggested that the residue from attempts to burn would sink, thereby posing a risk to the environment. The longer-term effects of burn residues on the marine environment are not fully understood and therefore, no assessment of the potential environmental impact can be determined. Furthermore, it is unlikely that MDO would achieve the required thickness for in situ burning, rendering this an unsuitable method.

Until further operational and environmental information becomes available, Woodside will not consider this option.

4.3 Stage 2: Predict outcomes

Woodside uses planning scenarios to assess potential impacts and response options for specific locations. Locations with potential environmental impacts, selected from the stochastic modelling are included for assessment. Response thresholds and deterministic modelling are then used to assess the feasibility/effectiveness of a response.

4.4 Stage 3: Balance trade-offs

Woodside considers environmental impacts and response effectiveness/feasibility to determine the most effective oil spill response tools and balance trade-offs, using an automated NEBA tool. The tool considers potential benefits and impacts associated with a response at sensitive receptors and then considers the effectiveness/feasibility of the response to select the response techniques carried forward to the ALARP assessment. The NEBA can be found in **ANNEX A**: Net Environmental Benefit Analysis detailed outcomes.

4.5 Stage 4: Select best response options

To select the response technique, all the other stages in the NEBA process are considered and used to establish response plans and any pre-approvals to support protection of identified environmental and social values.

The response techniques implemented may vary according to a particular spill. The hydrocarbon type released and the sensitivities of the receptors (both ecological and socio-economic) may influence the response. The pre-operational NEBA broadly evaluates each response technique and supports decisions on whether they are feasible and of net environmental benefit. Response techniques that are not feasible or beneficial are rejected at this stage and not progressed to planning.

Further risks and impacts from implementing the selected response options are outlined in **Section 7**.

Table 4-4: Selection and prioritisation of response techniques

Response planning scenario	Key characteristics for response planning	Feasibility of response techniques									
		Monitor and evaluate	Source control via vessel SOPEP	Surface dispersant application	Mechanical dispersion	In situ burning	Containment and recovery	Shoreline protection and deflection	Shoreline clean-up	Oiled wildlife response	Outline response technique
Release of up to 2000 m^3 marine diesel from a vessel collision (residual component of 100 m^3)	The shortest timeframe that shoreline contact from floating oil is predicted at >100 g/m is 2.2 days at Dampier Archipelago with shoreline accumulation peaking at approximately 3 m^3. Other islands, banks, shoals and mainland locations may be exposed to entrained hydrocarbons.	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	• Monitor and evaluate. • Initiate vessel source control if safe and feasible. • If operational monitoring activities indicate surface hydrocarbons in sufficient concentration are moving toward shorelines, the Protection and Deflection Operational Plan will be used. • Shoreline clean-up may be undertaken if sensitive receptors are impacted at levels that would permit an effective response and only if volatile levels are safe for responders. • Plan for oiled wildlife response and implement if oiled wildlife is observed.

From the NEBA undertaken on the WCCS identified the primary response techniques are;

- Monitor and evaluate
- Source control – vessel SOPEP
- Shoreline protection and deflection
- Shoreline clean-up
- Oiled wildlife response

Additional response strategies would be considered based on the inputs and field reports from the monitoring activities. This may include:

- Waste management
- Scientific monitoring programs

5 HYDROCARBON SPILL ALARP PROCESS

Woodside's hydrocarbon spill ALARP process is aligned with guidance provided by NOPSEMA in *Guidance Note GN1488* (2021) and is set out in the 'Woodside Hydrocarbon Spill Oil Spill Preparedness and Response Mitigation Assessment (OSPRMA) Development Guidelines'.

From the identified response planning need and pre-operational NEBA, Woodside conducts a structured, semi-quantitative hydrocarbon spill process which has the following steps:

1. Considers the Response Planning Need identified in terms of surface area (km^2) and available surface hydrocarbon volumes (m^3) against existing Woodside capability;
2. Considers alternative, additional, and improved options for each response technique/control measure by providing an initial and, if required, detailed evaluation of:
    - Predicted cost associated with adopting the control measure,
    - Predicted change/environmental benefit, and
    - Predicted effectiveness/feasibility of the control measure.
3. Evaluates the risks and impacts of implementing the proposed response techniques, and any further control measures with associated environmental performance to manage these additional risks and impacts.

Woodside considers the risks and impacts from a hydrocarbon spill to have been reduced to ALARP when:

1. A structured process for identifying and considering alternative, additional, and improved options has been completed for each selected response technique;
2. The analysis of alternate, additional, and improved control measures meets one of the following criteria:
    - All identified, reasonably practicable control measures have been adopted; or
    - No identified reasonably practicable additional, alternative and/or improved control measures would provide further overall increased proportionate environmental benefit; or
    - No reasonably practical additional, alternative, and/or improved control measures have been identified.
3. Where an alternative, additional and/or improved control measure is adopted, a measurable level of environmental performance has been assigned.
4. Higher order impacts/ risks have received more comprehensive alternative, additional, and improved control measure evaluations and do not just compare the cost of the adopted control measures to the costs of an extreme or clearly unreasonable control measure.
5. Cumulative effects have been analysed when considered in combination across the whole activity.

The response technique selection is based on the risk assessment conducted in the EP. The risk assessment identifies the type of oil, volume of release, duration of release, predicted fate, weathering and the EMBA (along with other requirements such as time to impact and predicted volumes ashore). Modelling is then used to inform the NEBA and the prioritisation of suitable response options. The scale of the response techniques selected in the pre-operational NEBA is informed through the assessment of results from deterministic modelling.

For the purpose of the ALARP assessment, the following terms and definitions have been used:

- Response techniques are considered the control measures that reduce consequences from hydrocarbon spill events. The terms ‘response technique’ and ‘control measure’ are used interchangeably.
- Cost is defined as the time, effort and/or trouble taken in financial, safety, design/storage/installation, capital/lease, and/or operations/maintenance terms to adopt a control measure.
- Where the predicted change to environmental impact is compared against standard environmental values and sensitivities impacts using positive or negative criteria from the NEBA Impact Ranking Classification Guidance in Annex A.

5.1 Monitor and evaluate (including operational monitoring)

Monitor and evaluate includes the gathering and evaluation of data to inform the oil spill response planning and operations. It includes fate and trajectory modelling, spill tracking, weather updates and field observations. This response option is deployed in some capacity for every event. The table below provides the operations monitoring plans that support the successful execution of this response technique.

Table 5-1 below provides the operations monitoring plans that support the successful execution of this response technique.

Table 5-1: Description of supporting operational monitoring plans

ID	Title
OM01	Predictive modelling of hydrocarbons to assess resources at risk
OM02	Surveillance and reconnaissance to detect hydrocarbons and resources at risk
OM03	Monitoring of hydrocarbon presence, properties, behaviour and weathering in water
OM04	Pre-emptive assessment of sensitive receptors at risk
OM05	Shoreline assessment

Woodside maintains an *Operational Monitoring Operational Plan*. If shoreline contact is predicted, Response Protection Areas (RPAs) will be identified and assessed before contact. If shorelines are contacted, a shoreline assessment survey will be completed to guide effective shoreline clean-up operations. This plan includes the process for the IMT to mobilise resources depending on the nature and scale of the spill.

The proximity of Exmouth to the spill event location means that multiple logistical options are available to monitor the spill in relatively short timeframes. The primary mobilisation base for initial monitoring activities would be Exmouth. However, in the event of an extended spill with potential to impact receptors further afield, monitoring activities may also be mobilised from Onslow, Dampier or Karratha.

5.1.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which a response need can be based:

- The shortest timeframe for shoreline contact from floating oil is predicted to be 2.2 days at Dampier Archipelago.
- Entrained hydrocarbon concentrations greater than 100 ppb may occur at numerous locations, including islands, banks, shoals or mainland locations, between 1 hour and 34 days following the release.
- Arrangements for support organisations who provide specialist services or resources should be tested regularly.
- Plans, procedures and support documents need to be in place for Operational and Support functions. These should be reviewed and updated regularly.

5.1.2 Environmental performance based on need

Table 5-2: Environmental Performance - Monitor and Evaluate

Environmental Performance Outcome		To gather information from multiple sources to establish an accurate common operating picture as soon as possible and predict the fate and behaviour of the spill to validate planning assumptions and adjust response plans as appropriate to the scenario.		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.9)**
1	Oil spill trajectory modelling	1.1	Initial modelling available within 6 hours using the Rapid Assessment Tool	1, 3B, 3C, 4
		1.2	Detailed modelling available within 4 hours of RPS receiving information from Woodside	
		1.3	Detailed modelling service available for the duration of the incident upon contract activation	
2	Tracking buoy	2.1	Tracking buoy located on facility/vessel and ready for deployment 24/7	1, 3A, 3C, 4
		2.2	Deploy tracking buoy from facility within 2 hours as per the First Strike Plan.	1, 3A, 3B, 4
		2.3	Contract in place with service provider to allow data from tracking buoy to be received 24/7 and processed.	1, 3B, 3C, 4
		2.4	Data received to be uploaded into Woodside common operating picture (COP) daily to improve the accuracy of other monitor and evaluate techniques.	1, 3B, 4
3	Satellite imagery	3.1	Contract in place with 3rd party provider to enable access and analysis of satellite imagery. Imagery source/type requested on activation of service.	1, 3C, 4
		3.2	3rd party provider will confirm availability of an initial acquisition within 2 hours	1, 3B, 3C, 4
		3.3	First image received with 24 hours of Woodside confirming to 3rd party provider its acceptance of the proposed acquisition plan.	1
		3.4	3rd party provider to submit report to Woodside per image. Report is to include a polygon of any possible or identified slick(s) with metadata.	1
		3.5	Data received to be uploaded into Woodside COP daily to improve accuracy of other monitor and evaluate techniques.	1, 3B, 4
		3.6	Satellite Imagery services available and employed during response	1, 3C, 4
4	Aerial surveillance	4.1	2 trained aerial observers available to be deployed by day 1 from resource pool.	1, 2, 3B, 3C, 4
		4.2	1 aircraft available for two sorties per day, available for the duration of the response from day 1	1, 3C, 4
		4.3	Observer to compile report during flight as per first strike plan. Observers report available to the IMT within 2 hours of landing after each sortie.	1, 2, 3B, 4
		4.4	Unmanned Aerial Vehicles/Systems (UAV/UASs) to support SCAT and pre-emptive assessments as contingency if required.	1, 2
5	Hydrocarbon detections in water	5.1	Activate 3rd party service provider as per first strike plan. Deploy resources within 2.5 days: • 3 specialists in water quality monitoring • 2 monitoring systems and ancillaries • 1 vessel for deploying the monitoring systems with a dedicated winch, A-frame or Hiab and ancillaries to deploy the equipment.	1, 2, 3C, 3D, 4
		5.2	Water monitoring services available and employed during response	1, 3C, 4
		5.3	Preliminary results of water sample as per contractor's implementation plan within 7 days of receipt of samples at the accredited lab	
		5.4	Daily fluorometry reports as per service provider's implementation plan will be provided to IMT to validate modelling and monitor presence/absence of entrained hydrocarbons.	
		5.5	Use of Autonomous Underwater Vehicles (AUVs) for hydrocarbon presence and detection may be used as a contingency if the operational NEBA confirms conventional methods are unsafe or not possible.	1, 2, 3C, 4
6	Pre-emptive assessment	6.1	Within 2 days, deployment of 2 specialists from resource pool in establishing the status of sensitive receptors.	1, 2, 3B, 3C, 4

	of sensitive receptors	6.2	Daily reports provided to IMT on the status of the receptors to prioritise Response Protection Areas (RPAs) and maximise effective utilisation of resources.	1, 3B, 4
7	Shoreline assessment	7.1	Within 2 days, deployment of 2 specialists in SCAT from resource pool for each of the Response Protection Areas (RPAs) with predicted impacts at greater than 100 g/m^2.	1, 2, 3B, 3C, 4
		7.2	SCAT reports provided to IMT daily detailing the assessed areas to maximise effective utilisation of resources.	1, 3B, 4
		7.3	Shoreline access routes with the least environmental impact identified will be selected by a specialist in SCAT operations.	1
8	Management of environmental impact of the response risks	8.1	If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified.	1

The control measures and capability of Woodside and its third-party service providers are shown to support Monitor and Evaluate activities up to and including the identified WCCS. This is demonstrated by the following:

- Woodside has a documented, structured and tested capability for Monitor and Evaluate operations including internal trajectory modelling capabilities, tracking buoys located offshore and contracted aerial observation platforms with access to trained observers.
- Woodside and its third-party service providers ensure there is sufficient capability for the duration of the response.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures. Where control measures have been selected and implemented, they are included in **Section 6**.
- The health and safety, financial, capital and operations/maintenance costs of implementing the alternative, additional or improved control measures identified and not carried forward are considered grossly disproportionate to the environmental benefit gained and/or not reasonably practicable for this PAP.
- The Monitor and Evaluate capability outlined in this section is part of the response developed to manage potential risks and impacts associated with the scenarios to ALARP, and there are no further additional, alternative and improved control measures other than those implemented that would provide further benefit.

5.2 Source Control via Vessel SOPEP

Vessel source control will be conducted, where feasible and in accordance with International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 Annex I, by the Vessel Master under the Shipboard Oil Pollution Emergency Plan (SOPEP) triggered by any loss of containment from the PAP vessels.

The SOPEP provides guidance to the Master and Officers on board the vessel with respect to the extra steps to be taken when an unexpected pollution incident has occurred or is likely to occur. The SOPEP contains all information and operational instructions required by International Marine Organisation (IMO) Resolution MEPC.54 (32) adopted on 6 March 1992, as amended by resolution MEPC.86 (44) adopted on 13 March 2000.

Its purpose is to set in motion the necessary actions to stop or minimise oil discharge and mitigate its effects and outlines responsibilities, pollution reporting requirements, procedures and resources needed in the event of a hydrocarbon spill from vessel activities.

In the event of a potential vessel collision, the vessel master may engage precautionary marine manoeuvres to avoid collision or commence pumping operations to transfer marine diesel and thus minimise the release.

5.2.1 Environmental performance based on need

Woodside has established control measures, environmental performance outcomes, performance standards and measurement criteria to be used for vessel-source oil spill response during the PAP which are detailed in Section 6.7 of the EP. The vessel master's roles and responsibilities are described in EP Section 7.3**.**

Performance standards for each contracted PAP vessel are detailed in the vessel's specific SOPEP.

These standards ensure that sufficient resources are available and are adequately tested to ensure implementation of the SOPEP in the event of a hydrocarbon spill.

5.3 Shoreline protection and deflection

The placement of containment, protection or deflection booms on and near a shoreline is a response technique to reduce the potential volume of hydrocarbons contacting or spreading along shorelines, which may reduce the scale of shoreline clean-up. Hydrocarbons contained by the booms would be collected where practicable.

Shorelines would be protected where accessible via vessel or shore. Where hydrocarbon contact has already occurred, there may still be value in deploying protection equipment to limit further accumulations and preventing remobilisation of stranded hydrocarbons.

Shoreline protection and deflection equipment would be mobilised to selected locations, where the following conditions were met:

- Sea-states and hydrocarbon characteristics are safe to deploy protection and deflection measures,
- Oil trajectory has been identified as heading towards identified RPAs.

5.3.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which the response need can be based.

- Floating oil at the 10 g/m^2 threshold is predicted to arrive at the Dampier Archipelago with a probability of 2% after 27 hours (CS-01).
- Shoreline accumulation greater than the 100 g/m^2 threshold is predicted to occur at Dampier Archipelago after a minimum of 2.2 days with a maximum shoreline accumulation of 156 g/m^2 (CS-01).
- Pre-emptive assessment and shoreline assessments (OM04 and OM05) will be mobilised prior to shoreline accumulation at 100 g/m^2.
- Following pre-emptive assessments of sensitive receptors at risk, and in agreement of prioritisation with WA DoT (if a Level 2/3 incident and within State Waters), protection and deflection operations would commence until agreed termination criteria are reached.
- Shoreline response operations may extend 1-2 weeks following the release based on the predicted time for shoreline contact and the time to complete shoreline clean-up operations.
- Arrangements for support organisations who provide specialist services (trained personnel, protection and deflection equipment) and/or resources and should be tested regularly.
- Tactical Response Plans (TRPs) for Response Protection Areas (RPAs) along with other relevant plans, procedures and support documents need to be in place for Operational and Support functions. These should be reviewed and updated regularly.

In addition, a number of assumptions are required to estimate the response need for Shoreline Protection and Deflection. These assumptions have been described in the table below.

Table 5-3: Response Planning Assumptions – Shoreline Protection and Deflection

Response Planning Assumptions	
Safety considerations	Shoreline protection and deflection operations cannot be implemented if the safety of response personnel cannot be guaranteed. This requires an initial and ongoing risk assessment of health and safety hazards and risks at the site. Personnel safety issues may include: • hydrocarbon gas and/or liquid exposure • safe for deployment and conditions within range of vessels • high ambient temperatures.

Shoreline Protection and Deflection	One (1) Shoreline Protection and Deflection operation may include; • Quantity of shoreline sealing boom (as outlined in TRP) • Quantity of fence or curtain boom (as outlined in TRP) • 1-2 x trained supervisors • 8-10 x personnel / labour hire Specific details of each operation would be tailored to the Tactical Response Plan implemented (where available).

5.3.2 Environmental performance based on need

Table 5-4: Environmental Performance – Shoreline Protection and Deflection

Environmental Performance Outcome		To stop hydrocarbons encountering particularly sensitive areas		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.9)**
9	Response teams	9.1	Relevant Tactical Response Plans (TRPs) will be identified in the first strike plan for activation within 12 hours of the release.	1, 3A, 3C, 4
		9.2	In liaison with WA DoT (for Level 2/3 incidents), mobilise teams to RPAs within 12 hours of operational monitoring predicting impacts. Teams to contaminated RPAs comprised of: • 1-2 trained specialists per operation • 8-10 personnel/labour hire Personnel sourced through resource pool	1, 2, 3B, 3C, 4
		9.3	One operation mobilised within 24 hours to each identified RPA. Expected to be one RPAs within two days (operation as detailed above)	1, 3A, 3B, 4
		9.4	12 trained personnel available within 48 hours sourced through resource pool.	1, 2, 3A, 3B, 3C, 4
		9.5	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s)	1, 3A, 3B
		9.6	The safety of shoreline response operations will be considered and appropriately managed. During shoreline operations: • All personnel in a response will receive an operational/safety briefing before commencing operations • Gas monitoring and site entry protocols will be used to assess safety of an operational area before allowing access to response personnel	1, 3B, 4
10	Response equipment	10.1	Equipment mobilised from closest stockpile within 12 hours.	1, 3A, 3C, 4
		10.2	Supplementary equipment mobilised from State, AMOSC, AMSA stockpiles within 24 hours.	1, 3C, 3D, 4
		10.3	Supplementary equipment mobilised from OSRL within 48 hours.	
		10.4	Woodside maintains integrated fleet of vessels. Additional vessels can be sourced through existing contracts/frame agreements	1, 3A, 3C, 4
11	Management of Environmental Impact of the response risks	11.1	If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic primary producer habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified	1
		11.2	Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines	

The resulting shoreline protection and deflection capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to shoreline protection and deflection at identified RPAs.

Under optimal conditions, during the subsea and surface releases the capability available exceeds the need identified. It indicates that, the shoreline protection and deflection capability have the following expected performance:

- Deterministic modelling scenarios indicate that first shoreline impact at Dampier Archipelago may occur within 2.2 days for CS-01.
- Existing capability allows for mobilization and deployment of 1 protection and deflection operation (approximately 10-12 responders) within 24 hours (if required). The existing capability is considered sufficient to mobilise and deploy protection at RPAs prior to hydrocarbon contact, guided by the ongoing operational monitoring.

- The most significant constraint on expanding the scale of response operations is the availability of accommodation and transport services in the region between Exmouth and Port Hedland, and the management of response generated waste. From previous assessment of accommodation in this region, Woodside estimates that current accommodation can cater for a range of 500-700 personnel per day for an ongoing operation.
- TRPs have been developed for all identified RPAs excepting international locations.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures (**Section 6.3**).
- No further control measures that may result in an increased environmental benefit that involve moderate to significant cost and/or dedication of resources have been adopted as the timeframe required for deployment of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

5.4 Shoreline clean-up

Shoreline clean-up may be undertaken using a broad range of techniques when floating hydrocarbons contact shorelines. The timing, location and extent of shoreline clean-up activities can vary from one scenario to another, depending on the hydrocarbon type, sensitivities and values contacted, shoreline type and access, degree of oiling, and area oiled.

Shoreline clean-up is typically undertaken as a three-phase process, phase one (gross contamination removal) involving the collection of bulk oil, either floating against the shoreline or stranded on it, phase two (moderate to heavy contamination removal) involving removal or in situ treatment of shoreline substrates such as sand or pebble beaches, and phase three (final treatment or polishing) involving removal of the remaining residues of oil. As phase one typically involves recovery of floating and pooled oil, and phase three removes minor volumes, they have not been considered in the assessment of response need for the scenarios identified.

The *Shoreline Clean-up Operational Plan* details the mobilisation and resource requirements for a shoreline clean-up operation including the logistics, support and facility arrangements to manage the movement of personnel and resources. The *Shoreline Cleanup Operational Plan* includes the process for the IMT to mobilise resources depending on the nature and scale of the spill. Woodside would activate and mobilise trained and competent personnel in shoreline assessment before or following shoreline contact at response thresholds.

Shoreline clean-up consists of different manual recovery techniques to remove hydrocarbons and contaminated debris from a shoreline; this is to minimise ongoing environmental contamination and impact. The National Plan also provides guidance on shoreline clean-up techniques as outlined in National Plan Guidance *Response, assessment and termination of cleaning for oil contaminated foreshores* (AMSA 2015).

5.4.1 Response need based on predicted consequence parameters

A number of assumptions are required to estimate the response need for shoreline clean-up. These assumptions have been described in the table below.

Table 5-5: Response Planning Assumptions – Shoreline Clean-up

Response planning assumptions: Shoreline clean-up	
Manual shoreline clean-up operation (Phase 2)	One, manual shoreline clean-up operation (Phase 2) may include: • 1–2 x trained supervisor • 8–10 x personnel/labour hire • Supporting equipment for manual clean-up including rakes, shovels, plastic bags etc.

Physical properties	**<u>Surface Threshold</u>**
	• Lower – 100 g/m^2 - 100% coverage of 'stain' – cannot be scratched off easily on coarse sediments or bedrock
	  − Expected trigger to undertake detailed shoreline survey
	• Optimum – 250 g/m^2 – 25% coverage of 'coat' – can be scratched off with a fingernail on coarse sediments
	  − Expected trigger to commence clean-up operations

Efficiency (m^3 oil recovered per person per day)	Manual shoreline clean-up (Phase 2) - approx. 0.25–1 m^3 oil recovered per person per 10 hr day is based on moderate to high coverage of oil (100 g/m^2–1000 g/m^2) with manual removal using shovels/rakes, etc. from studies of previous response operations and exercises
Field operation supervisors required (per team)	Manual shoreline clean-up (Phase 2) – 1-2 trained supervisor(s) per operation (assumes one team per operation)
Personnel/ labour hire (per team)	Manual shoreline clean-up (Phase 2) – 8-10 personnel/labour hire per operation (assumes one team per operation)

- The shortest timeframe that shoreline contact from floating oil is predicted is 2.2 days at Dampier Archipelago with shoreline accumulation peaking at approximately 3 m^3.
- Pre-emptive assessment and shoreline assessments (OM04 and OM05) will be mobilised prior to shoreline contact.
- Following Shoreline Assessment and agreement of prioritisation with WA Department of Transport, clean-up operations would commence until agreed termination criteria are reached.
- Arrangements for support organisations who provide specialist services (trained personnel, labour hire, shoreline clean-up, and site management equipment) and/or resources and should be tested regularly.
- Tactical Response Plans (TRPs) for Response Protection Areas (RPAs) along with other relevant plans, procedures and support documents should be in developed and in place for Operational and Support functions. These should be reviewed and updated regularly.

In addition, a number of assumptions are required to estimate the response need for shoreline clean-up. These assumptions have been described in the table below.

Table 5-6: Shoreline Clean-up techniques and recommendations

Technique	Description	Shoreline type		Application
		Recommended	Not recommended	
Natural recovery	Allowing shoreline to self-clean; no intervention undertaken.	Remote and inaccessible shorelines for personnel, vehicles and machinery. Other clean-up techniques may cause more damage than allowing the shoreline to naturally recover. Natural recovery may be recommended for areas with mangroves and coral reefs due to their sensitivity to disturbance from other shoreline clean-up techniques. High-energy shorelines: where natural removal rates are high, and hydrocarbons will be removed over a short timeframe.	Low-energy shorelines: these areas tend to be where hydrocarbon accumulates and penetrates soil and substrates.	May be employed, if the operational NEBA identifies that other clean-up techniques will have a negligible or negative environmental impact on the shoreline. May also be used for buried or reworked hydrocarbons where other techniques may not recover these.
Manual recovery	Use of manpower to collect hydrocarbons from the shoreline. Use of this form of clean-up is based on type of shoreline.	Remote and inaccessible shorelines for vehicles and machinery. Areas where shorelines may not be accessible by vehicles or machinery and personnel can recover hydrocarbons manually. Where hydrocarbons have formed semi-solid to solid masses that can be picked up manually. Areas where nesting and breeding fauna cannot or should not be disturbed.	Coral reef or other sensitive intertidal habitats, as the presence of a response may cause more environmental damage then allowing them to recover naturally. For some high-energy shorelines such as cliffs and sea walls, manual recovery may not be recommended as it may pose a safety threat to responders.	May be used for sandy shorelines. Buried hydrocarbons may be recovered using shovels into small carry waste bags, but where possible the shoreline should be left to naturally recover to prevent any further burying of hydrocarbons (from general clean-up activities).

Technique	Description	Shoreline type		Application
		Recommended	Not recommended	
Sorbents	Sorbent boom or pads used to recover fluid or sticky hydrocarbons. Can also be used after manual clean-up to remove any residues from crevices or from vegetation.	When hydrocarbons are free-floating close to shore or stranded onshore. As a secondary treatment method after hydrocarbon removal and in sensitive areas where access is restricted.	Access for deploying and retrieving sorbents should not be through soft or sensitive habitats or affect wildlife.	Used for rocky shorelines. Sorbent boom will allow for deployment from small shallow draught vessels, which will allow deployment close to shore where water is sheltered and to aid recovery. Sorbents will create more solid waste compared with manual clean-up, so will be limited to clean rocky shorelines.
Vacuum recovery, flushing, washing	The use of high volumes of low-pressure water, pumping and/or vacuuming to remove floating hydrocarbons accumulated at shorelines.	Suited to rocky or pebble shores where flushing can remobilise hydrocarbons (to be broken up) and aid natural recovery. Any accessible shoreline type from land or water. May be mounted on barges for water-based operations, on trucks driven to the recovery area, or hand-carried to remote sites. Flushing and vacuum may be useful for rocky substrate. Medium- to high-energy shorelines where natural removal rates are moderate to high. Where flushed hydrocarbons can be recovered to prevent further oiling of shorelines.	Areas of pooled light, fresh hydrocarbons may not be recoverable via vacuum due to fire and explosion risks. Shorelines with limited access. Flushing and washing not recommended for loose sediments. High-energy shorelines where access is restricted.	High volume low pressure (HVLP) flushing and washing into a sorbent boom could be used for rocky substrate, if protection booming has been unsuccessful in deflecting hydrocarbons from these areas.

Technique	Description	Shoreline type		Application
		Recommended	Not recommended	
Sediment reworking	Movement of sediment to surf to allow hydrocarbons to be removed from the sediment and move sand via heavy machinery.	When hydrocarbons have penetrated below the surface. Recommended for pebble/cobble shoreline types. Medium- to high-energy shorelines where natural removal rates are moderate to high.	Low-energy shorelines as the movement of substrate will not accelerate the natural cleaning process. Areas used by fauna which could potentially be affected by remobilised hydrocarbons.	Use of wave action to clean sediment: appropriate for sandy beaches where light machinery is accessible.
Vegetation cutting	Cutting vegetation to prevent oiling and reduce volume of waste and debris.	Vegetation cutting may be recommended to reduce the potential for wildlife being oiled and reduce oiled waste before contact. Where oiling is restricted to fringing vegetation.	Access in bird-nesting areas should be restricted during nesting seasons. Areas of slow-growing vegetation.	May be used on shorelines where vegetation can be safely cleared to reduce oiling.
Cleaning agents (OSCA)	Application of chemicals such as dispersants to remove hydrocarbons.	May be used for manmade structures and where public safety may be a concern.	Natural substrates and in low-energy environments where sufficient mixing energy is not present.	Not recommended for shorelines. Could be used for manmade structures such as boat ramps.

5.4.2 Environmental performance based on need

Table 5-7: Environmental Performance – Shoreline Clean-up

<table>
<tr><th colspan="2">Environmental Performance Outcome</th><td colspan="3">To remove bulk and stranded hydrocarbons from shorelines and facilitate shoreline amenity habitat recovery.</td></tr>
<tr><th colspan="2">Control measure</th><th colspan="2">Performance Standard</th><th>Measurement Criteria (Section 5.9)</th></tr>
<tr><td rowspan="7">12</td><td rowspan="7">Shoreline responders</td><td>12.1</td><td>In liaison with WA DoT (for Level 2/3 incidents), deployment of one shoreline clean-up team to each contaminated RPA comprised of:
• 1-2 trained specialists per operation
• 8-10 personnel/labour hire
Personnel sourced through resource pool within 48 hours of request from the IMT.</td><td>1, 2, 3A, 3B, 3C, 4</td></tr>
<tr><td>12.2</td><td>Relevant Tactical Response Plans (TRPs) will be identified in the first strike plan for activation within 12 hours of the release</td><td>1, 3A, 3C, 4</td></tr>
<tr><td>12.3</td><td>Clean-up operations for shorelines in line with results and recommendations from SCAT outputs</td><td rowspan="2">1, 3A, 3B</td></tr>
<tr><td>12.4</td><td>All shoreline clean-up sites will be zoned and marked before clean-up operations commence.</td></tr>
<tr><td>12.5</td><td>In liaison with WA DoT (for Level 2/3 incidents), mobilise and deploy one shoreline clean-up operation where operational monitoring predicts accumulations >100 g/m^2 by Day 2.</td><td>1, 2, 3A, 3C, 4</td></tr>
<tr><td>12.6</td><td>The safety of shoreline response operations will be considered and appropriately managed. During shoreline clean-up operations:
• All personnel in a response will receive an operational/safety briefing before commencing operations
• Gas monitoring and site entry protocols will be used to assess safety of an operational area before allowing access to response personnel</td><td>1, 3B, 4</td></tr>
<tr><td>12.7</td><td>Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s)</td><td>1, 3A, 3B</td></tr>
<tr><td rowspan="4">13</td><td rowspan="4">Shoreline clean-up equipment</td><td>13.1</td><td>Contract in place with 3rd party providers to access equipment.</td><td rowspan="2">1, 3A, 3C, 4</td></tr>
<tr><td>13.2</td><td>Equipment mobilised from closest stockpile within 24 hours.</td></tr>
<tr><td>13.3</td><td>Supplementary equipment mobilised from State, AMOSC, AMSA stockpiles within 2 days, if required.</td><td rowspan="2">1, 3C, 3D, 4</td></tr>
<tr><td>13.4</td><td>Supplementary equipment mobilised from OSRL within 5 days, if required.</td></tr>
<tr><td rowspan="7">14</td><td rowspan="7">Management of Environmental Impact of the response risks</td><td>14.1</td><td>If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic primary producer habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified</td><td rowspan="7">1</td></tr>
<tr><td>14.2</td><td>Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines</td></tr>
<tr><td>14.3</td><td>Vehicular access will be restricted on dunes, turtle nesting beaches and in mangroves</td></tr>
<tr><td>14.4</td><td>Removal of vegetation will be limited to moderately or heavily oiled vegetation</td></tr>
<tr><td>14.5</td><td>Shoreline access routes with the least environmental impact identified will be selected by a specialist in SCAT operations</td></tr>
<tr><td>14.6</td><td>Oversight by trained personnel who are aware of the risks</td></tr>
<tr><td>14.7</td><td>Trained unit leader’s brief personnel of the risks prior to operations</td></tr>
</table>

The resulting shoreline clean-up capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to shoreline clean-up at identified RPAs. Woodside’s capability can cover all required shoreline clean-up operations for the PAP. Whilst modelling predicts shoreline contact from day 2 at Dampier Archipelago Woodside is satisfied that the current capability is managing risks and impacts to ALARP.

The capability available meets the need identified for this activity. The shoreline clean-up capability has the following expected performance (if required during a response):

- Woodside has the capacity to mobilise and deploy up to 1-2 shoreline clean-up teams (approx. 10-20 responders) by Day 2 using existing labour hire contracts with Woodside, AMOSC, Core Group, AMSA, WA DoT and OSRL team leads.
- Pre-emptive assessment and shoreline assessments (OM04 and OM05) will be mobilised prior to shoreline contact to determine if shoreline clean-up is feasible and necessary.
- Assessment of response capability indicates that for a worst-case scenario the actual teams required would meet the available capability.
- Woodside has considered deployment of additional personnel to undertake shoreline clean-up operations but is satisfied that the identified level of resource is balanced between cost, time and effectiveness. The most significant constraint on expanding the scale of response operations is accommodation and transport of personnel in Exmouth and management of response generated waste. From previous assessment of accommodation in Exmouth, Woodside estimates that current accommodation can cater for a range of 500-700 personnel per day for an ongoing operation, which exceeds the number of personnel that would be required.
- TRPs have been developed for all identified RPAs.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures (**Section 6.3**).
- No further control measures that may result in an increased environmental benefit that involve moderate to significant cost and/or dedication of resources have been adopted as the limited scale and timeframe for deployment of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

5.5 Oiled wildlife response (including hazing)

Woodside would implement a response in accordance with the Western Australian *Oiled Wildlife Operational Plan* (WA OWRP). This plan includes the process for the IMT to mobilise resources depending on the nature and scale of the spill. Oiled wildlife operations would be implemented with advice and assistance from the Oiled Wildlife Advisor from the Western Australia Department of Biodiversity, Conservation and Attractions (DBCA).

Oiled wildlife response is undertaken in accordance with the (WA OWRP) to ensure it is conducted in accordance with legislative requirements under the Animal Welfare Act 2002.

If there is a net environmental benefit, oiled wildlife operations will be conducted 24 hours per day to reduce the time for rehabilitation and release of oiled wildlife. Hazing and pre-emptive capture techniques to keep non-oiled animals away from contaminated habitat in instances where it is deemed appropriate will be conducted in accordance with the (WA OWRP), specifically vessels used in hazing/pre-emptive capture will approach fauna at slow speeds to ensure animals are not directed towards the oil and deterrence/hazing and pre-emptive capture will only be conducted if Woodside has licensed authority from DBCA and approval from the Incident Controller.

Shoreline access will be considered as part of the operational NEBA. Vehicle access would be restricted on dunes, turtle nesting beaches and in mangroves. Woodside retains specialist personnel to support and manage oiled wildlife operations, including trained and competent responders in Exmouth or the wider region. Additional personnel would be sourced through Woodside's arrangements to support an oiled wildlife response as required.

5.5.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which a response need can be based:

- Modelling predicts the shortest time to shoreline contact at day 2 at Dampier Archipelago.
- The offshore location of the release site is expected to initially result in low numbers of at-risk or impacted wildlife.
- As the surface oil approaches shorelines, potential for oiled wildlife impacts are likely to increase.
- It is estimated that an oiled wildlife response would be between Level 2 and 3, as defined in the WA OWRP.

Table 5-8: Key at-risk species potentially in Priority Protection Areas and open ocean

Species	Open ocean	Dampier Archipelago	Montebello AMP	Gascoyne AMP	Dampier AMP
Marine turtles (including foraging and inter-nesting areas and significant nesting beaches)	√	√	√	√	√
Whale sharks (migration to and from waters at Ningaloo)	√		√	√	
Seabirds and/or migratory shorebirds	√	√	√	√	√
Cetaceans – migratory whales	√	√	√	√	√
Cetaceans – dolphins and porpoises	√	√	√	√	√
Dugongs	√	√			√
Sea snakes	√	√	√	√	√

The oiled wildlife response technique targets key wildlife populations at risk within Commonwealth open waters and the nearshore waters. Responding to oiled wildlife consists of eight key stages, as described in **Table 5-9** below.

Table 5-9: Oiled wildlife response stages

Stage	Description
Stage 1: Wildlife first strike response	Gather situational awareness including potential wildlife assets at risk.
Stage 2: Mobilisation of wildlife resources	Resources include personnel, equipment and facilities.
Stage 3: Wildlife reconnaissance	Reconnaissance to identify potentially affected animals.
Stage 4: IAP wildlife sub-plan development	The IAP includes the appropriate response options for oiled wildlife, including wildlife priorities for protection from oiling; deterrence measures (see below); and recovery and treatment of oiled wildlife; resourcing of equipment and personnel. It includes consideration of deterrence practices such as ‘hazing’ to prevent fauna from entering areas potentially contaminated by spilled hydrocarbons, as well as dispersing, displacing or relocating fauna to minimise/prevent contact and provide time for clean-up.
Stage 5: Wildlife rescue and staging	This includes the different roles of finding oiled wildlife, capturing wildlife, and holding and/or transportation of wildlife to oiled wildlife facilities.
Stage 6: Establishment of an oiled wildlife facility	Treatment facilities would be required for the first-aid, 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. Suitable staging sites in Exmouth and/or Onslow have been identified in the draft Regional Oiled Wildlife Response Operational Plan (OWROP), should a land-based site be required.
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping and success tracking.
Stage 8: Oiled wildlife response termination	Once a decision has been made to terminate operations, the Incident Controller will stand down individual participating and supporting agencies.

Reconnaissance and primary response would be done during operational monitoring and surveillance activities. Where marine fauna is observed on water or transiting near or within the spill area, observations would be recorded through surveillance records. The shoreline assessments would be done in accordance with OM05, which would be used as a further tool to identify fauna and habitats contacted by hydrocarbons.

Staging sites would be established as forward bases for shoreline- or vessel-based field teams. Once recovered to a staging site, wildlife would be transported to the designated oiled wildlife facility or a temporary holding centre (before being transported to the oiled wildlife facility). Temporary holding centres are required when there is significant distance between a staging site and the oiled wildlife facility, to enable stabilisation of oiled animals. The oiled wildlife facility is the primary location where animals would be housed and treated. Sites proposed for staging a regional oiled wildlife response in Exmouth and/or Onslow have been identified.

To deploy a response that is appropriate to the nature and scale of the event, as well as scalable over time, Woodside would implement an oiled wildlife response in consultation with DBCA and use the capability outlined in the WA OWRP, with additional capability if required (e.g. volunteers) accessible through Woodside’s *People & Global Capability Surge Labour Requirement Plan*.

The WA OWRP provides indicative oiled wildlife response levels (**Table 5-10**) and the resources likely to be needed at each increasing level of response.

Table 5-10: Indicative oiled wildlife response (OWR) level (adapted from the 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

5.5.2 Environmental performance based on need

Table 5-11: Environmental Performance – Oiled Wildlife Response

Environmental Performance Outcome		Oiled Wildlife Response is conducted in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to ensure it is conducted in accordance with legislative requirements to house, release or euthanise fauna under the Animal Welfare Act 2002.		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.9)**
15	Wildlife response equipment	15.1	Contracted capability to treat 100 individual fauna for immediate mobilisation to Response Priority Areas (RPAs)	1, 3A, 3B, 3C, 4
		15.2	Contracted capability to treat up to an additional 250 individual fauna within a five-day period.	
		15.3	National plan access to additional resources under the guidance of the DoT (up to a Level 5 oiled wildlife response as specified in the OWRP), with the ability to treat about 600 individual fauna by the time hydrocarbons contact the shoreline.	1, 3C, 4
		15.4	Vessels used in hazing/pre-emptive capture will approach fauna at slow speeds to ensure animals are not directed towards the hydrocarbons.	1, 3A, 3B, 4
		15.5	Facilities for the rehabilitation of oiled wildlife are operational 24/7 as per WAOWRP.	1, 3A, 4
16	Wildlife responders	16.1	2 OWR Team Members to lead the oiled wildlife operations who have completed an Oiled Wildlife Response Management course	1, 2, 3B
		16.2	Wildlife responders to be accessed through resource pool and additional agreements with specialist providers	1, 2, 3A, 3B, 3C, 4
		16.3	Operations conducted with advice from the DBCA Oiled Wildlife Advisor and in accordance with the processes and methodologies described in the WA OWRP and the relevant regional plan	1
		16.4	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s)	1, 3A, 3B

The resulting wildlife response capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to response at identified RPAs.

Wildlife collection operations would be expected to peak between Day 3 and Day 14 and decrease thereafter. Additional personnel are unlikely to increase the net environmental benefit and this capability is considered to be a manageable balance between effectiveness and minimising environmental impact.

Under optimal conditions, during the surface release the capability available meets the need identified. It indicates that, the wildlife response capability has the following expected performance:

- Mobilisation and deployment of approximately 1-2 wildlife collection teams within the first 5 days of the incident
- Mobilisation and deployment of 1-2 central wildlife treatment and rehabilitation locations at Exmouth and/or Onslow in accordance with WA OWRP.

Woodside would establish a wildlife collection point at the RPA for identified oiled wildlife collection and sorting. From these locations, recovered wildlife would be transported to a central treatment location at Exmouth and/or Onslow.

5.6 Waste Management

Waste management is considered a support technique to wildlife response and shoreline clean-up. Waste generated and collected during the response that will require handling, management and disposal may consist of:

- Liquids (hydrocarbons and contaminated liquids) collected during shoreline clean-up and wildlife response; and/or
- Solids/semi-solids (oily solids, garbage, contaminated materials) and debris (e.g. seaweed, sand, woods, and plastics) collected during shoreline clean-up and wildlife response.

Expected waste volumes during an event are likely to vary depending on oil type, volume released, response techniques employed and how weathering of hydrocarbons. Waste management, handling and capacity should be scalable to ensure continuous response operations can be maintained.

All waste management activities will follow the Environment Protection (Controlled Waste) Regulations 2004 and the waste will be managed to minimise final disposal volumes. Waste treatment techniques will consider contaminated solids treatment to allow disposal to landfill and solids with high concentrations of hydrocarbon will be treated and recycled where possible or used in clean fill if suitable.

The waste products would be transported from response locations to the nearest suitable staging area/waste transfer station for treatment, disposal or recycling. Waste will be transferred with appropriately licensed vehicles. Containers will be available for temporary waste storage and will be:

- labelled with the waste type
- provided with appropriate lids to prevent waste being blown overboard
- bunded if storing liquid wastes.
- processes will be in place for transfers of bulk liquid wastes and include:
  - inspection of transfer hose undertaken prior to transfer
  - watchman equipped with radio visually monitors loading hose during transfer
  - tank gauges monitored throughout operation to prevent overflow

The Oil Spill Preparedness Waste Management Support Plan details the procedures, capability and capacity in place between Woodside and its primary waste services contractor (Veolia Waste Management) to manage waste volumes generated from response activities.

5.6.1 Response need based on predicted consequence parameters

Table 5-12: Response Planning Assumptions – Waste Management

Response planning assumptions: Waste management	
Waste loading per m^3 oil recovered (multiplier)	Shoreline clean-up (manual) – approx. 5-10x multiplier for oily solid and liquid wastes generated by manual clean-up
	Oiled wildlife response – approx. $1m^3$ of oily liquid waste generated for each wildlife unit cleaned

5.6.2 Environmental performance based on need

Table 5-13: Environmental Performance – Waste Management

Environmental Performance Outcome		To minimise further impacts, waste will be managed, tracked and disposed of in accordance with laws and regulations.		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.9)**
17	Waste Management	17.1	Contract with waste management services for transport, removal, treatment and disposal of waste	1, 3A, 3B, 3C, 4
		17.2	Access to at least 213 m^3 of solid and liquid waste storage available within 2 days upon activation of 3rd party contract.	
		17.3	Access to up to 675 m^3 by day 4.	
		17.4	Recovered hydrocarbons and wastes will be transferred to licensed treatment facility for reprocessing or disposal.	
		17.5	Response teams will segregate liquid and solid wastes at the earliest opportunity.	
		17.6	Waste management provider support staff available year-round to assist in the event of an incident with waste management as detailed in contract.	
		17.7	Open communication line to be maintained between IMT and waste management services to ensure the reliable flow of accurate information between parties.	1, 3A, 3B
		17.8	Waste management to be conducted in accordance with Australian laws and regulations	1, 3A, 3B, 3C, 4
		17.9	Waste management services available and employed during response	

The resulting waste management capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to waste management at identified RPAs.

It indicates that the waste management capability has the following expected performance:

- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures.
- The waste management requirements of all credible spill scenarios are well within Woodside's and its service providers existing capacity.
- No further control measures that may result in an increased environmental benefit that involve moderate to significant cost and/or dedication of resources have been adopted as the requirements of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

5.7 Scientific monitoring

A scientific monitoring program (SMP) would be activated following a Level two or three unplanned hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. This would consider receptors at risk (ecological and socio-economic) for the entire predicted Environment that Maybe Affected (EMBA) and in particular, any identified Pre-emptive Baseline Areas (PBAs) for the credible spill scenario or other identified unplanned hydrocarbon releases associated with the operational activities (refer to **Table 2-1**).

The outputs of the stochastic hydrocarbon spill modelling were used to assess the environmental risk of the hydrocarbon affected area as delineated by the ecological impact EMBA and socio-cultural EMBA based on exceedance of environmental and social-cultural hydrocarbon threshold concentrations (refer to **Table 2-2** and see Section 4 and 6 of the Scarborough Seabed Intervention and Trunkline Installation activity EP for further information on applicable thresholds and the EMBAs). The PAP credible spill scenarios (CS-01, CS-02 and CS-03) defines the combined EMBA which is the basis of the SMP approach presented in this section.

It should be noted that the resulting SMP receptor locations differ from the Response Protection Areas presented and discussed in **Section 3** of this document due to the applicability of different hydrocarbon threshold levels. The SMP would be informed by the data collected via the operational monitoring program (OMP) studies; however, it differs from the OMP in being a long-term program independent of, and not directing, the operational oil spill response or monitoring of impacts from response activities (refer to **Section 5.1** for operational monitoring overview).

Key objectives of the Woodside oil spill SMP are:

- Assess the extent, severity and persistence of the environmental impacts from the spill event.
- Monitor subsequent recovery of impacted key species, habitats and ecosystems.

The SMP comprises ten targeted environmental monitoring programs to assess the condition of a range of physico-chemical (water and sediment) and biological (species and habitats) receptors including EPBC Act listed species, environmental values associated with protected areas and socio-economic values, such as fisheries. The ten SMPs are as follows:

- SM01 – Assessment of the presence, quantity and character of hydrocarbons in marine waters (linked to OM01 to OM03)
- SM02 – Assessment of the presence, quantity and character of hydrocarbons in marine sediments (linked to OM01 and OM05)
- SM03 – Assessment of impacts and recovery of subtidal and intertidal benthos
- SM04 – Assessment of impacts and recovery of mangroves/saltmarsh habitat
- SM05 – Assessment of impacts and recovery of seabird and shorebird populations
- SM06 – Assessment of impacts and recovery of nesting marine turtle populations
- SM07 – Assessment of impacts to pinniped colonies including haul-out site populations
- SM08 – Desktop assessment of impacts to other non-avian marine megafauna
- SM09 – Assessment of impacts and recovery of marine fish (linked to SM03)
- SM10 – Assessment of physiological impacts to important fish and shellfish species (fish health and seafood quality/safety) and recovery.

These SMPs have been designed to cover all key tropical and temperate habitats and species within Australian waters and broader, if required. A planning area for scientific monitoring is also identified to acknowledge potential hydrocarbon contact below the environmental threshold concentrations and beyond the EMBA. This planning area has been set with reference to the entrained low exposure value of 10 ppb detailed in NOPSEMA Bulletin #1 Oil Spill Modelling (2019), as shown in **Figure 5-1**.

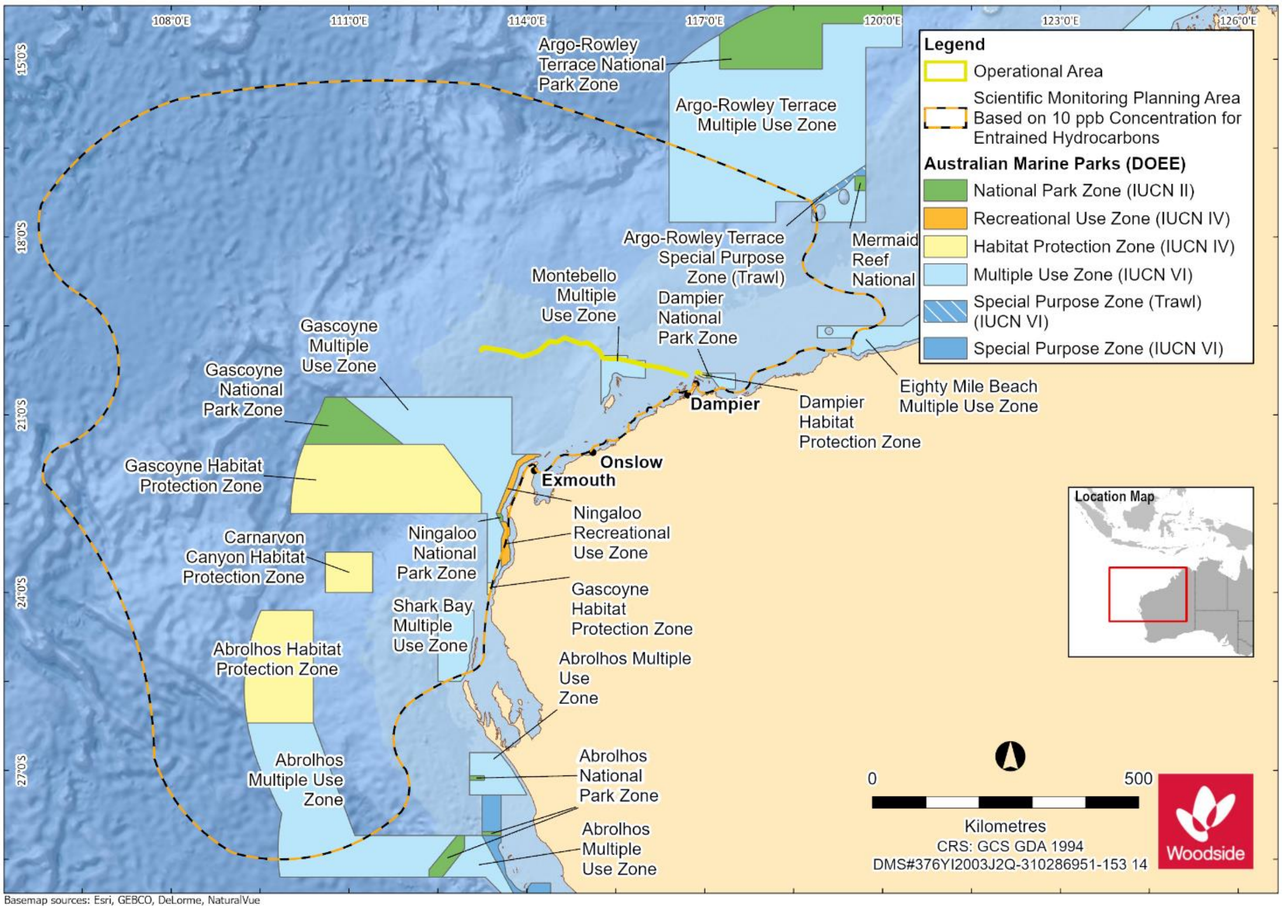


Figure 5-1: The planning area for scientific monitoring based on the area potentially contacted by the low (below ecological impact) entrained hydrocarbon threshold of 10 ppb representing the EMBA for the combined marine diesel credible spill scenarios (CS-01, CS-02 and CS-03)

Please note that **Figure 5-1** represents the overall combined extent of the marine diesel spill model outputs for the credible scenarios (CS-01, CS-02 and CS-03), based on a total of 100-200 replicate simulations over an annual period, and therefore represents the largest spatial boundaries of the spill combinations, not the spatial extent of a single spill.

5.7.1 Scientific monitoring deployment considerations

Table 5-14: Scientific monitoring deployment considerations

Scientific Monitoring Deployment Considerations	
Existing baseline studies for sensitive receptor locations predicted to be affected by a spill	PBAs of the following two categories: • PBAs within the predicted <10-day hydrocarbon contact time prediction: As part of this assessment, a desktop review was conducted of available and appropriate baseline data for key receptors for locations (if any) that are potentially impacted within 10 days of a spill (based on the EMBA). Furthermore, the need to conduct baseline data collection to address data gaps and demonstrate spill response preparedness is assessed (refer to Annex D). In the scenario, that baseline data needs are identified, planning for baseline data acquisition is typically commenced pre-PAP and the execution of studies undertaken considers the receptor type, seasonality and temporal assessment requirements and location conditions. • PBAs predicted >10 days to hydrocarbon contact: As part of this assessment, a desktop review is conducted of available and appropriate baseline data for key receptors for locations (if any) that are potentially impacted >10 days' time of a hydrocarbon spill event and documented (refer to **Table 5-15**). In the event of a spill, the SMP activation (as per the Scarborough Seabed Intervention and Trunkline Installation activity First Strike Response Plan) directs the SMP team to follow the steps outlined in the SMP Operational Plan. The steps include: the review of availability and type of existing baseline data, with particular reference to any Pre-emptive Baseline Areas (PBAs) identified as >10 days to hydrocarbon contact as predicted by forecast modelling trajectories. Such information is used to identify response phase PBAs and plan for the activation of SMPs for pre-emptive (i.e. pre-hydrocarbon contact) baseline assessment.
Pre-emptive Baseline in the event of a spill	Activation of SMPs in order to collect baseline data at sensitive receptor locations with predicted hydrocarbon contact time > 10 days (as documented in **ANNEX C**: Oil Spill Scientific monitoring Program).
Survey platform suitability and availability	In the event of the SMP activation, suitable survey platforms are available and can support the range of equipment and data collection methodologies to be implemented in nearshore and offshore marine environments.
Trained personnel to implement SMPs suitable and available.	Access to trained personnel and the sampling equipment contracted for scientific monitoring via a dedicated scientific monitoring program standby contract.
Met-ocean conditions	The following met-ocean conditions have been identified to implement SMPs: • Waves < 1 m for nearshore systems • Waves < 1.5 m for offshore systems • Winds < 20 knots • Daylight operations only. SMP implementation will be planned and managed according to HSE risk reviews and the met-ocean conditions on a day to day basis by SMP operations.

5.7.2 Response planning assumptions

Table 5-15: Scientific monitoring response planning assumptions

Response Planning Assumptions	
PBAs	PBAs identified through the application of defined hydrocarbon impact thresholds during the Quantitative Spill Risk Assessment process and a consideration of the minimum time to contact at receptor locations fall into two categories: • PBAs for which baseline data are planned for and data collection may commence pre-PAP (≤ 10 days minimum time to contact), where identified as a gap. • PBAs (> 10 days minimum time to contact) for which baseline data may be collected in the event of an unplanned hydrocarbon release. Response phase PBAs are prioritised for SMP activities due to vulnerability (i.e. time to contact and environmental sensitivity) to potential impacts from hydrocarbon contact and an identified need to acquire baseline data. Time to hydrocarbon contact of > 10 days has been identified as a minimum timeframe within which it is feasible to plan and mobilise applicable SMPs and commence collection of baseline (pre-hydrocarbon contact) data, in the event of an unplanned hydrocarbon release from the Scarborough Seabed Intervention and Trunkline Installation activity. PBAs for Scarborough Seabed Intervention and Trunkline Installation activity are identified and listed in **ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program**, Table D-1**. The PBAs together with the situational awareness (from the operational monitoring) are the basis for the response phase SMP planning and implementation.
Pre-Spill	A review of existing baseline data for receptor locations with potential to be contacted by floating or entrained hydrocarbons at environmental thresholds within ≤10 days has identified the following based on the combined EMBA for the credible spill scenarios (CS-01, CS-02 and CS-03): • Rankin Bank [8] • Dampier Archipelago • Montebello Islands and Montebello State Marine Park • Barrow Island and the Lowendal Islands • Pilbara Islands – Middle and Southern Island Groups • Ningaloo coast and the Muiron Islands (state marine park, AMP and WHA) Australian Marine Parks (AMPs) potentially affected include: • Dampier AMP • Montebello AMP • Gascoyne AMP Note: The Australian Marine Parks (AMPs) are located in offshore, open waters where hydrocarbon exposure is possible on surface waters and in the upper water column (entrained hydrocarbons), only.

[8] Floating oil will contact submerged features in open ocean locations; therefore, only entrained hydrocarbon contact is predicted at ≤ 10 days. Predicted upper water column entrained hydrocarbons may extend to approximately 20 m depth and contact the submerged shoal benthic communities.

Response Planning Assumptions	
In the Event of a Spill	Receptor locations with > 10 days to hydrocarbon contact, as well as the wider area, will be investigated and identified by the SMP team (in the Environment Unit of the Incident Control Centre (ICC)) as the spill event unfolds and as the situational awareness provided by the OMPs permits delineation of the spill affected area (for example, updates to the spill trajectory tracking). The full list is presented in **ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program, based on the PAP credible spill scenarios (CS-01, CS-02 and CS-03) (**Table 2-1**). To address the initial focus in a response phase SMP planning situation, receptor locations predicted to be contacted between > 10 days have been identified as follows: • Glomar Shoal[9] • Pilbara Islands – Northern Island Group • Shark Bay outer barrier islands (Bernier and Dorre) • Argo-Rowley Terrace AMP • Shark Bay AMP • Abrolhos AMP The unfolding spill affected area predictions and confirmation of appropriate baseline data will determine the selection of receptor locations and SMPs to be activated in order to gather pre-emptive (pre-hydrocarbon contact) data. Refer to **ANNEX C**: Oil Spill Scientific monitoring Program for further details on the process for scientific monitoring plan implementation and delivery. The timing of SMP activation and mobilisation of the individual SMPs to undertake data collection will be decided and documented by the Woodside SMP team following the process outlined in the SMP Operational Plan. In the event key receptors within geographic locations that are potentially impacted after ten days following a spill event or commencement of the spill and where adequate and appropriate baseline data are not available, there will be a response phase effort to collect baseline data for the following purposes: i. Priority will be given to the collection of baseline data for receptors predicted to be within the spill affected area prior to hydrocarbon contact. The process is initiated with the investigation of available baseline and time to hydrocarbon contact (>10 days which is sufficient time to mobilise SMP teams and acquire data before hydrocarbon contact). With reference to the Scarborough Seabed Intervention and Trunkline Installation activity, dependent on the location of the hydrocarbon release, priority would be focused on Dampier Archipelago, Montebello, Barrow and Lowendal Island Groups, Ningaloo Coast and the Muiron Islands. ii. Highly sensitive and/or valued habitats and communities in coastal waters will be prioritised for pre-emptive baseline surveys over open water areas of AMPs, such as Dampier and Montebello AMPs. iii. Collect baseline data for receptors predicted to be outside the spill affected area so reference datasets for comparative analysis with impacted receptor types can be assessed post-spill.

[9] Floating oil will contact submerged features in open ocean locations; therefore, only entrained hydrocarbon contact is predicted at ≤ 10 days. Predicted upper water column entrained hydrocarbons may extend to approximately 20 m depth and contact the submerged shoal benthic communities.

Response Planning Assumptions	
Baseline Data	• A summary of the spill affected area and receptor locations as defined by the combined EMBA for the PAP credible spill scenarios (CS-01, CS-02 and CS-03), presented in the Scarborough Seabed Intervention and Trunkline Installation activity EP (Section 6). • The key receptors at risk by location and corresponding SMPs based on the EMBAs for the PAP are presented in **ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program, as per the PAP credible spill scenarios. This matrix maps the receptors at risk with their location and the applicable SMPs that may be triggered in the event of a Level two or three hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. Receptor locations and applicable SMPs are colour coded to highlight possible time to contact based on receptor locations identified as PBAs. • The status of baseline studies relevant to the PAP are tracked by Woodside through the maintenance of a Corporate Environment Environmental Baseline Database (managed by the Woodside Environmental Science team), as well as accessing external databases such as the Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA)[10] (refer to **ANNEX C**: Oil Spill Scientific monitoring Program).

5.7.3 Summary – scientific monitoring

The resulting scientific monitoring capability has been assessed against the PAP credible spill scenarios for marine diesel. The range of strategies provide an ongoing approach to monitoring operations to assess and evaluate the scale and extent of impacts. All known reasonably practicable control measures have been adopted with the cost and organisational complexity of these options determined to be moderate and the overall delivery effectiveness determined to be medium. The SMP's main objectives can be met, with no additional, alternative or improved control measures providing further benefit.

5.7.4 Response planning: need, capability and gap – scientific monitoring

The receptor locations identified in **ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program provide the basis of the SMPs likely to be selected and activated. Once the Woodside SMP Delivery team and Standby SMP contractor have been stood up and the exact nature and scale of the spill becomes known, the SMPs to be activated will be confirmed as per the process set out in the SMP Operational Plan.

Scope of SMP Operations in the event of a hydrocarbon spill

Receptor locations of interest for the SMP during the response phase in the event of a spill are:

- Dampier Archipelago
- Rankin Bank
- Montebello Islands and Montebello State Marine Park
- Barrow Island and the Lowendal Islands
- Pilbara Islands – Middle and Southern Island Groups
- Ningaloo Coast and Muiron Islands (State Marine Park, AMP and WHA)

Documented baseline studies are available for certain sensitive receptor locations including the Dampier Archipelago, Montebello Islands, Barrow Island, Lowendal Islands, Rankin Bank, Pilbara Islands – Middle and Southern Island Groups, and Ningaloo coast and the Muiron Islands (**ANNEX D**: Monitoring Program and Baseline Studies for the Petroleum Activities Program**, Table D-2**). The SMP approach in the response phase would still deploy SMP teams to maximise the opportunity to collect pre-emptive baseline data at sensitive receptor locations, i.e., the sections of the WA Coast not immediately contacted to hydrocarbons. As the exact locations where hydrocarbon contact

[10] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

occurs may be unpredictable, SM01 would be mobilised as a priority to be able to detect hydrocarbons and track the leading edge of the spill to verify where hydrocarbon contact occurs which will assist with where SMP resources are a priority need to obtain pre-emptive baseline data.

The option analysis in **Section 6.7** considers ways to reduce the gap by considering alternate, additional, and/or improved control measures on each selected response strategy.

5.7.5 Environmental performance based on need

Table 5-16: Environment performance – scientific monitoring

Environmental Performance Outcome	Woodside can demonstrate preparedness to stand up the SMP to quantitatively assess and report on the extent, severity, persistence and recovery of sensitive receptors impacted from the spill event.			
Control measure		**Performance Standard**		**Measurement Criteria**
18	• Woodside has an established and dedicated SMP team comprising the Environmental Science Team and additional Environment Advisers within the Health Safety Environment (HSE) Function.	18.1	SMP team comprises a pool of competent Environment Advisers (stand up personnel) who receive training regarding the SMP, SMP activation and implementation of the SMP on an annual basis.	• Training materials. • Training attendance registers. • Process that maps minimum qualification and experience with key SMP role competency and a tracker to manage availability of competent people for the SMP team including redundancy and rostering.
19	• Woodside has contracted SMP service provider to provide scientific personnel to resource a base capability of one team per SMP (SM01-SM10, see **ANNEX C:** Oil Spill Scientific monitoring Program**, Table C-2**) as detailed in Woodside's SMP standby contractor Implementation Plan, to implement the oil spill scientific monitoring programs. The availability of relevant personnel is reported to Woodside on a monthly basis via a simple report on the base-loading availability of people for each of the SMPs comprising field work for data collection (SMP resourcing report register). • In the event of a spill and the SMP is activated, the base-loading availability of scientific personnel will be provided by SMP standby contractor for the individual SMPs and where gaps in resources are identified, SMP standby contractor/Woodside will seek additional personnel (if needed) from other sources including Woodside's Environmental Services Panel.	19.1	Woodside maintains the capability to mobilise personnel required to conduct scientific monitoring programs SM01 to SM10 (except desktop-based SM08): • Personnel are sourced through the existing standby contract with SMP standby contractor, as detailed within the SMP Implementation Plan. • Scientific Monitoring Program Implementation Plan describes the process for standing up and implementing the scientific monitoring programs. • SMP team stand up personnel receive training regarding the stand up, activation and implementation of the SMP on an annual basis.	• OSPU Internal Control Environment tracks the quarterly review of the Oil Spill Contracts Master. • SMP resource report of personnel availability provided by SMP contractor on monthly basis (SMP resourcing report register). • Training materials. • Training attendance registers. • Competency criteria for SMP roles. • SMP annual arrangement testing and reporting.
20	• Roles and responsibilities for SMP implementation are captured in **ANNEX C:** Oil Spill Scientific monitoring Program**, Table C-1**) and the SMP team (as per the organisational structure of the ICC) is outlined in SMP Operational Plan. Woodside has a defined Crisis and Incident Management structure including Source Control, Operations, Planning and Logistics	20.1	• Woodside has established an SMP organisational structure and processes to stand up and deliver the SMP.	• SMP Oil Spill Scientific Monitoring Operational Plan. • SMP Implementation Plan. • SMP annual arrangement testing and reporting.

	functions to manage a loss of well control response. • SMP Team structure, interface with SMP standby contractor and linkage to the ICC is presented in **ANNEX C:** Oil Spill Scientific monitoring Program**, Figure C-1**. • Woodside has a defined Command, Control and Coordination structure for Incident and Emergency Management that is based on the Australasian Inter-Service Incident Management System (AIIMS) framework utilised in Australia. • Woodside uses an online Incident Management System (IMS) to coordinate and track key incident management functions. This includes specialist modelling programs, geographic information systems (GIS), as well as communication flows within the Command, Control and Coordination structure. • SMP activated via the First Strike Plan (FSP). • Step by step process to activation of individual SMPs provided in the SMP Operational Plan. • All decisions made regarding SMP logged in the online IMS (SMP team members trained in using Woodside's online Incident Management System). • SMP component input to the ICC IAP as per the identified ICC timed sessions and the SMP IAP logged on the online IMS. • Woodside Environmental Science Team provide awareness training on the activation and stand-up of the Scientific Monitoring Programme (SMP) for the Environment Advisers in Woodside who are listed on the SMP team on an annual basis. • Woodside Environmental Science Team provide awareness training on the activation and stand-up of the SMP for the SMP Standby contractor. • Woodside Environmental Science Team co-ordinates an annual SMP arrangement testing exercise which the Standby SMP contractor SMP team participates in since 2016 (refer to the SMP Document Register).			
21	• Chartered and mutual aid vessels. • Suitable vessels would be secured from the Woodside support vessels, regional fleet of vessels operated by Woodside and other operators and the regional charter market. • Vessel suitability will be guided by the need to be equipped to operate grab samplers, drop camera systems and water sampling equipment (the individual vessel requirements are outlined in the relevant SMP methodologies (refer to **ANNEX C:** Oil	21.1	Woodside maintains standby SMP capability to mobilise equipment required to conduct scientific monitoring programs SM01 to SM10 (except desktop-based SM08): • Equipment are sourced through the existing standby contract with Standby SMP standby contractor, as detailed	• HSP Internal Control Environment tracks the quarterly review of the Oil Spill Contracts Master. • SMP standby monthly resource reports of equipment availability provided by SMP contractor (SMP resourcing report register).

	Spill Scientific monitoring Program, **Table C-2**). • Nearshore mainland waters could use the same approach as for open water. Smaller vessels may be used where available and appropriate. Suitable vehicles and machinery for onshore access to nearshore SMP locations would be provided by Woodside's transport services contract and sourced from the wider market. • Dedicated survey equipment requirements for scientific monitoring range from remote towed video and drop camera systems to capture seabed images of benthic communities to intertidal/onshore surveying tools such as quadrats, theodolites and spades/trowels, cameras and binoculars (specific survey equipment requirements are outlined in the relevant SMP methodologies (refer to **ANNEX C**: Oil Spill Scientific monitoring Program, **Table C-2**)). Equipment would be sourced through the existing SMP standby contract with Standby SMP contractor for SMP resources and if additional surge capacity is required this would be available through the other Woodside Environmental Services Panel Contractors and specialist contractors. Standby SMP contractor can also address equipment redundancy through either individual or multiple suppliers. MoUs are in place with marine sampling equipment suppliers and analytical laboratories (SMP resourcing report register). • Availability of SMP equipment for offshore/onshore scientific monitoring team mobilisation is within one week to ten days of the commencement of a hydrocarbon release. This meets the SMP mobilisation lead time that will support meeting the response objective of 'acquire, where practicable, the environmental baseline data prior to hydrocarbon contact required to support the post-response SMP.		within the SMP Implementation Plan.	• SMP annual arrangement testing and reporting.
22	Woodside's SMP approach addresses the pre-PAP acquisition of baseline data for PBAs with ≤ 10 days if required following a baseline gap analysis process. Woodside maintains knowledge of Environmental Baseline data through: • Documentation annual reviews of the Woodside Baseline Environmental Studies Database, and specific activity baseline gap analyses. • Accessing external databases such as the Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA) (refer to **ANNEX C**: Oil Spill Scientific monitoring Program).	22.1	• Annual reviews of environmental baseline data. • PAP specific Pre-emptive Baseline Area baseline gap analysis.	• Annual review/update of Woodside Baseline Environmental Studies Database. • Desktop review to assess the environmental baseline study gaps completed prior to EP submission. • Accessing baseline knowledge via the SMP annual arrangement testing.

Environmental Performance Outcome	SMP plan to acquire response phase monitoring targeting pre-emptive data achieved.			
Control measure		**Performance Standard**		**Measurement Criteria**
23	Woodside's SMP approach addresses: • Scientific data acquisition for PBAs >10 days to hydrocarbon contact and activated in the response phase and • Transition into post-response SMP monitoring.	23.1	**PBA baseline data acquisition in the response phase** If baseline data gaps are identified for PBAs that has predicted hydrocarbon contact (contact time > 10 days), there will be a response phase effort to collect baseline data with priority in implementing SMPs given to receptors where pre-emptive baseline data can be acquired or improved. SMP team (within the Environment Unit of the ICC) contribute SMP component of the ICC Planning Function in development of the IAP.	• Response SMP plan. • Woodside's online Incident Management System Records. • SMP component of the Incident Action Plan.
		23.2	**Post Spill contact** For the receptors contacted by the spill in where baseline data are available, SMPs programs to assess and monitor receptor condition will be implemented post spill (i.e. after the response phase).	• SMP planning document. • SMP Decision Log. • IAPs.

<table>
<tr><th colspan="2">Environmental Performance Outcome</th><td colspan="3">Implementation of the SMP (response and post-response phases).</td></tr>
<tr><th colspan="2">Control measure</th><th colspan="2">Performance Standard</th><th>Measurement Criteria</th></tr>
<tr><td rowspan="3">24</td><td rowspan="3">Scientific monitoring will address quantitative assessment of environmental impacts of a level two or three spill or any release event with the potential to contact sensitive environmental receptors. The SMP comprises ten targeted environmental monitoring programs.
SMP supporting documentation: (1) Oil Spill Scientific Monitoring Operational Plan; (2) SMP Implementation Plan and (3) SMP Process and Methodologies Guideline.
The Oil Spill Scientific Monitoring Operational Plan details the process of SMP selection, input to the IAP to trigger operational logistic support services. Methodology documents for each of the ten SMPs are accessible detailing equipment, data collection techniques and the specifications required for the survey platform support.
The SMP standby contractor holds a Woodside SMP implementation plan detailing activation processes, linkage with the Woodside SMP team and the general principles for the planning and mobilisation of SMPs to deliver the individual SMPs activated. Monthly resourcing report are issued by the SMP standby contractor (SMP resourcing report register). All SMP documents and their status are tracked via SMP document register.</td><td>24.1</td><td>Implementation of SM01
SM01 will be implemented to assess the presence, quantity and character of hydrocarbons in marine waters during the spill event in nearshore areas.</td><td>Evidence SM01 has been triggered:
Documentation as per requirements of the SMP Operational Plan.
Woodside’s online Incident Management System Records.
SMP component of the IAP.
SMP data records from field.</td></tr>
<tr><td>24.2</td><td>Implementation of SM02 to SM10
SM02-SM10 will be implemented in accordance with the objectives and activation triggers as per ANNEX C: Oil Spill Scientific monitoring Program, Table C-2.</td><td>Evidence SMPs have been triggered:
Documentation as per requirements of the SMP Operational Plan.
Woodside’s online Incident Management System Records.
SMP component of the IAP.
SMP Data records from field.</td></tr>
<tr><td>24.3</td><td>Termination of SMP plans
The Scientific Monitoring Program will be terminated in accordance with termination triggers for the SMPs detailed in ANNEX C: Oil Spill Scientific monitoring Program, Table C-2, and the Termination Criteria Decision-tree for Oil Spill Environmental Monitoring (ANNEX C: Oil Spill Scientific monitoring Program, Figure C-3):</td><td>Evidence of Termination Criteria triggered:
Documentation and approval by relevant stakeholders to end SMPs for specific receptor types.</td></tr>
</table>

5.8 Incident Management System

The Incident Management System (IMS) is both a control measure and a measurement criterion. As a control measure the IMS function is to prompt, facilitate and record the completion of three key response planning processes detailed below. As a measurement criterion the IMS records the evidence of the timeliness of all response actions included in the environmental performance standards and the plans used of the PAP. As the IMS does not directly remove hydrocarbons spilt into the marine environment there is no direct relationship to the response planning need.

5.8.1 Incident action planning

The ICC will be required to collect and interpret information from the scene of the incident to determine support requirements to the site based IMT, develop an incident action plan (IAP) and assist the IMT with the execution of that plan. The site-based incident controller (IC) may request the ICC to complete notifications internally within Woodside, to stakeholders and government agencies as required. Depending on the type and scale of the incident either the ICC Duty Manager (DM) or IC will be responsible for ensuring the development of the IAP. Incident Action Planning is an ongoing process that involves continual review to ensure techniques to control the incident are appropriate to the situation at the time.

5.8.2 Operational NEBA process

In the event of a response Woodside will confirm that the response techniques adopted at the time of Environment Plan/Oil Pollution Emergency Plan (EP/OPEP) acceptance remain appropriate to reduce the consequences of the spill. This process verifies that there is a continuing net environmental benefit associated with continuing the response technique through the operational NEBA process. This process manages the environmental risks and impacts of response techniques during the spill response, an operational NEBA will be undertaken throughout the response, for each operational period.

The operational NEBA will consider the risks and benefits of conducting a response activity. For example, if vessels are required for access to nearshore or onshore areas, anchoring locations will be selected to minimise disturbance to benthic habitats. Vessel cleanliness would be commensurate with the receiving environment. The operational NEBA will consider the risks and benefits of conducting other response techniques.

The operational NEBA process is also used to terminate a response. Using data from operational and scientific monitoring activities the response to a hydrocarbon spill will be terminated in accordance with the termination process outlined in the Oil Pollution Emergency Arrangements (Australia). In effect the operational NEBA will determine whether there is net environmental benefit to continue response operations.

5.8.3 Stakeholder engagement process

Woodside will ensure stakeholders are engaged during the spill response in accordance with internal standards as outlined in **Table 5-17**. This process requires that Woodside will:

- Undertake all required notifications (including government notifications) for stakeholders in the region (identified in the First-Strike Response Plan). This includes notification to mariners to communicate navigational hazards introduced through response equipment and personnel.
- In the event of a response, identify and engage with relevant stakeholders and continually assess and review.

5.8.4 Environmental performance based on need

Table 5-17: Environmental Performance – Incident Management System

Environmental Performance Outcome		To support the effectiveness of all other control measures and monitor/record the performance levels achieved.		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.9)**
25	Operational NEBA	25.1	Confirm that the response techniques adopted at the time of acceptance remain appropriate to reduce the consequences of the spill within 24 hours.	1, 3A
		25.2	Record the evidence and justification for any deviation from the planned response activities.	
		25.3	Record the information and data from operational and scientific monitoring activities used to inform the NEBA.	
26	Stakeholder engagement	26.1	Prompt and record all notifications (including government notifications) for stakeholders in the region are made	
		26.2	In the event of a response, identification of relevant stakeholders will be re-assessed throughout the response period.	
		26.3	Undertake communications in accordance with: • Woodside Crisis Management Functional Support Team Guideline – Reputation • External Communication and Continuous Disclosure Procedure • External Stakeholder Engagement Procedure	
27	Personnel required to support any response	27.1	Action planning is an ongoing process that involves continual review to ensure techniques to control the incident are appropriate to the situation at the time.	1, 3B
		27.2	A duty roster of trained and competent people will be maintained to ensure that minimum manning requirements are met all year round.	3C
		27.3	Immediately activate the IMT with personnel filling one or more of the following roles: • Operations Duty Manager • D&C Duty Manager • Operations Coordinator • Deputy Operations Coordinator • Planning Coordinator • Logistics (materials, aviation, marine and support positions) • Management Support • Health and Safety Advisor • Environment Duty Manager • People Coordinator • Public Information Coordinator • Intelligence Coordinator; and • Finance Coordinator.	1, 2, 3B, 3C, 4
		27.4	Collect and interpret information from the scene of the incident to determine support requirements to the site based IMT, develop an Incident Action Plan (IAP) and assist with the execution of that plan.	
		27.5	Security and emergency management (S&EM) advisors will be integrated into ICC to monitor performance of all functional roles.	
		27.6	Continually communicate the status of the spill and support Woodside to determine the most appropriate response by delivering on the responsibilities of their role.	
		27.7	Follow the OPEA, Operational Plans, FSPs, support plans and the IAPs developed.	1, 2, 3A, 4

		27.8	Contribute to Woodside's response in accordance with the aims and objectives set by the Duty Manager.	1, 2, 3B, 3C, 4

5.9 Measurement criteria for all response techniques

Woodside ensures compliance with environmental performance outcomes and standards through four primary mechanisms. The performance tables aforementioned identify which of these four mechanisms monitors the readiness and records the effectiveness and performance of the control measures adopted.

1. The Incident Management System

The Incident Management System (IMS) supports the implementation of the Incident and Crisis Management Procedure. The IMS provides a near real-time, single source of information for monitoring and recording an incident and measuring the performance of those control measures.

The Incident and Crisis Management Procedure defines the management framework, including roles and responsibilities, to be applied to any size incident (including hydrocarbon spills). The organisational structure required to manage an incident is developed in a modular fashion and is based on the specific requirements of each incident. The structure can be scaled up or down.

The Incident Action Plan (IAP) process formally documents and communicates the:

- Incident objectives;
- Status of assets;
- Operational period objectives;
- Response techniques (defined during response planning); and
- The effectiveness of response techniques.

The information captured in the IMS (including information from personal logs and assigned tasks/close outs) confirms the response techniques implemented remain appropriate to reduce the consequences of the spill. The system also records all information and data that can be used to support the site based IMT, development and the execution of the IAP.

2. The S&EM Competency Dashboard

The S&EM competency dashboard records the number of trained and competent responders that are available across Woodside, and some external providers, to participate in a response.

This number varies dependent on expiry of competency certificates, staff attrition, internal rotations, leave and other absences. As such the Dashboard is designed to identify the minimum manning requirements and to identify sufficient redundancy to cater for the variances listed above.

Figure 5-2 shows the minimum manning numbers for the different hydrocarbon spill response roles and the number of qualified persons against those roles.

Woodside's pool of trained responders is composed of but not limited to personnel from the following organisations:

- Woodside internal
- Australian Marine Oil Spill Centre (AMOSC) core group
- AMOSC
- Oil Spill Response Limited (OSRL)
- Marine Spill Response Corporation (MSRC)
- AMSA
- Woodside contracted workforce

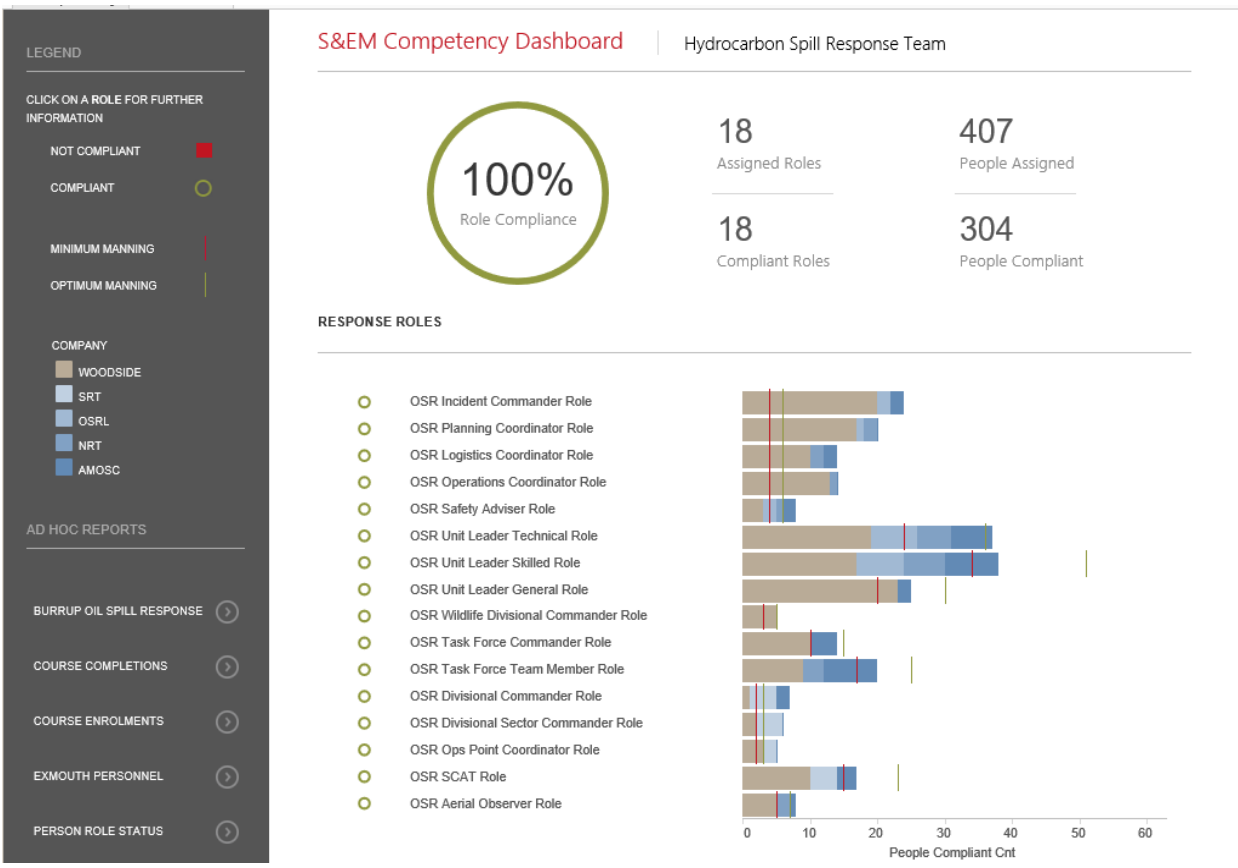


Figure 5-2: Example screen shot of the hydrocarbon spill preparedness (HSP) competency dashboard

The Dashboard is one of Woodside's key means of monitoring its readiness to respond. It also and shows that Woodside can meet the requirements of the environmental performance standard that relate to filling certain response roles.

Figure 5-3 shows deeper dive into the Ops Point Coordinator role and the training modules required to show competence.

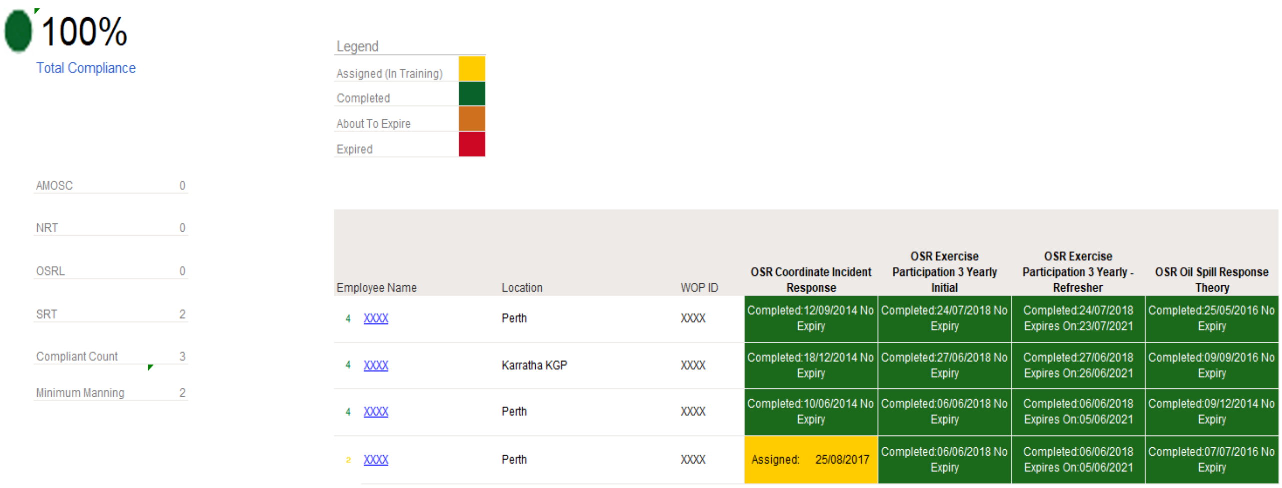


Figure 5-3: Example screen shot for the Ops Point Coordinator role

3. The Hydrocarbon Spill Preparedness ICE Assurance Process

The Hydrocarbon Spill Response Team has developed a Hydrocarbon Spill Preparedness and Response Internal Control Environment (ICE) process to align and feed into the Woodside Management System Assurance process for hydrocarbon spill. The process tracks compliance over four key control areas:

a) **Plans** – Ensures all plans (including: Oil Pollution Emergency Arrangements, first strike response plans, operational plans, support plans and tactical response plans in Annex E) are current and in line with regulatory and internal requirements.

b) **Competency** – Ensures the competency dashboard is up to date and there are the minimum competency numbers across ICC, Crisis Management Team (CMT) and hydrocarbon spill response roles. The hydrocarbon spill training plan and exercise schedule, including testing of arrangements is also tracked. The Testing of Arrangements (TOA) register tracks the testing of all hydrocarbon spill response arrangements, key contracts and agreements in place with internal and external parties to ensure compliance.

c) **Capability** – Tracks and monitors capability that could be required in a hydrocarbon incident, including but not limited to: integrated fleet[11] vessel schedule, dispersant availability, rig/vessels monitoring, equipment stockpiles, tracking buoy locations and the CICC duty roster.

d) **Compliance & Assurance** – Ensures all regulator inspection outcomes are actioned and closed out, the global legislation register is up to date and that the key assurance components are tracked and managed. Assurance activities (including Audits) conducted on memberships with key Oil Spill Response Organisations (OSROs) including AMOSC and OSRL are also tracked and recorded in the ICE.

The ICE assurance process records how each commitment listed in the performance tables above is managed to ensure ongoing compliance monitoring. The level of compliance can be reviewed in real time and is reported on a monthly basis through the S&EM Function.

The completion of the assurance checks (over and above the ICE process) is also applied via the Woodside Integrated Risk & Compliance System (WiRCs) and subject to the requirements of Woodside's Provide Assurance Procedure.

4. The Hydrocarbon Spill Preparedness and Response Procedure

This procedure sets out how to plan and prepare for a liquid hydrocarbon spill to the marine environment. (Note, this procedure does not apply to scenarios relating to gas releases in the marine environment).

This procedure details the:

- Requirement for an Oil Pollution Emergency Plan (OPEP) to be developed, maintained, reviewed, and approved by appropriate regulators (where applicable) including:
  - Defining how spill scenarios are developed on an activity specific basis;
  - Developing and maintaining all hydrocarbon spill related plans;
  - Ensuring the ongoing maintenance of training and competency for personnel;
  - Developing the testing of spill response arrangements; and
  - Maintaining access to identified equipment and personnel.
- Planning for hydrocarbon spill response preparedness
- Accountabilities for hydrocarbon spill response preparedness
- Spill training requirements
- Requirements for spill exercising / testing of spill response arrangements

[11] The Integrated fleet consists of vessels from multiple operators that have been contracted to Woodside to undertake a number of duties including hydrocarbon spill response

- Spill equipment and services requirements.

The procedure also details the roles and responsibilities of the dedicated Woodside Hydrocarbon Spill Preparedness team. This team is responsible for:

- Assuring that Woodside hydrocarbon spill responders meet competency requirements.
- Establishing the competency requirements, annual training schedule and a training register of trained personnel.
- Establishing and maintaining the total numbers of trained personnel required to provide an effective response to any hydrocarbon spill incident.
- Ensuring equipment and services contracts are maintained
- Establishing OPEPs
- Establishing OPEAs
- Priority response receptor determination
- ALARP determination
- Ensuring compliance and assurance is undertaken in accordance with external and internal requirements.

6 ALARP EVALUATION

This Section should be read in conjunction with **Section 5** which is the capability planned for this activity.

6.1 Monitor and evaluate – ALARP assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.1.1 Monitor and Evaluate – Control Measure Options Analysis

6.1.1.1 Alternative Control Measures

Alternative Control Measures considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Aerostat (or similar inflatable observation platform) for localised aerial surveillance.	Lead time to Aerostat surveillance is disproportionate to the environmental benefit. The system also provides a very limited field of visibility around the vessel it is deployed from.	Long lead time to access (>10 days). Each system would require an operator to interpret data and direct vessels accordingly. Requires multiple systems for shoreline use.	Purchase cost per system approx. A$300,000.	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost and complexity of its implementation.	**No**

6.1.1.2 Additional Control Measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Additional personnel trained to use systems.	Current arrangement provides an environmental benefit in the availability of trained personnel facilitating access to monitoring data used to inform all other response techniques. No improvement required.	No improvement can be made, all personnel in technical roles e.g. intelligence unit are trained and competent on the software systems. Personnel are trained and exercised regularly. Use of the software and systems forms part of regular work assignments and projects.	Cost for training in-house staff would be approx. A$25,000.	This option is not adopted as the current capability meets the need.	**No**
Additional satellite tracking buoys to enable greater area coverage.	Increased capability does not provide an environmental benefit compared to the disproportionate cost in having an additional contract in place.	Tracking buoy on location at manned facility, additional needs are met from Woodside owned stocks in King Bay Support Base (KBSB) and Exmouth or can be provided by service provider.	Cost for an additional satellite tracking buoy would be A$200 per day or A$6000 to purchase.	This option is not adopted as the current capability meets the need, but additional units are available if required.	**No**
Additional trained aerial observers.	Woodside has access to a pool of trained, competent observers at strategic locations to ensure timely and sustainable response. Additional observers are available through current contracts with AMOSC and OSRL.	Aviation standards and guidelines ensure all aircraft crews are competent for their roles. Woodside maintains a pool of trained and competent aerial observers with various home base locations to be called upon at the time of an incident. Regular audits of oil spill response organisations ensure training and competency is maintained.	Cost for additional trained aerial observers would be A$2000 per person per day.	This option is not adopted as the current capability meets the need, but additional observers are available via response contractors if required.	**No**

6.1.1.3 Improved Control Measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Faster turnaround time from modelling contractor.	Improved control measure does not provide an environmental benefit compared to the disproportionate cost in having an additional contract in place.	External contractor on ICC roster to be called as soon as required. However initial information needs to be gathered by ICC team to request an accurate model. External	Modelling service with a faster activation time would be achieved via membership of an alternative modelling service at an annual cost of A$50,000	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost	**No**

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
		contractor has person on call to respond from their own location.	for 24hr access plus an initial A$5000 per modelling run.	and the challenge of collecting essential data/implementing reliable modelling in shorter timeframes.	
Night time aerial surveillance.	The risk of undertaking the aerial observations at night is disproportionate to the limited environmental benefit. The images would be of low quality and as such the variable is not adopted.	Flights will only occur when deemed safe by the pilot. The risk of night operations is disproportionate to the benefit gained, as images from sensors (IR, UV, etc.) will be low quality. Flight time limitations will be adhered to.	No improvement can be made without risk to personnel health and safety and breaching Woodside's Golden Rules.	This option is not adopted as the safety considerations outweigh any environmental benefit gained.	**No**
Faster mobilisation time (for water quality monitoring).	Due to the restriction on accessing the spill location on Day one there is no environmental benefit in having vessels available from day one. The cost of having dedicated equipment and personnel is disproportionate to the environmental benefit. The availability of vessels and personnel meets the response need. Shortening the timeframes for vessel availability would require dedicated response vessels on standby in KBSB. The cost and organisational complexity of employing two dedicated response vessels (approximately $15M/year per vessel) is considered disproportionate to the potential environmental benefit to be realised by adopting this delivery options.	Operations are not feasible on day 1 as the hydrocarbon will take time to surface, and volatility has potential to cause health concerns within the first 24 hours of the response.	Cost for purchase of equipment approx. A$200,000. Ongoing costs per annum for cost of hire and pre-positioning for life of asset/activity would be larger than the purchase cost. Dedicated equipment and personnel, living locally and on short notice to mobilise. The cost would be approx. A$1 m per annum, which is disproportionate to the incremental benefit this would provide, assets are already available on day 1. 2 integrated fleet vessels are available from day 1, however these could be tasked with other operations.	This option is not adopted as the area could not be accessed earlier due to safety considerations. Additionally, the cost and complexity of implementation outweighs the benefits.	**No**

6.1.2 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.2 Source control via Vessel SOPEP - ALARP assessment

Alternative, Additional and Improved options have been assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.2.1 Source Control via Vessel SOPEP – Control Measure Options Analysis

6.2.1.1 Alternative Control Measures

Alternative Control Measures considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.1.2 Additional Control Measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.1.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.2 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.3 Shoreline Protection and Deflection - ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.3.1 Existing Capability – Shoreline Protection and Deflection

Woodside's existing level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.3.2 Response Planning: Scarborough Seabed Intervention and Trunkline Installation – Shoreline Protection and Deflection

Planning for shoreline protection is based upon identification of Response Protection Areas (RPAs) from deterministic modelling and the logistics associated with deploying protection at these locations. The response planning scenarios indicate that this would require effective mobilisation to priority shorelines and maintenance of protection until operational monitoring confirms that the locations were no longer at risk. Woodside has identified the RPAs from deterministic modelling results provided from specific scenarios.

The control measures selected provide capability to mobilise shoreline protection equipment within 24 hours.

Modelling for CS-01 indicates that the shortest timeframe for shoreline contact at the Dampier Archipelago is 2.2 days. No shoreline impact is predicted for CS-02 and CS-03.

The existing capability is considered sufficient to mobilise and deploy protection at all identified RPAs prior to hydrocarbon contact. In the event of a real spill, protection activities will be guided by predictive modelling, direct observation/surveillance and remote sensing methods (OM01, OM02 and OM03) which will be employed from the outset of a spill to track the oil and assess receptors at risk. This will then trigger the undertaking of pre-emptive assessments of sensitive receptors at risk (OM04). OM04 would only be undertaken in liaison with WA DoT. Due to potentially high levels of volatiles from a spill of marine diesel, shoreline protection and deflection operations would only be undertaken if safety of responders could be ensured.

TRPs exist for many of the RPAs identified. The plans identify values and sensitivities that would be protected at each location. Modelling does not predict that all priority protection shorelines will be at risk of contact at the same time. Therefore, to allow for the best use of available shoreline protection and deflection resources, operational monitoring (OM01, OM02 and OM03) will inform the response, targeting RPAs where contact is predicted. **Table 6-1** below outlines the capability required (number of RPAs predicted to be impacted) against the capability available (number of shoreline protection and deflection operations that can be mobilised and deployed). As can be seen from the table below. Woodside's capability exceeds the response planning need identified for shoreline protection and deflection operations at identified RPAs.

Table 6-1: Response planning – shoreline protection and deflection

	Shoreline Protection & Deflection (SPD)	Day	Day	Day	Day	Day	Day	Day		Week	Week	Week		Month	Month	Month
		1	2	3	4	5	6	7		2	3	4		2	3	4
	Oil on shoreline (from deterministic modelling) m^3	0	3	0	0	0	0	0		0	0	0		0	0	0
A	Capability Required															
A1	Number of RPAs contacted (> 100 g/m^2) – Marine diesel release (CS-01)	0	1	0	0	0	0	0		0	0	0		0	0	0
B	Capability Available (operations per day)															
B1	SPD operations available – per day (lower)	0	1	1	2	2	4	6		70	70	70		330	330	330
B2	SPD operations available – per day (upper)	1	2	3	4	6	8	10		84	84	84		336	336	336
C	Capability Gap (operations per day)															
C1	SPD operations gap – per day (lower)	0	0	0	0	0	0	0		0	0	0		0	0	0
C2	SPD operations gap – per day (upper)	0	0	0	0	0	0	0		0	0	0		0	0	0

A1 – the number of Response Protection Areas contacted by surface hydrocarbons above 100 g/m^2
*B1 and B2 – the upper and lower number of shoreline protection and deflection operations available (based on response planning assumptions in **Section 0**),*
C1 and C2 – the gap between the upper and lower number of shoreline protection and deflection operations required in A1 compared to the operations available in B1 and B2

Table 6-2: RPAs for Scarborough Seabed Intervention and Trunkline Installation

Areas of coastline contacted	Conservation status	IUCN protection category	CS-01	
			Minimum time to shoreline contact (above 100 g/m^2) in days [12]	Maximum shoreline accumulation (above 100 g/m^2) in m^3 [13]
Dampier Archipelago	National Heritage Property	N/A	2.2	3 m^3

[12] This volume and time represent the first time to contact on defined shoreline polygon and the maximum volume ashore for that 24 hour period.
[13] This volume and time represent the maximum volume ashore on defined shoreline polygon for any 24 hour time period

Table 6-3: Indicative Tactical response plan, objectives and methods for RPAs with predicted contact

Tactical Response Plan	Response aims and methods
Legendre Island – Dampier	**First response aim:** Ongoing operational monitoring and evaluation of the hydrocarbon spill to adapt aims and response tactics to the evolving nature of the incident and to assist in locating relevant booming areas. **Second response aim:** Protection of sensitive shorelines (mangrove) at Legendre Island through use of shoreline booms. Formation types to deploy will be dependent on the time available until the hydrocarbon impacts the shoreline and local geographical and tidal/weather conditions **Third response aim:** Clean-up of the shoreline. Manual clean up techniques, use of mechanical recovery methods and techniques where appropriate **Fourth response aim:** Collection and specialist cleaning/rehabilitation of oiled wildlife • Relevant permissions must be sought from DBCA to carry out any response operations within the limits of the area • In the event that the existing Woodside equipment stockpile at the King Bay Supply Base becomes exhausted, Woodside has an MOU with AMSA and the DoT to provide surplus equipment from their stockpile. Additionally, Woodside is a member of both AMOSC and OSRL and has the ability to call upon their relevant technical advisory services and equipment stockpiles 24/7. NOTE: This TRP should be considered a draft until it has been verified and tested.
Rosemary Island – Dampier	**First response objective:** Ongoing operational monitoring and evaluation of the hydrocarbon spill to adapt aims and response tactics to the evolving nature of the incident and to assist in locating relevant booming areas **Second response objective**: Recovery of floating oil at sea where possible through the use of skimming systems and other appropriate recovery devices to reduce shoreline impact **Third response objective:** Protection of sensitive shorelines at Rosemary Island through use of shoreline booms. Formation types to deploy will be dependent on the time available until the hydrocarbon impacts the shoreline and local geographical and tidal/weather conditions **Fourth response objective**: Clean-up of the shoreline. Manual clean up techniques, use of mechanical recovery methods and techniques where appropriate • Relevant permissions must be sought from DBCA to carry out any response operations within the limits of the area • In the event that the existing Woodside equipment stockpile at the King Bay Supply Base becomes exhausted, Woodside has an MOU with AMSA and the DoT to provide surplus equipment from their stockpile. Additionally, Woodside is a member of both AMOSC and OSRL and has the ability to call upon their relevant technical advisory services and equipment stockpiles 24/7. NOTE: • See Port of Dampier MOPP page 113 for Rosemary Island response plan. • Dependent on seasonality presence of sensitive receptors, the strategies to either protect or clean-up the shorelines will be decided through NEBA. • This TRP should be considered a draft until it has been verified and tested.

Pre-emptive mobilisation of equipment and personnel would commence as soon as practicable prior to oil contact. Additional resources would be mobilised depending on the scale of the event to increase the length or number of shorelines being protected.

A shoreline protection and deflection response would be launched and any additional TRPs drafted only when operational monitoring (OM02 and OM03) and modelling (OM01) indicate that contact could occur at RPA(s). The outputs from the monitoring will inform the need for and/or direct any additional response techniques and, additionally, if/when the spill enters State Waters and control of the incident passes to WA DoT.

6.3.3 Shoreline Protection and Deflection – Control Measure Options Analysis

6.3.3.1 Alternative Control Measures

Alternative Control Measures Considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Pre-position equipment at Response Protection Areas (RPAs)	Additional environmental benefit of having equipment prepositioned is considered minor. Equipment is currently available to RPAs and additional shorelines, within estimated minimum times until shoreline contact at RPAs, enabling mobilisation of the selected delivery options.	The incremental environmental benefit associated with these delivery options is considered minor and unlikely to reduce the environmental consequence of a significant hydrocarbon release beyond the adopted delivery options. Considering the highly unlikely nature of a significant hydrocarbon release and the costs and organisational complexity associated with prepositioning and maintenance of equipment, the sacrifice is considered disproportionate to the limited environmental benefit that might be realised. Furthermore, these options would conflict with the mutual aid philosophy being adopted under the selected delivery options. The selected delivery options for shoreline protection and deflection meet the relevant objectives of this control measure and do not require prepositioned or additional equipment in Exmouth.	Total cost to preposition protection/ deflection packages at each site of potential impact would be approx. A$6100 per package per day.	This option is not adopted as the existing capability meets the need.	**No**

6.3.3.2 Additional Control Measures

Additional Control Measures Considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Supplemented stockpiles of equipment in Exmouth to protect additional shorelines	Additional equipment would increase the number of receptor areas that could be protected from hydrocarbon contact. However, current availability of personnel and equipment is capable of protecting up to 30 km of shoreline, commensurate with the scale and progressive nature of shoreline impact. Additional stocks would be made available from international sources if long term up scaling were necessary. A reduction in environmental consequence from a 'B' rating (serious long-term impacts) is unlikely to be realised as a result of having more equipment available locally.	The incremental environmental benefit associated with these delivery options is considered minor and unlikely to reduce the environmental consequence of a significant hydrocarbon release beyond the adopted delivery options. Considering the highly unlikely nature of a significant hydrocarbon release and the costs and organisational complexity associated with prepositioning and maintenance of equipment, the sacrifice is considered disproportionate to the limited environmental benefit that might be realised. Furthermore, these options would conflict with the mutual aid philosophy being adopted under the selected delivery options. The selected delivery options for shoreline protection and deflection meet the relevant objectives of this control measure and do not require prepositioned or additional equipment in Exmouth.	Total cost for purchase supplemental protection and deflection equipment would be approx. A$455,000 per package.	This option is not adopted as the existing capability meets the need.	**No**
Additional trained personnel	The level of training and competency of the response personnel ensures the shoreline protection and deflection operation is delivered with minimum secondary impact to the environment. Training additional personnel does not provide an increased environmental benefit.	Additional personnel required to sustain an extended response can be sourced through the Woodside *People & Global Capability Surge Labour Requirement Plan*. Additional personnel sourced from contracted OSRO's (OSRL/AMOSC) to manage other responders. Response personnel are trained and exercised regularly in shoreline response techniques and methods. All personnel involved in a response will receive a full operational/safety brief prior to commencing operations.	Additional Specialist Personnel would cost A$2000 per person per day.	This option is not adopted as the existing capability meets the need.	**No**

6.3.3.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Faster response/ mobilisation time	Hydrocarbons are predicted to strand after a period of approximately 2.5 days therefore allowing enough time to re-locate existing equipment, personnel and other resources to the most appropriate areas.	Response teams, trained personnel, contracted oil spill response service providers, government agencies and the associated mitigation equipment required to enact an initial protection and deflection response will be available for mobilisation within 24-48hrs of activation. Additional equipment from existing stockpiles and oil spill response service providers can be on scene within days. Given modelling does not predict shoreline accumulation until approx. 2.5 days, Woodside considers that there is sufficient time for deployment of protection and deflection operations prior to impact.	The cost of establishing a local stockpile of new mitigation equipment (including protection and deflection boom) closer to the expected hydrocarbon stranding areas is not commensurate with the need.	This option is not adopted as the existing capability meets the need.	**No**

6.3.4 Selected Control Measures

Following review of alternative, additional and improved control measures as outlined above, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.4 Shoreline clean-up – ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.4.1 Existing Capability – Shoreline Clean-up

Woodside's exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.4.2 Response planning: Scarborough Seabed Intervention and Trunkline Installation - Shoreline Clean-up

Woodside has assessed existing capability against the WCCS and has identified that the range of techniques provide an ongoing approach to shoreline clean-up at identified RPAs.

Modelling for CS-01 indicates that the shortest timeframe for shoreline contact at the Dampier Archipelago is 2.2 days. No shoreline impact is predicted for CS-02 and CS-03.

The maximum shoreline accumulation volumes from CS-01 have been presented for any given day/ week / month of the response to provide a single response planning scenario so that it provides a worst-case scenario for planning purposes, as outlined below in **Table 6-4**. The existing shoreline clean-up capability would be sufficient by Day 2. From Day 2 onwards, the available response capability is predicted to be sufficient as the number of personnel and equipment mobilised to RPAs increases. The volumes of accumulated oil and the required scale of the response will also depend on the success of other offshore techniques preventing shoreline oiling occurring; other offshore response techniques and their associated reduction in oil volumes have not been taken into account when determining the shoreline clean-up requirements in **Table 6-4** and the approach is therefore conservative.

The potential scale and remoteness of a response precludes the stockpiling or prepositioning of equipment specific to shorelines. The most significant constraint is accommodation and transport of personnel in the Exmouth region to undertake clean-up operations and to manage wastes generated during the response effort. From previous assessment of facilities in the Exmouth region, Woodside estimates that current accommodation can cater for a range of 500-700 personnel per day.

Woodside has identified several options which could be mobilised to achieve defined response objectives. Evaluation considers the benefit in terms of the time to respond and the scale of response made possible by each option. The evaluation of possible alternative, additional and improved control measures is summarised in **Section 6.4.3**.

Table 6-4: Response Planning – Shoreline Clean-up

	Shoreline clean-up (Phase 2)	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Week 2	Week 3	Week 4	Month 2	Month 3	Month 4	Month 5
	Oil on shoreline (from deterministic modelling) m^3														
	Shoreline accumulation (above 100 g/m^2) – m^3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
	Oil remaining following response operations – m^3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	**Capability Required (number of operations)**														
A1	Shoreline clean-up operations required (lower)	0	1	0	0	0	0	0	0	0	0	0	0	0	0
A2	Shoreline clean-up operations required (upper)	0	1	0	0	0	0	0	0	0	0	0	0	0	0
B	**Capability Available (number of operations)**														
B1	Shoreline clean-up operations available - Stage 2 - Manual (lower)	0	1	3	5	8	12	15	105	105	105	560	560	560	560
B2	Shoreline clean-up operations available - Stage 2 - Manual (upper)	0	2	5	8	10	15	20	140	140	140	560	560	560	560
C	**Capability Gap**														
C1	Shoreline clean-up operations gap (lower)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C2	Shoreline clean-up operations gap (upper)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

A1 and A2 – the number of Shoreline Clean-up operations required based on the hydrocarbon volumes ashore above 100 g/m^2
*B1 and B2 – the upper and lower number of shoreline clean-up operations available (based on response planning assumptions in **Section 5.2**),*
C1 and C2 – the gap between the upper and lower number of shoreline clean-up operations required in A1 and A2 compared to the operations available in B1 and B2

Table 6-5: RPAs for Scarborough Seabed Intervention and Trunkline Installation

Areas of coastline contacted	Conservation status	IUCN protection category	CS-01	
			Minimum time to shoreline contact (above 100 g/m^2) in days [14]	Maximum shoreline accumulation (above 100 g/m^2) in m^3 [15]
Dampier Archipelago	National Heritage Property	N/A	2.2	3 m^3

[14] This volume and time represent the first time to contact on defined shoreline polygon and the maximum volume ashore for that 24 hour period.
[15] This volume and time represent the maximum volume ashore on defined shoreline polygon for any 24 hour time period

6.4.3 Shoreline Clean-up – Control measure options analysis

6.4.3.1 Alternative Control Measures

Alternative Control Measures Considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*				
Option considered	**Environmental consideration**	**Feasibility**	**Approx. cost**	**Implemented**
No reasonably practical alternative control measures identified.				

6.4.3.2 Additional Control Measures

Additional Control Measures Considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Train additional personnel in shoreline clean-up	No environmental benefit is gained through having additional personnel trained. Current personnel arrangements meet the ongoing need for trained personnel for all scenarios.	It is feasible to train more personnel in shoreline clean-up, however, additional personnel required to sustain an extended response can be sourced through the Woodside People & Global Capability Surge Labour Requirement Plan. This surge capacity is not expected to be required for any of the scenarios.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**No**
Additional trained personnel deployed	Maintaining control of 200 competent personnel is deemed manageable and appropriate for this activity. Additional personnel conducting clean-up activities may be able to complete the clean-up in a shorter timeframe, however managing a smaller, targeted response is expected to achieve an environmental benefit through ensuring the shoreline clean-up response is suitable and scalable for the shoreline substrate and sensitivity type. This will ensure there is no increased impact from the shoreline clean-up through the presence of unnecessary personnel and equipment. Therefore, no environmental benefit is expected from deploying additional trained personnel past 200.	It is feasible to deploy additional trained personnel in addition to the 200 already sourced through existing arrangements. These could be sourced through existing contracts with oil spill response organisations, labour hire organisations and environmental panel contractors. This additional capacity is not expected to be required for any of the scenarios.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**No**

6.4.3.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Faster response/mobilisation time	No environmental benefit is identifiable due to the timeframes to contact.	It is feasible to preposition equipment and personnel in Dampier to allow a faster mobilisation time. However, response teams, trained personnel, contracted oil spill response service providers, government agencies and the associated mitigation equipment required to enact an initial response will be available for mobilisation within the first week. Additional equipment from existing stockpiles and oil spill response service providers can be on scene within 6 days.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**No**

6.4.4 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected

- Additional
  - None selected
- Improved
  - None selected

6.5 Wildlife Response – ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.5.1 Existing Capability – Wildlife Response

Woodside's exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.5.2 Oiled Wildlife Response – Control measure options analysis

6.5.2.1 Alternative Control Measures

Alternative Control Measures Considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Direct contracts as service providers	This option duplicates the capability accessed through AMOSC and OSRL and would compete for the same resources. Does not provide a significant increase in environmental benefit.	These delivery options provide increased effectiveness through more direct communication and control of specialists. However, no significant net benefit is anticipated.	Duplication of capability – already subscribed to through contracts with AMOSC and OSRL	**No**

6.5.2.2 Additional Control Measures

Additional Control Measures Considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Additional wildlife treatment systems	Current arrangements allow for all wildlife to be treated. Hydrocarbon is only limited to open water above the impact threshold. Therefore, there is no environmental benefit for having additional wildlife treatment systems as current capability meets the need.	Current arrangements allow response equipment and personnel to be delivered by day one, scaling up by day six, enough to treat up to 600 wildlife. An additional wildlife treatment system is feasible and would potentially reduce the time to deploy additional wildlife systems.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**No**
Additional trained wildlife responders	Current numbers meet the needs required and additional personnel are available through existing contracts with oil spill response organisations and environmental panel contractors. Numbers of oiled wildlife are expected to be low in the remote offshore setting of the oiled wildlife response, given the distance from known aggregation areas. The potential environmental benefit of training additional personnel is expected to be low.	Providing additional trained wildlife responders is feasible, however current capacity provides the capacity to treat approximately 600 wildlife units (primarily avian fauna) by day six, with additional capacity available from OSRL.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	**No**

6.5.2.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Faster mobilisation time for wildlife response through pre-positioned equipment and personnel.	Response time is limited by specialist personnel mobilisation time. Current timing is sufficient considering there is no potential for shoreline receptors to be contacted.	The selected delivery options provide the capacity to mobilise an oiled wildlife response capable of treating up to 600 wildlife from at least day six and exceeds the estimated Level 4 OWR response thought to be applicable. This delivery option	The cost of having dedicated equipment and personnel available to respond faster is considered disproportionate to the environmental benefit.	**No**

	This control measure provides increased effectiveness through faster mobilisation of specialists. However, no significant net environmental benefit is expected due to shoreline stranding times.	provides the maximum expertise pooled across the participating operators, backed up by the international resources provided by OSRL. The availability of vessels and personnel meets the response need.		

6.5.3 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.6 Waste Management – ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.6.1 Existing Capability – Waste Management

Woodside's exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.6.2 Waste Management – Control measure options analysis

6.6.2.1 Alternative Control Measures

Alternative Control Measures Considered
Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control

Option considered	Environmental consideration	Feasibility	Approx. cost	Implemented
No reasonably practical alternative control measures identified.				

6.6.2.2 Additional Control Measures

Additional Control Measures Considered
Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures

Option considered	Environmental consideration	Feasibility	Approximate cost	Implemented
Increased waste storage capability	The procurement of waste storage equipment options on the day of the event will allow immediate response and storage of collected waste. The environmental benefit of immediate waste storage is to reduce ecological consequence by safely securing waste, allowing continuous response operations to occur.	Access to Veolia's storage options provides the resources required to store and transport sufficient waste to meet the need. Access to waste contractors existing facilities enables waste to be stockpiled and gradually processed within the regional waste handling facilities. Additional temporary storage equipment is available through existing contract and arrangements with OSRL. Existing arrangements meet identified need for the PAP.	The cost of having increased waste storage capability is considered disproportionate to the environmental benefit.	**No**

6.6.2.3 Improved Control Measures

Improved Control Measures considered
Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility

Option considered	Environmental consideration	Feasibility	Approximate cost	Implemented
Faster response time	The access to Veolia waste storage options provides the resources to store and transport waste, permitting the wastes to be stockpiled and gradually processed within the regional waste handling facilities. Bulk transport to Veolia's licensed waste management facilities would be undertaken via controlled-waste-licensed vehicles and in accordance with Environmental Protection (Controlled Waste) Regulations 2004. The environmental benefit from successful waste storage will reduce pressure on the treatment and disposal facilities reducing ecological consequences by safely securing waste. In addition, waste storage and transport will allow continuous response operations to occur. This delivery option would increase known available storage, eliminating the risk of additional resources not being available at the time of the event. However, the environmental benefit of Woodside procuring additional waste storage is considered minor as the risk of additional storage not being available at the time of the event is considered low and existing arrangements provide adequate storage to support the response.	Woodside already maintains an equipment stockpile in Exmouth to enable shorter response times to incidents. This stockpile includes temporary waste storage equipment. Woodside has access to stockpiles of waste storage and equipment in Dampier and Exmouth through existing contracts and arrangements.	The incremental benefit of having a dedicated local Woodside owned stockpile of waste equipment and transport is considered minor and cost is considered disproportionate to the benefit gained given predicted shoreline contact times.	**No**

6.6.3 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.7 Scientific Monitoring – ALARP Assessment

Alternative, additional and improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.7.1 Scientific monitoring – control measure options analysis

6.7.1.1 Alternative Control Measures

Evaluate Alternative, Additional and Improved Control Measures

Alternative Control Measures considered

Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control

Ref	Control Measure Category	Option considered	Implemented	Environmental Consideration	Feasibility/Cost
SM01	System	Analytical laboratory facilities closer to the likely spill affected area	**No**	SM01 water quality monitoring requires water samples to be transported to NATA rated laboratories in Perth or interstate. Consider the benefit of laboratory access and transportation times to deliver water samples and complete lab analysis. There is a time lag from collection of water samples to being in receipt of results and confirming hydrocarbon contact to sensitive receptors). The environmental consideration of having access to suitable laboratory facilities in Exmouth or Karratha to carry out the hydrocarbon analysis would provide faster turnaround in reporting of results only by a matter of days (as per the time to transport samples to laboratories).	Laboratory facilities and staff available at locations closer to the spill affected area can reduce reporting times only to a moderate degree (days) with associated high costs of maintaining capability do not improve the environmental benefit.
SM01	System	Dedicated contracted SMP vessel (exclusive to Woodside)	**No**	Would provide faster mobilisation time of scientific monitoring resources, environmental benefit associated with faster mobilisation time would be minor compared to selected options.	Chartering and equipping additional vessels on standby for scientific monitoring has been considered. The option is reasonably practicable but the sacrifice (charter costs and organisational complexity) is significant, particularly when compared with the anticipated availability of vessels and resources within in the required timeframes. The selected delivery provides capability to meet the scientific monitoring objectives, including collection of pre-emptive data where baseline knowledge gaps are identified for receptor locations where spill predictions of time to contact are > 10 days. The effectiveness of this alternative control (weather dependency, availability and survivability) is rated as very low. The cost and organisational complexity of employing a dedicated response vessel is considered disproportionate to the potential environmental benefit by adopting these delivery options.

6.7.1.2 Additional Control Measures

Additional Control Measures considered

Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures

Ref	Control Measure Category	Option considered	Implemented	Environmental Consideration	Feasibility / Cost
SM01	System	Determine baseline data needs and provide implementation plan in the event of an unplanned hydrocarbon release	**Yes**	Address resourcing needs to collect post spill (pre-contact) baseline data as spill expands in the event of an instantaneous MDO release from the PAP activities.	Woodside relies on existing environmental baseline for receptors which have predicted hydrocarbon contact (above environment threshold) < 10 days and acquiring pre-emptive data in the event of an instantaneous MDO release from the PAP activities based on receptors predicted to have hydrocarbon contact > 10 days. Ensure there is appropriate baseline for key receptors for all geographic locations that are potentially impacted < 10 days of spill event, where practicable. Address resourcing needs to collect pre-emptive baseline as spill expands in the event of an instantaneous marine diesel release from the PAP activities.

6.7.1.3 Improved control measures

Improved control measures considered – No reasonably practicable improved Control Measures identified.

6.7.2 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP:

- Alternative:
  - None selected.
- Additional:
  - Determine baseline data needs and provide implementation plan in the event of an unplanned hydrocarbon release.
- Improved:
  - None selected.

6.7.3 Operational plan

Key actions from the Scientific Monitoring Program Operational Plan for implementing the response are outlined in **Table 6-6**.

Table 6-6: Scientific monitoring program operational plan actions

Responsibility	Action
Activation	
Perth ICC Planning (ICC Planning – Environment Unit)	Mobilises SMP Lead/Manager and SMP Coordinator to the ICC Planning function.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager and SMP Coordinator)	Constantly assesses all outputs from OM01, OM02 and OM03 (**Section 5** and **ANNEX B**: Operational Monitoring Activation and Termination Criteria**)** to determine receptor locations and receptors at risk. Confirm sensitive receptors likely to be exposed to hydrocarbons, timeframes to specific receptor locations and which SMPs are triggered. Review baseline data for receptors at risk.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager and SMP Coordinator)	SMP co-ordinator stands up SMP standby contractor as the SMP Contractor. Stands up subject matter experts, if required.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager SMP Coordinator, SMP Standby Contractor, SMP Manager)	Establish if, and where, pre-contact baseline data acquisition is required. Determines practicable baseline acquisition program based on predicted timescales to contact and anticipated SMP mobilisation times. Determines scope for preliminary post-contact surveys during the Response Phase. Determines which SMP activities are required at each location based on the identified receptor sensitivities.

Responsibility	Action
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, Standby Contractor, SMP Manager)	If response phase data acquisition is required, stand up the contractor SMP teams for data acquisition and instruct them to standby awaiting further details for mobilisation from the ICC.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP Standby Contractor, SMP Manager)	SMP contractor, SMP standby contractor to prepare the Field Implementation Plan. Prepare and obtain sign-off of the Response Phase SMP work plan and Field Implementation Plan. Update the IAP.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP Standby Contractor, SMP Manager)	Liaise with ICC Logistics, and determine the status and availability of aircraft, vessels and road transportation available to transport survey personnel and equipment to point of departure. Engage with SMP Standby Contractor SMP Manager and ICC Logistics to establish mobilisation plan, secure logistics resources and establish ongoing logistical support operations, including: • vessels, vehicles and other logistics resources • vessel fit-out specifications (as detailed in the SMP Operational Plan) • equipment storage and pick-up locations • personnel pick-up/airport departure locations • ports of departure • land based operational centres and forward operations bases accommodation and food requirements.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP Standby Contractor, SMP Manager)	Confirm communications procedures between Woodside SMP team, SMP Standby Contractor, SMP Manager, SMP Team Leads and Operations Coordinator (ICC).
Mobilisation	
Perth ICC Logistics	Engage vessels and vehicles and arrange fitting out as specified by the mobilisation Plan Confirm vessel departure windows and communicate with the SMP Contractor, SMP Duty Manager. Agree SMP mobilisation timeline and induction procedures with the Operations Coordinator (ICC).
Perth ICC Logistics	Coordinate with SMP Standby Contractor, SMP Duty Manager to mobilise teams and equipment according to the logistics plan and Sector induction procedures.
SMP Survey Team Leads	SMP Survey Team Leader(s) coordinate on-ground/on-vessel mobilisations and support services with the Operations Coordinator (ICC).

6.7.4 ALARP and Acceptability summary

<table>
<tr><th colspan="3">ALARP and Acceptability Summary</th></tr>
<tr><th colspan="3">Scientific Monitoring</th></tr>
<tr><td rowspan="4">ALARP Summary</td><td>X</td><td>All known reasonably practicable control measures have been adopted</td></tr>
<tr><td>X</td><td>No additional, alternative and improved control measures would provide further benefit</td></tr>
<tr><td>X</td><td>No reasonably practical additional, alternative, and/or improved control measure exists</td></tr>
<tr><td colspan="2">The resulting scientific monitoring capability has been assessed against the combined credible spill scenarios for Scarborough Seabed Intervention and Trunkline Installation activity. The range of strategies provide an ongoing approach to monitoring operations to assess and evaluate the scale and extent of impacts.
All known reasonably practicable control measures have been adopted with the cost and organisational complexity of these options determined to be Moderate and the overall delivery effectiveness considered Medium. The SMP’s main objectives can be met, with the addition of one alternative control measures to provide further benefit.</td></tr>
<tr><td>Acceptability Summary</td><td colspan="2">• The control measures selected for implementation manage the potential impacts and risks to ALARP.
• In the event of a hydrocarbon spill for the PAP, the control measures selected, meet or exceed the requirements of Woodside Management System and industry best-practice.
• Throughout the PAP, relevant Australian standards and codes of practice will be followed to evaluate the impacts from an instantaneous marine diesel release.
• The level of impact and risk to the environment has been considered with regard to the principles of Environmentally Sustainable Development; and risks and impacts from a range of identified scenarios were assessed in detail. The control measures described consider the conservation of biological and ecological diversity, through both the selection of control measures and the management of their performance. The control measures have been developed to account for the combined credible spill scenarios for Scarborough Seabed Intervention and Trunkline Installation activity, and uncertainty has not been used as a reason for postponing control measures.</td></tr>
<tr><td colspan="3">On the basis from the impact assessment above and in Section 6 of the Scarborough Seabed Intervention and Trunkline Installation activity EP, Woodside considers the adopted controls discussed manage the impacts and risks associated with implementing scientific monitoring activities to a level that is ALARP and acceptable.</td></tr>
</table>

7 ENVIRONMENTAL RISK ASSESSMENT OF SELECTED RESPONSE TECHNIQUES

The implementation of response techniques may modify the impacts and risks identified in the EP and response activities can introduce additional impacts and risks from response operations themselves. Therefore, it is necessary to complete an assessment to ensure these impacts and risks have been considered and specific measures are put in place to continually review and manage these further impacts and risks to ALARP and Acceptable levels. A simplified assessment process has been used to complete this task which covers the identification, analysis, evaluation and treatment of impacts and risks introduced by responding to the event.

7.1 Identification of impacts and risks from implementing response techniques

Each of the control measures can modify the impacts and risks identified in the EP. These impacts and risks have been previously assessed within the scope of the EP. Refer to the EP for details regarding how these risks are being managed. They are not discussed further in this document.

- Atmospheric emissions
- Routine and non-routine discharges
- Physical presence, proximity to other vessels (shipping and fisheries)
- Routine acoustic emissions vessels
- Lighting for night work/navigational safety
- Invasive marine species
- Collision with marine fauna
- Disturbance to Seabed

Additional impacts and risks associated with the control measures not included within the scope of the EP include:

- Vessel operations and access in the nearshore environment
- Presence of personnel on the shoreline
- Human presence (manual cleaning)
- Additional stress or injury caused to wildlife
- Secondary contamination from the management of waste

7.2 Analysis of impacts and risks from implementing response techniques

The table below compares the adopted control measures for this activity against the environmental values that can be affected when they are implemented.

Table 7-1: Analysis of risks and impacts

	Environmental Value						
	Soil & Groundwater	Marine Sediment Quality	Water Quality	Air Quality	Ecosystems/ Habitat	Species	Socio-Economic
Monitor and evaluate		✓	✓		✓	✓	
Source control		✓	✓	✓	✓	✓	✓
Shoreline Protection & Deflection	✓	✓	✓		✓	✓	✓
Shoreline Clean-up	✓	✓	✓		✓	✓	✓
Oiled Wildlife					✓	✓	
Scientific Monitoring		✓	✓		✓	✓	✓
Waste Management	✓			✓	✓	✓	✓

7.3 Evaluation of impacts and risks from implementing response techniques

Vessel operations and anchoring

During the implementation of response techniques, where water depths allow, it is possible that response vessels will be required to anchor (e.g. during shoreline surveys). The use of vessel anchoring will be minimal and likely to occur when the impacted shoreline is inaccessible via road. Anchoring in the nearshore environment of sensitive receptor locations will have the potential to impact coral reef, seagrass beds and other benthic communities in these areas. Recovery of benthic communities from anchor damage depends on the size of anchor and frequency of anchoring. Impacts would be highly localised (restricted to the footprint of the vessel anchor and chain) and temporary, with full recovery expected.

Presence of personnel on the shoreline

Presence of personnel on the shoreline during shoreline operations could potentially result in disturbance to wildlife and habitats. During the implementation of response techniques, it is possible that personnel may have minimal, localised impacts on habitats, wildlife and coastlines. The impacts associated with human presence on shorelines during shoreline surveys may include:

- Damage to vegetation/habitat to gain access to areas of shoreline oiling;
- Damage or disturbance to wildlife during shoreline surveys;
- Removal of surface layers of intertidal sediments (potential habitat depletion); and
- Excessive removal of substrate causing erosion and instability of localised areas of the shoreline.

Human presence

Human presence for manual clean-up operations may lead to the compaction of sediments and damage to the existing environment especially in sensitive locations such as mangroves and turtle nesting beaches. However, any impacts are expected to be localised with full recovery expected.

Additional stress or injury caused to wildlife

Additional stress or injury to wildlife could be caused through the following phases of a response:

- Capturing wildlife
- Transporting wildlife
- Stabilisation of wildlife
- Cleaning and rinsing of oiled wildlife
- Rehabilitation (e.g. diet, cage size, housing density)
- Release of treated wildlife

Inefficient capture techniques have the potential to cause undue stress, exhaustion or injury to wildlife, additionally pre-emptive capture could cause undue stress and impacts to wildlife when there are uncertainties in the forecast trajectory of the spill. During the transportation and stabilisation phases there is the potential for additional thermoregulation stress on captured wildlife. Additionally, during the cleaning process, it is important personnel undertaking the tasks are familiar with the relevant techniques to ensure that further injury and the removal of water proofing feathers are managed and mitigated. Finally, during the release phase it's important that wildlife is not released back into a contaminated environment.

Waste generation

Implementing the selected response techniques will result in the generation of the following waste streams that will require management and disposal:

- Liquids (recovered oil/water mixture), recovered from shoreline clean-up operations
- Semi-solids/solids (oily solids), collected during shoreline clean-up operations
- Debris (e.g. seaweed, sand, woods, plastics), collected during shoreline clean-up operations and oiled wildlife response.

If not managed and disposed of correctly, wastes generated during the response have the potential for secondary contamination similar to that described above, impacts to wildlife through contact with or ingestion of waste materials and contamination risks if not disposed of correctly onshore.

7.4 Treatment of impacts and risks from implementing response techniques

In respect of the impacts and risks assessed the following treatment measures have been adopted. It must be recognised that this environmental assessment is seeking to identify how to maintain the level of impact and risks at levels that are ALARP and of an acceptable level rather than exploring further impact and risk reduction. It is for this reason that the treatment measures identified in this assessment will be captured in Operational Plans, Tactical Response Plans (**ANNEX E**), and/or First Strike Plans.

Vessel operations and access in the nearshore environment

- If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic primary producer habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified (Performance Standard (PS) 8.1, 11.1, 14.1)

- Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines (PS 11.2, 14.2)

Presence of personnel on the shoreline

- Oversight by trained personnel who are aware of the risks (PS 14.6)
- Trained unit leader's brief personnel of the risks prior to operations (PS 14.7)

Human Presence

- Shoreline access route (foot, car, vessel and helicopter) with the least environmental impact identified will be selected by a specialist in shoreline contamination assessment techniques (SCAT) operations (PS 7.3, 14.5)
- Vehicular access will be restricted on dunes, turtle nesting beaches and in mangroves (PS 14.3)

Additional stress or injury caused to wildlife

- Operations conducted with advice from the DBCA Oiled Wildlife Advisor and in accordance with the processes and methodologies described in the WA OWRP and the relevant regional plan (PS 16.3)

Waste generation

- All shoreline clean-up sites will be zoned and marked before clean-up operations commence (PS 12.4)
- Removal of vegetation will be limited to moderately or heavily oiled vegetation (PS 14.4).

8 ALARP CONCLUSION

An analysis of alternative, additional and improved control measures has been undertaken to determine their reasonableness and practicability. The tables in **Section 6** document the considerations made in this evaluation. Where the costs of an alternative, additional, or improved control measure have been determined to be clearly disproportionate to the environmental benefit gained from its adoption it has been rejected. Where this is not considered to be the case the control measure has been adopted.

The risks from a hydrocarbon spill have been reduced to ALARP because:

- Woodside has a significant hydrocarbon spill response capability to respond to the WCCS through the control measures identified.
- New and modified impacts and risks associated with implementing response techniques have been considered and will not increase the risks associated with the activity.
- A consideration of alternative, additional, and improved control measures identified any other control measures that delivered proportionate environmental benefit compared to the cost of adoption for this activity ensuring that:
    - All known, reasonably practicable control measures have been adopted.
    - No additional, reasonably practicable alternative and/or improved control measures would provide further environmental benefit.
    - No reasonably practical additional, alternative, and/or improved control measure exists.
- A structured process for considering alternative, additional, and improved control measures was completed for each control measure.
- The evaluation was undertaken based on the outputs of the WCCS so that the capability in place is sufficient for all other scenario from this activity.
- The likelihood of the WCCS spill has been ignored in evaluating what was reasonably practicable.

9 ACCEPTABILITY CONCLUSION

Following the ALARP evaluation process, Woodside deems the hydrocarbon spill risks and impacts to have been reduced to an acceptable level by meeting all of the following criteria:

- Techniques are consistent with Woodside's processes and relevant internal requirements including policies, culture, processes, standards, structures and systems.
- Levels of risk/ impact are deemed acceptable by relevant persons (external stakeholders) and are aligned with the uniqueness of, and/or the level of protection assigned to the environment, its sensitivity to pressures introduced by the activity, and the proximity of activities to sensitive receptors, and have been aligned with Part 3 of the EPBC Act.
- Selected control measures meet requirements of legislation and conventions to which Australia is a signatory (e.g. International Convention for the Prevention of Pollution from Ships (MARPOL), the World Heritage Convention, the Ramsar Convention, and the Biodiversity Convention etc.). In addition to these, other non-legislative requirements met include:
  - Australian IUCN reserve management principles for Commonwealth marine protected areas and bioregional marine plans.
  - National Water Quality Management Strategy and supporting guidelines for marine water quality).
  - Conditions of approval set under other legislation.
  - National and international requirements for managing pollution from ships.
  - National biosecurity requirements.
- Industry standards, best practices and widely adopted standards and other published materials have been used and referenced when defining acceptable levels. Where these are inconsistent with mandatory/ legislative regulations, explanation has been provided for the proposed deviation. Any deviation produces the same or a better level of environmental performance (or outcome).

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11 GLOSSARY & ABBREVIATIONS

11.1 Glossary

Term	Description / Definition
ALARP	Demonstration through reasoned and supported arguments that there are no other practicable options that could reasonably be adopted to reduce risks further.
Availability	The availability of a control measure is the percentage of time that it is capable of performing its function (operating time plus standby time) divided by the total period (whether in service or not). In other words, it is the probability that the control has not failed or is undergoing a maintenance or repair function when it needs to be used.
Control	The means by which risk from events is eliminated or minimised.
Control effectiveness	A measure of how well the control measures perform their required function.
Control measure (risk control measure)	The features that eliminate, prevent, reduce or mitigate the risk to environment associated with PAP.
Credible spill scenario	A spill considered by Woodside as representative of maximum volume and characteristics of a spill that could occur as part of the PAP.
Dependency	The degree of reliance on other systems in order for the control measure to be able to perform its intended function.
Environment that may be affected	The summary of quantitative modelling where the marine environment could be exposed to hydrocarbons levels exceeding hydrocarbon threshold concentrations.
Incident	An event where a release of energy resulted in or had the potential to cause injury, ill health, damage to the environment, damage to equipment or assets or company reputation.
Major Environment Event	The events with potential environment, reputation, social or cultural consequences of category C or higher (as per Woodside's operational risk matrix) which are evaluated against credible worst-case scenarios which may occur when all controls are absent or have failed.
Performance outcome	A statement of the overall goal or outcome to be achieved by a control measure
Performance standard	The parameters against which [risk] controls are assessed to ensure they reduce risk to ALARP. A statement of the key requirements (indicators) that the control measure has to achieve in order to perform as intended in relation to its functionality, availability, reliability, survivability and dependencies.
Preparedness	Measures taken before an incident in order to improve the effectiveness of a response
Reasonably practicable	... a computation ... made by the owner, in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) [showing whether or not] that there is a gross disproportion between them ... made by the owner at a point of time anterior to the accident. (Judgement: Edwards v National Coal Board [1949])
Receptors at risk	Physical, biological and social resources identified as at risk from hydrocarbon contact using oil spill modelling predictions.
Receptor areas	Geographically referenced areas such as bays, islands, coastlines and/or protected area (World Heritage Area, WHA, Commonwealth or State marine reserve or park) containing one or more receptor type.

Term	Description / Definition
Receptor Sensitivities	This is a classification scheme to categorise receptor sensitivity to an oil spill. The Environmental Sensitivity Index (ESI) is a numerical classification of the relative sensitivity of a particular environment (particularly different shoreline types) to an oil spill. Refer to the Woodside Oil Pollution Emergency Arrangements (Australia) for more details.
Regulator	NOPSEMA are the Environment Regulator under the Environment Regulations.
Reliability	The probability that at any point in time a control measure will operate correctly for a further specified length of time.
Response technique	Measures taken in response to an event to reduce or prevent adverse consequences. Response techniques are selected to achieve an effective response that meets incident objectives. Response techniques are selected according to the specific conditions and environment of the event.
Survivability	Whether or not a control measure is able to survive a potentially damaging event is relevant for all control measures that are required to function after an incident has occurred.
Threshold	Hydrocarbon threshold concentrations applied to the risk assessment to evaluate hydrocarbon spills. These are defined as: surface hydrocarbon concentration – ≥10 g/m^2, dissolved – ≥100 ppb and entrained hydrocarbon concentrations – ≥500 ppb.
Zone of Application (ZoA)	The zone in which Woodside may elect to apply dispersant. The zone is determined based on a range of considerations, such as hydrocarbon characteristics, weathering and metocean conditions. The zone is a key consideration in the Net Environmental Benefit Analysis for dispersant use.

11.2 Abbreviations

Abbreviation	Meaning
AHV	Anchor Handler Vessel
AIIMS	Australasian Inter-Service Incident Management System
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
AUV	Autonomous Underwater Vehicle
BAOAC	Bonn Agreement Oil Appearance Code
BOPE	Blowout Preventer Equipment
CEDRE	Centre of Documentation, Research and Experimentation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CICC	Corporate Incident Coordination Centre
CMT	Crisis Management Team
COP	Common Operating Picture
CS	Credible Scenario
DBCA	Department of Biodiversity, Conservation and Attractions (former Department of Parks and Wildlife)
DM	Duty Manager
DNA	Deoxyribonucleic Acid
DoT	Department of Transport
DP	Dynamically Positioned
EMBA	Environment that May Be Affected
EMSA	European Maritime Safety Agency
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
EROD	ethoxyresorufin-O-deethylase
ESI	Environmental Sensitivity Index
ESD	Environmentally Sustainable Development
ESP	Environmental Services Panel
FSP	First Strike Plan
FST	Functional Support Team
GIS	Geographic Information System
GSI	Gonadosomatic Index
HSE	Health Safety and Environment
HSEQ	Health Safety Environment and Quality
HSP	Hydrocarbon Spill Preparedness

Abbreviation	Meaning
IAP	Incident Action Plan
I&CM	Incident and Crisis Management
IC	Incident Controller
ICC	Incident Coordination Centre
ICE	Internal Control Environment
ID	Identification
IGEM	Industry-Government Environmental Meta-database
IMIS	Incident Management Information System
IMS	Incident Management System
IMO	International Marine Organisation
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environment Conservation Association
IR	Infrared
ISV	Infield Support Vessels
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
KBSB	King Bay Support Base
KGP	Karratha Gas Plant
LEL	Lower Explosive Limit
LSI	Liver Somatic Index
MARPOL	International Convention for the Prevention of Pollution from Ships
MoU	Memorandum of Understanding
MSRC	Marine Spill Response Corporation
NATA	National Association of Testing Authorities
NEBA	Net Environmental Benefit Analysis
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NRDA	Natural Resource Damage Assessment
NWBM	Non-Water Based Muds
OIE	Offset Installation Equipment
OILMAP	Oil Spill Model and Response System
OM	Operational Monitoring
OMP	Operational Monitoring Program
OPEA	Oil Pollution Emergency Arrangements
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OSPRMA	Oil Spill Preparedness and Response Mitigation Assessment
OSRL	Oil Spill Response Limited

Abbreviation	Meaning
OSRO	Oil Spill Response Organisation
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
OWRP	Oiled Wildlife Response Plan
OWROP	Oiled Wildlife Response Operational Plan
QA/QC	Quality Assurance/Quality Control
PAH	Polyaromatic Hydrocarbon
PAP	Petroleum Activities Program
PBA	Pre-emptive Baseline Areas
PPB	Parts per billion
PS	Performance Standard
PS&BR	Property, Security and Business Resilience
ROV	Remotely Operated Vehicle(s)
RPA	Response Protection Area
S&EM	Security and Emergency Management
SCAT	Shoreline Contamination Assessment Techniques
SDH	Sorbitol Dehydrogenase
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous Operations
SME	Subject Matter Expert
SMP	Scientific Monitoring Program
SOPEP	Ship Oil Pollution Emergency Plan
SPD	Shoreline Protection and Deflection
SQGV	Sediment Quality Guideline Values
TOA	Testing of Arrangements
TRP	Tactical Response Plan
TRSV	Tubing Retrievable Safety Valve
TSS	Total Suspended Solids
UV	Ultraviolet
WA DoT	Western Australia Department of Transport
WBM	Water Based Muds
WCCS	Worst Case Credible Scenario
WHA	World Heritage Area
WMS	Woodside Management System
WiRCs	Woodside Integrated Risk & Compliance System
WEL/ Woodside	Woodside Energy Limited
WWCI	Wild Well Control Inc
ZoA	Zone of Application

ANNEX A: NET ENVIRONMENTAL BENEFIT ANALYSIS DETAILED OUTCOMES

A NEBA has been conducted to assess the net environmental benefit of different response techniques to selected receptors in the event of an oil spill from the PAP for marine diesel (representing platform surface release during operations). The locations utilised for the NEBA were limited to the identified RPAs of the PAP identified from modelling. These include receptors which have potential for the following:

- Surface contact (>50 g/m²)
- Shoreline accumulation (100 g/m²)
- Entrained contact (>100 ppb and <14 days)

The detailed NEBA assessment outcomes are available via this Link.

Table A-1: NEBA assessment technique recommendations for marine diesel

Receptor	Contact	Monitor and Evaluate	Source control via vessel SOPEP	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Mechanical dispersion	In situ burning	Containment and Recovery	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response
Open Commonwealth waters (Operational Area)	>50 g/m² surface >100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Dampier Archipelago	>100 g/m² shoreline >50 g/m² surface >100 ppb entrained	Yes	Yes	No	No	No	No	Yes	Yes	No	No	Yes
Muiron Islands, Muiron Islands MMA-WHA	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Pilbara - Middle Pilbara – Islands & Shoreline	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Pilbara Islands – Southern Island Group	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Montebello Marine Park	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	No	No	No	Yes
Montebello State Marine Park	>100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Montebello Islands	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Dampier Marine Park	>100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Gascoyne Marine Park	>100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Barrow Island	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Ningaloo Coast North and WHA, Ningaloo RUZ	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
Rankin Bank	>100 ppb entrained	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Lowendal Islands	>100 ppb entrained	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes

Overall assessment

Sensitive receptor (Sites identified in EP)	Monitor and Evaluate	Source control via vessel SOPEP	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Mechanical dispersion	In situ burning	Containment and Recovery	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response
Is this response Practicable?	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes
NEBA identifies Response potentially of Net Environmental Benefit?	Yes	Yes	No	No	No	No	Potentially	Potentially	No	No	Yes

NEBA Impact Ranking Classification Guidance

To reduce variability between assessments, the following ranking descriptions have been devised to guide the workshop process:

			Degree of impact [16]	Potential duration of impact	Equivalent Woodside Corporate Risk Matrix Consequence Level
Positive	3P	Major	Likely to prevent: • behavioural impact to biological receptors • behavioural impact to socio-economic receptors e.g. changes to day-today business operations, public opinion/behaviours (e.g. avoidance of amenities such as beaches) or regulatory designations.	Decrease in duration of impact by > 5 years	N/A
	2P	Moderate	Likely to prevent: • significant impact to a single phase of reproductive cycle of biological receptors • detectable financial impact, either directly (e.g. loss of income) or indirectly (e.g. via public perception), for socio-economic receptors.	Decrease in duration of impact by 1–5 years	N/A
	1P	Minor	Likely to prevent impacts on: • significant proportion of population or breeding stages of biological receptors • socio-economic receptors such as: ○ significant impact to the sensitivity of protective designation; or ○ significant and long-term impact to business/industry.	Decrease in duration of impact by several seasons (< 1 year)	N/A
	0	Non-mitigated spill impact	**No detectable difference to unmitigated spill scenario.**		
Negative	1N	Minor	Likely to result in: • behavioural impact to biological receptors • behavioural impact to socio-economic receptors e.g. changes to day-to-day business operations, public opinion/behaviours (e.g. avoidance of amenities such as beaches), or regulatory designations. **[Note 1]**	Increase in duration of impact by several seasons (< 1 year)	Increase in risk by one sub-category, without changing category (e.g. Minor (E) to Minor (D))
	2N	Moderate	Likely to result in: • significant impact to a single phase of reproductive cycle for biological receptors; or • detectable financial impact, either directly (e.g. loss of income) or indirectly (e.g. via public perception), for socio-economic receptors. This level of negative impact is recoverable and unlikely to result in closure of business/industry in the region.	Increase in duration of impact by 1–5 years	Increase in risk by one category (e.g. Minor (D) to Moderate (C or B))
	3N	Major	Likely to result in impacts on: • significant proportion of population or breeding stages of biological receptors • socio-economic receptors resulting in either: ○ significant impact to the sensitivity of protective designation; or ○ significant and long-term impact to business/industry.	Increase in duration of impact by > 5 years or unrecoverable	Increase in risk by two categories (e.g. Minor (E) to Major (A))

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[16] NOTE: the maximum likely impact should be considered; for example, if a spill were to directly impact the behaviour that results in an impact to reproduction and/or the breeding population (such as fish failing to aggregate to spawn), then the score should be a 2 or 3 rather than a 1. Similarly, if a change in behaviour resulted in an increased risk of mortality of a population, then it should be scored as a 2 or 3

ANNEX B: OPERATIONAL MONITORING ACTIVATION AND TERMINATION CRITERIA

Table B-1: Operational monitoring objectives, triggers and termination criteria

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 1 (OM01) Predictive Modelling of Hydrocarbons to Assess Resources at Risk	OM01 focuses on the conditions that have prevailed since a spill commenced, as well as those that are forecasted in the short term (1–3 days ahead) and longer term. OM01 utilises computer-based forecasting methods to predict hydrocarbon spill movement and guide the management and execution of spill response operations to maximise the protection of environmental resources at risk. The objectives of OM01 are to: • Provide forecasting of the movement and weathering of spilled hydrocarbons • Identify resources that are potentially at risk of contamination • Provide simulations showing the outcome of alternative response options (booming patterns etc.) to inform on-going Net Environmental Benefit Analysis (NEBA) and continually assess the efficacy of available response options in order to reduce risks to ALARP	OM01 will be triggered immediately following a level 2/3 hydrocarbon spill.	The criteria for the termination of OM01 are: • The hydrocarbon discharge has ceased • Response activities have ceased • Hydrocarbon spill modelling (as verified by OM02 surveillance observations) predicts no additional natural resources will be impacted

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 2 (OM02) Surveillance and reconnaissance to detect hydrocarbons and resources at risk	OM02 aims to provide regular, on-going hydrocarbon spill surveillance throughout a broad region, in the event of a spill. The objectives of OM02 are: • Verify spill modelling results and recalibrate spill trajectory models (OM01) • Understand the behaviour, weathering and fate of surface hydrocarbons • Identify environmental receptors and locations at risk or contaminated by hydrocarbons • Inform ongoing Net Environmental Benefit Analysis (NEBA) and continually assess the efficacy of available response options in order to reduce risks to ALARP • To aid in the subsequent assessment of the short- to long-term impacts and/or recovery of natural resources (assessed in SMPs) by ensuring that the visible cause and effect relationships between the hydrocarbon spill and its impacts to natural resources have been observed and recorded during the operational phase.	OM02 will be triggered immediately following a level 2/3 hydrocarbon spill.	The termination triggers for the OM02 are: • 72 hours has elapsed since the last confirmed observation of surface hydrocarbons • Latest hydrocarbon spill modelling results (OM01) do not predict surface exposures at visible levels
Operational Monitoring Operational Plan 3 (OM03) Monitoring of hydrocarbon presence, properties, behaviour and weathering in water	OM03 will measure surface, entrained and dissolved hydrocarbons in the water column to inform decision-making for spill response activities. The specific objectives of OM03 are as follows: • Detect and monitor for the presence, quantity, properties, behaviour and weathering of surface, entrained and dissolved hydrocarbons • Verify predictions made by OM01 and observations made by OM02 about the presence and extent of hydrocarbon contamination Data collected in OM03 will also be used for the purpose of longer-term water quality monitoring during SM01.	OM03 will be triggered immediately following a level 2/3 hydrocarbon spill.	The criteria for the termination of OM03 are as follows: • The hydrocarbon release has ceased • Response activities have ceased • Concentrations of hydrocarbons in the water are below available ANZECC/ ARMCANZ (2000) trigger values for 99% species protection.

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 4 (OM04) Pre-emptive assessment of sensitive receptors at risk	OM04 aims to undertake a rapid assessment of the presence, extent and current status of shoreline sensitive receptors prior to contact from the hydrocarbon spill, by providing categorical or semi-quantitative information on the characteristics of resources at risk. The primary objective of OM04 is to confirm understanding of the status and characteristics of environmental resources predicted by OM01 and OM02 to be at risk, to further assist in making decisions on the selection of appropriate response actions and prioritisation of resources. Indirectly, qualitative/semi-quantitative pre-contact information collected by OM04 on the status of environmental resources may also aid in the verification of environmental baseline data and provide context for the assessment of environmental impacts, as determined through subsequent SMPs.	Triggers for commencing OM04 include: • Contact of a sensitive habitat or shoreline is predicted by OM01, OM02 and/or OM03 • The pre-emptive assessment methods can be implemented before contact from hydrocarbons (once a receptor has been contacted by hydrocarbons it will be assessed under OM05)	The criteria for the termination of OM04 at any given location are: • Locations predicted to be contacted by hydrocarbons have been contacted • The location has not been contacted by hydrocarbons and is no longer predicted to be contacted by hydrocarbons (resources should be reallocated as appropriate)

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational monitoring operational plan 5 (OM05) Monitoring of contaminated resources	OM05 aims to implement surveys to assess the condition of fauna and habitats contacted by hydrocarbons at sensitive habitat and shoreline locations. The primary objectives of OM05 are: • Record evidence of oiled fauna (mortalities, sub-lethal impacts, number, extent, location) and habitats (mortalities, sub-lethal impacts, type, extent of cover, area, hydrocarbon character, thickness, mass and content) throughout the response and clean-up at locations contacted by hydrocarbons to inform and prioritise clean-up efforts and resources, while minimising the potential impacts of these activities. Indirectly, the information collected by OM05 may also support the assessment of environmental impacts, as determined through subsequent SMPs.	OM05 will be triggered when a sensitive habitat or shoreline is predicted to be contacted by hydrocarbons by OM01, OM02 and/or OM03.	The criteria for the termination of OM05 at any given location are: • No additional response or clean-up of fauna or habitats is predicted • Spill response and clean-up activities have ceased OM05 survey sites established at sensitive habitat and shoreline locations will continue to be monitored during SM02. The formal transition from OM05 to SM02 will begin on cessation of spill response and clean-up activities.

ANNEX C: OIL SPILL SCIENTIFIC MONITORING PROGRAM

Oil Spill Environmental Monitoring

The following provides some further detail on Woodside's oil spill scientific monitoring Program and includes the following:

- The organisation, roles and responsibilities of the Woodside oil spill scientific monitoring team and external resourcing.
- A summary table of the ten scientific monitoring programs as per the specific focus receptor, objectives, activation triggers and termination criteria.
- Details on the oil spill environmental monitoring activation and termination decision-making processes.
- Baseline knowledge and environmental studies knowledge access via geo-spatial metadata databases.
- An outline of the reporting requirements for oil spill scientific monitoring programs.

Oil Spill Scientific Monitoring – Delivery Team Roles and Responsibilities

Woodside Oil Spill Scientific Monitoring Delivery Team

The Woodside science team are responsible for the delivery of the oil spill scientific monitoring. The roles and responsibilities of the Woodside scientific monitoring delivery team are presented in Table C-1 and the organisational structure and Incident Control Centre (ICC) linkage provided in Figure C-1.

Woodside Oil Spill Scientific monitoring program - External Resourcing

In the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors, scientific monitoring personnel and scientific equipment to implement the appropriate SMPs will be provided by SMP Standby contractor who hold a standby contract for SMP via the Woodside Environmental Services Panel (ESP). In the event that additional resources are required other consultancy capacity within the Woodside ESP will be utilised (as needed and may extend to specialist contractors such as research agencies engaged in long-term marine monitoring programs). In consultation with the SMP Standby Contractor and/or specialist contractors, the selection, field sampling and approach of the SMPs will be determined by the nature and scale of the spill.

Table C-1: Woodside and Environmental Service Provider – Oil Spill Scientific Monitoring Program Delivery Team Key Roles and Responsibilities

Role	Location	Responsibility
Woodside Roles		
SMP Lead/Manager	Onshore (Perth)	• Approves activated the SMPs based on operational monitoring data provided by the Planning Function • Provides advice to the ICC in relation to scientific monitoring • Provides technical advice regarding the implementation of scientific monitoring • Approves detailed sampling plans prepared for SMPs • Directs liaison between statutory authorities, advisors and government agencies in relation to SMPs.
SMP Co-Ordinator	Onshore (Perth)	• Activates the SMPs based on operational monitoring data provided by the Planning Function • Sits in the Planning function of the ICC. • Liaises with other ICC functions to deliver required logistics, resources and operational support from Woodside to support the Environmental Service Provider in delivering on the SMPs. Acts as the conduit for advice from the SMP Lead/Manager to the Environmental Service Provider • Manages the Environmental Service Provider's implementation of the SMPs • Liaises with the Environmental Service Provider on delivery of the SMPs • Arranges all contractual matters, on behalf of Woodside, associated with the Environmental Service Provider's delivery of the SMPs.

Role	Location	Responsibility
Environmental Service Provider Roles		
SMP standby contractor: SMP Duty Manager/Project Manager	Onshore (Perth)	• Coordinates the delivery of the SMPs • Provides costings, schedule and progress updates for delivery of SMPs • Determines the structure of the Environmental Service Provider's team to necessitate delivery of the SMPs • Verifies that HSE Plans, detailed sampling plans and other relevant deliverables are developed and implemented for delivery of the SMPs • Directs field teams to deliver SMPs • Arranges all contractual matters, on behalf of Environmental Service Provider, associated with the delivery of the SMPs to Woodside • Manages sub-consultant delivery to Woodside • Provides required personnel and equipment to deliver the SMPs
SMP Field Teams	Offshore – Monitoring Locations	• Delivers the SMPs in the field consistent with the detailed sampling plans and HSE requirements, within time and budget. • Early communication of time, budget, HSE risks associated with delivery of the SMPs to the Environmental Service Provider – Project Manager • Provides start up, progress and termination updates to the Environmental Service Provider – Project Manager (will be led in-field by a party chief).

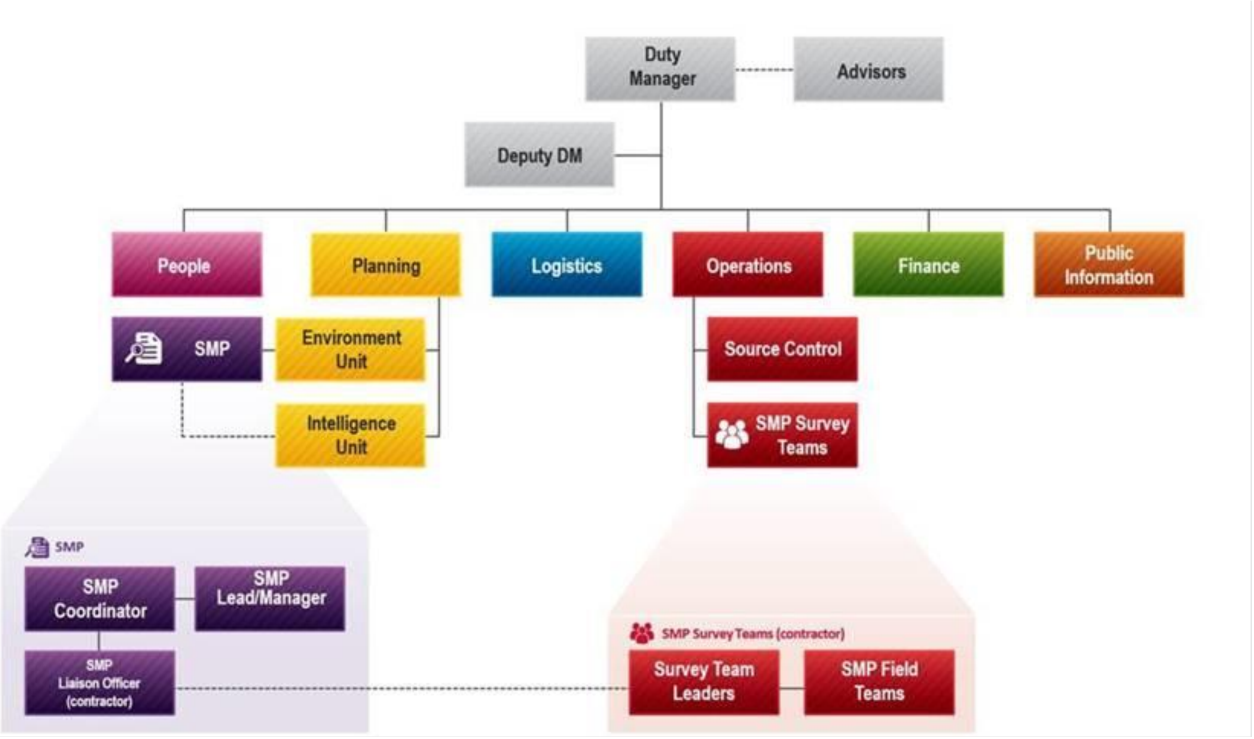

Figure C-1: Woodside Oil Spill Scientific Monitoring Program Delivery Team and Linkage to Incident Control Centre (ICC) organisational structure.

Table C-2: Oil Spill Environmental Monitoring: Scientific Monitoring Program - Objectives, Activation Triggers and Termination Criteria

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
Scientific monitoring program 1 (SM01) **Assessment of Hydrocarbons in Marine Waters**	SM01 will detect and monitor the presence, extent, persistence and properties of hydrocarbons in marine waters following the spill and the response. The specific objectives of SM01 are as follows: • Assess and document the extent, severity and persistence of hydrocarbon contamination with reference to observations made during surveillance activities and / or in-water measurements made during operational monitoring; and • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs.	SM01 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors	SM01 will be terminated when: • Operational monitoring data relating to observations and / or measurements of hydrocarbons on and in water have been compiled, analysed and reported; and • The report provides details of the extent, severity and persistence of hydrocarbons which can be used for analysis of impacts recorded for sensitive receptors monitored under other SMPs. SMP monitoring of sensitive receptor sites: • Concentrations of hydrocarbons in water samples are below NOPSEMA guidance note (2019[17]) concentrations of 1 g/m^2 for floating, 10 ppb for entrained and dissolved; and • Details of the extent, severity and persistence of hydrocarbons from concentrations recorded in water have been documented at sensitive receptor sites monitored under other SMPs.
Scientific monitoring program 2 (SM02) **Assessment of the Presence, Quantity and Character of Hydrocarbons in Marine Sediments**	SM02 will detect and monitor the presence, extent, persistence and properties of hydrocarbons in marine sediments following the spill and the response. The specific objectives of SM02 are as follows: • Determine the extent, severity and persistence of hydrocarbons in marine sediments across selected sites where hydrocarbons were observed or recorded during operational monitoring; and • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs.	SM02 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • Response activities have ceased; and • Operational monitoring results made during the response phase indicate that shoreline, intertidal or sub-tidal sediments have been exposed to surface, entrained or dissolved hydrocarbons (at or above 0.5 g/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² for shoreline accumulation).	SM02 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Concentrations of hydrocarbons in sediment samples are below ANZECC/ ARMCANZ (2013[18]) sediment quality guideline values (SQGVs) for biological disturbance; and • Details of the extent, severity and persistence of hydrocarbons from concentrations recorded in sediments have been documented.
Scientific monitoring program 3 (SM03) **Assessment of Impacts and Recovery of Subtidal and Intertidal Benthos**	The objectives of SM03 are: • Characterize the status of intertidal and subtidal benthic habitats and quantify any impacts to functional groups, abundance and density that may be a result of the spill; and • Determine the impact of the hydrocarbon spill and subsequent recovery (including impacts associated with the implementation of response options). Categories of intertidal and subtidal habitats that may be monitored include: • Coral reefs • Seagrass • Macro-algae • Filter-feeders SM03 will be supported by sediment contamination records (SM02) and characteristics of the spill derived from OMPs.	SM03 will be activated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of PBAs of receptor locations identified by time to hydrocarbon contact >10 days, to target receptors and sites where it is possible to acquire pre-hydrocarbon contact baseline; and • Operational monitoring identified shoreline potential contact of hydrocarbons (at or above 0.5 g/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² for shoreline accumulation) for subtidal and intertidal benthic habitat.	SM03 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Overall impacts to benthic habitats from hydrocarbon exposure have been quantified. • Recovery of impacted benthic habitats has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 4 (SM04) **Assessment of Impacts and Recovery of Mangroves / Saltmarsh**	The objectives of SM04 are: • Characterize the status of mangroves (and associated salt marsh habitat) at shorelines exposed/contacted by spilled hydrocarbons; • Quantify any impacts to species (abundance and density) and mangrove/saltmarsh community structure; and • Determine and monitor the impact of the hydrocarbon spill and potential subsequent recovery (including impacts associated with the implementation of response options). SM03 will be supported by sediment sampling undertaken in SM02 and characteristics of the spill derived from OMPs.	SM04 will be activated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; and	SM04 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Impacts to mangrove and saltmarsh habitat from hydrocarbon exposure have been quantified. • Recovery of impacted mangrove/saltmarsh habitat has been evaluated.

[17] NOPSEMA (2019) Bulletin #1 – Oil spill modelling – April 2019, https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf
[18] Simpson SL, Batley GB and Chariton AA (2013). Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO and Water Science Report 08/07. Land and Water, pp. 132.

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
		• Operational monitoring identified shoreline potential contact of hydrocarbons (at or above 0.5 g/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² for shoreline accumulation) for mangrove/saltmarsh habitat.	• Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 5 (SM05) **Assessment of Impacts and Recovery of Seabird and Shorebird Populations**	The Objectives of SM05 are to: • Collate and quantify impacts to avian wildlife from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population level; and • Undertake monitoring to quantify and assess impacts of hydrocarbon exposure to seabirds and shorebird populations at targeted breeding colonies / staging sites / important coastal wetlands where hydrocarbon contact was recorded.	SM05 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Operational monitoring predicts shoreline contact of hydrocarbons (at or above 0.5 g/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² for shoreline accumulation) at important bird colonies / staging sites / important coastal wetland locations; or • Records of dead, oiled or injured bird species made during the hydrocarbon spill or response.	SM05 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to seabird and shorebird populations from hydrocarbon exposure have been quantified. • Recovery of impacted seabird and shorebird populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 6 (SM06) **Assessment of Impacts and Recovery of Nesting Marine Turtle Populations**	The objectives of SM06 are to: • To quantify impacts of hydrocarbon exposure or contact on marine turtle nesting populations (including impacts associated with the implementation of response options); • Collate and quantify impacts to adult and hatchling marine turtles from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population levels (including impacts associated with the implementation of response options); .and • Undertake monitoring to quantify and assess impacts of hydrocarbon exposure to nesting marine turtle populations at known rookeries (including impacts associated with the implementation of response options).	SM06 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring has: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Predicted shoreline contact of hydrocarbons (at or above 0.5 g/m² surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² for shoreline accumulation) at known marine turtle rookery locations; or • Records of dead, oiled or injured marine turtle species made during the hydrocarbon spill or response.	SM06 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to nesting marine turtle populations from hydrocarbon exposure have been quantified. • Recovery of impacted nesting marine turtle populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 7 (SM07) **Assessment of Impacts to Pinniped Colonies including Haul-out Site Populations**	The objectives of SM07 are to: • Quantify impacts on pinniped colonies and haul-out sites as a result of hydrocarbon exposure/contact. • Collate and quantify impacts to pinniped populations from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population levels.	SM07 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring has: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Identified shoreline contact of hydrocarbons ((at or above 0.5 g/m² surface, ≥5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m² for shoreline accumulation) at known pinniped colony or haul-out site(s) (i.e. most northern site is the Houtman Abrolhos Islands); or • Records of dead, oiled or injured pinniped species made during the hydrocarbon spill or response.	SM07 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to pinniped populations from hydrocarbon exposure have been quantified. • Recovery of pinniped populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 8 (SM08) **Desk-Based Assessment of Impacts to Other Non-Avian Marine Megafauna**	The objective of SM08 is to provide a desk-based assessment which collates the results of OM02 and OM05 where observations relate to the mortality, stranding or oiling of mobile marine megafauna species not addressed in SM06 or SM07, including: • Cetaceans; • Dugongs; • Whale sharks and other shark and ray populations; • Sea snakes; and • Crocodiles.	SM08 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring reports records of dead, oiled or injured non-avian marine megafauna during the spill/ response phase.	SM08 will be terminated when the results of the post-spill monitoring have quantified impacts to non-avian megafauna. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
	The desk-based assessment will include population analysis to infer potential impacts to marine megafauna species populations.		
Scientific monitoring program 9 (SM09) **Assessment of Impacts and Recovery of Marine Fish associated with SM03 habitats**	The objectives of SM09 are: • Characterise the status of resident fish populations associated with habitats monitored in SM03 exposed/contacted by spilled hydrocarbons; • Quantify any impacts to species (abundance, richness and density) and resident fish population structure (representative functional trophic groups); and • Determine and monitor the impact of the hydrocarbon spill and potential subsequent recovery (including impacts associated with the implementation of response options).	SM09 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented with SMO3.	SM09 will be undertaken and terminated concurrent with monitoring undertaken for SM03, as per the SMP termination criteria process • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 10 (SM10) **SM10 - Assessment of physiological impacts important fish and shellfish species (fish health and seafood quality/safety) and recovery**	SM10 aims to assess any physiological impacts to important commercial fish and shellfish species (assessment of fish health) and if applicable, seafood quality/safety. Monitoring will be designed to sample key commercial fish and shellfish species and analyse tissues to identify fish health indicators and biomarkers, for example: • Liver Detoxification Enzymes (ethoxyresorufin-O-deethylase (EROD) activity) • PAH Biliary Metabolites • Oxidative DNA Damage • Serum SDH • Other physiological parameters, such as condition factor (CF), liver somatic index (LSI), gonado-somatic index (GSI) and gonad histology, total weight, length, condition, parasites, egg development, testes development, abnormalities. • Seafood tainting may be included (where appropriate) using applicable sensory tests to objectively assess targeted finfish and shellfish species for hydrocarbon contamination. Results will be used to make inferences on the health of commercial fisheries and the potential magnitude of impacts to fishing industries.	SM10 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring (OM01, OM02 and OM05) indicates the following: • The hydrocarbon spill will or has intersected with active commercial fisheries or aquaculture activities. • Commercially targeted finfish and/or shellfish mortality has been observed/recorded. • Commercial fishing or aquaculture areas have been exposed to hydrocarbons (≥0.5 g/m² surface and ≥5 ppb for entrained/dissolved hydrocarbons); and • Taste, odour or appearance of seafood presenting a potential human health risk is observed.	SM10 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Physiological impacts to important commercial fish and shellfish species from hydrocarbon exposure have been quantified. • Recovery of important commercial fish and shellfish species from hydrocarbon exposure has been evaluated. • Impacts to seafood quality/safety (if applicable) have been assessed and information provided to the relevant stakeholders and regulators for the management of any impacted fisheries. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.

Activation Triggers and Termination Criteria

Scientific monitoring program Activation

The Woodside oil spill scientific monitoring team will be stood up immediately with the occurrence of a hydrocarbon spill (actual or suspected) Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors via the first strike plan for the petroleum activity programme. The presence of any level of hydrocarbons in the marine environment triggers the activation of the oil spill scientific monitoring program (SMP). This is to ensure the full range of eventualities relating to the environmental, socio-economic and health consequences of the spill are considered in the planning and execution of the SMP. The activation process also takes into consideration the management objectives, species recovery plans, conservation advices and conservations plans for any World Heritage Area (WHA), CMRs, State Marine Parks, other protected area designations (e.g., State nature reserves) and Matters of National Environmental Significance (including listed species under part 3 of the Environment Protection and Biodiversity Conservation (EPBC) Act) potentially exposed to hydrocarbons. With the first 24-48 hours of a spill event, such information will be sourced and evaluated as part of the SMP planning process guided by Appendix D (identified receptors vulnerable to hydrocarbon contact), the information presented in the Existing Environment section of the EP as well as other information sources such as the Woodside Baseline Environmental Studies Database.

The starting point for decision-making on what SMPs are activated and spatial extent of monitoring activities will be based on the predictive modelling results (OM01) in the first 24-48 hours until more information is made available from other operational monitoring activities such as aerial surveillance and shoreline surveys. Pre-emptive Baseline Areas (WHA, CMRs and State Marine Parks encompassing key ecological and socio-economic values) are a key focus of the SMP activation decision-making process, particularly, in the early spill event/response phase. As the operational monitoring progresses and further situational awareness information becomes available, it will be possible to understand the nature and scale of the spill. The SMP activation and implementation decision-making will be revisited on a daily basis to account for the updates on spill information. One of the priority focus areas in the early phase of the incident will be to identify and execute pre-emptive SMP assessments at key receptor locations, as required. The SMP activation and implementation decision tree is presented in Figure C-2.

Scientific monitoring Program Termination

The basis of the termination process for the active SMPs (SMPs 1-10) will include quantification of impacts, evaluation of recovery for the receptor at risk and consultation with relevant authorities, persons and organisations. Termination of each SMP will not be considered until the results (as presented in annual SMP reports for the duration of each program) indicate that the target receptor has returned to pre-spill condition.

Once the SMP results indicate impacted receptor(s) have returned to pre-spill condition (as identified by Woodside) a termination decision-making process will be triggered and a number of steps will be undertaken as follows:

- Woodside will engage expert opinion on whether the receptor has returned to pre-spill condition (based on monitoring data). Subject Matter Expert (SMEs) will be engaged (via the Woodside SME scientific monitoring terms of reference to review program outcomes, provide expert advice and recommendations for the duration of each SMP.
- Where expert opinion agrees that the receptor has returned to pre-spill condition, findings will then be presented to the relevant authorities, persons and organisations (as defined by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulation 11A). Stakeholder identification, planning and engagement will be managed by Woodside's Reputation Functional Support Team (FST) and follow the stakeholder management FST. These guidelines outline the FST roles and responsibilities, competencies, stakeholder communications and planning

processes. An assessment of the merits of any objection to termination will be documented in the SMP final report.

- Woodside will decide on termination of SMP based on expert opinion and merits of any stakeholder objections. The final report following termination will include: monitoring results, expert opinion and stakeholder consultation including merits of any objections.
- Termination of SMPs will also consider applicable management objectives, species recovery plans, conservation advices and conservations plans for any World Heritage Area (WHA), CMRs, State Marine Parks, other protected area designations (e.g., State nature reserves) and Matters of National Environmental Significance (including listed species under part 3 of the EPBC Act).

The SMP termination decision-making process will be applied to each active SMP and an iterative process of decision steps continued until each SMP has been terminated (refer to decision-tree diagram for SMP termination criteria, Figure C-3).

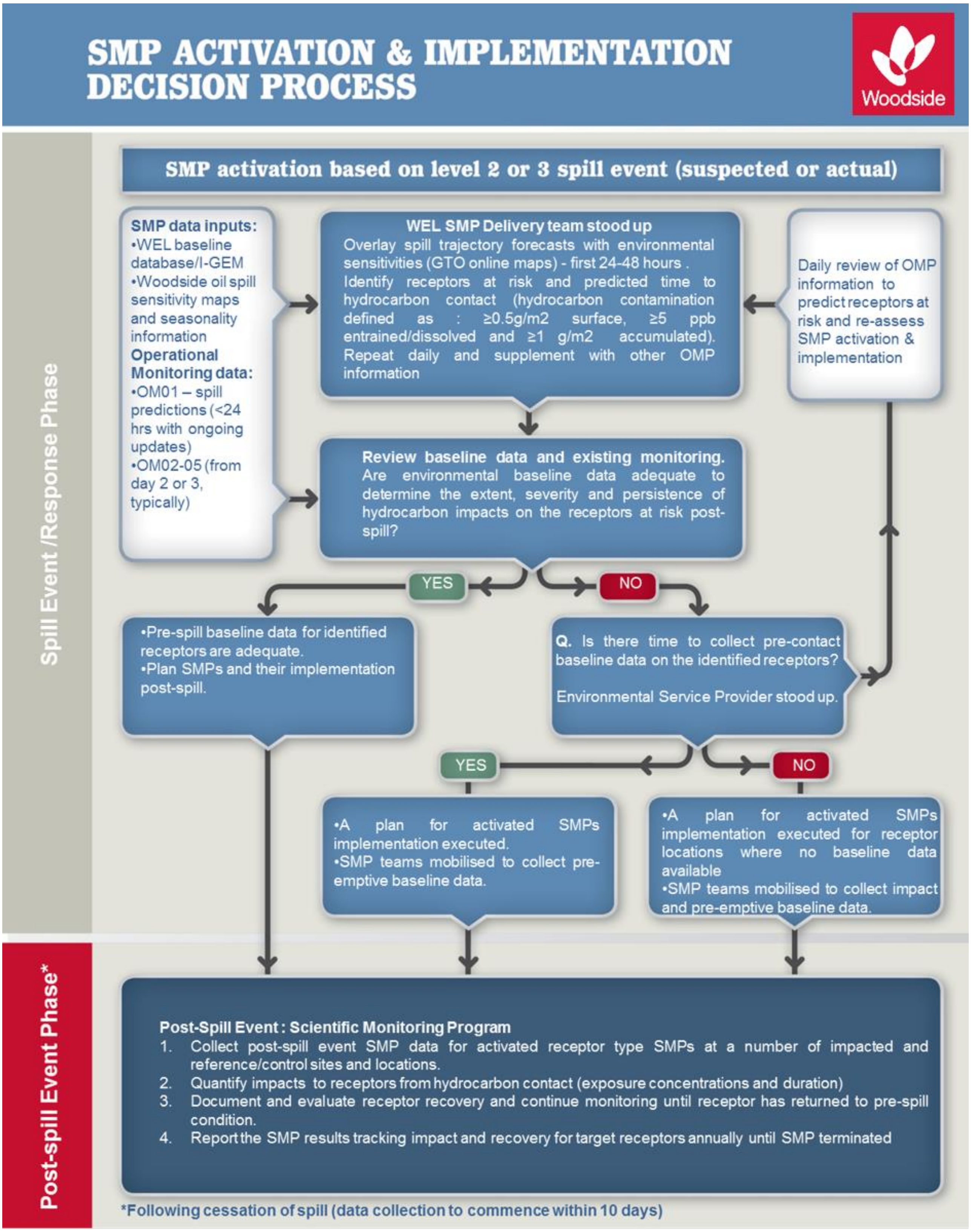

Figure C-2: Activation and Implementation Decision-tree for Oil Spill Environmental Monitoring

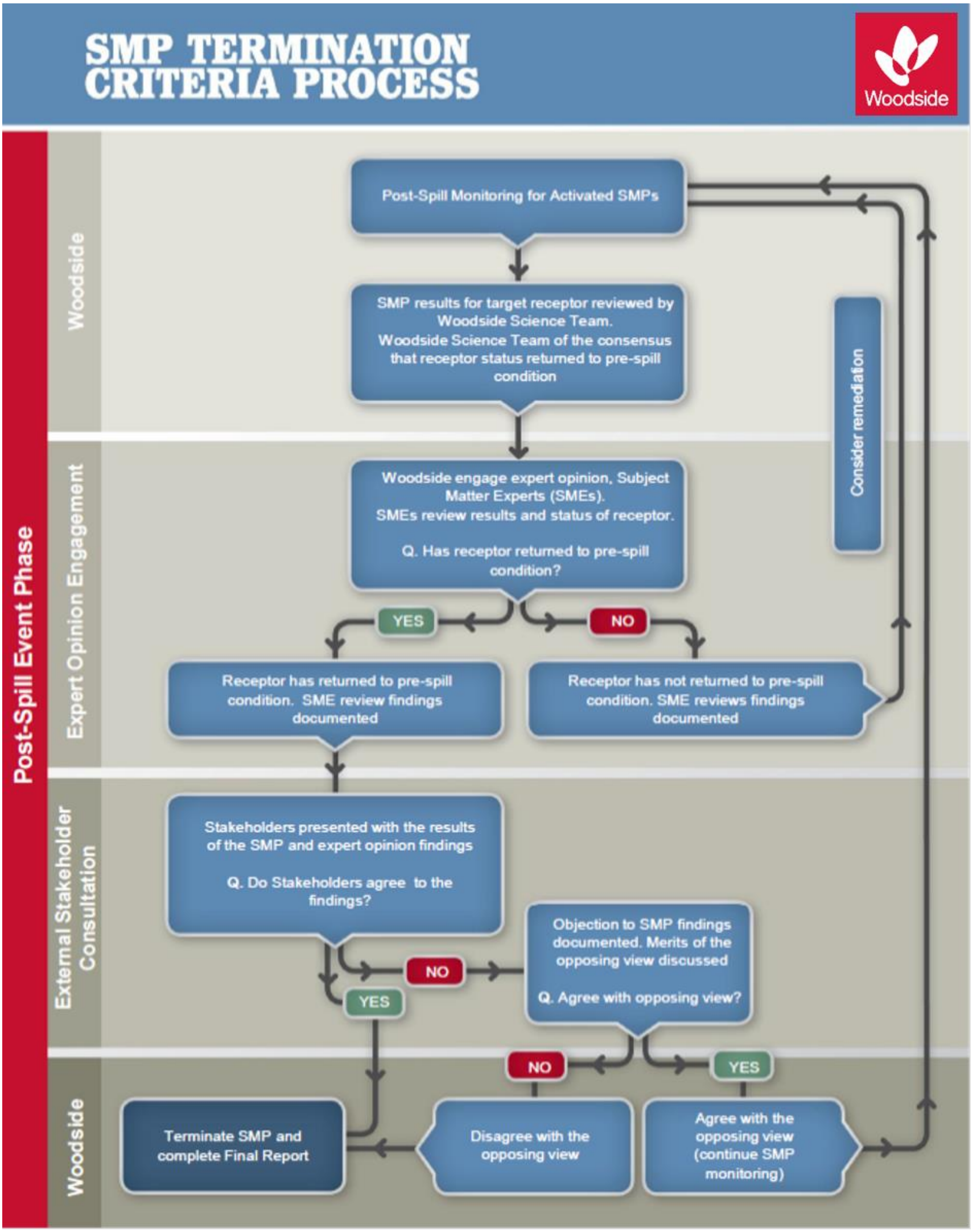

Figure C-3: Termination Criteria Decision-tree for Oil Spill Environmental Monitoring

Receptors at Risk and Baseline Knowledge

In order to assess the baseline studies available and suitability for oil spill scientific monitoring, Woodside maintains knowledge of environmental baseline studies through the upkeep and use of its Environmental Knowledge Management System.

Woodside's Environmental Knowledge Management System is a centralised platform for scientific information on the existing environment, marine biodiversity, Woodside environmental studies, key environmental impact topics, key literature and web-based resources. The system comprises a number of data directories and an environmental baseline database, as well as folders within the 'Corporate Environment' server space. The environmental baseline database was set up to support Woodside's SMP preparedness and as a SMP resource in the event of an unplanned hydrocarbon spill. The environmental baseline database is subject to updates including annual reviews completed as part of SMP standby contract. This database is accessed pre-PAP to identify Pre-emptive Baseline Areas (PBAs) where hydrocarbon contact is predicted to occur <10 days.

In addition to Woodside's Environmental Knowledge Management System, it is acknowledged that many relevant baseline datasets are held by other organisations (e.g. other oil and gas operators, government agencies, state and federal research institutions and non-governmental organisations). In order to understand the present status of environmental baseline studies a spatial environmental metadata database for Western Australia (Industry-Government Environmental Metadata, I-GEM) was established. IGEM is a collaboration comprising oil and gas operators (including Woodside), government and research agencies and other organisations. IGEM held data were integrated into the Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA)[19] in 2020. The Index of Marine Surveys for Assessments (IMSA) is an online portal for information about marine-based environmental surveys in Western Australia. IMSA is a project of the Department of Water and Environmental Regulation (the department) for the systematic capture and sharing of marine data created as part of an environmental impact assessment (EIA).

In the event of an unplanned hydrocarbon release, Woodside intends to interrogate the information on baseline studies status as held by the various databases (e.g. Woodside Environmental Knowledge Management System, IMSA and other sources of existing baseline data) to identify Pre-emptive Baseline Areas (PBAs), i.e., receptors at risk where hydrocarbon contact is predicted to be >10 days, and baseline data can be collected before hydrocarbon contact.

Reporting

For the scientific monitoring program relevant regulators will be provided with:

- Annual reports summarising the SMPs deployed and active, data collection activities and available findings; and
- Final reports for each SMP summarising the quantitative assessment of environmental impacts and recovery of the receptor once returned to pre-spill condition and termination of the monitoring program.

The reporting requirements of the scientific monitoring program will be specific to the individual SMPs deployed and terms of responsibilities, report templates, schedule, Quality Assurance/Quality Control (QA/QC) and peer-review will be agreed with the contractors engaged to conduct the SMPs. Compliance and auditing mechanisms will be incorporated into the reporting terms.

[19] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

ANNEX D: MONITORING PROGRAM AND BASELINE STUDIES FOR THE PETROLEUM ACTIVITIES PROGRAM

Table D-1: Oil Spill Environmental Monitoring – scientific monitoring program scope for the Petroleum Activities Program based on Worst Case Credible Spill EMBA (based three modelled marine diesel scenarios)

Receptors to be Monitored	Applicable SMP	Receptor Areas - Potential Impact and Reference Scientific Monitoring Sites (marked X)																																							
		Kimberley AMP	Agro-Rowley Terrace AMP	Montebello AMP	Dampier AMP	Carnarvon Canyon AMP	Ningaloo AMP	Gascoyne AMP	Shark Bay Open Ocean (including AMP)	Abrolhos AMP	Jurien AMP	Two Rocks AMP	Perth Canyon AMP	Geographe AMP	South-west Corner AMP	Ashmore Reef and AMP	Seringapatam Reef	Scott Reef (North and South)	Mermaid Reef and AMP	Clerke Reef and State Marine Park	Imperieuse Reef and State Marine Park	Rankin Bank	Glomar Shoals	Rowley Shoals (including State Maine Park)	Fantome Shoal	Adele Island	Lacepede Islands	Montebello Islands (including State Marine Park)	Lowendal Islands (including State Nature Reserves)	Barrow Island (including State Nature Reserves, State Marine Park and Marine Management Area)	Muiron Islands (WHA, Marine Management Area)	Pilbara Islands – Middle and Southern Island Group (Serrurier, Thevenard and Bessieres Islands - State Nature Reserves)	Pilbara Islands - Northern Island Group (Sandy Island Passage Islands - State nature reserves)	Abrolhos Islands	Kimberley Coast	Dampier Peninsula	Northern Pilbara Shoreline	Ningaloo Coast (North/North West Cape, Middle and South) (WHA, and State Marine Park)	Shark Bay - Open Ocean Coast	Shark Bay (WHA, State Marine Park)	Dampier Archipelago
Habitat																																									
Water Quality	SM01	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marine Sediment Quality	SM02	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Coral Reef	SM03	X		X												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	
Seagrass / Macro-Algae	SM03	X									X					X	X	X									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Deeper Water Filter Feeders	SM03	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X							X			X
Mangroves and Saltmarsh	SM04																											X						X	X	X	X	X		X	X
Species																																									
Sea Birds and Migratory Shorebirds (significant colonies / staging sites / coastal wetlands)	SM05	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marine Turtles (significant nesting beaches)	SM06	X	X	X	X		X	X	X							X	X	X	X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pinnipeds (significant colonies / haul-out sites)	SM07									X	X	X			X																										
Cetaceans - Migratory Whales	SM08	X	X	X	X		X	X	X	X	X	X	X	X	X			X									X	X	X	X	X			X	X	X		X		X	X
Oceanic and Coastal Cetaceans	SM08	X	X	X	X		X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dugongs	SM08	X							X							X												X	X	X	X	X	X		X	X	X	X	X	X	X
Sea Snakes	SM08	X		X	X			X	X	X						X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Whale Sharks	SM08			X			X	X										X										X	X	X	X							X			
Other Shark and Ray Populations	SM08, SM09	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Assemblages	SM09	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Socio-economic																																									
Fisheries - Commercial	SM10		X	X	X	X	X	X	X	X	X	X										X	X	X	X			X	X	X		X	X	X	X	X	X	X	X	X	X
Fisheries - Traditional	SM10															X	X	X									X													X	X
Tourism (incl. recreational fishing)	SM10	X		X			X	X	X		X			X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X

(dark red)	Receptor areas identified as Pre-emptive Baseline Areas (based on criteria of surface contact and/or entrained hydrocarbon contact ≤10 days (Offshore Australian Marine Parks contacted by hydrocarbons in this timeframe also noted)
(pink)	Receptor areas identified as Pre-Emptive Basline Areas in the response phase >10 days (based on criteria of surface contact and/or entrained hydrocarbon contact >10 days)
(white)	Receptor areas that may be identified as impact or reference sites in the event of major hydrocarbon release and would be identified as part of the SMP planning process

Table D-2: Baseline Studies for the SMPs applicable to identified Pre-emptive Baseline Areas for the Petroleum Activities Program

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
Benthic Habitat (Coral Reef)	**SM03** Quantitative assessment using image capture using either diver held camera or towed video. Post analysis into broad groups based on taxonomy and morphology.	**Studies:**							
		1. Glomar Shoal and Rankin Bank Environmental Survey Report, 2013, quantitatively surveyed benthic habitats and communities. AIMS report to Woodside. Scientific Publication - Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems, 2018. 2. Rankin Bank Environmental Survey Extension, 2014, Habitat assessment of an area southeast of Rankin Bank. 3. Glomar Shoal and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoal, 2018.	1. Broad benthic habitat classifications and habitat maps for the Montebello islands by DBCA. 2. Coral monitoring at sites across Barrow Island, Lowendal and the Montebello islands. Most recent survey 2012 3. Benthic community monitoring as part of DBCA Western Australian Marine Monitoring Program (2015-ongoing). 4. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Chevron LTM of corals for the Gorgon Gas Development. Marine Baseline Program (2008), Marine Monitoring Program (2010) Post Development Surveys (2011 – 2013). 2.Coral monitoring at sites around Barrow Island, Lowendal and the Montebello islands. Most recent survey 2012. 3.Benthic community (coral, seagrass and macroalgae) monitoring as part of DBCA's Western Australian Marine Monitoring Program (2015-ongoing). 4.Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Benthic habitats surrounding the Lowendal Islands for the Gorgon Gas Development. Coral assemblages on the eastern side of Double Island, and coral bommies on the south-western edge of the Lowendal Shelf. 2. Coral monitoring at sites across Barrow Island, Lowendal and the Montebello islands. Most recent survey 2012. 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Benthic habitat mapping of the subtidal and intertidal habitats of the islands and shoals. Coral communities in shallow subtidal habitat, intertidal pavement. 2. Coral monitoring at Varanus and Airlie Islands (2000 to present) to identify corals, growth from and percentage cover 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013; 2016)	Coral Reefs & Filter Feeders 1. Montebello Marine Park, 2019, Identification and qualitative descriptions of benthic habitat. 2. Montebello Australian Marine Parks – 2019 – Baseline survey on benthic habitats. 3. Pluto Trunkline within Montebello Marine Park – Monitoring marine communities.	1. DBCA LTM Ningaloo Reef program: 1991-ongoing 2. AIMS/DBCA 2014 Baseline Ningaloo and Muiron Islands Survey – repeat and expansion on the LTM (Co-funded survey: Woodside and AIMS). 3. Pilbara Marine Conservation Partnership. 4. WAMSI LTM Study: Ningaloo Research node: 2009 -10 over the length of Ningaloo reef system (with a focus on coral and fish recruitment). 5. Ningaloo Outlook (CSIRO) - Shallow and Deep Reefs Program (2015-ongoing). 6. Ningaloo Collaboration Cluster: Habitats of the Ningaloo Reef and adjacent coastal areas determined through hyperspectral imagery.	1. Coral Monitoring, Mermaid Sound. URS on behalf of Chevron, 2004. 2. Pluto baseline marine habitat surveys 2007 – 2008. 3. Pluto dredge and post dredge monitoring 2008-2010. 4. Benthic habitat survey at the Eastern Flank Development area commissioned by Woodside. 5. Benthic community monitoring as part of DBCA's Dampier Archipelago Marine Monitoring Program (2007-ongoing). 6. WA Museum study on the Scleractinian corals collected in 1998. (Griffith 2004). 7. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013). 8. Coral recruitment in the Northern Pilbara (2015 and 2016). 9. Distribution, patterns and key processes of major marine communities and large marine fauna – DBCA Pluto Offset Program (of the proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area). 10. Establishment of long-term monitoring reference sites in the Pluto Offset program with DBCA (proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area). 11. Study of the spatial and temporal distribution of coral assemblages at Dampier Archipelago (Cape Preston to Delambre Island), using 871 datasets dating back to the early 1970s. Sites surveyed in May 2017.
		Methods:							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
		1. Towed video transects, photo quadrats using towed video system. 2. Towed video transects, photo quadrats using towed video system. 3. Towed video transects, photo quadrats using towed video system. 4. Towed video transects, photo quadrats using towed video system.	1. Habitat mapping. 2. Quantitative assessment details not available. 3. Drop camera. 4. Fixed long-term monitoring sites. Diver video transect. 5. Towed video, benthic trawl and sled.	1. Belt transect, size class frequency, video transects, photo quadrat, tagged colonies and terracotta tiles for coral recruitment. 2. Quantitative assessment 3. Fixed long-term monitoring sites. Diver video transects. 4. Towed camera, benthic trawl and sled.	Benthic habitat mapping, diver swum transects, tagged colonies. Quantitative assessment Towed video, benthic trawl and sled.	1. ROV transects. 2. ROV transects and driver surveys 3. Towed video, benthic trawl and sled	1.ROV Transects 2. Benthic habitat mapping, multibeam acoustic swathing. 3. ROV video.	1. LTM transects, diver based (video) photo quadrats, specimen collection. 2. LTM sites, transects, diver-based video quadrat. 3. Diver video transects, still photography, video and in situ visual estimates from transects, quadrats, manta-tows, towed video and ROV. 4. Video point intercept transects recorded by towed video or diver hand-held video camera. 5. Video transects. 6. LTM transects, diver based (video) photo quadrat.	1. Towed Video. 2. Multibeam hyperspectral, Diver swum surveys, drop camera. 3. Diver swum – belt transects, photo quadrats. 4. Drop camera. 5. Diver swum – belt transects, photo quadrats. 6. Coral collection for taxonomic records. 7. Towed video, benthic trawl and sled. 8. Coral settlement tiles. 9. Collection of fish, coral, mangrove and seagrass samples from reefs along the WA coast, including reefs within the proposed Dampier Archipelago Marine Park. Samples subject to genetic testing. 10. The major datasets collected in 2016/17 were for mangroves, seagrass, macroalgae, coral and fish communities. Monitoring of coral and fish communities undertaken using LIT and UVC methods. with all 15 sites visited and surveyed for the second time in this project. four permanent temperature loggers were exchanged on two occasions, November and May, and a full year of data was downloaded. 11. Photo quadrants and recruitment tiles
		References and Data:							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
		1. AIMS 2014a and Abdul Wahab et al., 2018. DATAHOLDER: AIMS. 2. AIMS 2014b. DATAHOLDER: AIMS. 3.Currey-Randall et. al., 2019. DATAHOLDER: AIMS 4. Currey-Randall et. al., 2019. DATAHOLDER: AIMS	1. DBCA 2007. DATAHOLDER: DBCA. 2. RPS, 2012. DATAHOLDER: Santos. 3. DATAHOLDER: DBCA. 4. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. Baseline: Chevron Australia 2010. Marine Monitoring Program: Chevron Australia 2011 Post Dredge: Chevron Australia 2013 DATAHOLDER: Chevron Australia. 2. RPS, 2012. DATAHOLDER: Santos. 3. Bancroft 2009. DATAHOLDER: DBCA. 4. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. RPS-Bowman Bishaw Gorham 2005. DATAHOLDER: Chevron. 2. RPS, 2012. DATAHOLDER: Santos. 3. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. Chevron 2010. DATAHOLDER: Chevron. 2. Quadrant Energy/Santos 2016 DATAHOLDER: Santos 3. CSIRO (2013; 2016). Roland Pitcher. DATAHOLDER	1. Advisian 2019 2. Keesing 2019 3. McLean et al. 2019	1. DBCA unpublished data. DATAHOLDER: DBCA 2. AIMS 2015. DATAHOLDER: AIMS. 3. Pilbara Marine Conservation Partnership DATAHOLDER: CSIRO 4. Depczynski et al. 2011 DATAHOLDER: AIMS, DBCA and WAMSI. 5. CSIRO 2019 – Ningaloo Outlook Program 6. Murdoch University - Kobryn et al 2011 and Keulen & Langdon 2011.	1. URS Australia Pty Ltd. 2004. DATAHOLDER: Woodside. 2. SKM, 2008. DATAHOLDER: Woodside, SKM. 3. MSCIENCE, 2010. DATAHOLDER: MSCIENCE. 4. Woodside 2012. DATAHOLDER: Woodside. 5. DBCA. 6. Griffith (2004) Western Australian Museum. 7. CSIRO (2013). DATAHOLDER: Roland Pitcher. 8. CSIRO (2015 and 2016). 9. DBCA (2017) 10. DBCA (2017) 11. Moustaka, et al. 2019 Dataholder: DBCA
Benthic Habitat (Seagrass and Macro-algae)	**SM03** Quantitative assessment using image capture using either diver held camera or towed video. Post analysis into broad groups based on taxonomy and morphology.	**Studies:**							
		1. Glomar Shoal and Rankin Bank Environmental Survey Report, 2013, quantitatively surveyed benthic habitats and communities. AIMS report to Woodside. Scientific Publication - Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems, 2018. 2. Rankin Bank Environmental Survey Extension, 2014, Habitat assessment of an area southeast of Rankin Bank. 3. Glomar Shoal and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoal, 2018.	1. Santos, macroalgae monitoring at sites across Lowendal and the Montebello islands in 2012. 2. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Chevron LTM of Seagrass and Macro algae habitats for the Gorgon Gas Development project. Marine baseline Program (2008, 2009), Marine Monitoring Program (2010), Post Dredge Survey one (2011) 2. Chevron study by RPS in 2004 on Barrow Island intertidal zone. 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Benthic habitats including seagrass and macroalgae for the (Lowendal Islands, Chevron Janz Feed Gas Pipeline Project.) Gorgon Gas Development Project. 2. Santos macroalgae monitoring at sites across Lowendal and the Montebello islands in 2012. 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013).	1. Benthic habitat mapping of the subtidal and intertidal habitats of the islands and shoals. Algae communities in shallow subtidal habitat, intertidal pavement. 3. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013; 2016)	N/A – see Table D-1	1. Quantitative descriptions of Ningaloo sanctuary zones habitats types including lagoon and offshore areas – Cassata and Collins (2008). 2. CSIRO/BHP Ningaloo Outlook Program. 3. Ningaloo Collaboration Cluster: Habitats of the Ningaloo Reef and adjacent coastal areas determined through hyperspectral imagery. 4. Australian Institute of Marine Science – CReefs: Ningaloo Reef Biodiversity Expeditions (2008-2010).	1. Benthic habitat onitoring, Mermaid Sound by URS on behalf of Chevron. 2. Pluto baseline marine habitat surveys 2007 – 2008. 3. West Australian Museum marine biodiversity collection. 5. Benthic community monitoring as part of DBCA's Dampier Archipelago Marine Monitoring Program (2007-ongoing). 6. Pilbara Marine Conservation Partnership Seabed biodiversity survey (2013). 7. Distribution, patterns and key processes of major marine communities and large marine fauna (Pluto Offset Program DBCA) 8. Establishment of long-term monitoring reference sites for the Pluto Offset Program – DBCA (in the proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area).
		Methods:							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
		1. Towed video transects, photo quadrats using towed video system. 2. Towed video transects, photo quadrats using towed video system. 3. Towed video transects, photo quadrats using towed video system. 4. Towed video transects, photo quadrats using towed video system	1. Quantitative assessment details not available. 2. Towed video, benthic trawl and sled.	1. Diver transects, photo quadrats, biomass. 2. Physical observational survey of intertidal habitats on Barrow Island. 3. Towed video, benthic trawl and sled.	1. Diver Transects, Photo Quadrats. 2. Quantitative assessment details not available. 3. Towed video, benthic trawl and sled.	1. ROV transects. 2. Towed video, benthic trawl and sled	N/A – see Table D-1	1. Video transects to ground truth aerial photographs and satellite imagery. 2. Diver video transects. 3. LTM transects, diver based (video) photo quadrat. 4. LTM transects, diver based (video) photo quadrats, specimen collection.	1. Towed Video. 2. Multi-beam hyperspectral, Diver swum surveys, drop camera. 3. Diving collection to establish diversity, distribution and abundance of biota. 5. Diver swum – belt transects, photo quadrats. 6. Towed video, benthic trawl and sled. 7. Collection of fish, coral, mangrove and seagrass samples from reefs along the WA coast, including reefs within the proposed Dampier Archipelago Marine Park. Samples subject to genetic testing. 8. The major datasets collected in 2016/17 were for mangroves, seagrass, macroalgae, coral and fish communities. Several techniques were trialled for both seagrass and macroalgae monitoring; including benthic imagery, quadrat counts, line intercept measures, and laboratory analysed collections.
		References and Data:							
		1. AIMS 2014a and Abdul Wahab et al., 2018. DATAHOLDER: AIMS. 2. AIMS 2014b. DATAHOLDER: AIMS. 3. Currey-Randall et. al., 2019. DATAHOLDER: AIMS 4. Currey-Randall et. al., 2019. DATAHOLDER: AIMS	1. RPS 2012. DATAHOLDER: Santos. 2. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. Baseline: Chevron Australia 2010. Marine Monitoring Program: Chevron Australia 2011 Post Dredge: Chevron Australia 2013 DATAHOLDER: Chevron Australia. 2. RPS-Bowman Bishaw Gorham 2005. DATAHOLDER: Chevron Australia. 3. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. RPS-Bowman Bishaw Gorham 2005. DATAHOLDER: Chevron. 2. RPS 2012. DATAHOLDER: Santos. 3. Pitcher et al. (2016). DATAHOLDER: CSIRO.	1. Chevron 2010. DATAHOLDER: Chevron 2. CSIRO (2013, 2016). Roland Pitcher. DATAHOLDER	N/A – see Table D-1	1. Cassata and Collins 2008. DATAHOLDER: Curtin University – Applied Geology. 2. CSIRO – Ningaloo Outlook Program 3. Murdoch University - Kobryn et al 2011 and Keulen and Langdon 2011. 4. AIMS (2010) - http://www.aims.gov.au/creefs	1. URS Australia Pty Ltd. 2005. DATAHOLDER: Woodside. 2. SKM, 2008. DATAHOLDER: Woodside, SKM. 3. West Australian Museum 2002. DATAHOLDER: WAM, Woodside. 4. Keesing et. Al. 2011 5.DBCA. 6. Towed video, benthic trawl and sled. 7. DBCA (2017) 8. DBCA (2017)
	SM03	**Studies:**							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
Benthic Habitat (Deeper Water Filter Feeders)	Quantitative assessment using image capture using towed video. Post analysis into broad groups based on taxonomy and morphology.	1. Glomar Shoal and Rankin Bank Environmental Survey Report, 2013, quantitatively surveyed benthic habitats and communities. AIMS report to Woodside. Scientific Publication - Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems, 2018. 2. Rankin Bank Environmental Survey Extension, 2014, Habitat assessment of an area southeast of Rankin Bank. 3. Glomar Shoal and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoal, 2018.	N/A – See Table D-1	N/A – See Table D-1	N/A – See Table D-1	N/A – See Table D-1	N/A – see Table D-1	1. WAMSI 2007 deep-water Ningaloo benthic communities' study, Colquhoun and Heyward (2008). 2. CSIRO/BHP Ningaloo Outlook Program - Deep reef themes 2020	1. Baseline Marine Habitat Survey for the Pluto LNG Project. A total of 315 km2 of Mermaid Sound was mapped in high resolution to distinguish habitat location and extent and further verified with 389 km of towed video.
		Methods:							
		1. Towed video transects, photo quadrats using towed video system. 2. Towed video transects, photo quadrats using towed video system. 3. Towed video transects, photo quadrats using towed video system. 4. Towed video transects, photo quadrats using towed video system.	N/A – See Table D-1	N/A – See Table D-1	N/A – See Table D-1	N/A – See Table D-1	N/A – see Table D-1	1. Towed video and benthic sled (specimen sampling). 2. Side-scan sonar and AUV transects.	1. Drop camera surveys of Deepwater sites (approx. 10 – 35 m depth).
		References and Data:							
		1. AIMS 2014a and Abdul Wahab et al., 2018. DATAHOLDER: AIMS. 2. AIMS 2014b. DATAHOLDER: AIMS. 3. Currey-Randall et. al., 2019. DATAHOLDER: AIMS 4. Currey-Randall et. al., 2019. DATAHOLDER: AIMS	N/A – See Table D-1	N/A – See Table D-1	N/A – See Table D-1	N/A – See Table D-1	N/A – see Table D-1	1.Colquhoun and Heyward (eds) 2008. DATAHOLDER: WAMSI, AIMS. 2.CSIRO – Ningaloo Outlook 2020	1. SKM 2008. DATAHOLDER: Woodside.
	SM04	**Studies:**							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
Mangroves and Saltmarsh	Aerial photography and satellite imagery will be used in conjunction with field surveys to map the range and distribution of mangrove communities.	N/A – See Table D-1	1. Atmospheric correct and land cover classification, NW Cape. 2. Advanced Land Observing Satellite (ALOS) images taken in 2006, 2008, and 2010 by DBCA. Digital Aerial Photos were taken in 2009, and the area ground-truthed in 2006. 3. Ground truthing aerial photography to map the spatial extent of mangroves on the Montebello Islands. 4. Mangrove monitoring as part of DBCA Western Australian Marine Monitoring Program (ongoing).	1. Chevron LTM of Mangroves for the Gorgon Gas Development project. Marine Baseline Program (2009), Post Dredge Survey 1 (2011), Post Dredge Survey 2 (2013). 2. Baseline state of the mangroves 2008.	1. Atmospheric correct and land cover classification, NW Cape. 2. Santos Mangrove baseline (2010). 3. Santos - Long-term mangrove monitoring (1999-2011).	1. Study conducted by URS (November 2008 to May 2009) to ground truth aerial photography taken between 2001 and 2009 and to identify mangrove species present in the area.	N/A – see Table D-1	1.Atmospheric correct and land cover classification, NW Cape. 2.Woodside hold Rapid Eye imagery of the Ningaloo Reef and coastal area. 3.Hyperspectral survey (2006) of Ningaloo Reef and coastal area (not yet analysed for Mangroves). 4.North West Cape sensitivity mapping 2012 included Mangrove Bay. 5.Global mangrove distribution as mapped by the USGS and located on UNEP's Ocean Data viewer.	1. Woodside hold Rapid Eye imagery of the Reef and coastal area (2011) 2. Chemical and Ecological Monitoring in Mermaid Sound, 1985 – 2021 3. Woodside Mangrove Habitat Distribution in Mermaid Sound, Dampier Archipelago - 2004. 4. Distribution, patterns and key processes of major marine communities and large marine fauna – Pluto Offset Program DBCA (of the proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area). 5. Establishment of long-term monitoring reference sites – Pluto Offset Program DBCA (in the proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area). 6. Lymburner et al. (2019) applies quantitative analysis to assess the extent and canopy density of mangroves for each year between 1987 and 2018 7. Mangrove baseline data 2017 - Woodside has acquired satellite imagery of coastal areas of mainland and offshore islands from Geraldton and the Abrolhos Islands (in the south) to Dampier Archipelago (out to the Montebello Islands in the north), land classification completed and mangrove habitats identified and mapped
		Methods:							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
		N/A – See Table D-1	1. Modular Inversion Program. May 2017 2. ALOS and Digital aerial photos, ground truthing, for Mangrove extent and mangrove relative canopy density. 3. Species Composition, LUX, canopy density. 4. Methods unknown.	1.Health scoring system, percentage cover, mean canopy density, qualitative health assessment. 2. Annual Mangrove composition, canopy density, pneumatophore density, leaf pathology, qualitative health.	1. Modular Inversion Program. May 2017 2.Aerial imagery (resolution of 0.2 m2 captured in 2010). 3. Qualitative data includes the presence of new growth, reproductive state, extent of defoliation and pneumatophore condition. Quantitative data, collected at the tree level, includes seedling density, stem diameter, number of defoliated branches and a number of canopy condition parameters.	1.Aerial Photography and Satellite imagery Species identification and community composition.	N/A – see Table D-1	1. Modular Inversion Program. May 2017 2. Rapid Eye imagery – High resolution satellite imagery from October/November/December 2011 and 2017. 3. Remote sensing – acquisition of HyMap airborne hyperspectral imagery and ground truthing data collection. 4. Reconnaissance surveys of the shorelines of the North West Cape and Muiron Islands. 5. Remote sensing study of global mangrove coverage.	1. Rapid Eye imagery – High resolution satellite imagery from October/November/December 2011. 2. Mangrove canopy cover, phenology, photography, vegetation descriptions. 3. Aerial photography to identify coverage of mangrove habitat in the area. 4. Collection of fish, coral, mangrove and seagrass samples from reefs along the WA coast, including reefs – Pluto Offset Program DBCA (within the proposed Dampier Archipelago Marine Park. Samples subject to genetic testing). 5. The major datasets collected in 2016/17 were for mangroves, seagrass, macroalgae, coral and fish communities. Mangrove communities were monitored using two discreet methods. Mangrove extent was analysed using satellite imagery and this was then verified in the field. Quantitative data was also collected for mangrove health at nine sites; this included density, diversity, recruitment, tree size, height and canopy cover. 6. PCC% for mangroves using optical and radar data (Landsat sensor spectral composite data (all spectral wavebands) and Advanced Land Observing Satellite (ALOS) Phased Arrayed L-band Synthetic Aperture Radar (SAR) data). for the entire Australian coastline. 7. Land cover classification was performed based on atmospherically corrected Sentinel-2 data
		References and Data:							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
		N/A – See Table D-1	1. EOMAP, 2017 DATAHOLDER: Woodside. 2.DBCA unpublished data. DATAHOLDER: DBCA. 3. Voga unpublish data DATAHOLDER: Voga Contact: voga.envrironment@vermilionenergy.com 4. DBCA. DATAHOLDER DBCA.	Baseline: Chevron Australia 2010. Marine Monitoring Program: Chevron Australia 2011 Post Dredge: Chevron Australia 2013 DATAHOLDER: Chevron Australia. Chevron 2014. DATAHOLDER: Chevron.	1. EOMAP, 2017 DATAHOLDER: Woodside. 2.Santos 2014. DATAHOLDER: Santos. 3. Santos 2011. DATAHOLDER: Santos.	1. URS (2010) DATAHOLDER: Chevron Australia	N/A – see Table D-1	1. EOMAP 2017 DATAHOLDER: Woodside. 2. AAM 2014. Dataholder: Woodside 3. Kobryn et al. 2013. DATAHOLDER: Murdoch University, AIMS; Woodside. 4. Joint Carnarvon Basin Operators, 2012. DATAHOLDER: Woodside and Apache Energy Ltd. 5. http://data.unep-wcmc.org/	1. AAM 2012. DATAHOLDER: Woodside. 2. URS 2013. DATAHOLDER: URS, Woodside. 3. Woodside 2004. 4. DBCA (2017) 5. DBCA (2017) 6. Lymburner et al. 2019. DATAHOULDER: Geoscience Australia, Author (leo.lymburner@ga.gov.au) 7. SOURCE: EOMAP 2017 report to Woodside
Seabirds	**SM05** Visual counts of breeding seabirds, nest counts, intertidal bird counts at high tide.	**Studies:**							
		N/A – See Table D-1	1.No recent studies. A DBCA/WAM study of terrestrial fauna of the islands was published in 2000 (Burbidge et al 2000). The most recent bird survey referenced in this review was 1998 by DBCA (DPaW, CALM).	1. Barrow Island migratory behaviour, nesting and foraging behaviour. 2. Migratory waders at Barrow Island. 3. LTM on Barrow island (island wide) Study September 2003 – 2006. 4. Chevron - Gorgon Gas Development. Terrestrial and subterranean environment monitoring program (2008-2015). Monitoring of Wedge-tailed Shearwaters, Bridled Terns, Silver Gulls.	1. Ongoing study of Bridled Terns from 2009. 2. Quadrant Energy seabird nesting on Lowendal Island, study 2013. 3. Lowendal Islands, common breeding bird species, structure, feeding and disturbances to the population. 4. Quadrant Energy/Santos – Integrated Shearwater Monitoring Program (1994-2016).	1. Migratory waterbirds relevant to the Wheatstone Project on behalf of URS in 2008 - 2009. 2. Quadrant Energy/Santos – Integrated Shearwater Monitoring Program (1994-2016). 3. Exmouth Sub-basin Avifauna Monitoring Program (2013-2014)	Present, in open water, no breeding habitat.	1. LTM Study of marine and shoreline birds: 1970-2011. 2. LTM of shorebirds within the Ningaloo coastline (Shorebirds 2020). 3. Exmouth Sub-basin Marine Avifauna Monitoring Program (Quadrant Energy/Santos). 4. Seabird and Shorebird baseline studies, Ningaloo Region – Report on January 2018 bird surveys. 5.Wedge-tailed shearwater foraging behaviour in the Exmouth Region – Final Report	1. Baseline information in the Pilbara oiled wildlife response plan 2014. 2. Advisian (2021) NMWR Seabird and Shorebird baseline review (Woodside report)
		Methods:							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
		N/A – See Table D-1	1. Bird observations and counts.	1. Species, total numbers, Distribution, Roosting locations and foraging numbers. Migratory behaviour. 2. High tide roost counts, abundance counts. 3. Nest burrow density (number of burrows per m2); presence/absence of eggs or chicks in burrows; collapsed burrows and predation and mortality records. 4. Barrow Island: Variation in abundance and spatial/temporal distribution on beaches. Middle Island: Abundance; nest density; Presence and absence of eggs/chicks in nest.	1. Nest Density, presence and absence of chicks, predation and mortality counts. 2. Nest burrow density (number of burrows per m2); presence/absence of eggs or chicks in burrows. 3. Burrow scopes, Ultrasonic monitors to monitor burrows. 4. The distribution and abundance of other nesting seabirds within the Lowendal Island group, including up to 45 islands and islets, also occurred from 2004 onwards.	1. Ground counts, aerial surveys of wetlands by helicopter. 2. Burrow count and observation data, burrow density, colony stability, breeding participation, incubation effort and reproductive success has been determined. Tagging data 3. Aerial surveys and onshore island surveys.	N/A	1. Counts of nesting areas, counts of intertidal zone during high tide. 2. The Shorebirds 2020 database comprises the most complete shorebird count data available in Australia. The data have been collected by volunteer counters and BirdLife Australia staff for approximately 150 roosting and feeding sites, mainly in coastal Australia. The data go back as far as 1981 for key areas. 3. The Exmouth Sub-basin Marine Avifauna Monitoring Program undertook a detailed assessment of seabird and shorebird use in the Exmouth Sub-basin. Four aerial surveys and four island surveys were conducted between February 2013 and January 2015 for this Program, inclusive of the mainland coasts, of shore islands and a 2,500 km^2 area of ocean adjacent to the Exmouth Sub-basin. 4.Shorebird counts, Shearwater Burrow Density. 5. Telemetry (GPS & Satellite).	1. Species, total numbers, Distribution, presence/absence of eggs or chicks in burrows. 2. Desktop literature review
		References and Data:							
		N/A – See Table D-1	DBCA/WAM – Burbidge et al 2000.	1. Bamford M.J. & A.R 2004. DATAHOLDER: Chevron. 2. Bamford M.J & A.R 2011. DATAHOLDER: Chevron. 3. Chevron, 2013. DATAHOLDER: Chevron. 4. Chevron 2013. DATAHOLDER: Chevron.	1. Bamford M.J. & A.R 2004. DATAHOLDER: Chevron. 2. Surman 2012. DATAHOLDER: Santos. 3. Bamford M.J & A.R 2011. DATAHOLDER: Chevron. 4. DATAHOLDER: Santos.	1. Bamford, MJ & AR. 2011. DATAHOLDER: Chevron. 2. Quadrant Energy/Santos. Dataholders. Santos 3. Quadrant Energy/Santos. Dataholders. Santos	N/A	1. Johnstone et al. 2013. DATAHOLDER: WA MUSEUM. AMOSC/DBCA (DPaW) 2014. 2. BirdLife Australia DATAHOLDER: Woodside and BirdlLife Australia 3. Surman & Nicholson 2015. 4. BirdLife Australia: DATAHOLDER: Woodside 5. Cannel et al. 2019 DATAHOLDER: UWA and BirdLife Australia	1. AMOSC/DBCA 2014. DATAHOLDER: AMOSC/DBCA. 2. Report to Woodside commissioned study – Advisian (2021)
Turtles	**SM06**	**Studies:**							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
	Beach surveys (recording species, nests, and false crawls).	N/A – See Table D-1	1. LTM Study of Green, Flatback, Hawksbill turtles on beaches within the Barrow, Lowendal and Montebello Island Complex for Chevron. 2. Marine turtle monitoring as part of DBCA long-term turtle monitoring program (ongoing).	Chevron - Gorgon Gas Development. Long-term Turtle Monitoring Program - Flatback tagging program and marine turtle track census program (2005 –ongoing).	1. LTM Study of Green, Flatback, Hawksbill turtles on beaches within the Barrow, Lowendal and Montebello Island Complex. 2. Santos 2013 turtle nesting survey on the Lowendal islands. 3. Varanus Island Turtle monitoring program (2005 – present).	1. Baseline marine turtle surveys 2009 (included the islands of Serrurier, Bessieres and Thevenard), Pendoley (2009). 2. Exmouth Islands Turtle Monitoring Program (2013 and 2014) 3. North West Shelf Flatback Turtle Conservation Program's 4. Inter-nesting distribution of flatback turtles and industrial development in Western Australia (Thevenard Island)	Present, in open water, no nesting habitats.	1. Exmouth Islands Turtle Monitoring Program. 2. Ningaloo Turtle Program 3. Turtle activity and nesting on the Muiron Islands and Ningaloo Coast (2018). 4. Spatial and temporal use of inter-nesting habitat by sea turtles along the Murion Islands and Ningaloo Coast – 2018-2019	1. DBCA Photogrammetry survey of marine turtle nesting beaches in Dampier Archipelago 2019-2020 2.Holden Beach sea turtle habitat. Pendoley Environmental (2006) on behalf of Woodside for the Pluto Development. 3. Marine turtle monitoring as part of DPAWs long-term turtle monitoring program within the Dampier Archipelago (ongoing) 4. Nesting ecology of flatback sea turtles *Natator depressus* from Delambre Island collected over 2–3 weeks each nesting season across six nesting seasons (2010-2016).
		Methods:							
		N/A – See Table D-1	Nesting demographics (composition, spatial variability, seasonal distribution, post-nesting dispersion).	Island wide (though primary nesting occurs on east coast). Mundabullangana on mainland is the reference location for the Flatback tagging program.	1. Nesting demographics (composition, spatial variability, seasonal distribution, post-nesting dispersion). 2. Tagging and nest counts. 3. Tagging and nest counts. Varanus, Beacon, Bridled, Abutilon and Parakeelya islands.	1. Beach/Nesting surveys (counts by species). 2. Beach/Nesting surveys (counts by species). 3. Nesting and tagging studies 4. Satellite tracking methods	N/A	1. Astron (on behalf of Santos) to address a gap in the knowledge of turtle numbers at key locations (offshore islands within the region) that are not currently part of an existing monitoring programs (e.g. the NTP). Field surveys were conducted in October 2013 and January 2014. Surveys were conducted on 12 islands, with each island surveyed once (with the exception of Beach 8 at North Muiron Island) and all tracks counted. 2. Long term trends in marine turtle populations, beach surveys, track counts, best location, mortality counts. 3. On-beach monitoring and aerial surveys. 4. Tagging (satellite transmitter), analysis of internesting, migration and foraging grounds movements and behaviour.	1. High Resolution aerial surveys 2. Adult tracks, body pits, nests, emerged nests. 3. Adult tracks, body pits, nests, emerged nests. 4. Flipper tag resightings and track counts
		References/Data:							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
		N/A – See Table D-1	1. AMOSC/DPaW 2014. DATAHOLDER: Chevron. 2.DBCA.	Pendoley Environmental (2005-ongoing). DATAHOLDER: Chevron.	1. Pendoley 2005. AMOSC/DBCA (DPaW) 2014. DATAHOLDER: Chevron/ Santos. 2. Santos, 2014. DATAHOLDER: Santos. 3. Santos (2005 – present)	1. Pendoley 2009. DATAHOLDER: Chevron. 2. Quadrant Energy/Santos. Dataholders. Santos 3. DBCA. Dataholder 4. Pendoley Environment -Whittock, Pendoley and Hamann (2010-2011)	N/A	1.Santos – Report. 2. NTP Annual Reports DATAHOLDERS: DBCA. Reports available at http://www.ningalooturtles.org.au/media_reports.html 3.Rob et al. 2019 DATAHOLDER: DBCA 4.Tucker et al. 2019 DATAHOLDER: DBCA	1. DBCA Karratha office 2. Pendoley Environmental 2006. DATAHOLDER: Woodside. 3. DBCA 4. Thums et al 2019 DATAHOLDER: AIMS
Fish	**SM09** Baited Remote Underwater Video Stations (BRUVS), Visual Underwater Counts (VUC), Diver Operated Video (DOV).	**Studies:**							
		1. Glomar Shoal and Rankin Bank Environmental Survey Report, 2013, quantitatively surveyed benthic habitats and communities. AIMS report to Woodside. Scientific Publication - Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems, 2018. 2. Rankin Bank Environmental Survey Extension, 2014, Habitat assessment of an area southeast of Rankin Bank. 3. Glomar Shoal and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoal, 2018.	1. DBCA diver surveys 2009-2012. 2. Pilbara Marine Conservation Partnership Stereo BRUVS drops in shallow water (~8-20m) in 2014 and deeper (20-60m) in 2015 inside and outside sanctuary zones at the Montebello Islands and in the area from Cape Preston to the Montebello Islands in 2015. 3. Finfish monitoring as part of DBCA Western Australian Marine Monitoring Program (2015-ongoing).	1. Chevron LTM of demersal fish for the Gorgon Gas Development project. Marine Baseline Program (2008, 2009), Post Dredge Survey 1 (2011), Post Dredge Survey 2 (2012). 2. Pilbara Marine Conservation Partnership Stereo BRUVS drops in shallow water (~10m) from Exmouth to Barrow Islands in 2015. 3. Finfish monitoring as part of DBCAs Western Australian Marine Monitoring Program (2015-ongoing).	1. Pilbara Marine Conservation Partnership Stereo BRUVS drops in shallow water (~10m) Montebello Sanctuaries 2015. 2. WA Museum fish surveys of Dampier Archipelago 1998-2000 (Hutchins 2004).	1.Pilbara Marine Conservation Partnership Stereo BRUVS drops in deep water (20-55m) offshore of Bessieres Island in 2016.	1. CSIRO – Fish Diversity. 2. Fish species richness and abundance.	1. AIMS/DBCA 2014 Baseline Ningaloo Survey – repeat and expansion on the LTM (Co-funded survey: Woodside and AIMS). 2. Demersal fish populations – baseline assessment (AIMS/WAMSI). 3. DBCA study measured Species Richness, Community Composition, and Target Biomass, through UVC. BRUVS studies determining max N, Species Richness, and Biomass. 4. Pilbara Marine Conservation Partnership Stereo BRUVS in shallow water (~10m) in 2014 in northern region of the Ningaloo Marine Park, in shallow water (~10m) inside the lagoonal reef of the Ningaloo Marine Park in 2016, in deep water (~40m) across the length of the Ningaloo Marine Park in 2015, in shallow water outside of Ningaloo Reef from Waroora to Jurabi in 2015 and offshore of the Muiron Islands in 2015. 5. Elasmobranch faunal composition of Ningaloo Marine Park. 6. Juvenile fish recruitment surveys at Ningaloo reef. 7. Demersal fish assemblage sampling method comparison 8. Ningaloo Outlook (CSIRO) - Shallow and Deep Reefs Program	1. Fish assemblages quantitatively described Mermaid Sound using BRUVs. Recorded main habitat types (sand, reef, coral and macroalgae) and at a total of 412 sites. 2. West Australian Museum of Fish of Dampier archipelago. 3. Pilbara Marine Conservation Partnership Stereo BRUVS drops in shallow water (~10m) in 2015 around the Dampier Archipelago. 4. Finfish community monitoring as part of DBCA Dampier Archipelago Marine Monitoring Program (2007-ongoing).
		Methods:							

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank & Glomar Shoal	Montebello Islands	Barrow Island	Lowendal Islands	Pilbara Islands – Southern Island Group (Serrurier, Thevenard and Bessieres Islands – State Nature Reserve)	Montebello AMP	Ningaloo and the Muiron Islands	Dampier Archipelago
		1. BRUVs. 2. BRUVs. 3. BRUVs. 4. BRUVs.	1. Diver Operated Video - species richness, community composition, and biomass were recorded from 2009-2012. 2. Stereo BRUVS. 3. Diver UVS.	1. Intertidal and subtidal surveys using BRUVS and Netting. 2. Stereo BRUVS. 3. Diver UVS.	1. Stereo BRUVS 2. Diver surveys _ Underwater Visual Census (UVC).	1. Stereo BRUVs	1. Semi V Wing trawl net or an epibenthic sled. 2. ROV Video..	1. UVC surveys. 2. BRUVS Study with 304 video samples at three specific depth ranges (1-10 m, 10-30 m and 30-110m). 3. UVC surveys. 4. Stereo BRUVS 5. Snorkel and Scuba surveys. 5. Underwater visual census. 6. Diver operated video. 7. Diver UVC. 8. Diver UVC, stereo BRUVs	1. BRUVs, Stereo Baited Remote Underwater Video Systems. 2. Fish collected and species lists. 3. Stereo BRUVS. 4. Diver UVS.
		References/Data:							
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ANNEX E: TACTICAL RESPONSE PLANS

TACTICAL RESPONSE PLANS
Exmouth
Mangrove Bay
Turquoise Bay
Yardie Creek
Muiron Islands
Jurabi to Lighthouse Beaches Exmouth
Ningaloo Reef - Refer to Mangrove/Turquoise bay and Yardie Creek
Exmouth Gulf
Shark Bay Area 1: Carnarvon to Wooramel
Shark Bay Area 2: Wooramel to Petite Point
Shark Bay Area 3: Petite Point to Dubaut Point
Shark Bay Area 4: Dubaut Point to Herald Bight
Shark Bay Area 5: Herald Bight to Eagle Bluff
Shark Bay Area 6: Eagle Bluff to Useless Loop
Shark Bay Area 7: Useless Loop to Cape Bellefin
Shark Bay Area 8: Cape Bellefin to Steep Point
Shark Bay Area 9: Western Shores of Edel Land
Shark Bay Area 10: Dirk Hartog Island
Shark Bay Area 11: Bernier and Dorre Islands
Abrohlos Islands: Pelseart Group
Abrohlos Islands: Wallabi Group
Abrohlos Islands: Easter Group
Dampier
Rankin Bank & Glomar Shoals
Barrow and Lowendal Islands
Pilbara Islands - Southern Island Group
Montebello Island - Stephenson Channel Nth
Montebello Island Champagne Bay & Chippendale channel
Montebello Island - Claret Bay
Montebello Island - Hermite/Delta Is Channel
Montebello Island - Hock Bay
Montebello Island - North & Kelvin Channel
Montebello Island - Sherry Lagoon Entrance
Withnell Bay
Holden Bay
King Bay
No Name Bay / No Name Beach
Enderby Island - Dampier
Rosemary Island - Dampier
Legendre Island - Dampier

Karratha Gas Plant
KGP to Whitnell Creek
KGP to Northern Shore
KGP Fire Pond & Estuary
KGP to No Name Creek
Broome
Sahul Shelf Submerged Banks and Shoals
Clerke Reef (Rowley Shoals)
Imperieuse Island (Rowley Shoals)
Mermaid Reef (Rowley Shoals)
Scott Reef
Oiled Wildlife Response
Exmouth
Dampier region
Shark Bay