Operational and Scientific Monitoring (OSM) Bridging Implementation Plan

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Part A – Preparedness

This Plan is presented in two parts. Part A outlines the relationship between Shell Australia Pty Ltd.'s (Shell) environmental management document framework and the Joint Industry Operational and Scientific Monitoring Plan (OSMP) Framework (APPEA, 2020). Part B provides operationally focussed guidance for Shell personnel and OSMP Service Providers to coordinate the implementation of monitoring plans.

1 Introduction

As part of the Offshore Petroleum Greenhouse Gas Storage (OPGGS) (Environment) Regulations 2009 and various State/Territory regulations, titleholders are required to ensure they have a suitable OSMP for their offshore petroleum activities. To date, titleholders have worked independently to develop and implement their OSMP frameworks which has led to a variety of different procedures and methods being produced.

To create consistency across industry and strengthen the overall approach to spill monitoring, titleholders have been working on a collaborative 'Joint Industry OSMP Project'. This collaboration has resulted in the development of a Joint Industry OSMP Framework and a suite of Operational Monitoring Plans (OMP's) and Scientific Monitoring Plans (SMP's). The objectives of the Framework are to:

- Provide a standardised approach and guidance to titleholders, consultants and contractors that are undertaking operational and scientific monitoring in the event of an oil spill;
- Describe the suite of OMPs and SMPs that provide the minimum content requirements to meet the monitoring objective/s of each plan; and
- Recommend a common set of implementation arrangements, resulting in improved industry-wide OSMP capability.

Shell has elected to use the Joint Industry OSMP Framework and supporting OMPs and SMPs as the foundation of its operational and scientific monitoring approach. The Joint Industry OSMP Framework is available on the APPEA Environment Publications Webpage. Use of the Joint Industry OSMP Framework requires each titleholder to develop a Bridging Implementation Plan (this plan) which fully describes how the OSMP Framework interfaces with titleholders own activities, spill risks and internal management systems.

Table 1-1 describes key documents that form Shell's environmental management document framework.

Table 1-1: Key documents in Shell's environmental management framework

Document	Description
Activity specific Environment Plan (EP)	This plan describes the activity and the location, the environment, the risks to the environment as a result of the activity and the associated management controls. Of particular relevance to this plan, it identifies sensitive receptors, potential impacts from hydrocarbon spills and the zone of potential impact
Activity specific Oil Pollution Emergency Plan (OPEP)	This plan provides the activation and response process for the credible spill scenarios, including incident management, spill impact mitigation analysis (SIMA) process and detailed implementation guidance for individual response strategies. Of particular relevance to this plan, it identifies the credible spill scenarios and protection priorities
Shell Incident Management Team (West) (IMT(W)) Emergency Response Plan (HSE_GEN_011209)	Describes roles and responsibilities of the Level 2 IMT(W) in response to an all hazards emergency, with the exception of OSMP roles which are detailed in this plan
Weekly Contact List Work Instruction (HSE_GEN_011648)	This work instruction contains all relevant contact and communications information to enable effective communication amongst the response personnel and also external stakeholders. It is updated and kept live at all times and includes relevant OSMP contacts

Figure 1-1 illustrates how the OSMP, OPEP and EP relate to each other during a spill response. Operational and scientific monitoring should commence when the initiation criteria outlined in Appendix A are met.

Note: the monitor and evaluate strategy in Shell's OPEPs includes a wide range of tactics, including oil spill trajectory modelling which is often addressed in operational monitoring. Shell has retained spill modelling in the OPEP to ensure data inputs are managed by the Shell IMT and rapidly fed into the Common Operating Picture with other monitor and evaluate tactics during the initial stages of the spill.

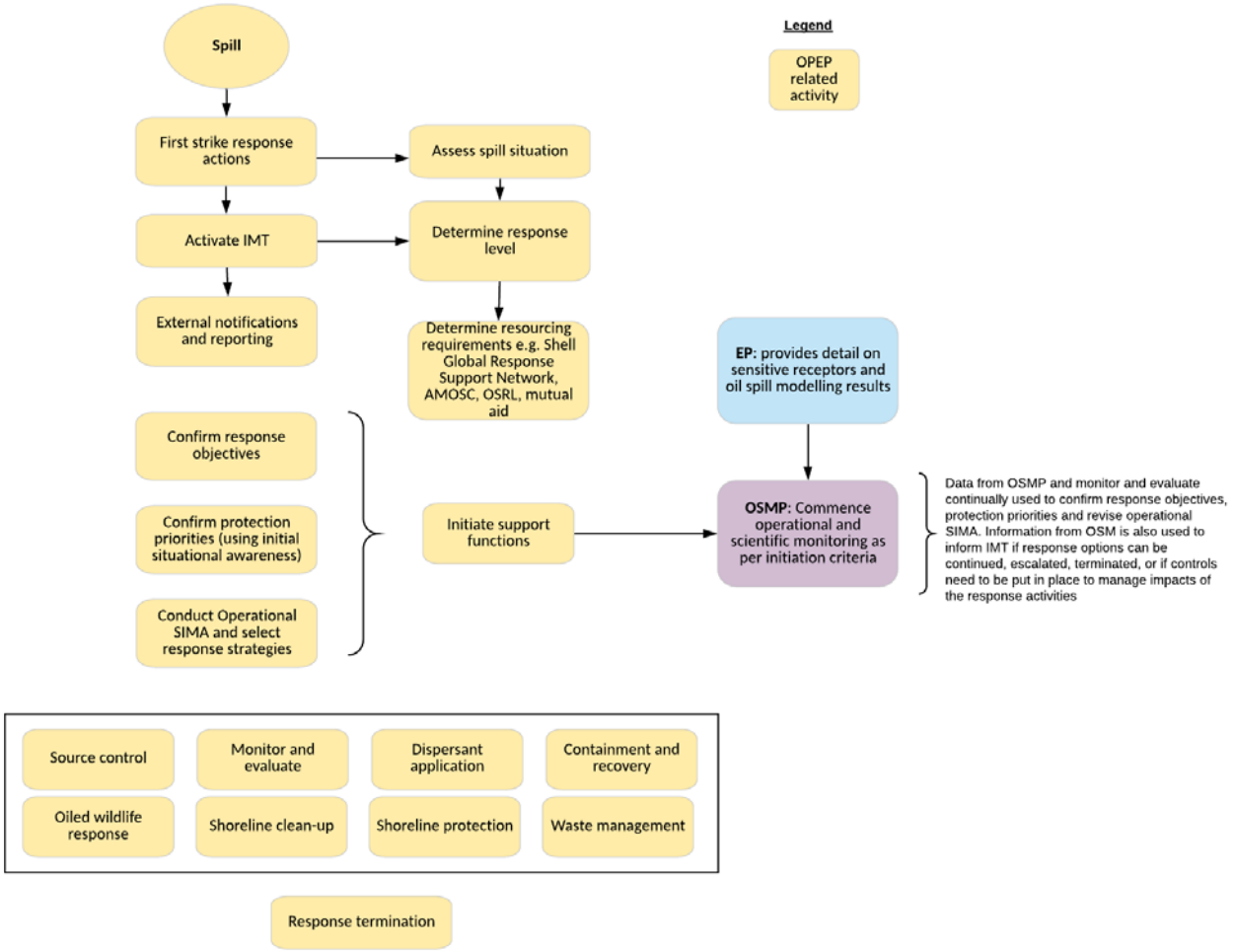


Figure 1-1: Relationship of OSMP, OPEP and EP during a spill response

2 Zone of Potential Impact and Monitoring Priorities

The Prelude Floating Liquified Natural Gas (FLNG) facility has been taken as the basis for oil spill monitoring planning for all of Shell's activities in the Browse Basin. Prelude FLNG has a larger geographical Zone of Potential Impact (ZPI) than Shell's other activities, including Bratwurst Drilling and Crux activities, as determined through oil spill trajectory modelling.

The outer boundary of the ZPI used for monitoring planning is based on the following thresholds (Refer to Prelude EP (2000-010-G000-GE00-G0000-HE-5880-00002):

- 1 g/m^2 floating oil thickness, which is considered to be below levels which would cause environmental harm and is more indicative of the areas perceived to be affected due to its visibility on the sea-surface;
- 10 g/m^2 for accumulated (shoreline) oil, which represents the area visibly contacted by the spill;
- 10 ppb for entrained hydrocarbons represents the lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC & ARMCANZ (2000) water quality guidelines; and
- 6 ppb dissolved aromatic hydrocarbons represents the low exposure zone, although it is not considered to be of significant biological impact.

Monitoring priorities have been drawn from the protection priorities identified in the Prelude FLNG OPEP (HSE_PRE_013075). These priorities were identified through analysis of hydrocarbon spill modelling results against the location of key sensitive receptors with high conservation value, including habitat, species and important socio-economic/heritage values.

Detailed information on the spill risks and modelling analysis of scenarios is provided in the activity-specific EP and OPEP. The following tables provide a summary of the locations, key receptors and spill modelling results for the worst-case scenarios from the Prelude FLNG OPEP (HSE_PRE_013075). Table 2-1 presents the results for floating oil, including probability and time to contact at the low threshold, as described above. Table 2-2 presents the entrained oil results, understanding that 10ppb aligns with the lowest trigger levels also described above.

Using spill trajectory modelling to help prioritise resources to implement monitoring programs, (including the collection of baseline data) can be useful. For example, sensitive locations with a high probability of rapid contact with an oil spill should be the priority of a monitoring program, compared to similar locations with a lower probability and longer time for contact following a spill, where time may permit the collection of reactive (post-spill but pre-contact) baseline data.

Analysis of the Prelude FLNG oil spill modelling results indicates the probability of contact of floating oil with any sensitive receptor is low, with the highest probability of contact being 11.5% with Heywood Shoal (submerged receptor) for the vessel collision scenario (1,000 m^3 of HFO over 1 hour). The highest probability of entrained oil reaching a receptor is 96% with Heywood Shoal (submerged receptor) for the subsea well blowout scenario (254,400 m^3 over 80 days).

These results have been used to determine the priority monitoring locations and receptors within the ZPI. The priorities vary according to each spill scenario, although the vessel collision scenario (42,000 m^3 over 2 hours) typically presents the worst-case time to contact and probabilities for floating oil. Quickest time and highest probabilities for entrained oil are represented by the subsea well blowout scenario, however, the modelling results presented here are for the original estimated spill volume of ~3,180 m^3/day. The modelled subsea well blow out flow rate is considered to be highly conservative as it is based on flow rates from the Upper Limit rather than the Base Case or High Case for a blowout through 9 5/8" casing. Whereas, the actual worst credible discharge during operations (blowout through the 7" production tubing) is predicted to be 10,138 bbl (~1,611 m^3) per day, yielding a total release volume of 811,040 bbl (128,944 m^3) over 80 days. As a result, planning for monitoring mobilisation throughout this plan is based on the vessel collision scenario (42,000 m^3 over 2 hours).

In addition to these locations, there are receptors that are transient (i.e. cetaceans, seabirds) and others that are broadscale, such as managed fisheries with large spatial extents, Key Ecological Features (KEF) and Biologically Important Areas (BIAs). These receptors are described in detail in the activity-specific EP.

Two broadscale KEFs not listed in Table 2-1 and Table 2-2 include the Continental Slope Demersal Fish Community and the Ancient Coastline at 125 m Depth, both of which are within relatively close proximity (14 km and 41 km respectively) to the Prelude FLNG Facility. These are subsea receptors and would be at a lower risk of exposure to a surface spill than shallow water communities (e.g. <30 m). However, deeper water (subsea) habitats are still at significant risk from subsea blowouts. Impacts on benthic habitats vary according to the species present, oil type and response options used.

The relationship between exposure levels and degree of impact should be considered when finalising the monitoring design. It should be noted that the monitoring priorities provided in Table 2-1 and Table 2-2 are listed for planning purposes. Shell will work with its monitoring providers and key stakeholders in the initial stages of the spill to confirm priority receptors and to assist in the finalisation of the monitoring design. This process is outlined in 14-1.

Table 2-1: Spill modelling results and monitoring priorities (Prelude FLNG) – Floating oil

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400 m^3 Prelude Condensate[1])		Vessel collision (42,000 m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2
Browse Island (emergent receptor)	40 km SE	Marine turtles (Green turtle nesting and foraging), Coral Reefs, Ramsar wetland, Key Ecological Feature and Marine Park (IUCN Ia), intertidal and shoreline habitats	6	3.5	6.5	1.8	7	2
Cartier Island (emergent receptor)	134 km N	Coral reefs, seabird breeding, foraging habitat for Whale Sharks, marine turtles (interesting and foraging), sea snakes, intertidal and shoreline habitats, Key Ecological Feature	2	9.5	5	4.5	5.5	8

[1] Note: The modelled subsea well blow out flow rate is considered to be highly conservative as it is based on flow rates from the Upper Limit rather than the Base Case or High Case for a blowout through 9 5/8" casing. Whereas, the actual worst credible discharge during operations (blowout through the 7" production tubing) is predicted to be 10,138 bbl (~1,611 m^3) per day, yielding a total release volume of 811,040 bbl (128,944 m^3) over 80 days.

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400 m^3 Prelude Condensate[1])		Vessel collision (42,000 m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2
Vulcan Shoal (submerged receptor)	146 km NE	Coral reefs	2	21	2.5	6.3	6.5	3.5
Echuca Shoal (submerged receptor)	61 km ESE	Coral reefs	4	3	6.5	3.5	8.5	3
Heywood Shoal (submerged receptor)	81 km NE	Coral reefs	5	6	7.8	3	11.5	2.5
Seringapatam Reef, Scott Reef and Sandy Islet (submerged receptor, with exception of small sand islet)	131 km W	Staging post for migratory shorebirds and a foraging area for seabirds, marine turtles (Green turtle nesting and foraging); and sea snakes, fish, coral reefs, Key Ecological Feature and Commonwealth Heritage Place, recreation and tourism	0.5	53	3	7.8	7.5	5.5
Ashmore Reef	162 km NNE	Marine turtles (interesting and foraging), sea snakes, coral reefs,	3	8	5.8	5.5	8	7

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400 m^3 Prelude Condensate[1])		Vessel collision (42,000 m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2
(emergent receptor)		seabird rookery, dugong, Ramsar wetland; Key Ecological Feature, Marine Park (IUCN Ia) – including cultural heritage (Indonesian artefacts); and Commonwealth Heritage Place, intertidal and shoreline habitats						
Buccaneer Archipelago (emergent receptor)	220 km S	Mangroves, Marine reptiles (turtles and saltwater crocodile), fish (including Vulnerable Green Sawfish, Freshwater Sawfish), coral reefs, cultural heritage (Kimberley Marine Park and West Kimberley National Heritage Place, Key Ecological Feature), recreation and tourism	0.5	NC	<0.25	NC	1.25	21

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400 m^3 Prelude Condensate[1])		Vessel collision (42,000 m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2
Indonesian Boundary (emergent receptor)	300 km north	Mangroves, coral reefs	0.5	63	0.5	15	0.75	15

Table 2-2: Spill modelling results and monitoring priorities (Prelude FLNG) – Entrained oil

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate)		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb
Browse Island	40 km SE	Marine turtles (Green turtle nesting and foraging), Coral Reefs, Ramsar wetland, Key Ecological Feature and Marine Park (IUCN Ia), intertidal and shoreline habitats	94	0.5	45	1.7	<0.25	NC

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate)		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb
Cartier Island	134 km N	Coral reefs, seabird breeding, foraging habitat for Whale Sharks, marine turtles (interesting and foraging), sea snakes, intertidal and shoreline habitats and Key Ecological Feature	87	3.5	50	5	<0.25	NC
Vulcan Shoal	146 km NE	Coral reefs	86	3.5	40	4.5	<0.25	NC
Echuca Shoal	61 km ESE	Coral reefs	94	1.5	38	3.5	<0.25	NC
Heywood Shoal	81 km NE	Coral reefs	96	1.5	41	3.2	<0.25	NC
Seringapatam Reef, Scott Reef and Sandy Islet	131 km W	Staging post for migratory shorebirds and a foraging area for seabirds, marine turtles (Green turtle nesting and foraging); and sea snakes, fish, coral reefs, Key	84	4.8	35	7	<0.25	NC

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate)		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb
		Ecological Feature and Commonwealth Heritage Place, recreation and tourism						
Ashmore Reef	162 km NNE	Marine turtles (interesting and foraging), sea snakes, coral reefs, seabird rookery, dugong, Ramsar wetland, and Key Ecological Feature, Marine Park (IUCN Ia) – including cultural heritage (Indonesian artefacts), and Commonwealth Heritage Place, intertidal and shoreline habitats	89	4.3	47	5.5	<0.25	NC
Buccaneer Archipelago	220 km S	Mangroves, Marine reptiles (turtles and saltwater crocodile), fish (including	21	21.5	1.25	23	<0.25	NC

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate)		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb
		Vulnerable Green Sawfish, Freshwater Sawfish), coral reefs, cultural heritage (Kimberley Marine Park and West Kimberley National Heritage Place, Key Ecological Feature), recreation and tourism						
Indonesian Boundary	300 km north	Mangroves, coral reefs	43	15	11	15	<0.25	NC

3 Relevant Existing Baseline Information Sources

Shell has access to a number of different baseline data sources that are relevant to the high value receptors in the ZPI. These include:

Industry-Government Environmental Metadata System (I-GEMS)
The I-GEM Project is facilitated by the Australian Petroleum Production and Exploration Association (APPEA). The project is a collaborative approach between industry, marine research institutes and Western Australian government agencies to share metadata on quantitative ecological data for key receptors in the mid to north-west of WA (approximately from the Abrolhos Islands to the Timor Sea) and to represent these in a geospatial database.

The marine environmental metadata includes instant online access to a list of available data sets on key receptor sensitivities in the event of spill. Shell's login access information can be found in the Shell IMT Weekly Contact List (HSE_GEN_011648).

Australian Ocean Data Network
The Australian Oceans Data Network is the primary access point for search, discovery, access and download of data collected by the Australian marine community. Data is presented as a regional view of all the data available from the Australian Ocean Data Network. Primary datasets are contributed to by Commonwealth Government agencies, State Government agencies, Universities, the Integrated Marine Observing System an Australian Government Research Infrastructure project, and the Western Australia Marine Science Institute.

Access is via the following link https://portal.aodn.org.au/search

Western Australian Oil Spill Response Atlas
The Western Australian Oil Spill Response Atlas (OSRA) is a spatial database of environmental, logistical and oil spill response data. Using a geographical information system (GIS) platform, OSRA displays datasets collated from a range of custodians allowing decision makers to visualise environmental sensitivities and response considerations in a selected location. Oil spill trajectory modelling (OSTM) can be overlaid to assist in determining protection priorities, establishing suitable response strategies and identifying available resources for both contingency and incident planning. OSRA is managed by the Oil Spill Response Coordination unit within Department of Transport (DoT) Marine Safety and is part funded through the National Plan for Maritime Environmental Emergencies and the Australian Maritime Safety Authority.

Access is via the following link https://www.transport.wa.gov.au/imarine/oil-spill-response-and-planning-tools.asp

The Atlas of Living Australia

The Atlas of Living Australia (ALA) is a collaborative, online, open resource that contains information on all the known species in Australia aggregated from a wide range of data providers. It provides a searchable database when considering species within the ZPI. The ALA receives support from the Australian Government through the National Collaborative Research Infrastructure Strategy and is hosted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Access is via the following link https://www.ala.org.au/

The ZPI is also covered by the following government management plans that identify the current condition of key receptors being managed for protection:

- Rowley Shoals Marine Park Management Plan (2007) 2007-2017, Management Plan No. 56. DEC, Perth, WA
- Department of Parks and Wildlife (2014) Eighty Mile Beach Marine Park Management Plan 2014-2024, Management Plan No. 80, DPaW, Perth, WA
- Department of Parks and Wildlife (2016) North Kimberley Marine Park Joint management plan 2016. Uunguu, Balanggarra, Miriuwung Gajerrong, and Wilinggin management areas, No. 89. DPaW, Perth, WA
- Department of Parks and Wildlife (2013) Lalang-garram / Camden Sound Marine Park management plan No. 73 2013–2023, DPaW, Perth, WA

Species recovery plans for various protected species and ecological communities can be found in this link - http://www.environment.gov.au/cgi-bin/sprat/public/publicshowallrps.pl

4 Baseline Data Review

In addition to the data sources listed above, Shell has compiled a list of baseline data relevant to the high value receptors in the ZPI (Appendix B: Baseline data sources). Shell has also undertaken a review of this baseline information (OSMP Baseline Environmental Data - HSE_PRE_16977) to assess the spatial and temporal relevance of this data and comparison of methods and parameters to those outlined in the Joint Industry SMPs. This review focused on priority monitoring locations with a minimum hydrocarbon contact timeframe of less than seven days (Table 2-1 and Table 2-2).

The criteria used during the baseline data review is outlined in Table 4-1.

Table 4-1: Assessment criteria for baseline data review

Year of most recent data capture	Duration of monitoring program	Frequency of data capture	Similarity of methods to Joint Industry SMP	Similarity of parameters to Joint Industry SMP
High = 2015-2020	High = > 4 years	High = 4+ sampling trips per year	High	High
Medium = 2010 – 2014	Medium = 2-4 years	Medium = 2-3 sampling trips per year	Medium	Medium
Low = <2010	Low = <2 years	Low = one-off sampling trip	Low	Low

This assessment was then used to determine if the available baseline data could be used to detect change in receptors at priority monitoring locations in the event of a significant impact. Table 4-2 compares priority monitoring locations and receptors, and provides guidance on where post-spill, pre-impact monitoring should be prioritised.

The different categories listed in Table 4-2 include:

- Not applicable (N/A) – this receptor and relevant SMP is not applicable to the priority monitoring location (i.e. shoreline habitat not present at submerged shoals);
- Survey - current monitoring/knowledge is considered sufficient (i.e. could be used to detect level of change in the event of a significant impact) and is considered a lower priority for post-spill, pre-impact data collection; and
- Priority survey - current monitoring/knowledge is not in place, not suitable or not practicable; and post-spill pre-impact baseline data collection should be prioritised.

It is noted that it is difficult to obtain absolute statistical proof of oil spill impacts, due to the variability (spatially and temporally) of the natural environment, the lack of experimental control due to the nature of spills and because suitable baseline data may not be available (Kirby, et al. 2018). Alternative approaches exist for detecting impacts where post-spill, pre-impact monitoring may not be feasible. These include impact versus control design approaches and/or a gradient approach. The Joint Industry OSMP Framework (APPEA, 2020a) provides guidance and considerations for survey designs to enable the acquisition of sufficiently powerful data during SMP implementation.

Once SMP monitoring reports are drafted (post-spill) they should be peer reviewed by an expert panel (Refer to Section 20).

Table 4-2: Recommended priority monitoring locations versus SMPs

Location	SMP									
	Water quality impact assessment	Sediment quality impact assessment	Intertidal and coastal habitat assessment	Seabirds and shorebirds	Marine mega-fauna assessment - reptiles	Marine mega-fauna assessment - whale sharks, dugong and cetaceans	Benthic habitat assessment	Marine fish assemblages assessment	Fisheries impact assessment	Heritage and social impact assessment
Browse Island (emergent receptor)	Priority survey	Priority survey	Priority survey	Survey	Priority survey	Priority survey	Survey	Survey	Priority survey (Locations to be determined in consultation with key stakeholders to reflect current fishing zones/effort)	Priority survey (Locations to be determined in consultation with key stakeholders)
Cartier Island (emergent receptor)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Survey	Priority survey		
Vulcan Shoal (submerged receptor)	Priority survey	Priority survey	N/A	N/A	N/A	Survey	Survey	Survey		
Echuca Shoal (submerged receptor)	Survey	Survey	N/A	N/A	N/A	Survey	Survey	Survey		
Heywood Shoal (submerged receptor)	Survey	Survey	N/A	N/A	N/A	Survey	Survey	Survey		
Seringapatam Reef, Scott Reef and Sandy Islet (submerged receptor, with exception of	Priority survey	Priority survey	Priority survey	Priority survey	Survey	Priority survey	Survey	Survey		

Location	SMP									
	Water quality impact assessment	Sediment quality impact assessment	Intertidal and coastal habitat assessment	Seabirds and shorebirds	Marine mega-fauna assessment - reptiles	Marine mega-fauna assessment - whale sharks, dugong and cetaceans	Benthic habitat assessment	Marine fish assemblages assessment	Fisheries impact assessment	Heritage and social impact assessment
small sand islet)										
Ashmore Reef (emergent receptor)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Survey	Priority survey		

5 Relevant OMPs and SMPs

Table 5-1 lists the Joint Industry OMPs and SMPs which are relevant to the receptors found in Shell's ZPI, aligning to those listed in Section 2. In addition, the OMPs are relevant to the response options listed in the Prelude FLNG OPEP, as outlined in Table 5-2.

These OMPs and SMPs will be activated when the individual initiation criteria (Appendix A) in each plan are met. The objectives for OMPs and SMPs can be found in the Joint Industry OSMP Framework and individual OMPs and SMPs. Detail on monitoring design considerations, survey techniques, standard operating procedures, equipment and personnel requirements, reporting and quality assurance / quality control (QA/QC) can be found in the individual OMPs and SMPs. A summary of the monitoring methods and parameters applicable to Shell's relevant OMPs and SMPs is provided in Appendix C: Summary of recommended sampling methods

Subsea dispersant injection monitoring is not currently included in the Joint Industry suite of OMPs. However, subsea dispersant injection is included as a response option in the Prelude FLNG OPEP. Information on monitoring design considerations, equipment and personnel requirements, data analysis and reporting can be found in Appendix D: Subsea dispersant injection monitoring.

Table 5-1: OMPs and SMPs relevant to receptors in Shell's ZPI

Receptor	Relevant OMP and SMP
Physical Environment	
Water quality	OMP: Oil properties and weathering behaviour at sea OMP: Water quality assessment OMP: Sediment quality assessment OMP: Chemical dispersant effectiveness and fate (surface and subsurface) OMP: Subsea dispersant injection monitoring SMP: Water quality impact assessment
Sediment quality	OMP: Water quality assessment OMP: Sediment quality assessment SMP: Sediment quality impact assessment
Biological Environment	
Benthic communities	
Benthic habitats	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Benthic habitat assessment

Receptor	Relevant OMP and SMP
Corals, seagrass and macroalgae	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Intertidal and coastal habitat assessment SMP: Benthic habitat assessment
Mangroves	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique SMP: Intertidal and coastal habitat assessment
Infauna, filter feeders and other sessile and mobile benthic invertebrates	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Intertidal and coastal habitat assessment SMP: Benthic habitat assessment
Shoreline and intertidal habitats	
Shoreline and intertidal habitats	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique SMP: Intertidal and coastal habitat assessment
Marine fauna	
Seabirds and shorebirds	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique OMP: Marine fauna assessment SMP: Seabirds and shorebirds
Marine megafauna	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique OMP: Marine fauna assessment SMP: Marine mega-fauna – Reptiles SMP: Marine mega-fauna (Whale Sharks, Dugongs and Cetaceans) SMP: Marine fish and elasmobranch assemblages assessment
Socio Economic Environment	
Commercial Fisheries and Aquaculture	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Water quality impact assessment SMP: Commercial and recreational fisheries impact assessment
Recreational Fisheries	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Water quality impact assessment SMP: Commercial and recreational fisheries impact assessment
Cultural Heritage	SMP: Heritage features assessment SMP: Social impact assessment
Commercial and recreational users	SMP: Social impact assessment

Table 5-2: OMPs relevant to Shell's oil spill response options

Response Option	Operational Monitoring Plan								
	A	B	C	D	E	F	G	H	I
Source Control	X					X	X		X
Natural Recovery	X					X			
Surface Dispersant Application	X	X		X		X	X	X	X
Subsea Dispersant Injection	X	X			X	X	X	X	X
Containment and Recovery	X					X		X	X
Shoreline Protection	X	X	X			X	X	X	X
Shoreline Clean-up	X	X	X			X	X	X	X
Oiled Wildlife Response	X	X	X					X	X
Waste Management	X	X	X				X	X	X

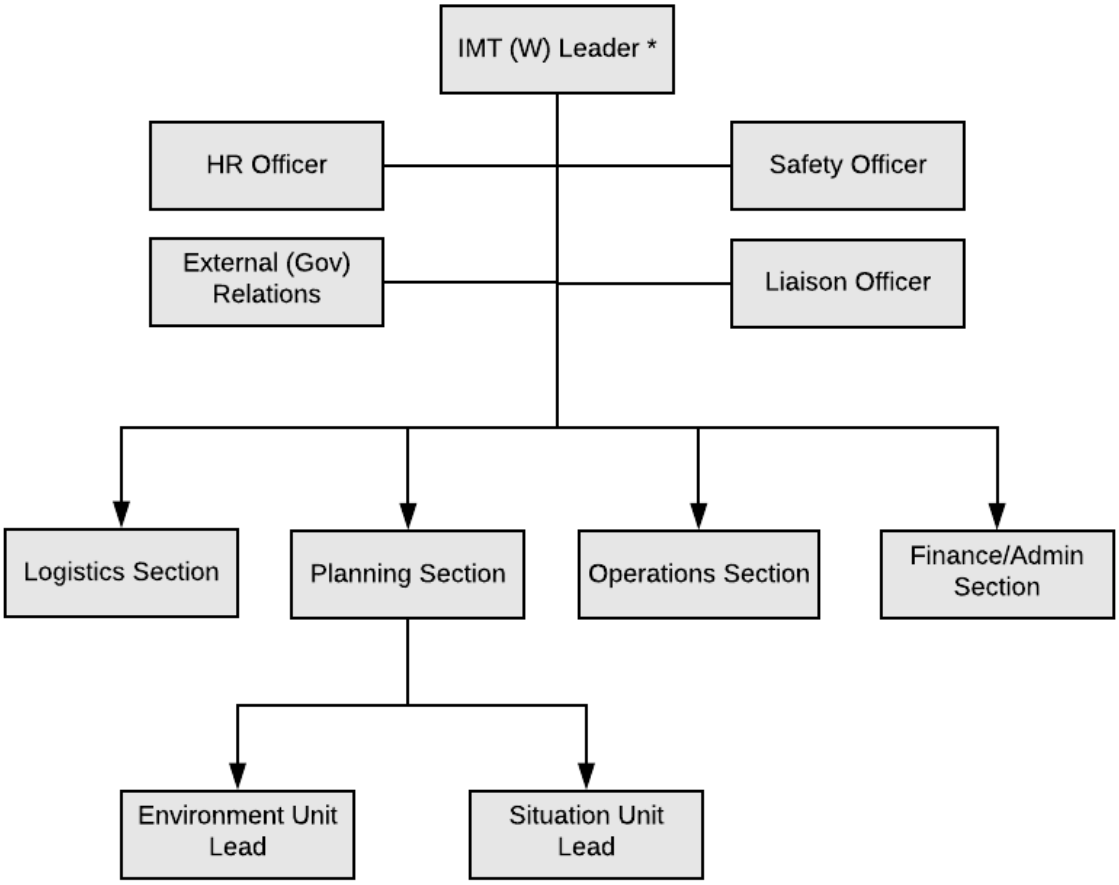
A. *Hydrocarbon properties and weathering behaviour at sea*
B. *Pre-emptive assessment of sensitive receptors at risk (desktop only)*
C. *Shoreline clean-up assessment technique (SCAT)*
D. *Surface chemical dispersant effectiveness and fate*
E. *Subsea dispersant injection monitoring*
F. *Water quality assessment*
G. *Sediment quality assessment*
H. *Marine fauna assessment*
   - o *Reptiles*
   - o *Cetaceans (observational only)*
   - o *Dugongs*
   - o *Seabirds and shorebirds*
   - o *Fish*

I. *Air quality monitoring (responder health and safety)*

6 OSMP Organisational Structure

Shell uses the Incident Command System (ICS) to respond to incidents and therefore adopts the key roles and responsibilities used in this system, as described in the activity EPs and/or OPEPs. The Shell Australia Incident Management Team West (IMT (W)) will be responsible for coordinating OSMP activities, which will be led by the Planning Section within the IMT, with support from each Section, in particular the Operations Section. The Shell IMT (W) structure is shown in Figure 6-1. Where the Western Australian Department of Transport is the Control Agency, the IMT (W) will be managed through coordinated command and Shell will still be expected to continue monitoring activities in State waters, with oversight from DoT.

Figure 6-2 illustrates the structure of the OSMP Management Team during the response phase. The IMT (W) Leader is ultimately accountable for managing the response operation, which includes this plan. Depending on the scale of the event, individual people may perform multiple roles; similarly, multiple people may share the same role.



* In Level 2 and 3 spills where DoT is activated as the Control Agency for State waters response, the IMT (W) will be managed through coordinated command (DoT is Control Agency in State waters, Shell is Control Agency in Commonwealth waters)

Figure 6-1: Shell IMT (W) Structure

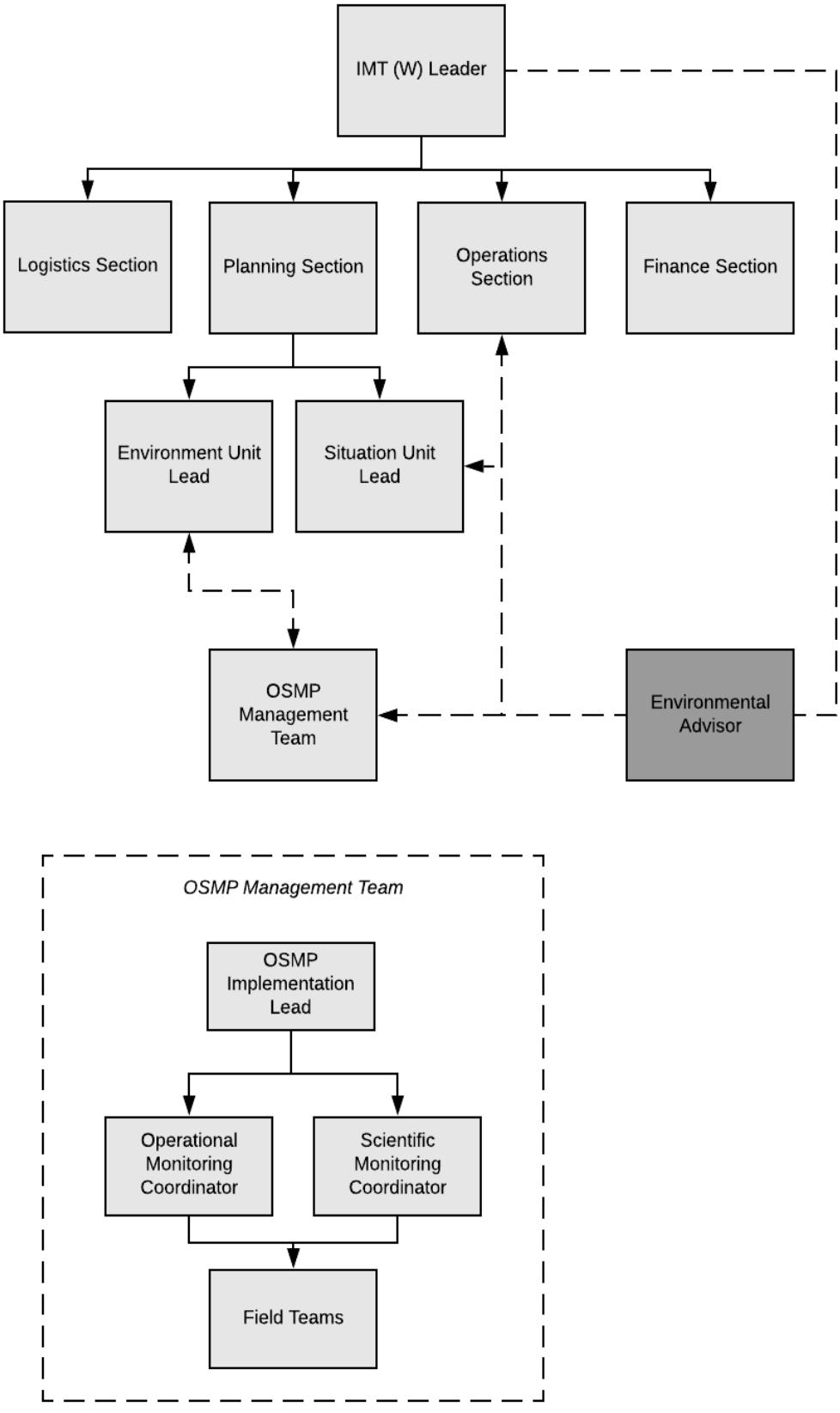


Figure 6-2: Shell IMT (W) Structure with OSMP Team

7 OSMP Roles and Responsibilities

The roles and responsibilities related to the management and implementation of operational and scientific monitoring for Shell's activities are outlined in Table 7-1. It should be noted that some of these roles will be filled internally, but the majority of OSMP personnel will be provided by Shell's OSMP Services Provider, BMT Australia Pty Ltd (BMT). The process to activate the OSMP Services Provider is provided in Section 13.

Roles and responsibilities for other IMT positions (e.g. Planning Section Chief) are described in the activity-specific EP or OPEP.

Table 7-1: Roles and Responsibilities – Shell OSMP

Role	Key Responsibilities
IMT (W) Leader (Shell)	Ultimately accountable for the implementation of the OSMP. Specific responsibilities related to the OSMP include: • Ensure OSMP-specific roles are established • Integrate operational and scientific monitoring with the spill response • Ensure that OMP and SMP components are implemented according to their specific initiation criteria and within nominated response times • Ensure that the OSMP Implementation Lead and Environment Unit Lead are sufficiently resourced to oversee and guide implementation of OSMP activities
Environment Unit Lead (EUL) (Shell)	The EUL is the key position for relaying information between the IMT and the OSMP Implementation Lead. Key OSMP responsibilities include: • Mobilise OSMP Service Provider • Validate protection and monitoring priorities • Validate strategic SIMA to generate the initial operational SIMA • Main point of contact between IMT and OSMP Service Provider • Provide overarching technical advice • Analysing data received from monitoring teams (this task may be delegated to OSMP Management Team) and ensuring the information is incorporated into the current/next operating period's Incident Action Plan • Advise on environmental impact from implementing monitoring • Management of scientific monitoring components once spill response operation is terminated
Situation Unit Lead (SUL) (Shell)	The SUL is the key position for receiving data from monitoring teams and disseminating it to the relevant team within the IMT.
OSMP Implementation Lead (Shell or OSMP Monitoring Provider/s)	Responsible for overseeing implementation of OMP and SMP components in accordance with this Plan, specifically identify: • The relevant OMP and SMP components that may be triggered based on the information collected during the initial response and OMP monitoring • Implementation of response options to ensure that the relevant OMP and SMP components are implemented at the appropriate times • Liaise with Shell Environment Advisor for advice on scientific monitoring components

Role	Key Responsibilities
	• Approve sampling and analysis plans for the SMP components within the nominated time frame of the SMP component being triggered • Ensure mobilisation of resources for sampling and analysis plans within the nominated time frame of the SMP component being triggered • Liaise with relevant stakeholders and regulators on monitoring design, monitoring priorities, and results
Operational Monitoring Coordinator and Scientific Monitoring Coordinator (OSMP Service Provider/s)	The Operational Monitoring Coordinator and Scientific Monitoring Coordinator are the technical leads for each monitoring type. Responsibilities include: • Finalise monitoring design for individual OMPs and/or SMPs • Understand the data metrics collected in the event of a spill • Advise the OSMP Implementation Lead on data collection, logistical support required, and monitoring priorities if constraints (e.g. safety, time, logistics) are encountered • Oversee data analyses and interpretation • Manage data, including spatial data • Present data in an appropriate and informative format to allow for timely decisions
OSMP Field Operations Manager (OSMP Service Provider/s)	Responsible of the coordination of resources and developing a schedule of movements, in close consultation with the IMT Logistics Section. Key responsibilities include: • Determine locations where monitoring teams are required and resource requirements for specific locations • Keep track of vessel/aerial movements associated with monitoring activities • Monitor resource availability • Direct communications with relevant Monitoring Coordinator and Field Team Leads • Monitor and coordinate simultaneous operations
OSMP Field Teams (OSMP Service Provider/s)	A Field Team includes one Field Team Lead, who is the key contact point to the relevant Monitoring Coordinator during a field deployment. The responsibilities of all Field Team members include: • Understand the details of monitoring methods • Ensure that they are supplied with adequate equipment and field data collection sheets to undertake the monitoring component • Ensure awareness and understanding of QA/QC procedures • Help with report preparation if required
Environment Advisor (Shell)	Oversight of scientific monitoring components both during and post-response

8 Mobilisation and Timing of OMP and SMP implementation

The time it takes to mobilise and implement each OMP and SMP will vary according to the spill risk profile, proximity of the spill to sensitive receptors, mobilisation constraints and logistical requirements. Table 8-1 provides an indicative implementation schedule for OMP and SMPs in the ZPI and adjacent waters. The locations listed are aligned to the initial monitoring priorities described in Section 2.

Note: 'Initiation' means that the monitoring plan has been triggered and the IMT/Monitoring Provider has commenced finalisation of the plan including implementation of the following actions (which may take 48-72 hours to complete all actions):

- Activate internal OSMP personnel and external contracts
- Select/confirm sites
- Finalise sampling technique
- Determine suitable sampling frequency
- Finalise standard operating procedures
- Allocate number of teams, personnel, equipment and supporting resource requirements
- Finalise Health, Safety and Environment (HES) documentation prior to mobilisation of field teams
- Confirm logistics (e.g. flights, accommodation, vessels)
- Commence deployment of field teams.

For SMPs:

- Gather existing baseline data and/or establish control/reference sites
- Establish benchmarks and guidelines to be used
- Confirm indicator species
- Confirm parameters and metrics.

Table 8-1: Indicative OMP and SMP implementation schedule for Shell OSMP activities

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
Spill site and immediate surrounding waters	OM	Initiation of: • OMP: Air quality modelling (responder health and safety) • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment Quality Assessment • OMP: Surface chemical dispersant effectiveness and fate (surface and subsurface) • OMP: Marine fauna assessment o Seabirds and shorebirds o Fish	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Seabirds and shorebirds • SMP: Marine mega-fauna assessment -	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			whale sharks, dugongs and cetaceans • SMP: Marine fish and elasmobranch assemblages assessment		
Browse Island	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment o Reptiles o Seabirds and shorebirds o Fish	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			• SMP: Marine mega-fauna assessment - reptiles • SMP: Marine mega-fauna assessment - whale sharks, dugongs and cetaceans • SMP: Marine fish and elasmobranch assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment		
Cartier Island	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Shoreline clean-up	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			assessment technique (SCAT) • OMP: Marine fauna assessment o Reptiles o Dugongs o Seabirds and shorebirds o Fish	specifics of the actual spill until termination criteria are met	specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine mega-fauna assessment - whale sharks, dugongs and cetaceans • SMP: Marine fish and elasmobranch assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			• SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment		
Echuca and Heywood Shoal	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Marine fauna assessment o Fish	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine fish and elasmobranch assemblages assessment • SMP: Benthic habitat assessment • SMP: Commercial and recreational	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			fisheries impact assessment		
Seringapatam Reef, Scott Reef and Sandy Islet	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Marine fauna assessment o Reptiles o Seabirds and shorebirds o Fish	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Seabirds and shorebirds • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine mega-fauna assessment - whale sharks, dugongs and cetaceans	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			• SMP: Marine fish and elasmobranch assemblages assessment • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment • SMP: Social impact assessment		
Ashmore Reef	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment o Reptiles o Dugongs o Seabirds and shorebirds o Fish	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine mega-fauna assessment - whale sharks, dugongs and cetaceans • SMP: Marine fish and elasmobranch assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment • SMP: Social impact assessment	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met
Buccaneer Archipelago	OM	Initiation of:	As results from implemented OMPs are	Initiation of:	As results from implemented OMPs are

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
		• OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	• OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment o Reptiles o Dugongs o Seabirds and shorebirds o Fish	available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads and finalisation of SMPs	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine mega-fauna assessment - whale sharks, dugongs and cetaceans	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			• SMP: Marine fish and elasmobranch assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment • SMP: Social impact assessment		
Indonesian Boundary	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment o Reptiles o Dugongs	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
				o Seabirds and shorebirds o Fish	
	SM	n/a	Commence activation and mobilisation process Activation of SMP Team Leads and finalisation of SMPs	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine mega-fauna assessment -whale sharks, dugongs and cetaceans • SMP: Marine fish and elasmobranch assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Commercial and recreational	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
				fisheries impact assessment • SMP: Social impact assessment	

9 Resource Requirements

The resources required to assist the Shell IMT in the coordination and management of OSM are outlined in Table 9-1. The resources required to implement operational and scientific monitoring components are presented in Table 9-2 and Table 9-3 respectively, which is based on the monitoring priorities in Section 2 and implementation schedule outlined in Table 8-1. This assessment is based on the vessel collision scenario (FLNG storage tank) of Prelude Condensate (42,000 m^3 over 2 hours). It should be noted that a single spill will not contact all locations and receptors listed in Table 9-2. In preparing for this capability, Shell has conservatively assessed its resource requirements to ensure it can obtain excess capability.

Table 9-1: Resources Required for Key OSMP Coordination Roles

Role	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
OSMP Implementation Lead (Shell or OSMP Monitoring Provider/s)	1 x Principal Scientist	1 x Principal Scientist	1 x Principal Scientist	BMT Australia Pty Ltd (BMT) Contract
Operational Monitoring Coordinator and Scientific Monitoring Coordinator (OSMP Service Provider/s)	1 x Principal Scientist	1 x Principal Scientist	1 x Principal Scientist	
OSMP Field Operations Manager (OSMP Service Provider/s)	1 x Senior Scientist	1 x Senior Scientist	1 x Senior Scientist	

Table 9-2: Resources required for implementing operational monitoring plans

OMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
Hydrocarbon properties and weathering behaviour at sea)*	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) Total 4 team leaders and 8 team members (3 per team)	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) Total 5 team leaders and 10 team members (3 per team) Note: these resources may not be required if relevant scientific monitoring components initiation criteria have been triggered.	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) 1 team (Buccaneer Archipelago) 1 teams (Indonesian Boundary) Total 7 team leaders and 14 team members (3 per team) Note: these resources may not be required if relevant scientific monitoring components initiation criteria have been triggered.	BMT Australia Pty Ltd (BMT) Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement
Pre-emptive assessment of sensitive receptors at risk (desktop only)	1 team (all sites)	1 team (all sites)	1 team (all sites)	BMT Contract (includes provision of equipment)
Shoreline clean-up assessment technique (SCAT)	1 team (Browse Island) 1 team (Cartier Island) 1 team (Ashmore Reef)	1 team (Browse Island) 1 team (Cartier Island) 1 team (Ashmore Reef)	1 team (Browse Island) 1 team (Cartier Island) 1 team (Ashmore Reef)	BMT Contract (includes provision of sampling equipment) AMOSC (AMOSPlan)

OMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
	Total 3 team leaders and 6 team members (3 per team)	2 teams (Indonesian Boundary) Total 5 team leaders and 10 team members (3 per team)	3 teams (Indonesian Boundary) 1 team (Buccaneer Archipelago) Total 7 team leaders and 14 team members (3 per team)	OSRL Master Services Agreement DoT and AMSA Marine contractors
Surface chemical dispersant effectiveness and fate	1 team leader 1 team member (for visual observations, which may be performed by trained aerial observers used during monitor and evaluate if trained in observation and verification of chemical dispersant effectiveness) For water quality observations, refer to OMP: Water quality assessment	1 team leader 1 team member (for visual observations, which may be performed by trained aerial observers used during monitor and evaluate if trained in observation and verification of chemical dispersant effectiveness) For water quality observations, refer to OMP: Water quality assessment Additional team/s (various locations as required)	1 team leader 1 team member (for visual observations, which may be performed by trained aerial observers used during monitor and evaluate if trained in observation and verification of chemical dispersant effectiveness) For water quality observations, refer to OMP: Water quality assessment Additional team/s (various locations as required)	AMOSC and OSRL Agreements BMT Contract (includes provision of sampling equipment) Marine contractors
Subsea dispersant injection monitoring	No subsea dispersant injection until week 2 due to transportation requirements	12 hour/day operation 1 team leader/operations manager 11 team members 24 hour/day operation 2 team leaders/operations manager 16 team members	12 hour/day operation 1 team leader/operations manager 11 team members 24 hour/day operation 2 team leaders/operations manager 16 team members	OSRL Subsea Well Intervention Service (SWIS) Capping Stack Membership

OMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
Water quality assessment*	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites) Additional teams, if required (dependent upon any modifications to sampling locations, frequency etc.)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement
Sediment quality assessment*	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites) Additional teams, if required (dependent upon any modifications to sampling locations, frequency etc.)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement
Marine fauna assessment	1 team to conduct initial aerial surveys for spill site, Browse Island, Ashmore Reef, Cartier Island, Echuca Shoal and Heywood Shoal (2 observers per aircraft) Note: these resources may not be required if relevant scientific monitoring components initiation criteria have been triggered.	If vessel based surveys selected: 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca and Heywood Shoal) 2 teams (Indonesian Boundary) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) Total 6 team leaders and 6 team members (2 per team)	If vessel based surveys selected: 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca and Heywood Shoal) 2 teams (Indonesian Boundary) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) 1 team (Buccaneer Archipelago)	BMT Contract Aviation contractors Marine contractors

OMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
		Note: these resources may not be required if relevant scientific monitoring components initiation criteria have been triggered.	Total 7 team leaders and 7 team members (2 per team) Note: these resources may not be required if relevant scientific monitoring components initiation criteria have been triggered.	
Air quality modelling (responder health and safety)	1 team (all sites)	1 team (all sites)	1 team (all sites)	Shell in-house personnel

* Initial co-mobilisation between OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Surface chemical dispersant effectiveness and fate, OMP: Water quality assessment and OMP: Sediment quality assessment

Table 9-3: Resources required for implementing scientific monitoring plans

SMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
Water quality impact assessment	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) Total 4 team leaders and 8 team members (3 per team) Note: can initially be performed by the same team	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) Total 5 team leaders and 10 team members (3 per team)	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) 1 team (Buccaneer Archipelago) 1 teams (Indonesian Boundary)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement

SMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
	as OMP: Water quality assessment. This SMP may replace OMP: Water quality assessment if the OMPs termination criteria are triggered	Note: can initially be performed by the same team as OMP: Water quality assessment. This SMP may replace OMP: Water quality assessment if the OMPs termination criteria are triggered	Total 7 team leaders and 14 team members (3 per team)	
Sediment quality impact assessment	Refer to SMP: Water quality impact assessment* (all sites)	Refer to SMP: Water quality impact assessment* (all sites)	Refer to SMP: Water quality impact assessment* (all sites)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement
Intertidal and coastal habitat assessment	1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) Total 2 team leaders and 2 team members (2 per team)	1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 2 teams (Indonesian Boundary) Total 4 team leaders and 4 team members (2 per team)	1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 3 teams (Indonesian Boundary) 1 team (Buccaneer Archipelago) Total 6 team leaders and 6 team members (2 per team)	BMT Contract (includes provision of sampling equipment) Marine contractors
Seabirds and shorebirds	1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) Total 2 team leaders and 2 team members (2 per team)	1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) 2 teams (Indonesian Boundary)	1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 3 teams (Indonesian Boundary) 1 team (Buccaneer Archipelago)	BMT Contract (includes provision of sampling equipment and contracted experienced senior ornithologists) Marine contractors Laboratory arrangement

SMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
	Note: can initially be performed by the same team as OMP: Marine fauna assessment – seabirds and shorebirds. This SMP may replace OMP: Marine fauna assessment – seabirds and shorebirds if the OMPs termination criteria are triggered	Total 5 team leaders and 5 team members (2 per team) Note: can initially be performed by the same team as OMP: Marine fauna assessment – seabirds and shorebirds. This SMP may replace OMP: Marine fauna assessment – seabirds and shorebirds if the OMPs termination criteria are triggered	Total 6 team leaders and 6 team members (2 per team) Note: can initially be performed by the same team as OMP: Marine fauna assessment – seabirds and shorebirds. This SMP may replace OMP: Marine fauna assessment – seabirds and shorebirds if the OMPs termination criteria are triggered	
Marine mega-fauna assessment o Reptiles o Whale sharks, dugongs and cetaceans	2 teams (spill site and surrounds) 2 teams (Browse Island) 2 teams (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) Total 7 team leaders and 21 team members (4 per team) Note: can initially be performed by the same team as the relevant OMP: Marine fauna assessment. This SMP may replace the relevant OMP: Marine fauna assessment if the OMPs termination criteria are triggered	2 teams (spill site and surrounds) 2 teams (Browse Island) 2 teams (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 2 teams (Seringapatam Reef, Scott Reef, Sandy Islet) Total 9 team leaders and 27 team members (4 per team) Note: can initially be performed by the same team as the relevant OMP: Marine fauna assessment. This SMP may replace the relevant OMP: Marine fauna assessment if the OMPs	2 teams (spill site and surrounds) 2 teams (Browse Island) 2 teams (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 2 teams (Seringapatam Reef, Scott Reef, Sandy Islet) 1 team (Buccaneer Archipelago) 1 team (Indonesian Boundary) Total 11 team leaders and 33 team members (4 per team) Note: can initially be performed by the same team	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement

SMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
		termination criteria are triggered	as the relevant OMP: Marine fauna assessment. This SMP may replace the relevant OMP: Marine fauna assessment if the OMPs termination criteria are triggered	
Benthic habitat assessment	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) Total 4 team leaders and 8 team members (3 per team)	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) Total 5 team leaders and 10 team members (3 per team)	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) 1 team (Buccaneer Archipelago) 1 teams (Indonesian Boundary) Total 7 team leaders and 14 team members (3 per team)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement
Marine fish and elasmobranch assemblages assessment	1 team (Cartier Island and Ashmore Reef and associated KEF) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Continental Slope Demersal Fish Communities KEF)	1 team (Cartier Island and Ashmore Reef and associated KEF) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Continental Slope Demersal Fish Communities KEF)	1 team (Cartier Island and Ashmore Reef and associated KEF) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Continental Slope Demersal Fish Communities KEF)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement

SMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
	Total 3 team leaders and 6 team members (3 per team) Note: can initially be performed by the same team as OMP: Marine fauna assessment – fish. This SMP may replace OMP: Marine fauna assessment – fish if the OMPs termination criteria are triggered	1 team (Seringapatam Reef and Commonwealth waters in the Scott Reef Complex KEF) 1 team (Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEF) Total 5 team leaders and 10 team members (3 per team) Note: can initially be performed by the same team as OMP: Marine fauna assessment – fish. This SMP may replace OMP: Marine fauna assessment – fish if the OMPs termination criteria are triggered	1 team (Seringapatam Reef and Commonwealth waters in the Scott Reef Complex KEF) 1 team (Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEF) 1 team (Buccaneer Archipelago) 1 team (Indonesian Boundary) Total 7 team leaders and 14 team members (3 per team) Note: can initially be performed by the same team as OMP: Marine fauna assessment – fish. This SMP may replace OMP: Marine fauna assessment – fish if the OMPs termination criteria are triggered	
Fisheries impact assessment	2 teams (Commonwealth fisheries with the potential to be impacted/are being impacted (Refer to Section 7.3 of Prelude EP)) Total 2 team leaders and 4 team members (3 per team)	3 teams (Commonwealth fisheries with the potential to be impacted/are being impacted (Refer to Section 7.3 of Prelude EP)) Total 3 team leaders and 6 team members (3 per team)	4 teams (Commonwealth fisheries with the potential to be impacted/are being impacted (Refer to Section 7.3 of Prelude EP)) Total 4 team leaders and 8 team members (3 per team)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement

SMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
	Note: can initially be performed by the same team as OMP: Marine fauna assessment – fish. This SMP may replace OMP: Marine fauna assessment – fish if the OMPs termination criteria are triggered	Note: can initially be performed by the same team as OMP: Marine fauna assessment – fish. This SMP may replace OMP: Marine fauna assessment – fish if the OMPs termination criteria are triggered	Note: can initially be performed by the same team as OMP: Marine fauna assessment – fish. This SMP may replace OMP: Marine fauna assessment – fish if the OMPs termination criteria are triggered	
Heritage features assessment	1 team Total 1 team leader and 2 team members (3 per team)	1 team Total 1 team leader and 2 team members (3 per team)	1 team Total 1 team leader and 2 team members (3 per team)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement
Social impact assessment	1 team Total 1 team leader and 2 team members (3 per team)	1 team Total 1 team leader and 2 team members (3 per team)	1 team Total 1 team leader and 2 team members (3 per team)	Shell in-house personnel

10 Capability Arrangements

Shell has contracted BMT to provide standby OSMP response and implementation services, which includes lead contract, logistics and reporting. BMT will be supported by Astron Environmental Services (Astron) and Curtin University of Technology. Details of OSMP services are provided in Table 10-1. Shell will maintain responsibility for implementing OMP: Air quality modelling (responder health and safety) and SMP: Social Impact Assessment.

The OSMP Services Provider is contracted to provide Shell with a monthly Standby Capability and Competency Report, which details personnel requirements for OMPs/SMPs, numbers of available personnel and competencies for service provider and sub-contracted personnel.

In addition, Shell is a Capping Member of OSRL's Subsea Well Intervention Service (SWIS), enabling access to trained personnel and specialised monitoring equipment for subsea dispersant injection monitoring.

Table 10-1: BMT OSMP Standby and Implementation Services

Standby	Implementation
24/7 monitoring support accessed through 24 hr. call out number	Provision of an OSMP Implementation Lead and Scientific Logistics Coordinator to the Shell IMT within 12 hours of notification
Provision of a suitably trained personnel, which includes support from Astron and Curtin University of Technology	Provision of a first-strike scientific team within 24 hours of notification, available in Perth and ready to deploy
Monthly reports on personnel and equipment availability	Development of scientific response and sampling plans (based on modelled hydrocarbon spill scenario)
Access to BMT's global network of scientific and engineering consulting expertise	Provision of a second-strike scientific team within 72 hours of notification, available in Perth and ready to deploy
Access to BMT's local network of terrestrial consultants, laboratories and field service providers	Priority access to BMT staff and equipment

10.1 Personnel competencies

Table 10-2 outlines the required competencies of key OSMP roles for Shell and its OSMP service providers. Shell will, where practicable, engage its most qualified local environmental advisors in the initial stages of the monitoring program to help activate and mobilise monitoring teams and work with the OSMP Services Provider to finalise monitoring designs. Personnel selected for contracted OSMP standby services are competent personnel with considerable experience in various monitoring roles.

Availability of personnel will be listed in the OSMP Service Provider's Standby Capability and Competency Report. Personnel listed on the monthly update will be

contactable via mobile phone during this period and accessible to Perth airport or another suitable port within 48 hours of Shell's initial activation of OSMP Services.

Table 10-2: Key OSMP roles and competencies

Role	Competencies
Environment Unit Lead[2]	• Bachelor degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • > 10 years' experience in environmental management • PMAOMIR320 – Manage Incident Response Information or ICS 100 and ICS 200 or AMOSC IMO2 Oil Spill Management Course. • Participation in one incident management exercise every two years • Operational and Scientific Monitoring Plan Awareness Training
OSMP Implementation Lead (Shell or OSMP Services Provider)	• Bachelor's degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • > 10 years' experience in environmental management • Familiarity with Shell Health, Security, Safety, Environment and Social Performance Management Framework • PMAOMIR320 – Manage Incident Response Information or ICS 100 and ICS 200 or AMOSC IMO2 Oil Spill Management Course • Participation in one incident management exercise per year • Operational and Scientific Monitoring Plan Awareness Training, including understanding of how to activate external OSMP providers
Operational Monitoring Coordinator and Scientific Monitoring Coordinator (OSMP Services Provider)	• Bachelor degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • > 5 years' experience in environmental management • PMAOMIR320 – Manage Incident Response Information or ICS 100 and ICS 200. • Participation in one incident management exercise per year • Operational and Scientific Monitoring Plan Awareness Training • Working knowledge of processes to engage additional support contracts and personnel (if required)
OSMP Field Operations Manager (OSMP Services Provider)	• Bachelor degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • >5 years' experience in relevant scientific field
OSMP Field Teams (OSMP Services Provider)	• Refer to OMPs and SMPs

[2] If the appointed Environment Unit Lead does not meet this competency requirement, then for OSMP decision making and implementation they must be supported by another person who does meet this level of competency and can sign off each Operational and Scientific Monitoring IAP. This may include someone appointed via Monitoring Service Provider or mutual aid (e.g. another Titleholder).

10.2 Equipment

Equipment requirements are listed in the individual OMPs and SMPs. A generalised breakdown of equipment types and the source is listed in Table 10-3. In accordance with the OSMP services contract, the OSMP Services Provider will provide all specialised field monitoring equipment to implement individual OMPs and SMPs. Shell will remain responsible for support and field logistics, including monitoring platforms (e.g. vessels, vehicles and aircraft), flights and accommodation for personnel and transportation/couriers for samples to be sent back to laboratories.

Availability of field equipment will be listed in the OSMP Services Provider's Standby Capability and Competency Report.

Table 10-3: OSMP Equipment

Equipment type	Source
Desktop equipment (e.g. Oil Spill Response Atlas, GIS)	Coordinated through IMT (W) Geomatics Team
In-field specialised monitoring equipment (e.g. fluorometers, sample bottles, ROVs)	Coordinated through the OSMP Services Provider's standby OSMP response and implementation services Specialised subsea monitoring equipment available through OSRL SWIS Capping Membership
Logistical equipment (e.g. in-field accommodation)	Refer to Appendix B: Oil Spill Resource Directory – Prelude FLNG OPEP HSE_PRE_013075

10.3 Exercises

Shell Australia maintains an Exercise and Training Schedule as detailed in the Shell Australia Emergency Management Manual (HSE_GEN_010996) to ensure its competency in responding to and managing major incidents, including oil spills. The Exercise and Training Schedule is reviewed and revised (if required) annually.

As part of this schedule, Shell conducts a number of different exercise types that may include a component of operational and scientific monitoring, which are outlined in Table 10-4.

Table 10-4: Exercise Types

Exercise Type	Description	Frequency
Notification exercise	Test procedures to notify and activate the IMT, oil spill response organisations, third party providers (including OSMP contractors) and regulators	At least annually
Tabletop exercise	Normally involves interactive desktop discussions of a simulated scenario. OSMP tabletop exercises may involve the following focus areas:	As per Shell Australia's Exercise and Training Schedule

Exercise Type	Description	Frequency
	• Test the time required to finalise monitoring design; • Test arrangements for delivery and use of data by IMT in decision making; or • Data exchange test with field (opportunistic when contractors in in the field)	
Incident Management Exercise	Involves IMT activation to establish command, control, and coordination of a Level 2 or 3 incident. Can simulate several different aspects of an oil spill incident and may involve third parties. OSMP activation may be included as component of this exercise.	As per Shell Australia's Exercise and Training Schedule

The purpose of this testing is to confirm that the response arrangements and capability in place is available when needed and function as intended. As part of the exercise process, Shell prepares a number of documents to ensure drills and exercises are well planned, conducted and evaluated. To support this, the following documents are used for Level 2-3 exercises:

- Exercise Scope Document – provides background context to the exercise, outlines the exercise need, aim, objectives, details of the scenario, participating groups and agencies, exercise deliverables and management structure. This document can be used to engage a third-party contractor to assist in conducting the exercise
- Exercise plan and instructions – provide instructions and 'play' (including any injects) for conducting the exercise
- Post exercise report – includes an after-action review of the exercise, evaluating how the exercise performed against meeting its aim and objectives.

Shell routinely undertakes post-exercise debriefings following Level 2-3 exercises and drills to identify opportunities for improvement and communicate lessons learned. Actions that are derived from drills and exercises including debriefs are documented in an action tracking system.

Shell annually tests its standby arrangements and activation process with its OSMP contractors, to ensure Shell IMT roles and key OSMP Services Provider personnel are familiar with the activation process and to check the OSMP Services Provider's Standby Capability and Competency Report.

Shell incorporates OSMP activation and planning into at least one tabletop or incident management exercise each year. In September 2019, Shell coordinated an incident management exercise which included mobilisation of OSMP contractors into the Incident Management Room. The OSMP contractors were embedded into the Environment Unit for two days, conducting mobilisation of relevant OMPs and working with the Logistics and Operations Units to coordinate delivery of monitoring.

11 Capability Assessment

11.1 Operational monitoring

OMP: Hydrocarbon properties and weathering behaviour at sea

Teams shall consist of one team lead and two team members. Initially teams may also conduct sampling for OMP: Surface chemical dispersant effectiveness and fate, OMP: Water quality assessment and OMP: Sediment quality assessment. This arrangement would rely upon suitable transportation arrangements for samples so that the sampling vessels can remain in-field.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)

Teams shall consist of one to two personnel, who may also be able to fulfil other desktop based assessments or analysis. This monitoring component will rely upon GIS specialist personnel (from existing Shell Geomatics Team) to input data into relevant software.

OMP: Shoreline clean-up assessment technique (SCAT)

SCAT shall consist of 3 members per team, including one team lead, which should to be able to cover 8-10 km per day. This distance may be more, especially if unmanned aerial vehicles (UAVs) are employed to cover shorelines that have access limitations. Shell has used the modelling data in Section 2 to plan worst case shoreline and habitat assessment personnel requirements. Team leaders will be sourced from Shell's OSMP Services Provider and supported by personnel from AMOSC and OSRL and will be trained in shoreline assessment techniques. Team members can include personnel who have completed basic training prior to mobilisation.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

OMP: Surface chemical dispersant effectiveness and fate

Initially, the water quality monitoring component may be conducted by the same team undertaking OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Water quality assessment and OMP: Sediment quality assessment. Depending upon the nature and scale of the spill, and as resources are scaled, a dedicated sampling team may be deployed.

Sampling teams shall consist of 2 to 3 personnel trained in the observation and verification of chemical dispersant effectiveness. It is difficult to quantify the number

of teams that would be required to implement this monitoring program, although one team could assess multiple locations. A suitable sampling vessel would be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

OMP: Subsea dispersant injection monitoring

Subsea dispersant injection would not commence until day 10-12. Water quality monitoring would need to commence prior to injection. Shell will access capability via its OSRL Subsea Well Intervention Service (SWIS) Capping Stack Membership, which can provide a dedicated sampling team with deepwater sampling and monitoring equipment.

Vessels and remote accommodation are required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

OMP: Water quality assessment

Initially, this monitoring component may be conducted by the same team undertaking OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Surface chemical dispersant effectiveness and fate and OMP: Sediment quality assessment. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

OMP: Sediment quality assessment

Initially, this monitoring component may be conducted by the same team undertaking OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Surface chemical dispersant effectiveness and fate and OMP: Water quality assessment. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

OMP: Marine fauna assessment

Initially, monitoring for all relevant marine fauna groups may be conducted via aerial surveys. Depending on the nature and scale of the spill, this could be conducted by the same platform conducting aerial surveillance of the slick. However, trained marine fauna aerial observers would be required to undertake the assessment,

which may mean additional personnel on each aircraft (unless personnel with a dual skill set in marine fauna aerial observation and aerial spill surveillance are available).

Aerial surveys provide a rapid and resource efficient method of collecting marine fauna assessment data, however, they do not enable the collection of detailed observations. If aerial surveys require validation then this may be performed via vessel based surveys and/or SCAT teams.

Aircraft will be sourced via Shell's existing aviation contracts. Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

OMP: Air quality modelling (responder health and safety)

Teams shall consist of one to two personnel, who may also be able to fulfil other desktop based assessments or analysis. This monitoring component will rely upon Shell in-house air quality specialists.

11.2 Scientific monitoring

SMP: Water quality impact assessment

Initially, this monitoring component may be conducted by the same team undertaking OMP: Water quality assessment or this SMP may replace OMP: Water quality assessment if the relevant termination criteria are triggered. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Sediment quality impact assessment

Initially, this monitoring component may be conducted by the same team undertaking OMP: Sediment quality assessment or this SMP may replace OMP: Sediment quality assessment if the relevant termination criteria are triggered. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Intertidal and coastal habitat assessment

Teams will consist of 2 members per team, including one team lead. Shell has used the modelling data in Section 2 to estimate the initial personnel requirements to undertake this sampling. Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Seabirds and shorebirds

Initially, this monitoring component may be conducted by the same team undertaking OMP: Marine fauna assessment – seabirds and shorebirds or this SMP may replace OMP: Marine fauna assessment – seabirds and shorebirds if the relevant termination criteria are triggered. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Aircraft will be sourced via Shell's existing aviation contracts. Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Marine mega-fauna assessment – Reptiles

Initially, this monitoring component may be conducted by the same team undertaking OMP: Marine fauna assessment – reptiles or this SMP may replace OMP: Marine fauna assessment – reptiles if the relevant termination criteria are triggered. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Aircraft will be sourced via Shell's existing aviation contracts. Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Marine mega-fauna assessment – Whale sharks, Dugongs and/or Cetaceans

Initially, this monitoring component may be conducted by the same team undertaking the relevant OMP: Marine fauna assessment or this SMP may replace the relevant OMP: Marine fauna assessment if the relevant termination criteria are triggered. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Aircraft will be sourced via Shell's existing aviation contracts. Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Benthic habitat assessment

Teams will consist of 3 members per team, including one team lead. Shell has used the modelling data in Section 2 to estimate the initial personnel requirements to undertake this sampling. Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Marine fish assemblages assessment

Initially, this monitoring component may be conducted by the same team undertaking the relevant OMP: Marine fauna assessment or this SMP may replace the relevant OMP: Marine fauna assessment if the relevant termination criteria are triggered. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Fisheries impact assessment

Initially, this monitoring component may be conducted by the same team undertaking the relevant OMP: Marine fauna assessment or this SMP may replace the relevant OMP: Marine fauna assessment if the relevant termination criteria are triggered. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Heritage features assessment

Initially, this monitoring component may be conducted by the same team undertaking SMP: Benthic habitat assessment if sampling locations and workloads permit. Depending upon the nature and scale of the spill, a dedicated sampling team with marine archaeology subject matter experts may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

SMP: Social impact assessment

This team shall consist of three personnel, who may be required to conduct the assessment in-field and/or via desktop based assessments or analysis. This monitoring component will rely upon Shell in-house social impact assessment specialists and, if additional resources are required Shell has established contracts in place with consultants with social impact assessment subject matter experts.

Table 11-1: Shell OSMP Capability

Component	Total Personnel Required (Weeks 1-2)[3]	Personnel available via BMT Standby Contract	Personnel available via OSROs	Shell	Total Personnel Available
OSMP Personnel embedded in Shell IMT	1 OSMP Implementation Lead 1 OM Monitoring Coordinator 1 SM Coordinator	1 OSMP Implementation Lead 1 OM Monitoring Coordinator 1 SM Coordinator	N/A	1 OSMP Implementation Lead (initial)	1 OSMP Implementation Lead 1 OM Monitoring Coordinator 1 SM Coordinator
OMPs					
Hydrocarbon properties and weathering behaviour at sea*	5 team leaders 10 team members	5 team leaders 10 team members	N/A	N/A	5 team leaders 10 team members
Pre-emptive assessment of sensitive receptors at risk (desktop only)	1 team member 1 GIS Specialist	1 team member	N/A	2 GIS Specialists	2 GIS Specialists 1 Team member
Shoreline clean-up assessment technique (SCAT)	5 team leaders 10 team members	13 team leaders 24 team members	13 team leaders (AMOSC) 12 team leaders (OSRL)	N/A	38 team leaders 24 team members
Surface chemical dispersant effectiveness and fate	Visual observations: 1 team leader 1 team member Water quality assessment – refer to SMP: Water quality assessment	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea	Visual observations: 3 team leader 4 team member	N/A	Visual observations: 3 team leaders 4 team members

[3] If additional resources are required for week 3 onwards then this will be identified early in the monitoring process and Shell will activate additional contracted resources through its OSMP Services Provider to increase capacity

Component	Total Personnel Required (Weeks 1-2)[3]	Personnel available via BMT Standby Contract	Personnel available via OSROs	Shell	Total Personnel Available
Subsea chemical dispersant injection monitoring	18 specialist personnel for 24 hour operation	N/A	18 specialist personnel available through OSRL sub-contracts	N/A	18 specialist personnel available through OSRL sub-contracts
Water quality assessment*	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea				
Sediment quality assessment*	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea				
Marine fauna assessment	1 aerial team (including 1 Marine Mammal Observer (MMO) and 1 Aerial survey observer) 6 vessel teams (including 1 vessel-based survey trained MMO, 1 experienced vessel survey observer per team)	16 MMOs 11 Aerial survey observers 21 vessel survey observers 6 experienced ornithologists 2 personnel with pathology or veterinary skills	N/A	N/A	16 MMOs 11 Aerial survey observers 21 vessel survey observers 6 experienced ornithologists 2 personnel with pathology or veterinary skills
Air quality modelling (responder health and safety)	1 Air Quality Specialist			1 Air Quality Specialist Specialists from Project and Technology Team (Shell Global)	1 Air Quality Specialist Specialists from Project and Technology Team (Shell Global)
SMPs					
Water quality impact assessment	Note: can initially be performed by the same team as OMP: Water quality assessment. This SMP may replace OMP: Water quality assessment if the OMPs termination criteria are triggered				
Sediment quality impact assessment	Refer to SMP: Water quality impact assessment* (all sites)				

Component	Total Personnel Required (Weeks 1-2)[3]	Personnel available via BMT Standby Contract	Personnel available via OSROs	Shell	Total Personnel Available
Intertidal and coastal habitat assessment	4 team leaders 4 team members	12 team leaders 21 team members	N/A	N/A	12 team leaders 21 team members
Seabirds and shorebirds	Note: can initially be performed by the same team as OMP: Marine fauna assessment – seabirds and shorebirds. This SMP may replace OMP: Marine fauna assessment – seabirds and shorebirds if the OMPs termination criteria are triggered				
Marine mega-fauna assessment	Note: can initially be performed by the same team as OMP: Marine fauna assessment. This SMP may replace OMP: Marine fauna assessment if the OMPs termination criteria are triggered				
Benthic habitat assessment	5 team leaders 10 team members	5 team leaders 10 team members	N/A	N/A	5 team leaders 10 team members
Marine fish assemblages assessment	5 team leaders 10 team members	2 senior marine scientists trained in fish identification and necropsy 9 scientists with fish survey and ROV/BRUV experience 7 team members	N/A	N/A	2 senior marine scientists trained in fish identification and necropsy 9 scientists with fish survey and ROV/BRUV experience 7 team members
Fisheries impact assessment	3 team leaders 6 team members	2 senior marine scientists trained in fish identification and necropsy 9 scientists with fish survey and ROV/BRUV experience 7 team members	N/A	N/A	2 senior marine scientists trained in fish identification and necropsy 9 scientists with fish survey and ROV/BRUV experience 7 team members

Component	Total Personnel Required (Weeks 1-2)[3]	Personnel available via BMT Standby Contract	Personnel available via OSROs	Shell	Total Personnel Available
Heritage features assessment	1 team leaders 2 team members (including either ROV operator or marine diver/s)	1 team leaders 2 team members (including either ROV operator or marine diver/s)	N/A	N/A	1 team leaders 2 team members (including either ROV operator or marine diver/s)
Social impact assessment	1 team leader 2 team members	N/A	N/A	3-4 Social impact assessment specialists	3-4 Social impact assessment specialists

* Initial co-mobilisation between OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Surface chemical dispersant effectiveness and fate, OMP: Water quality assessment and OMP: Sediment quality assessment

12 Review of Plan

This document shall be reviewed, updated and submitted to regulators every 5 years from date of acceptance.

As part of the Environment Plan review cycle, this document will be reviewed annually and revised, if required, in accordance with Shell's Management of Change Manual. This could include changes required in response to one or more of the following:

- When major changes have occurred which affect Operational and/or Scientific Monitoring coordination or capabilities (e.g. change of service provider/s);
- Changes to the activity that affect Operational and/or Scientific Monitoring coordination or capabilities (e.g. a significant increase in spill risk);
- Changes to legislative context related to Operational and/or Scientific Monitoring (e.g. EPBC Act protected maters requirements);
- Following routine testing of the OSMP if improvements or corrections are identified; or
- After a Level 2/3 spill incident.

The extent of changes made to the OSM Bridging Implementation Plan and resultant requirements for regulatory resubmission will be informed by the relevant Commonwealth regulations, i.e. the OPGGS (E) Regulations.

Part B – Implementation

13 Activation Process

Shell's IMT Environment Unit Leader is responsible for activating OSMP components, subject to approval from the IMT (W) Leader. Table 13-1 outlines Shell's OSMP activation process.

Table 13-1: Shell OSMP Activation Process

Responsibility	Task	Timeframe	Complete
Environment Unit Leader (Shell)	Obtain approval from IMT (W) Leader to initiate OSMP	Within 4 hours of spill notification	❑
	Contact OSMP Services Provider and notify on-call officer of incident, requesting provision of OSMP Implementation Lead and Scientific Logistics Coordinator to the Shell IMT	Within 4 hours of spill notification	❑
	Provide monitor and evaluate data (e.g. spill trajectory modelling, aerial surveillance, fate and weathering modelling, tracking buoy data) to OSMP Services Provider	Within 1 hour of data being received by IMT	❑
	Liaise directly with OSMP Services Provider to determine which OMPs and SMPs are to be initiated	Within 3 hours of monitor and evaluate data being received from IMT	❑
	Provide purchase order to OSMP Services Provider (cross reference OSMP Standby Services Scope of Work)	Within 72 hours of initial notification to OSMP Services Provider	❑
	If Operational SIMA indicates use of subsea dispersant injection may be beneficial, confirm with Logistics Section Chief and/or Source Control Branch that SSDI effectiveness monitoring is being mobilised through OSRL SWIS Capping Stack Membership	Within 12 hours of SSDI being confirmed for use through Operational SIMA	❑
	Record tasks in Personal Log	At time of completion of task	❑
OSMP Services Provider	On-call officer to notify Manager of activation and contact OSMP Implementation Lead and Scientific Logistics Coordinator	Within 8 hours of notification being made to OSMP Services Provider	❑
	Send OSMP Implementation Lead and Scientific Logistics Coordinator to the Shell IMT	Within 12 hours of notification being made to OSMP Services Provider	❑

Responsibility	Task	Timeframe	Complete
	Liaise directly with EUL to determine which OMPs and SMPs are to be initiated	Within 4 hours of monitor and evaluate data being received from IMT	❑
	Confirm availability of initial personnel and equipment resources	Within 5 hours of monitor and evaluate data being received from IMT	❑

14 Monitoring Priorities

As described in Section 2, Shell has analysed the available spill trajectory modelling to understand the likely initial monitoring priorities for its activities in the ZPI. In addition, Table 4-2 identifies priority monitoring locations and comparability of available baseline data for receptors, to assist in identifying where post-spill, pre-impact monitoring should be prioritised.

The monitoring priorities provided in Table 2-1, Table 2-2 and Table 4-2 are to be used for guidance when confirming monitoring priorities in consultation with key stakeholders and monitoring service providers (including subject matter experts, where available) at the time of the spill. 14-1 provides a checklist to assist in the confirmation of monitoring priorities for individual spills.

14-1: Checklist for determining monitoring priorities

Responsibility	Task	Timeframe	Complete
OSMP Services Provider with input from Environment Unit Leader (Shell)	Confirm monitoring locations for activated OMPs and SMPs based on: • Current monitor and evaluate data (i.e. situational awareness data, including post-spill trajectory modelling, predicted time to receptor impact, aerial/vessel surveillance observations, tracking buoy data, satellite data); • Nature of hydrocarbon spill (i.e. subsea blow out, surface release, hydrocarbon characteristics, volume, expected duration of release) • Seasonality and presence of receptors impacted or at risk of being impacted; • Current information on transient and broadscale receptors (surface and subsea) • Current operational considerations (e.g. weather, logistics); • Nature of hydrocarbon spill (i.e. subsea blow out, surface release, hydrocarbon characteristics, volume, expected duration of release) • Monitoring priorities in Table 2-1 and Table 2-2 • Existing literature, baseline data, and monitoring programs.	Within 12 hours of monitor and evaluate data being received from IMT	❑
	Confirm monitoring priorities with key stakeholders, including the appointed State/Territory Environment and Science Coordinator	Within 12 hours of monitor and evaluate data being received from IMT	❑
	Using the results of the baseline data analysis in Table 4-2 and the information above, determine priority locations for post-spill, pre-impact monitoring	Within 12 hours of monitor and evaluate data being received from IMT	❑
	Confirm the need for any additional reactive baseline monitoring data for SMPs and determine suitable locations, noting that suitable control or reference sites may be outside of the ZPI	Within 12 hours of monitor and evaluate data being received from IMT	❑
	Continually re-evaluate monitoring priorities in consultation with Shell EUL and relevant key stakeholders throughout spill response (and with Shell Environment Advisor and relevant key stakeholders post-response)	Ongoing	❑

15 Protected Matters Requirements

There are a number of receptors that attract protected status under various Commonwealth and State legislation, plans, policies including World Heritage Areas, National and Commonwealth Heritage Areas, Australian Marine Parks, Ramsar wetlands, threatened ecological communities, threatened species and migratory species.

The Commonwealth publishes recovery plans and conservation advice for a number of species listed as threatened under the EPBC Act. These documents are intended to assist in preventing the decline, and enhance the recovery, of threatened species. There are also management plans issued for Commonwealth and State/Territory marine parks which aim to protect and conserve ecological, cultural and heritage values of these areas through sustainable use of its resources. The requirements of these management plans, species recovery plans and conservation advice for threatened species are an important consideration when determining monitoring priorities and finalising monitoring designs.

Table 15-1 provides a checklist to ensure monitoring personnel consider protected matters requirements in the finalisation of OMPs and SMPs.

Table 15-1: Checklist for inclusion of protected matters into monitoring designs

Responsibility	Task	Complete
OSMP Services Provider with input from Environment Unit Leader (Shell)	Review Monitoring, Evaluation and Surveillance data and available OMP data to determine likely presence of protected species in predicted trajectory of the spill	❑
	Review the relevant recovery plan/conservation advice/management plan in Table 15-2 and determine if there have been any updates to the relevant conservation threats/actions. Integrate relevant considerations into the final monitoring design for affected OMPs and SMPs	❑
	Review restrictions on marine mammal buffer distances in SMP: Marine mega-fauna and ensure this is included in all relevant response and monitoring IAPs (e.g. Shoreline Protection Plan, Shoreline Clean-up Plan, OSM Plan), so that response and monitoring field teams maintain required buffer distances from fauna during operations	❑

Table 15-2 outlines the management plans, recovery plans and conservation advice statements relevant for the protected matters within the ZPI that are likely to be relevant to the final design of the OMPs and SMPs. Table 15-2 also includes relevant priority monitoring locations where these receptors are known to occur in order to expedite consideration of relevant information into finalised monitoring designs.

Table 15-2: Protected matters in the ZPI, relevant monitoring plans and priority sites

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
Mammals				
Sei whale	Approved conservation advice *Balaenoptera borealis* (sei whale) (Threatened Species Scientific Committee 2015a)	• Relevant threat/s: pollution, vessel disturbance • Relevant management actions: report vessel strikes	• OMP: Marine fauna assessment – Cetaceans • SMP: Marine mega-fauna assessment - Whale sharks, dugongs and cetaceans	N/A
Blue whale	Conservation management plan for the blue whale: A recovery plan under the Environment Protection and Biodiversity Conservation Act 1999 2015-2025 (Commonwealth of Australia 2015a)	• Relevant threat/s: pollution , vessel strike • Relevant management actions: Minimising vessel collisions, measuring and monitoring population recovery		Seringapatam Reef/Scott Reef (7.8 days)
Fin whale	Approved conservation advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee 2015b)	• Relevant threat/s: habitat modification, vessel disturbance • Relevant management actions: report vessel strikes		N/A
Humpback whale	Approved conservation advice for *Megaptera novaeangliae* (humpback whale) (Threatened Species Scientific Committee 2015c)	• Relevant threat/s: habitat degradation, vessel disturbance or strike. • Relevant management actions: Minimise vessel collisions.		Buccaneer Archipelago (23 days - entrained)
Southern right whale	Conservation management plan for the southern right whale: a recovery	• Relevant threat/s: habitat modification, vessel disturbance		N/A

[4] Planning scenario used = vessel collision (42,000 m^3 condensate from Table 2-1). Unless otherwise noted, all results are floating oil timeframes to contact.

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
	plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011-2021 (DSEWPaC 2012c)	• Relevant management actions: Addressing vessel collisions, measuring and monitoring population recovery		
Reptiles				
Loggerhead turtle, green turtle, leatherback turtle, hawksbill turtle, flatback turtle, olive ridley turtle	Recovery plan for marine turtles in Australia (Commonwealth of Australia 2017)	• Relevant threat/s: chemical and terrestrial discharge, light pollution, vessel disturbance, habitat modification • Relevant management actions from recovery plan : <u>Chemical and terrestrial discharge</u> o Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', e.g. nesting habitat, seagrass meadows or coral reefs. o Quantify the impacts of decreased water quality on stock viability. o Quantify the accumulation and effects of anthropogenic toxins in marine turtles, their foraging habitats and subsequent stock viability.	• OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment – Reptiles • SMP: Marine mega-fauna assessment – Reptiles	• Browse Island (1.8 days) • Cartier Island (4.5 days) • Ashmore Reef (5.5 days) • Seringapatam Reef/Scott Reef (7.8 days) • Buccaneer Archipelago (23 days - entrained)

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
		Light o Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats		
Leatherback turtle	Approved conservation advice for *Dermochelys coriacea* (Leatherback Turtle) (Threatened Species Scientific Committee 2008a)	• Relevant threat/s: changes to breeding sites, vessel strike • Relevant management actions: Addressing vessel collisions, Measuring and monitoring population recovery		N/A
Short-nosed seasnake	Approved conservation advice for *Aipysurus apraefrontalis* (short-nosed sea snake) (Threatened Species Scientific Committee 2010a)	No relevant threat or management actions identified		• Cartier Island (4.5 days) • Ashmore Reef (5.5 days)
Leaf-scaled seasnake	Approved conservation advice for *Aipysurus foliosquama* (leaf-scaled sea snake) (Threatened Species Scientific Committee 2010b)	No relevant threat or management actions identified		Ashmore Reef (5.5 days)
Sharks and rays				
White shark	Recovery plan for the white shark (*Carcharodon carcharias*) (DSEWPaC 2013)	• Relevant threat/s: habitat modification. • Relevant management objectives: Continue to identify and protect	• OMP: Marine fauna assessment – Fish • SMP: Marine mega-fauna assessment - Marine fish	N/A

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
		habitat critical to the survival of the white shark and minimise the impact of threatening processes within these areas	and elasmobranch assemblages assessment	
Northern river shark	Approved conservation advice for *Glyphis garricki* (northern river shark) (Threatened Species Scientific Committee 2014a)	• Relevant threat/s: habitat modification • Relevant management objectives: implement measures to reduce adverse impacts of habitat degradation and/or modification		Buccaneer Archipelago (23 days - entrained)
	Sawfish and river shark multispecies recovery plan (Commonwealth of Australia 2015b)			
Green sawfish	Approved conservation advice for green sawfish (Threatened Species Scientific Committee 2008b)	• Relevant threat/s: habitat degradation through coastal development • No relevant management actions identified		
	Sawfish and river shark multispecies recovery plan (Commonwealth of Australia 2015b)	• Relevant threat/s: habitat modification Relevant management objectives: implement measures to reduce adverse impacts of habitat degradation and/or modification		
Whale shark	Approved conservation advice *Rhincodon typus* whale shark (Threatened Species Scientific Committee 2015d)	No relevant threat or management actions identified	• OMP: Marine fauna assessment – Fish • SMP: Marine mega-fauna assessment - Whale sharks, dugongs and cetaceans	Cartier Island (4.5 days)

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
Grey nurse shark (west coast population)	Recovery plan for the grey nurse shark (*Carcharias taurus*) (Department of the Environment 2014)	No relevant threats or management actions identified	• OMP: Marine fauna assessment – Fish • SMP: Marine mega-fauna assessment - Marine fish and elasmobranch assemblages assessment	N/A
Dwarf sawfish	Approved conservation advice for *Pristis clavata* (dwarf sawfish) (Threatened Species Scientific Committee 2009) Sawfish and river shark multispecies recovery plan (Commonwealth of Australia 2015b)	• Relevant threat/s: habitat degradation due to increasing human development in northern Australia • No relevant management actions identified		N/A
Freshwater sawfish	Approved conservation advice for *Pristis pristis* (largetooth sawfish) (Threatened Species Scientific Committee 2014b) Sawfish and river shark multispecies recovery plan (Commonwealth of Australia 2015b)	• Relevant threat/s: habitat degradation and modification • No relevant management actions identified		N/A
Birds				
Migratory shorebird species[5]	Wildlife conservation plan for migratory shorebirds (Commonwealth of Australia 2015c)	• Relevant threat/s: habitat modification, acute pollution, anthropogenic disturbance • No relevant management actions identified	• OMP: Shoreline clean-up assessment technique (SCAT)	Ashmore Reef (5.5 days)

[5] Red knot, great knot, greater sand plover, lesser sand plover and bar-tailed godwit.

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
Albatrosses and giant petrels[6]	National recovery plan for threatened albatrosses and giant petrels (DSEWPaC 2011)		• OMP: Marine fauna assessment – Seabirds and shorebirds • SMP: Seabirds and shorebirds	N/A
Australian lesser noddy	Approved Conservation Advice for *Anous tenuirostris melanops* (Australian lesser noddy) (Threatened Species Scientific Committee 2015e)	• Relevant threat/s: damage to nesting habitat, oil spills • No relevant management actions identified		• Cartier Island (4.5 days) • Ashmore Reef (5.5 days)
Red knot, knot	Approved Conservation Advice for *Calidris canutus* (Red knot) (Threatened Species Scientific Committee 2016a)	• Relevant threat/s: damage to nesting habitat, pollution • Relevant management actions: manage disturbance at important sites which are subject to anthropogenic disturbance when red knot are present – e.g. discourage or prohibit vehicle access, implement temporary site closures		• Cartier Island (4.5 days) • Ashmore Reef (5.5 days)
Curlew sandpiper	Conservation advice *Calidris ferruginea* curlew sandpiper (Threatened Species Scientific Committee 2015f)	No relevant threats or management actions identified		• Cartier Island (4.5 days) • Ashmore Reef (5.5 days)

[6] Several albatrosses and giant petrels were identified as potentially occurring: Amsterdam albatross, southern royal albatross, wandering albatross, southern giant-petrel, northern giant petrel, soft-plumaged petrel, Indian yellow-nosed albatross, Tasmanian shy albatross, white-capped albatross, Campbell albatross, black-browed albatross, white-capped albatross.

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
Eastern curlew	Conservation advice *Numenius madagascariensis* eastern curlew (Threatened Species Scientific Committee 2015g)	• Relevant threat/s: human disturbance to feeding and roosting sites • Relevant management actions: reduce disturbance at key roosting and feeding sites		• Cartier Island (4.5 days) • Ashmore Reef (5.5 days)
Abbott's booby	Approved Conservation Advice for *Papasula abbotti* (Abbott's booby) (Threatened Species Scientific Committee 2015h)	• Relevant threat/s: new clearing • Relevant management actions: Preventing activities in habitat critical to the survival that will remove habitat and disturb birds; preventing activities in buffer areas that may disturb nesting and roosting birds e.g. clearing vegetation that would result in increased wind turbulence or weed invasion in nesting and roosting habitat.		N/A
Great knot	Conservation advice *Calidris tenuirostris* great knot (Threatened Species Scientific Committee 2016b)	• Relevant threat/s: habitat loss and degradation, pollution • Relevant management actions: manage disturbance at important sites which are subject to anthropogenic disturbance when red knot are present – e.g. discourage or prohibit vehicle access, implement temporary site closures		• Ashmore Reef (5.5 days)

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
Greater sand plover	Approved Conservation Advice for *Charadrius leschenaultii* (Greater sand plover) (Threatened Species Scientific Committee 2016c)	• Relevant threat/s: habitat loss and degradation, pollution • Relevant management actions: manage disturbance at important sites which are subject to anthropogenic disturbance when red knot are present – e.g. discourage or prohibit vehicle access, implement temporary site closures		• Ashmore Reef (5.5 days)
Lesser sand plover	Approved Conservation Advice for *Charadrius mongolus* (Lesser sand plover) (Threatened Species Scientific Committee 2016d)	• Relevant threat/s: habitat loss and degradation, pollution • Relevant management actions: manage disturbance at important sites which are subject to anthropogenic disturbance when red knot are present – e.g. discourage or prohibit vehicle access, implement temporary site closures		• Cartier Island (4.5 days) • Ashmore Reef (5.5 days)
Soft-plumaged petrel	Conservation advice *Pterodroma mollis* soft-plumage petrel (Threatened Species Scientific Committee 2015i)	• No relevant threats or management actions identified		N/A
Bar-tailed godwit (baueri)	Approved Conservation Advice for *Limosa lapponica baueri* (Bar-tailed godwit (western Alaskan) (Threatened Species Scientific Committee 2016e)	No relevant threats or management actions identified		• Ashmore Reef (5.5 days)

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
Australian painted snipe	Approved Conservation Advice on *Rostratula australis* (Australian Painted Snipe) (Threatened Species Scientific Committee 2013)	No relevant threats or management actions identified		N/A
Threatened Ecological Communities				
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Approved Conservation Advice for the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	• Relevant threat/s : Clearing (shoreline clean-up and/or shoreline based monitoring activities) • Relevant management actions: Protect and conserve remaining areas of the ecological community, monitor condition of Monsoon vine tickets	• OMP: Shoreline clean-up assessment technique (SCAT) • SMP: Intertidal and Coastal Habitat Assessment	Buccaneer Archipelago (23 days - entrained)
RAMSAR Wetlands (refer to Section 7.2.5 of EP for additional description of key receptors for each location)				
Ashmore Reef National Nature Reserve (birds, turtles, dugongs)	Ashmore Reef Commonwealth Marine Reserve Ramsar Site Ecological Character Description	• Relevant threat: oil and gas exploration and mining – boat strike, lighting, toxic effects of oil spills • Limits of acceptable change to elements (component, process, service) of ecological character defined in Table 27 of Ecological Character Description	• OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment – Seabirds and shorebirds • SMP: Water quality impact assessment	• Cartier Island (4.5 days) • Ashmore Reef (5.5 days)
Roebuck Bay (birds)	Ecological Character Description for Roebuck Bay	• No relevant threat identified • Limits of acceptable change to elements (component, process,		N/A

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
		service) of ecological character defined in Table 22 of Ecological Character Description	• SMP: Sediment quality impact assessment • SMP: Intertidal and Coastal Habitat Assessment • SMP: Seabirds and shorebirds • OMP: Marine fauna assessment – Dugongs • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs • SMP: Benthic habitat assessment	
Eighty-mile Beach (birds, intertidal habitats)	Ecological Character Description of the Eighty-mile Beach Ramsar Site	• Offshore petroleum / gas extraction identified as a minor driver (threatening activity); specifically, oil spills • Limits of acceptable change to elements (component, process, service) of ecological character defined in Table 21 and 22 of Ecological Character Description		N/A
The Dales (Christmas Island) (birds, cave communities)	Ecological Character Description for The Dales Ramsar Site	• No relevant threat identified • Limits of acceptable change to elements (component, process, service) of ecological character defined in Table 13 of Ecological Character Description		N/A
Australian Marine Parks (refer to Section 7.3.2 of EP for additional description of key receptors for each location)				
North-west Marine Parks Network	North-west Marine Parks Network Management Plan 2018	• Relevant management actions: Park protection and management—timely and appropriate preventative and restorative actions to protect natural, cultural and heritage values from impacts	• OMP: Water quality assessment • OMP: Sediment quality assessment	• Browse Island (1.8 days) • Heywood Shoal (3 days) • Echuca Shoal (3.5 days)

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
			• OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment – Seabirds and shorebirds • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Intertidal and Coastal Habitat Assessment • SMP: Seabirds and shorebirds • OMP: Marine fauna assessment – Dugongs • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs • SMP: Benthic habitat assessment • SMP: Marine fish and elasmobranch assemblages assessment	• Cartier Island (4.5 days) • Ashmore Reef (5.5 days) • Vulcan Shoal (6.3 days • Seringapatam Reef/Scott Reef (7.8 days) • Buccaneer Archipelago (23 days - entrained)
North Marine Parks Network	North Marine Parks Network Management Plan 2018	• Relevant management actions: Park protection and management—timely and appropriate preventative and restorative actions to protect natural, cultural and heritage values from impacts		N/A
South-west Marine Parks Network	South-west Marine Parks Network Management Plan 2018	• Relevant management actions: Park protection and management—timely and appropriate preventative and restorative actions to protect natural, cultural and heritage values from impacts		N/A
Western Australian Marine Parks (refer to Section 7.3.2 of EP for additional description of key receptors for each location)				
Lalang-garram / Camden Sound	Lalang-garram / Camden Sound Marine Park management plan 73 (2013–2023)	• Relevant management actions: marine mammal buffer distances, restrictions of access to whale calving	• OMP: Water quality assessment	Buccaneer Archipelago (23 days - entrained)

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
		and nursing areas, permitting requirements, all monitoring activities to comply with DPaW's Science Policy (No. 78) • Refer to Section 3.6 for performance measures and management targets	• OMP: Sediment quality assessment • OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment – Seabirds and shorebirds • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Intertidal and Coastal Habitat Assessment • SMP: Seabirds and shorebirds • OMP: Marine fauna assessment – Dugongs • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs • SMP: Benthic habitat assessment • SMP: Marine fish and elasmobranch assemblages assessment	
North Kimberley	North Kimberley Marine Park Joint management plan Uunguu, Balanggarra, Miriuwung Gajerrong, and Wilinggin management areas management plan 89 (2016)	• Relevant management issues: oil spills, physical disturbance from vessels • Relevant management actions: permitting requirements, all monitoring activities to comply with DPaW's Science Policy (No. 78)		N/A
Rowley Shoals	Rowley Shoals Marine Park Management Plan No. 56 (2007)	• Relevant management issues: oil spills, physical disturbance to reefs, anchoring from vessels, boat strike (turtles/cetaceans), • Relevant management actions: ensure the values of the park are fed into predictive models for oil spills, apply appropriate anchoring practices, report fauna vessel strikes, implement access controls to Bedwell Island (red-tailed tropic bird breeding site)		N/A
Eighty Mile Beach Marine Park	Eighty Mile Beach Marine Park management plan 80 2014 – 2024	• Relevant management issues: oil spills, physical disturbance to reefs, anchoring from vessels, boat strike (turtles/cetaceans)		N/A

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
		• Relevant management actions: ensure the values of the park are fed into predictive models for oil spills, apply appropriate anchoring practices		
Montebello Islands Marine Park/Barrow Island Marine Park/Barrow Island Marine Management Area	Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007–2017 Management Plan No 55	• Relevant management issues: oil spills, physical disturbance to reefs, anchoring from vessels, boat strike (turtles/cetaceans), lighting (turtles) • Relevant management actions: ensure the values of the park are fed into predictive models for oil spills, apply appropriate anchoring controls		N/A
Muiron Islands Marine Management Area and Ningaloo Marine Park	Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area (2005)	Plan no longer in effect. Refer to The Ningaloo Coast World Heritage Area.		N/A
Shark Bay Marine Park	Shark Bay Marine Reserves Management Plan	Plan no longer in effect. Refer to Shark Bay, Western Australia World Heritage Area		N/A
World Heritage Properties (refer to Section 7.3.1.1 of EP for additional description of key receptors for each location)				
Shark Bay World Heritage Property Strategic Plan 2008-2020	• Potential pollution sources include: oil spills. • Relevant management objective: Minimise the impact of pollution and waste on World Heritage	Relevant actions: Manage wildlife interactions in accordance with controls and regulations provided under the Wildlife Conservation Act and CALM Act; In consultation with relevant	• OMP: Water quality assessment • OMP: Sediment quality assessment	N/A

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
	values and the overall integrity of the World Heritage Property.	management agencies, identify research and monitoring priorities for cultural heritage	• OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment – Seabirds and shorebirds	
Ningaloo Coast Strategic Management Framework	• Major potential threats include: resource development. • Management consistent with the objectives and underlying principles of the Ningaloo Coast management system, including Ningaloo Marine Park (Commonwealth), WA Ningaloo Marine Park and Muiron Islands Marine Management Area, Cape Range National Park, unallocated Crown land, freehold owners and leaseholders, Learmonth Air Weapons Range Facility.	No relevant threats or management actions identified	• SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Intertidal and Coastal Habitat Assessment • SMP: Seabirds and shorebirds • OMP: Marine fauna assessment – Dugongs • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs • SMP: Benthic habitat assessment • SMP: Marine fish and elasmobranch assemblages assessment	N/A
Commonwealth Heritage Places (refer to Section 7.3.1.2 of EP for additional description of key receptors for each location)				
Scott Reef and surrounds	N/A	N/A	• OMP: Water quality assessment	• Seringapatam Reef/Scott Reef (7.8 days)

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
Ashmore Reef National Nature Reserve	N/A	N/A	• OMP: Sediment quality assessment • OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment – Seabirds and shorebirds • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Intertidal and Coastal Habitat Assessment • SMP: Seabirds and shorebirds • OMP: Marine fauna assessment – Dugongs • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs • SMP: Benthic habitat assessment • SMP: Marine fish and elasmobranch assemblages assessment	• Ashmore Reef (5.5 days)
Mermaid Reef – Rowley Shoals	N/A	N/A		N/A
Ningaloo Marine Area - Commonwealth Waters	N/A	N/A		N/A
HMAS Sydney II and HSK Kormoran	N/A	N/A	• SMP: Heritage Features Assessment	N/A

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
Shipwreck Sites				
National Heritage Places (refer to Section 7.3.1.3 of EP for additional description of key receptors for each location)				
The West Kimberley	N/A	N/A	• OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment – Seabirds and shorebirds • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Intertidal and Coastal Habitat Assessment • SMP: Seabirds and shorebirds • OMP: Marine fauna assessment – Dugongs • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs • SMP: Benthic habitat assessment	Buccaneer Archipelago (23 days - entrained)
Barrow Island and the Montebello-Barrow Islands Marine Conservation Reserves	N/A	N/A		N/A

Receptor	Recovery plan / conservation advice (date issued)	Relevant threats and conservation actions	Relevant OMPs and SMPs	Relevant priority monitoring locations (quickest modelled time to contact[4])
			• SMP: Marine fish and elasmobranch assemblages assessment • SMP: Social Impact Assessment	
The Ningaloo Coast	Refer to The Ningaloo Coast World Heritage Area			N/A
Shark Bay, Western Australia	Refer to Shark Bay, Western Australia World Heritage Area			N/A
HMAS Sydney II and HSK Kormoran Shipwreck Sites	N/A	N/A	SMP: Heritage Features Assessment	N/A

16 Finalising Monitoring Design

The methods presented in the Joint Industry OMPs and SMPs are designed to allow Monitoring Providers with the flexibility to modify the standard operating procedures, so that the latest research, technologies, equipment, sampling methods and variables may be used. Monitoring designs may also be varied in-situ, according to the factors presented in Section 10.6 of the Joint Industry OSMP Framework.

Shell's checklist for finalising monitoring designs post-spill is provided in Table 16-1. The OSMP Implementation Lead will be responsible for approving the finalised monitoring design used in the OMPs and SMPs.

Table 16-1: Checklist for finalising monitoring design

Responsibility	Task	Timeframe	Complete
OSMP Services Provider	Confirm survey objectives, sampling technique, for each initiated OMP and SMP	Within 48 hours of initial monitoring priorities being confirmed by IMT	❑
	Determine suitable sampling frequency	Within 48 hours of initial monitoring priorities being confirmed by IMT	❑
	Finalise standard operating procedures	Within 48 hours of initial monitoring priorities being confirmed by IMT	❑
	Scientific monitoring: • Establish benchmarks and guidelines to be used • Confirm indicator species • Confirm parameters and metrics	Within 96 hours of initial monitoring priorities being confirmed by IMT	❑

17 Mobilisation

When the monitoring design has been finalised for each OMP and SMP, the OSMP Services Provider's Scientific Logistics Coordinator should work in conjunction with the Shell IMT Planning and Logistics Section to develop and execute a monitoring mobilisation plan, which should be incorporated into the Incident Action Planning process.

The OSMP Services Provider will be required to coordinate the availability of personnel and equipment for all monitoring programs (with the exception of OMP: Air Quality Modelling and SMP: Social Impact Assessment). Shell will be responsible for flights, accommodation and victualing for field personnel. Shell will also be required to procure all vessels, aerial platforms and vehicles for OMP and SMP implementation.

SSDI effectiveness monitoring is mobilised in accordance with OSRL SWIS services. The monitoring equipment is stored and maintained at Trendsetter, Houston. Handover of the equipment would be at a nominated airport, likely George Bush Intercontinental/Houston Airport. Shell would be responsible for making the logistics arrangements from the nominated port to the incident location.

Shell's checklist for mobilising monitoring teams is provided in Table 17-1.

Note: OMP: Pre-emptive assessment of sensitive receptors at risk and OMP: Air quality modelling are desk top assessments and should be mobilised as soon as practicable as they are not reliant on any mobilisation of field personnel.

Table 17-1: Checklist for mobilisation of monitoring teams

Responsibility	Task	Complete
OSMP Services Provider with input from Environment Unit Leader (Shell)	Confirm availability of all monitoring personnel (noting required competencies in Section 10.1 and individual OMPs/SMPs)	❑
	Allocate number of teams, personnel, equipment and supporting resource requirements	❑
	Undertake HAZIDs as required and consolidate/review field documentation including safety plans, emergency response plans, and daily field reports	❑
	Develop site-specific health and safety plans which is compliant with Shell health safety and environment systems (including call in timing and procedures)	❑
	Conduct pre-mobilisation meeting with monitoring team/s on survey objectives, logistics, safety issues, reporting requirements and data management	❑
	Logistics	
	Confirm flights, accommodation, and car hire arrangements are in place	❑
	Develop field survey schedules, detailing staff rotation	❑
	Equipment	
	Arrange survey platform (vessel, vehicle, aircraft) as required to survey or access survey sites and ensure they are equipped with appropriate fridge and freezer space for transportation of samples (and carcasses if collecting)	❑
	Ensure vessels have correct fit-out specifications (e.g. winches, GPS, satellite, hiab, sufficient deck space, water supplies (fresh and/or salt), accommodation)	❑
	Confirm consumables (including personal protective equipment) have been purchased and will be delivered to required location	❑
	Liaise with NATA-accredited laboratories to confirm availability, limits of detection, sampling holding times, transportation, obtain sample analysis quotes and arrange provision of appropriate sample containers, Chain of Custody (CoC) forms and suitable storage options for all samples. Make arrangements for couriers (if necessary)	❑

Responsibility	Task	Complete
	Confirm specialist equipment requirements and availability (including redundancy)	❑
	Check GPS units and digital cameras are working and that sufficient spare batteries and memory cards are available	❑
	Confirm sufficient equipment to allow integration of survey software and navigational systems (e.g. GPS, additional equipment and adaptors), and additional GPS units prepared	❑
	Confirm GPS survey positions (where available) have been QA/QC checked and pre-loaded into navigation software/positioning system	❑
	Check field laptops, ensuring they have batteries (including spares), power cable, and are functional	❑
	Check if a first aid kit or specialist PPE is required	❑
	Confirm arrangements for freight to mobilisation port is in place	❑

18 Permits and Access Requirements

Permit and access requirements apply to Marine Parks, Marine Protected Areas, restricted heritage areas, operational areas of industrial sites, defence locations and managed fisheries. Table 18-1 lists relevant protected areas within the ZPI and the jurisdictional authority to be contacted to obtain the necessary permit or access permission.

The OSMP Services Provider is responsible for submitting access and permit applications to all relevant Jurisdictional Authorities to conduct monitoring for OMPs and SMPs.

Table 18-1: Permits required in ZPI

Receptor	Location	Jurisdictional Authority	Relevant information on permits
State/Territory Marine Protected Areas; Fish Habitat Protection Areas	• Lalang-garram / Camden Sound • North Kimberley • Rowley Shoals • Eighty Mile Beach • Montebello Islands • Barrow Island • Muiron Islands • Ningaloo • Shark Bay	State/Territory government department with jurisdiction for parks and wildlife State/Territory government department with jurisdiction for fisheries	No specific permitting requirements exist for monitoring in WA marine protected areas, but additional information is available at - https://www.dpaw.wa.gov.au/management/marine , https://www.dpaw.wa.gov.au/management/marine/marine-parks-and-reserves and https://www.fish.wa.gov.au/Sustainability-and-Environment/Aquatic-Biodiversity/Marine-Protected-Areas/Pages/default.aspx No specific permitting requirements exist for monitoring in NT fish protection areas, but zones are described here - https://nt.gov.au/marine/recreational-fishing/when-and-where-to-fish/reef-fish-protection-areas
Ramsar wetland	• Browse Island • Ashmore Reef Marine Park • Cobourg Peninsula Ramsar site • Dales Ramsar site • Hosnies Spring Ramsar site	Commonwealth Department of Environment and Energy	Additional information on Ramsar wetlands and how they are protected as a matter of national environmental significance under the EPBC Act is available at https://www.environment.gov.au/epbc/what-is-protected/wetlands
Australian (Commonwealth) Marine Parks	• Oceanic Shoals Marine Park • Arafura Marine Park • Arnhem Marine Park • Agro-Rowley Terrace Marine Park • Kimberley Marine Park	Parks Australia	Permit and licence application information for Marine Protected Areas (including monitoring) can be found at - https://onlineservices.environment.gov.au/parks/australian-marine-parks and https://onlineservices.environment.gov.au/parks/australian-marine-parks/permits Additional information on permitting requirements in Australian Marine Parks can be obtained through Parks Australia via email marineparks@environment.gov.au or phone 1800 069 352

Receptor	Location	Jurisdictional Authority	Relevant information on permits
	• Cartier Island Marine Park • Gascoyne Marine Park • Mermaid Reef Marine Park • Eighty Mile Beach Marine Park		Information on permits to access biological resources in Commonwealth areas can be found at - http://www.environment.gov.au/topics/science-and-research/australias-biological-resources/access-biological-resources-commonwealth
State/Territory Managed Fisheries	WA • Mackerel Fishery • Northern Demersal Scalefish Fishery • Northern Shark Fishery • Pearl Oyster Fisheries • West Coast Deep Sea Crustacean Fishery • Specimen Shell Managed Fishery • Marine Aquarium Fish Managed Fishery • Kimberley Gillnet and Barramundi Managed Fishery • WA Sea Cucumber Fishery • North Coast Prawn Fishery NT • Barramundi Fishery	State/Territory government department with jurisdiction for fisheries	No specific permitting requirements exist for WA Fisheries, but additional information is available at – https://www.fish.wa.gov.au/Fishing-and-Aquaculture/Pages/default.aspx No specific permitting requirements exist for NT Fisheries, but additional information is available at –- https://dpir.nt.gov.au/fisheries

Receptor	Location	Jurisdictional Authority	Relevant information on permits
	• Coastal Line Fishery • Coastal Net Fishery • Spanish Mackerel Fishery • Demersal Fishery • Offshore Net and Line Fishery • Mud Crab Fishery • Aquarium Fish/Display Fishery • Trepang Fishery • Timor Reef Fishery • Fishing Tour Operator Fishery • Pearl Oyster Fishery • Bait Net Fishery		
Commonwealth Managed Fisheries	• Western Tuna and Billfish Fishery • Western Skipjack Fishery • Southern Bluefin Tuna Fishery • North West Slope Trawl Fishery • Northern Prawn Fishery • Western Deepwater Trawl Fishery	Australian Fishing Management Authority	Commonwealth Managed Fisheries (scientific permit for research/monitoring in an Australian Fishing Zone) https://www.afma.gov.au/fisheries-services/fishing-rights-permits

Receptor	Location	Jurisdictional Authority	Relevant information on permits
Indigenous Cultural Heritage	Sites are located throughout EMBA	State/Territory government department with jurisdiction for indigenous heritage	Entry access permits to Aboriginal Lands in WA - https://www.dplh.wa.gov.au/entrypermits Aboriginal heritage sites in WA - https://www.wa.gov.au/service/aboriginal-affairs/aboriginal-cultural-heritage/search-aboriginal-sites-or-heritage-places and https://www.dplh.wa.gov.au/information-and-services/aboriginal-heritage Indigenous heritage information in NT - https://nt.gov.au/leisure/arts-culture-heritage/visit-a-cultural-or-heritage-site/indigenous-heritage-information
Defence/restricted military area	North Australian Exercise Area (NAXA) offshore training area and the Browse Basin and Northern Carnarvon Basin offshore air-to-air weapons ranges (maritime military zones)	Department of Defence	Unexploded Ordanances (mapping information)– https://www.defence.gov.au/UXO/default.asp Maritime military firing practice and exercise areas - http://www.hydro.gov.au/factsheets/WFS_Firing_Practice_And_Exercise_Areas.pdf
Industry (e.g. operational zone of offshore oil or gas platform)	• Montara FPSO Facility (Jadestone) • Ichthys Facility (INPEX)	Operating company	Safety zones (up to 500 m from outer edge of well or equipment) – https://www.nopsema.gov.au/safety/safety-zones/
Shipwrecks	• A number of unnamed Indonesian fishing vessels and the *Sinar Bonerate* are known to be in the vicinity of Ashmore Reef and Cartier Island • The *Unident* and *Selina* are known to be in the	State/Territory or Commonwealth government department with jurisdiction for maritime cultural heritage/archaeology	Underwater heritage protected zones (Commonwealth) - www.environment.gov.au/heritage/underwater-heritage/protected-zones Commonwealth permit application - https://dmzapp17p.ris.environment.gov.au/shipwreck/public/forms/disturbanceAndZone.do?mode=add NT protected zones - https://nt.gov.au/leisure/arts-culture-heritage/visit-a-cultural-or-heritage-site/maritime-heritage

Receptor	Location	Jurisdictional Authority	Relevant information on permits
	vicinity of Browse Island		

19 Use of Data in Response Decision Making

The OSMP Services Provider is responsible for the collection of data by field teams, which shall be QA/QC checked by the Field Team Lead in accordance to the requirements listed in the finalised OMPs and SMPs (where applicable). The Team Lead will be responsible for communicating data back to the OSMP Management Team (led by the OSMP Services Provider) via field reporting forms, debriefs and reports. Laboratory analysis reports should also be directed to the OSMP Management Team.

The OSMP Management Team is responsible for the interpretation and analysis of data. OMP data should be rapidly analysed so that it may be used to inform planning and decisions in the current and/or next operating period. SMP data is designed to be more scientifically robust and long-term in nature and is not relied upon by the IMT for decision making. Therefore, SMP data will be analysed more thoroughly by the OSMP Management Team.

Once data is analysed, it will be provided to the IMT Situation Unit Lead, who will then distribute the data from each monitoring component to the relevant IMT Unit and/or Section. Table 19-1 provides guidance on the type of data generated from each OMP, which IMT Section/Unit requires the data and how the data may be used during a response. All SMP data received during a response will be received by the IMT Situation Unit Lead and IMT Environment Unit Lead simultaneously.

Analysed data would then be incorporated into the Common Operating Picture (managed by the Situation Unit Lead) and used by the Environment Unit Lead during development of the operational SIMA, which would then be included in the IAP for the current or next operating period.

As ultimately responsible for the IAPs, the Planning Section Chief will be required to determine if the response options can be continued, escalated, terminated, or if controls need to be put in place to manage impacts of the response activities. These decisions will be communicated to the broader IMT during regular situation debriefs.

Table 19-1: Data generated from each OMP and how this may be used by IMT in decision making

Operational Monitoring Plan	Data generated[9]	IMT Section requiring data	How data may be used by IMT
Hydrocarbon properties and weathering behaviour at sea	Hydrocarbon physical characteristics (e.g. viscosity, asphaltene content, fingerprinting, weathering ratios of hydrocarbon chains)	Planning Section to aid in response option selection / modification	Changes to the hydrocarbon properties will affect the window of opportunity for particular responses and the associated logistical requirements of these responses, such as use of chemical dispersants, recovery and pumping equipment suitability, hydrocarbon storage and hydrocarbon disposal requirements
Pre-emptive assessment of sensitive receptors at risk (desktop only)	Location of sensitive receptors in relation to known spill extent (derived initially from spill modelling and any surveillance data)	Planning Section to aid in IAP development	Confirm initial protection priorities in ICS 232 form (or similar); understand extent of baseline data; provide an understanding of stakeholders to be contacted to obtain local knowledge and validate current information
Shoreline clean-up assessment technique (SCAT)	Assessment of shoreline character; assessment of shoreline oiling; recommendations for response activities; post-treatment surveys	Planning Section to aid in IAP development and response option selection / modification	Confirmation of shoreline character, habitats and fauna present which may influence selection of response tactics (e.g. no mechanical recovery if turtles are known to be nesting); Oil removal rate for a shoreline sector will help determine effectiveness of relevant tactics (e.g. shoreline protection and/or clean-up operations); SCAT teams provide ground truthing of sites that are not possible via satellite imagery, therefore the IMT can rely on recommendations SCAT teams (e.g. flagging access issues, suitable tactics, likely resourcing needs)
Surface chemical dispersant effectiveness and fate	Visual observations of dispersant efficacy; concentration of hydrocarbons in water column (see also water quality assessment);	Environment Unit for use in operational SIMA; Planning Section to aid in IAP development; Operations Section to confirm dispersant effectiveness for decision making purposes in current operations period.	Determine the effectiveness of dispersant in removing oil from sea surface and how dispersed oil is being distributed through the water column. This information can be used in SIMA to help decide if dispersants are being effective at treating high value receptors (SIMA to evaluate any trade-offs between receptors)

[9] Summary only. For additional detail, please refer to individual OMPs. Also note data outputs will be reliant on finalised monitoring design.

Operational Monitoring Plan	Data generated[9]	IMT Section requiring data	How data may be used by IMT
Subsea dispersant injection	Visual observations of dispersant efficacy; concentration of hydrocarbons in water column (see also water quality assessment)	Source Control Branch to aid decision making for other source control operations; Environment Unit for use in operational SIMA; Planning Section to aid in IAP development.	Determine efficacy of subsea dispersant in treating oil to help understand if injection should continue or be modified; understand the nature and extent of the subsea plume; and provide an initial assessment of potential ecological effects. This information can be used in SIMA to help decide if dispersants are being effective at treating high value receptors (SIMA to evaluate any trade-offs between receptors) and also if subsea dispersants are effectively reducing volatile organic compound (VOC) levels so that operations are within lower explosive limits (LEL)
Hydrocarbon spill modelling	Forecasting and movement of spill; simulations of spill with different response options applied (e.g. dispersants)		Trajectory will help understand movement of spill and identify receptors that may be at risk of exposure to help direct resources for best effect; modelling will help predict hydrocarbon concentrations, which can be verified when used in conjunction with water quality monitoring and surveillance tactics; simulations with different response options could help the IMT/EMT predict the outcome of applying different response options in different locations (e.g. dispersants in deeper waters and containment and recovery in nearshore waters)
Water quality assessment	Distribution of oil in water column and change in hydrocarbon concentrations (e.g. total recoverable hydrocarbons, BETEXN, PAH), physio-chemical parameters and dispersant detection	Situation Unit Lead to validate surveillance and modelling data; Planning Section for use in IAP	Confirm spatial extent of spill within the water column and verify spill modelling and surveillance data; extent of spill can in turn influence location of other OMP and SMP monitoring components and sites. Data can also influence ongoing use of dispersant through ongoing operational SIMA.
Sediment quality assessment	Distribution of oil in sediment and change in hydrocarbon concentrations (e.g. Total recoverable hydrocarbons, BETEXN, PAH)	Situation Unit Lead to validate surveillance and modelling data; Planning Section for use in IAP	Confirm spatial extent of spill; extent of spill can in turn influence location of other OMP and SMP monitoring components and sites

Operational Monitoring Plan	Data generated[9]	IMT Section requiring data	How data may be used by IMT
Marine fauna assessment • Reptiles • Cetaceans (observational only) • Dugongs • Seabirds and shorebirds • Fish	Rapid assessment of presence and distribution of marine fauna; evaluate impact of spill and response activities on fauna	Planning Section for use in IAP; Oiled Wildlife Unit/Division to help in developing Wildlife Response Sub-plan	Understanding of species, populations and geographical locations at greatest risk from spill impacts. IMT can use this information to help qualify locations with highest level of protection priority (e.g. dugong nursery area is at risk of high contact therefore dispersant use closest to spill source may be a preferred option); understanding the impacts of spill response activities can help IMT to modify or terminate activities if they are assessed as creating more harm than the oil alone (e.g. large shoreline clean-up teams and staging areas may disturb shorebird nesting resulting in adults abandoning chicks)
Air quality modelling (responder health and safety)	Modelled outputs of airborne hydrocarbons, gases and chemicals and their predicted distribution	Operations Section to help determine safe zones in close vicinity of spill; Planning Section for use in IAP	Determine safe distances from spill source for response personnel; determine the presence and persistence of volatile organic compounds to know if response areas are safe for personnel

20 Impacts from Response Activities

Implementation of spill response options have the potential of introducing impacts to receptors, as described in detail in the relevant EP. Operational monitoring is required to provide the IMT with information on any impacts detected from response activities, so that the IMT can make informed decisions regarding whether activities should commence, continue, continue with variations or cease. It should be noted that response activities may result in impacts where there is no oil (e.g. shoreline clean-up staging sites, vessel movements) and this should also be considered in the selection of monitoring sites.

Table 20-1 lists potential impacts from the relevant response options. It also outlines the OMPs and SMPs that are relevant for detecting potential impacts from the listed response options.

Table 20-1: Potential impacts from response activities and relevant monitoring plan

Potential impact	Response activity	Relevant OMP/SMP for monitoring impacts
Physical presence	• Source control • Surface dispersant application • Containment and recovery • Shoreline protection and deflection • Shoreline clean-up • Oiled wildlife response	• OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Marine mega-fauna assessment – Reptiles • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs • SMP: Benthic habitat assessment • SMP: Social impact assessment
Physical disturbance (ground and seabed)	• Source control • Shoreline protection and deflection • Shoreline clean-up • Oiled wildlife response	• OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment – Seabirds and shorebirds • OMP: Marine fauna assessment – Dugongs • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Marine mega-fauna assessment – Reptiles • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs
Water quality decline	• Source control • Surface dispersant application	• OMP: Water quality assessment • OMP: Sediment quality assessment • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment

Potential impact	Response activity	Relevant OMP/SMP for monitoring impacts
	• Containment and recovery • Shoreline protection and deflection • Shoreline clean-up • Oiled wildlife response	• SMP: Intertidal and coastal habitat assessment • SMP: Benthic habitat assessment
Sediment quality decline	• Source control • Surface dispersant application • Containment and recovery • Shoreline protection and deflection • Shoreline clean-up • Oiled wildlife response	• OMP: Water quality assessment • OMP: Sediment quality assessment • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Intertidal and coastal habitat assessment • SMP: Benthic habitat assessment
Lighting impacts to fauna	• Source control • Shoreline clean-up	• OMP: Marine fauna assessment – Seabirds and shorebirds • OMP: Marine fauna assessment – Reptiles • SMP: Seabirds and shorebirds • SMP: Marine fauna assessment – Reptiles
Noise impacts to fauna	• Source control • Monitoring, evaluation and surveillance • Surface dispersant application • Containment and recovery • Shoreline protection and deflection • Shoreline clean-up • Oiled wildlife response	• OMP: Marine fauna assessment – Seabirds and shorebirds • OMP: Marine fauna assessment – Reptiles • SMP: Seabirds and shorebirds • SMP: Marine fauna assessment – Reptiles • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs
Vessel strike to fauna	• Source control • Monitoring, evaluation and surveillance (vessel) • Surface dispersant application (vessel) • Containment and recovery • Shoreline protection and deflection	• OMP: Marine fauna assessment – Reptiles • OMP: Marine fauna assessment – Dugongs • OMP: Marine fauna assessment – Cetaceans • OMP: Marine fauna assessment – Fish • SMP: Seabirds and shorebirds • SMP: Marine fauna assessment – Reptiles • SMP: Marine mega-fauna assessment – Whale sharks, cetaceans and dugongs

Potential impact	Response activity	Relevant OMP/SMP for monitoring impacts
	• Oiled wildlife response	

21 Data Management

The following reporting to Shell should be undertaken:

- Operational monitoring reports will be provided to the IMT as soon as possible to maintain situational awareness and advise response option requirements.
- Daily field survey reports detailing activities undertaken, HSE performance and survey progress.
- All sampling data and data interpretation provided in spatial data format (e.g. shape file) and spreadsheets as appropriate.
- Technical survey reports detailing whether the termination criteria have been reached, including recommendations on the requirements of future monitoring. Where possible, reports will investigate if monitoring results indicate that the concentrations of hydrocarbons/chemicals are equal to or below reference/baseline data or benchmark levels. Reporting should also include the spatial assessment of the distribution of hydrocarbons/chemicals over time. Where possible, reporting should also include an assessment of the performance of the response options against the environmental performance objectives in the relevant regulatory environmental permits or other relevant environmental management documentation.
- Scientific monitoring data and reports shall be reviewed by the OSMP Implementation Lead prior to being submitted to Shell.
- Draft technical survey reports for SMPs will be peer reviewed by an expert panel to be approved by the Commonwealth Department of Agriculture, Water and the Environment (DoAWE) and/or Department of Biodiversity Conservation and Attractions (DBCA) (depending on jurisdiction), as appropriate. Comments from peer reviews will be taken into account when finalising SMP reports.
- Any OMP's implemented during a response will have simple reporting requirements. Reports will be sent through to the IMT on a daily basis (or more frequently as requested by the IMT). OMP reporting will not be peer reviewed. No final reporting is required for OMPs. However, information from OMP may feed into certain SMP draft and final reports as appropriate.

22 Quality Assurance and Quality Control

Robust QA/QC measures are required to instil confidence in the operational and particularly the scientific monitoring programs. The requirements for QA/QC for Shell's monitoring plans include:

- Use of chain of custody forms, procedures for sampling, data collection templates, data management, statistical analysis and interpretation;
- Adhering to handling, storage, holding times and transport requirements in accordance with the finalised monitoring design;
- Collection and analyses of QA/QC samples in accordance with the finalised monitoring design;
- Archiving of samples where applicable;
- Maintenance and calibrations of systems and equipment;
- Certifications of competency for personnel and required training;
- Maintenance of metadata; and
- Data backup, storage and archiving.

23 Communication Protocol

Communication protocols between Shell and its OSMP Services Provider with respect to delivery of the OMPs and SMPs (during both preparedness and implementation) are intentionally defined to ensure clear and consistent information is provided in both directions. This clear and consistent messaging is critical in what would be a highly dynamic and evolving situation.

The following communication protocols must be observed:

- Communication between Shell and its OSMP Services Provider during the preparedness phase (pre-spill) and during activation (prior to deployment) will be between the Environment Unit Lead (EUL) (or delegate) and the OSMP Services Provider Lead respectively.
- During implementation (post deployment), primary communication occurs via two pathways:
    - EUL and the OSMP Services Provider Lead for contractual, management, scientific and general direction matters; and
    - Shell On-Scene Commander and the OSMP Services Provider's Field Operations Manager for on-site matters.
- All OSMP operational decisions should be logged in an OSMP decision log by key personnel.
- All OSMP tasks, actions and requirements should be documented in an IAP during the response phase of the spill.
- The Shell EUL will keep the Operations Section Chief, Logistics Section Chief and Planning Section Chief briefed of the OSMP status as required.
- All correspondence (copies of emails and records of phone calls) between Shell and the OSMP Services Provider during a response should be recorded and kept on file.

- All communication received by OSMP Services Provider not in line with these protocols should be reported to the EUL who will seek guidance on the accuracy of the information received.
- Unless related to safety (e.g. evacuation), any direction or instruction received by the OSMP Services Provider outside of these protocols should be confirmed via the Shell EUL or On-Scene Commander prior to implementation.

During the post-response phase all communications shall be between the Shell Environment Advisor and the OSMP Services Provider OSMP Implementation Lead.

24 Stakeholder communications protocol

Results of OMPs and SMPs will be discussed with relevant stakeholders. Information will be shared with regulatory agencies/authorities as required and inputs received from stakeholders will be evaluated and where practicable, will be used to refine the ongoing spill response and/or ongoing operational and/or scientific monitoring.

Shell's IMT Public Information Officer and/or Liaison Officer (initially be will same individual) will be the focal point for external engagement during the response operation.

Stakeholder communications post-response will be managed by Shell's External (Government) Relations Team.

25 Stand Down Process

Monitoring for each component will continue until termination criteria for individual components are reached. Typically, OMPs will terminate when agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response or a relevant SMP has been activated. SMPs will continue after the spill response has been terminated and until such time as their termination criteria are also reached. A list of criteria is provided in Appendix A.

After OMPs are terminated, the OMP monitoring teams will be advised to stand down. Following this stage, the OSMP Services Provider will run a lessons-learnt meeting between Shell, all monitoring providers and other relevant stakeholders. It is the responsibility of Shell to ensure that lessons learnt are communicated to the relevant stakeholder groups. The lessons discussed should include both positive actions to be reinforced and lessons for actions that could be improved in future standby or response campaigns.

26 References

APPEA (2020a). Joint Industry Operational and Scientific Monitoring Plan Framework. Report prepared by BlueSands Environmental for APPEA Marine and Environmental Science Working Group.

APPEA (2020b). Scientific Monitoring Plan: Intertidal and Coastal Habitat Assessment. Prepared by BlueSands Environmental for APPEA Marine and Environmental Science Working Group.

APPEA (2020c). Scientific Monitoring Plan: Benthic Habitat Assessment. Prepared by BlueSands Environmental for APPEA Marine and Environmental Science Working Group.

BMT Australia Pty Ltd (2019). Oil Spill Operational and Scientific Monitoring Plan (OSMP) Response and Implementation Capability - Scope of Work. Report prepared for Shell Australia Pty Ltd.

Department of Environment and Conservation (DEC) 2007. Rowley Shoals Marine Park Management Plan (2007) 2007-2017, Management Plan No. 56. DEC, Perth, WA

Department of Parks and Wildlife (DPaW) 2014. Eighty Mile Beach Marine Park Management Plan 2014-2024, Management Plan No. 80, DPaW, Perth, WA

DPaW. 2016. North Kimberley Marine Park Joint management plan 2016. Uunguu, Balanggarra, Miriuwung Gajerrong, and Wilinggin management areas, No. 89. DPaW, Perth, WA

DPaW. 2013. Lalang-garram / Camden Sound Marine Park management plan No. 73 2013–2023, DPaW, Perth, WA

Kirby, M.F., Brant, J., Moore, J., Lincoln, S., (eds.) 2018. PREMIAM – Pollution Response in Emergencies – Marine Impact Assessment and Monitoring: Post-incident monitoring guidelines. Second Edition. Science Series Technical Report. Cefas, Lowestoft.

27 Abbreviations/Acronyms and Definitions

Abbreviation/Acronym	Definition
ALA	Atlas of Living Australia
AMOSC	Australian Marine Oil Spill Centre
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
BIA	Biologically Important Areas
CoC	Chain of Custody
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DBCA	Department of Biodiversity Conservation and Attractions
DoAWE	Department of Agriculture, Water and the Environment
DoT	Western Australia Department of Transport
IMT Leader	Incident Management Team Leader. Equivalent to an Incident Controller or Incident Commander.
EP	Environment Plan
EUL	Environment Unit Lead
FLNG	Floating Liquid Natural Gas
FPSO/ FSO	Floating Production Storage and Offloading /Floating Storage and Offloading
GIS	Geographic information system
GPS	Geographic positioning system
HSE	Health, Safety and Environment
IAP	Incident Action Plan
ICS	Incident Command System
IMT	Incident Management Team
IMT (W)	Incident Management Team (West)
KEF	Key Ecological Feature
OMP	Operational Monitoring Plan
OSM	Operational and Scientific Monitoring
OSMP	Operational and Scientific Monitoring Plan
OSRA	Oil Spill Response Atlas
OPEP	Oil Pollution Emergency Plan
OPGGS (E)	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations
OSRL	Oil Spill Response Limited
OSTM	Oil spill trajectory modelling
OWR	Oiled wildlife response
PPE	Personal protective equipment

Abbreviation/Acronym	Definition
QA/QC	Quality assurance and quality control
SCAT	Shoreline Clean-up Assessment Team
Shell	Shell Australia Pty Ltd
SIMA	Spill Impact Mitigation Assessment
SMP	Scientific Monitoring Plan
SSDI	Subsea dispersant injection
STASCo	Shell Tankers and Shipping Company (the group activates mobilisation of the GRSN)
SWIS	Subsea Well Intervention Services
UAV	Unmanned Aerial Vehicle
ZPI	Zone of Potential Impact

Appendix A: Initiation and Termination Criteria

Table A1: Operational Monitoring Plan Initiation and Termination Criteria

Operational Monitoring Plan	Initiation criteria	Termination criteria
Hydrocarbon properties and weathering behaviour at sea	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred	• The IMT (W) Leader (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT (W) Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • This OMP is no longer contributing to or influencing spill response decision-making; or • Relevant scientific monitoring components initiation criteria have been triggered.
Pre-emptive assessment of sensitive receptors at risk (desktop only)	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • A probable hydrocarbon impact (or impact of dispersed hydrocarbon) on a resource, habitat or shoreline is anticipated on the basis of trajectory modelling or other assessment of the incident; or • Damage to a natural resource or sensitive receptor is possible as a result of that impact.	• Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The assessment of sensitive receptors that were identified as being potentially impacted/contact by the hydrocarbon spill are completed.
Shoreline clean-up assessment technique (SCAT)	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and	• This OMP will not result in a change to the scale or location of active response options; or

Operational Monitoring Plan	Initiation criteria	Termination criteria
	• Analysis of data from hydrocarbon spill modelling, monitoring, evaluation and/or surveillance predicts an exposure of hydrocarbons to shoreline habitat; or • Relevant response activities are being undertaken.	• Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • Continuation of monitoring of this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation criteria have been triggered.
Chemical dispersant effectiveness and fate (surface and/or subsea)	• Application of dispersant has been selected as a response option.	• Dispersant operations have ceased; and • Measurements indicate that dispersed hydrocarbons are diluted to below levels of detection or below levels of concern; or • Monitoring data indicates that dispersant operations are unlikely to cause harm; or • Continuation of monitoring of this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation criteria have been triggered.
Hydrocarbon spill modelling	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred.	• Hydrocarbon spill modelling is no longer beneficial to predict spill trajectory and concentrations; or • Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response.
Water quality assessment	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred.	• The IMT (W) Leader (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT (W) Leader (or delegate) has advised that agreement has been reached with the Jurisdictional

Operational Monitoring Plan	Initiation criteria	Termination criteria
		Authority relevant to the spill to terminate the response; or • The spill is or is likely to be below visible criteria for surface oil (0.5g/m^2), and low thresholds for entrained (10ppb) and dissolved (6ppb) oil concentrations; or • The Monitoring Coordinator (or delegate) considers that continuation of monitoring under this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.
Sediment quality assessment	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Modelling and/or analysis of data from MES predicts an exposure of hydrocarbons to marine and/or coastal sediment.	• The IMT (W) Leader (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT (W) Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The Monitoring Coordinator (or delegate) considers that continuation of monitoring under this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.
Marine fauna assessment • Reptiles	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and	• The IMT (W) Leader (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or

Operational Monitoring Plan	Initiation criteria	Termination criteria
• Cetaceans (observational only) • Dugongs • Seabirds and shorebirds • Fish	• Modelling and/or analysis of data from MES predicts, or has reported, an exposure of hydrocarbons to known sensitive fauna habitat.	• The IMT (W) Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The Monitoring Coordinator (or delegate) considers that continuation of monitoring under this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.
Air quality modelling (responder health and safety)	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Response operations that may pose a risk to the air quality of response personnel and/or public will occur.	• Completion of the gas, vapour and hydrocarbon discharge, containment and recovery, dispersant operations and shoreline clean-up operations; and • Continuing hazardous and noxious plume detection modelling has a low probability of contributing or influencing spill response decision making.

Table A2: Scientific Monitoring Plan Initiation and Termination Criteria

Scientific Monitoring Plan	Initiation criteria	Termination criteria
Water quality impact assessment	• Spill modelling (see OMP: Hydrocarbon spill modelling) has indicated that contact on a sensitive resource is possible and it is considered likely that ongoing (scientific) monitoring of impacts will be required, supported by scientifically rigorous water quality monitoring; or	• The relevant Jurisdictional Authority/ Government Agency has been consulted and has agreed that water quality monitoring can be ceased; and • Hydrocarbon concentrations in marine waters are below benchmark levels which can be defined as:

Scientific Monitoring Plan	Initiation criteria	Termination criteria
	• OMP: Water quality assessment has identified hydrocarbon and/or dispersant concentrations exceed accepted guidelines and benchmarks; or • Chemical dispersants have been applied as part of the spill response program.	o Toxicant default guideline values for water quality in aquatic ecosystems[10]; or o the relevant regulatory site-specific trigger level (where these exist); or o below baseline levels; or o control site values (whichever is applicable).
Sediment quality impact assessment	• OMP: Sediment quality assessment has identified hydrocarbon concentrations exceed accepted guidelines and benchmarks; or • Spill modelling has indicated that an impact on a sensitive resource that is closely linked to marine sediments is possible, and it is considered likely that ongoing (scientific) monitoring of a biological parameter will be required that supported by scientifically rigorous sediment quality monitoring.	• The relevant Jurisdictional Authority/ Government Agency has been consulted and has agreed that water quality monitoring can be ceased; and • All hydrocarbon concentrations in sediments are below benchmark/guideline levels, which can be defined as: o Toxicant default guideline values for sediment quality[11]; or o the relevant regulatory site-specific trigger level (where these exist); or o below baseline levels; or o control site values (whichever is applicable).

[10] Water Quality Australia (2019) Toxicant default guideline values for water quality in aquatic ecosystems. Available from https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants#retrieval-of-default-guideline-values-for-fresh-and-marine-water, Australian and New Zealand Guidelines for Fresh and Marine Water Quality

[11] Water Quality Australia (2019) Toxicant default guideline values for sediment quality. Available from https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/sediment-quality-toxicants, Australian and New Zealand Guidelines for Fresh and Marine Water Quality

Scientific Monitoring Plan	Initiation criteria	Termination criteria
Intertidal and coastal habitat assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure of coastal or intertidal habitats or communities to hydrocarbons.	• Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor; and • There has been no impact to coastal and intertidal habitats and associated biological communities (confirmation that habitats and species were not exposed to hydrocarbons); or • Measured parameters of coastal and intertidal habitats and associated biological communities impacted by hydrocarbons spills have returned to within the expected natural dynamics of baseline state (taking into account natural variability) and/or control sites.
Seabirds and shorebirds	• Spill trajectory modelling, surveillance or monitoring predicts contact is possible to seabirds and/or shorebird populations or any of their habitats of importance for breeding, nesting or foraging; or • Monitoring (OMP: Marine fauna assessment seabirds and shorebirds) has identified contact or an impact to seabirds and/ or shorebird populations as a result of the hydrocarbon spill; or • There are reports or scientific evidence of oiled seabirds and/or shorebird populations.	• Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor; and • There has been no impact on seabirds and/or shorebirds or their key biological activities; or • The extent of damage and rate of recovery of key seabird and/or shorebird behaviour and breeding activities has been quantified; and • Measured parameters have returned to baseline conditions (taking into account natural variability) in terms of breeding population (for seabirds) or counts (for shorebirds) and impacts on species and taxa are no longer detectable, with regard to control sites; or • Oil pollution effects/impacts on critical species and taxa are no longer detectable.

Scientific Monitoring Plan	Initiation criteria	Termination criteria
Marine mega-fauna assessment o reptiles	<u>Reptiles</u> • Spill trajectory modelling, surveillance or monitoring predicts contact is possible at important habitat locations for turtles (foraging and rookery), sea snakes and/or estuarine crocodiles; or • Monitoring (OMP: Marine fauna assessment - reptiles) has identified contact or an impact to reptiles (dead, oiled, or injured reptiles) within area affected by hydrocarbons	<u>Reptiles</u> • There has been no impact on reptiles or their key biological activities from the hydrocarbon spill; or • The extent of damage of impacted reptiles has been quantified; and • Measured parameters of turtle (and sea snakes and/or estuarine crocodiles, if determined appropriate) communities impacted by hydrocarbon spill have returned to within the expected natural dynamics of baseline state and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Marine mega-fauna assessment o Whale sharks, dugongs and cetaceans	<u>Whale sharks, dugongs and cetaceans</u> • Spill trajectory modelling, surveillance or monitoring predicts contact is possible at important habitat locations for whale sharks, dugongs and/or cetaceans (foraging, migratory routes, breeding locations; or • Monitoring (OMP: Marine fauna assessment - whale sharks, dugongs and/or cetaceans) has identified contact or an impact to whale sharks, dugongs and/or cetaceans within area affected by hydrocarbons	<u>Whale sharks, dugongs and cetaceans</u> • There has been no impact on whale sharks, dugongs and/or cetaceans or their key biological activities from the hydrocarbon spill; or • The extent of damage of impacted whale sharks, dugongs and/or cetaceans has been quantified; and • Measured parameters of whale sharks, dugongs and/or cetaceans, if determined appropriate) communities impacted by hydrocarbon spill have returned to within the expected natural dynamics of baseline state and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Benthic habitat assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure of benthic habitats or communities to hydrocarbons.	• There has been no impact to benthic habitats and associated biological communities (confirmation that benthic habitats were not exposed to hydrocarbons); or

Scientific Monitoring Plan	Initiation criteria	Termination criteria
		• Measured parameters of benthic habitats and associated biological communities impacted by hydrocarbons spills have returned to within the expected natural dynamics of baseline state (taking into account natural variability) and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Marine fish and elasmobranch assemblages assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure to fish areas or fish habitat.	• There has been no impact on fish and fish population structure; or • Measured parameters of fish, fish habitat, and marine fisheries locations impacted by hydrocarbon spills have returned to within the expected natural dynamics of baseline state and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Fisheries impact assessment	• Spill trajectory modelling, surveillance or monitoring predicts contact is possible to commercial, recreational, traditional species and or aquaculture species; or • Advice has been provided to government to restrict, ban or close a fishery; or • Declarations of intent by commercial fisheries or government agencies to seek compensation for alleged or possible damage.	• Agreement has been reached with the relevant Jurisdictional Authorities to cease monitoring of fisheries; and • Contamination in the edible portion or in the stomach/intestinal contents attributable to the spill is no longer detected; or • No differences are detected in commercial, recreational or aquaculture fisheries from control and impact sites; or

Scientific Monitoring Plan	Initiation criteria	Termination criteria
		• The physiological and biochemical parameters in the studied species have returned to baseline levels; or • Evidence that catch rates, species composition, community abundance, distribution and age structure of commercial fisheries and their by-catches have returned to baseline levels.
Heritage features assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms hydrocarbon exposure to known shipwreck sites.	• There has been no detectable impact to the integrity of the shipwreck; or • Measured parameters of shipwreck sites impacted by hydrocarbon spills have returned to within the expected natural dynamics of baseline state and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Social impact assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms hydrocarbon exposure to socio-economic features.	• There has been no detectable impact to known socio-economic features; or • Measured parameters of socio-economic features impacted by hydrocarbon spills have returned to within the expected natural dynamics of baseline state and/or control sites; or • This SMP has been replaced by more detailed investigations; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring these receptor.

Appendix B: Baseline data sources

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
Water and sediment quality	Hydrocarbon abundance and distribution (including natural seeps) in the vicinity of the Prelude/Ichthys fields of the Browse Basin	CSIRO/AIMS (Link to report)	East Browse Basin
	McAlpine, KW, Sim, CB, Masini, RJ and Daly, T 2010, Baseline petroleum hydrocarbon content of marine water, shoreline sediment and intertidal biota at selected sites in the Kimberley bioregion, Western Australia. Marine Technical Report Series No. MTR3, Office of the Environmental Protection Authority (OEPA), Perth, Western Australia.	WA EPA (Link to report)	Kimberley bioregion (16 shoreline sites, mainland and islands, spanning 340 km)
	Browse Island habitat descriptions – Draft EIS Technical Appendices - Appendix 4 Ichthys Gas Field Development Project Studies of the Offshore Marine Environment (also described in Ecological studies of the Bonaparte Archipelago and Browse Basin – Cetacean survey – additional detail on a 2006 aerial survey in contained in this report)	INPEX (Link to report)	Browse Basin Region (Ichthys Field to Echuca Shoal)
	Montara Reports 'Control site water quality data' (Operational Monitoring Study O2 – Monitoring of Oil Character, Fate and Effects, Report 02 Water Quality and Monitoring of Oil Character, Fate and Effects, Report 03 Dispersant Treated Oil Distribution)	PTTEP (Link to report)	Broome to Darwin (Mainland) Islands – Browse, Ashmore, Cartier, Hibernia Reef
Shorelines and intertidal habitats	Browse Island habitat descriptions – Draft EIS Technical Appendices - Appendix 4 Ichthys Gas Field Development Project Studies of the Offshore Marine Environment	INPEX (Link to report)	Browse Island

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
	Montara Reports: Shoreline Ecological Assessment Aerial and Ground Surveys 7-19 November 2009 (Kimberley Coast)	PTTEP (Link to report)	Kimberley Coast
	Shoreline Assessment Ground Survey: An operational component of the Monitoring Plan for the Montara Well Release Timor Sea (Ashmore, Cartier and Hibernia Islands).	PTTEP (Link to report)	Ashmore, Cartier and Hibernia Islands
Benthic communities and fish assemblages	Scott Reef Research Project - Long-term monitoring of shallow water coral and fish communities at Scott Reef	AIMS (Link to reports)	Scott Reef (South Reef, North Reef and Seringapatam Reef)
	The composition and structure of shallow benthic reef communities in the Kimberley, north-west Australia	WA Museum (Link to report)	Kimberley Region
	Montara: Vulcan, Barracouta East and Goeree Shoals Survey 2013; Heyward et al 2013; Report for PTTEP Australasia (Ashmore Cartier) Pty Ltd. Australian Institute of Marine Science, Perth.	PTTEP (Link to report)	Barracouta, Goeree and Vulcan Shoals
	Montara: Barracouta, Goeree and Vulcan Shoals Survey 2016 Report for PTTEP Australasia (Ashmore Cartier) Pty Ltd. Australian Institute of Marine Science, Townsville.	PTTEP (Link to report)	Barracouta, Goeree and Vulcan Shoals
	Montara reports: Final Report on Benthic Surveys at Ashmore, Cartier and Seringapatam Reefs (post-spill)	PTTEP (Link to report)	Ashmore, Cartier and Seringapatam Reefs
	Applied Research Program (ARP7): Subtidal Benthos: towards benthic baselines in the Browse Basin. Final report – Submerged Shoals	Shell/INPEX (Link to report)	Echuca and Heywood shoals
	Marine Biodiversity Survey of Mermaid Reef (Rowley Shoals), Scott and Seringapatam Reef	Western Australian Museum (Link to report)	Mermaid Reef (Rowley Shoals), Scott and Seringapatam Reef

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
	Browse Island habitat descriptions – Draft EIS Technical Appendices - Appendix 4 Ichthys Gas Field Development Project Studies of the Offshore Marine Environment	INPEX (2010) (Link to report)	Browse Island, Echuca Shoal, Ichthys Field
	ARP7: Subtidal Benthos: towards benthic baselines in the Browse Basin - Quantitative information on the abundance, diversity and temporal variability of benthos and associated fish – Browse Island reef	AIMS (Shell/INPEX)	Browse Island
	Benthic primary productivity: production and herbivory of seagrasses, macroalgae and microalgae	WAMSI (Link to report)	Bardi Jawi Indigenous Protected Area (IPA), encompassing Cygnet Bay, One Arm Point, Jalan (Tallon Island) and Iwany (Sunday Island)
	Baselines of benthic communities, herbivory and reef metabolism at Browse Island	CSIRO/UWA/AIMS (Link to report)	Browse Island
	Egg size and fecundity of biannually spawning corals at Scott Reef	AIMS - Foster, T and Gilmour, J (Link to report)	Scott Reef
Marine reptiles	Long term monitoring of the marine turtles of Scott Reef	SKM/Woodside (Link to report)	Scott Reef
	Marine Turtles in the Kimberley: key biological indices required to understand and manage nesting turtles along the Kimberley coast	WAMSI (Link to report)	Near complete coverage of Kimberley Coast and Islands (>44,000 georeferenced images)
	Ecology of Marine Turtles of the Dampier Peninsula and the Lacepede Island Group, 2009–2010	RPS/Woodside (Link to report)	Dampier Peninsula and the Lacepede Islands
	Ecological studies of the Bonaparte Archipelago and Browse Basin – Marine Turtles	INPEX (Waayers, D) (Link to report)	Maret Islands and other islands in the Bonaparte Archipelago

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
Seabirds and shorebirds	The status of seabirds and shorebirds at Ashmore Reef, Cartier Island and Browse Island. Monitoring Program for the Montara Well Release. Pre-Impact Assessment and First Post-Impact Field Survey	PTTEP (Clarke, R. et al) (Link to report)	Ashmore Reef (including Cartier Island) and Browse Island
	Evaluating the impacts of local and international pressures on migratory shorebirds in Roebuck Bay and Eighty Mile Beach	WAMSI (Rogers et al.) (Link to report)	Roebuck Bay and Eighty Mile Beach
	Adele Island Bird Survey Report	DBCA (Boyle, et al.) (Link to report)	Adele Island
	Shell/INPEX ARP6 Milestone Report #7- Lacepede Islands: Report comparing the diet composition, foraging habitat and breeding between species and between years on Lacepede islands	Monash/UWA/AIMS	Lacepede Islands
	Ecological studies of the Bonaparte Archipelago and Browse Basin – Seabird survey	INPEX (Link to report)	Browse Island and Maret Islands
Marine mammals	Humpback Whale Survey Report. Browse Marine Mammal Fauna Survey	Woodside (RPS) (Link to Humpback Whale report 2010) (Link to Humpback Whale report 2011) (Link to dugong report 2009)	Browse Basin – James Price Point Migration Corridor, Pender Bay, Gourdon Bay, Scott Reef
	Humpback whale use of the Kimberley: understanding and monitoring spatial distribution (analysis of historical data, including other reports mentioned in this review. Also provides analysis of whale survey techniques and recommendations for future monitoring)	WAMSI	Kimberley region
	Browse Island habitat descriptions – Draft EIS Technical Appendices - Appendix 4 Ichthys Gas Field Development Project Studies of the Offshore Marine Environment (also described in Ecological studies of the Bonaparte Archipelago and Browse	INPEX (Link to report)	Browse Basin Region (Browse Island to Scott Reef)

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
	Basin – Cetacean survey – additional detail on a 2006 aerial survey in contained in this report)		
	Integrating Indigenous knowledge and survey techniques to develop a baseline for dugong (Dugong dugon) management in the Kimberley	WAMSI (Link to report)	North Kimberley (Broome to NT border) South Kimberley (Broome to Port Hedland)
Commercial fisheries	Commercial Fisheries data collected by WA Department of Fisheries (WA DoF) and Australian Fishing Management Authority (AFMA)	WA Department of Fisheries / Australian Fishing Management Authority	Australia wide
	Montara Well Release: Olfactory analysis of Timor Sea fish fillets	Curtin University/PTTEP (Link to report)	Timor Sea
	Montara Well Release Monitoring Study S4A - Assessment of Effects on Timor Sea Fish	Curtin University/PTTEP (Link to report)	Vulcan Shoal, Heywood Shoal, Browse Island, Echuca Shoal, Scott Reef
	Montara Well Release: Assessment of Fish catch for the presence of Oil	PTTEP (Link to report)	Northern Demersal Scalefish Managed Fishery (NDSF)
	Monitoring the Northern Demersal Scalefish Managed Fishery: Establishing Baseline Biomarker Levels in Commercially Important Demersal Fishes	Curtin/AIMS	East Browse Basin
	Monitoring the Northern Demersal Scalefish Managed Fishery: accounting for spatial variability and detecting change in key fish populations	Curtin/CSIRO/AIMS	East Browse Basin

Appendix C: Summary of recommended sampling methods and parameters from Joint Industry SMPs

Scientific Monitoring Plan	Sampling Methods	Parameters/Metrics
Water quality impact assessment	• Water profiling • Surface water sampling • Sub-surface water sampling	Hydrocarbon concentrations • Total recoverable hydrocarbons (TRH) • Benzene, toluene, ethylbenzene and xylenes and naphthalene (BTEXN) • Polycyclic aromatic hydrocarbons (PAH) • UV fluorometer data, profile of aromatic hydrocarbons fluorescing through water column. Results should be based on raw fluorometer units (RFUs) until calibration curve can be prepared identifying relationship between RFUs and laboratory data Physio-chemical • Temperature (°C) • Conductivity (approximate salinity) • Depth • Dissolved oxygen (DO) • pH • COD Dispersant injection (if applied) • 2-Butoxyethanol • Ethylene glycol monobutyl ether (EGMBE) • Dipropylene glycol n-butyl ether (DPnB) • Propylene glycol • Dioctylsulfosuccinate (DOSS) Hydrocarbon characterisation, fingerprinting and weathering • Geochemical organic biomarkers • Fingerprinting: TPH, PAH, GC/MS TRH

Scientific Monitoring Plan	Sampling Methods	Parameters/Metrics
Sediment quality impact assessment	• Sub-tidal surveys • Intertidal surveys	• Total Recoverable Hydrocarbons (TRH)/Total Petroleum Hydrocarbons (TPH); • Particle Size Distribution (PSD); to characterise the effective surface area of particles available for hydrocarbon adsorption and allow for normalisation of samples (if required); • Total Organic Carbon (TOC); • Polycyclic Aromatic Hydrocarbons (PAH); • Benzene, toluene, ethylbenzene and xylenes and naphthalene (BTEXN); and • Heavy metals and metalloids (optional) (Aluminum, Arsenic, Barium, Beryllium, Cadmium, Cobalt, Chromium, Copper, Mercury, Manganese, Nickel, Lead, Antimony, Vanadium and Zinc).
Intertidal and coastal habitat assessment	<u>Physical sampling</u> • Shoreline profiling <u>Biological sampling</u> • Ground and vessel-based intertidal surveys (e.g. quadrats, transects, including video and still photography) • Remote sensing • Infauna sampling <u>Chemical sampling</u> • Water quality sampling • Sediment quality sampling • Biota tissue sampling	<u>Physical sampling</u> • Surface and subsurface oil observations, mass of oil on intertidal zone • Substrate type • Form: geomorphological type, dimensions, profile, or gradient • Energy: winds, waves • Water quality • Sediment quality <u>Biological sampling</u> • Community, population, individual health and condition parameters – dependent upon habitat type. Described in detail in SMP: Intertidal and Coastal Habitat Assessment (APPEA, 2020a)
Seabirds and shorebirds	• Shoreline surveys • Aerial surveys • Vessel surveys	<u>Nesting</u> • Nest count • Adult counts

Scientific Monitoring Plan	Sampling Methods	Parameters/Metrics
		• Nest density Community Structure • Mortality • Sp. diversity • Sp. richness • Abundance • Spatial distribution • Bird density Hydrocarbon presence and quantification in samples from birds/ Effects of hydrocarbon exposure to birds • TRH/TPH • PAH • Hydrocarbon fingerprinting • Number of oiled individuals (dead and alive) • Cause of death and any sub-lethal findings • Health/condition and behaviour, including any injury
Marine mega-fauna assessment o Reptiles	Turtles • Aerial surveys • Ground surveys • Vessel surveys • Electronic (satellite) tagging Sea snakes • Manta board surveys • Snorkel surveys • Opportunistic observations during implementation of other OMPs/SMPs Estuarine crocodiles • Vessel based spotlight surveys at night	Turtles • Annual marine turtle nesting abundance • Marine turtle nesting distribution on beaches • In-water abundance marine turtles and distribution • Spatial and temporal movements of turtles impacted by spill Sea snakes • In- water sea snake presence/absence, distribution and population estimate Crocodiles • Presence/absence, distribution and population estimate Marine reptile exposure/mortality/ health • Evidence of direct impacts of hydrocarbons

Scientific Monitoring Plan	Sampling Methods	Parameters/Metrics
	• Opportunistic observations during implementation of other OMPs/SMPs <u>Marine reptile exposure/mortality/ health</u> • Necropsies/tissue sampling • External sampling/swabbing for evidence of hydrocarbon exposure • Excavation of hatched nests to characterise clutch sizes, hatching success, emergence success, and record any deformities <u>Beach condition, benthic, coastal and intertidal habitats</u> • Refer to SMP: Sediment Quality Impact Assessment; SMP- Benthic Habitats and SMP – Intertidal and Coastal Habitats	• Marine turtle hatching and emergence success <u>Beach condition, benthic, coastal and intertidal habitats</u> • Evidence of impacts to benthic, coastal and intertidal habitats
Marine mega-fauna assessment o Whale sharks, dugongs and cetaceans	<u>Changes in populations</u> • Aerial surveys • Vessel based surveys • Passive Acoustic Monitoring (marine mammals) • Electronic (satellite) tagging • Opportunistic observations during implementation of other OMs/SMs <u>Exposure/ mortality/ health</u> • Necropsies/tissue sampling • Hydrocarbon distribution on individuals (aerial/vessel-based surveys)	<u>Changes in populations</u> • Species present • Estimate of abundance • Behaviour <u>Exposure/ mortality/ health</u> *Chemical contamination* • TRH/TPH • PAH • Hydrocarbon spill fingerprinting • Health/condition and behaviour, including any injury • Number of mortalities • Cause of death and any sub-lethal findings *Hydrocarbon distribution* • Number of oiled individuals (dead and alive) • Distribution of oil on individuals
Benthic habitat assessment	<u>Physical sampling</u> • Visual observations	<u>Physical sampling</u> • Sea state and weather

Scientific Monitoring Plan	Sampling Methods	Parameters/Metrics
	• Vessel depth sounder • ROV, video, drop camera observation • Water quality (Refer to SMP: Water Quality Assessment) <u>Biological sampling</u> • Vessel-based benthic surveys (e.g. including video and still photography) • Remote sensing • Infauna sampling <u>Chemical sampling</u> • Water quality sampling • Sediment quality sampling • Biota tissue sampling	• Observations of hydrocarbon slicks on surface • Depth, bathymetry, and bottom profiles • Habitat structure (e.g. substrate type) • Water quality <u>Biological sampling</u> • Community, population and individual parameters – dependent upon habitat type. Described in detail in SMP: Benthic Habitat Assessment (APPEA, 2020c)
Marine fish assemblages assessment	<u>Biological sampling</u> • Stereo Baited Remote Underwater Video System (SBRUVS) Survey • Remotely Operated Vehicle (ROV) Survey • Towed Video Surveys <u>Chemical sampling</u> • Water quality sampling • Sediment quality sampling • Biota tissue sampling	<u>Biological sampling</u> • Fish species richness, relative abundance and fish length <u>Chemical sampling</u> • Refer to SMP: Water Quality Assessment and SMP: Sediment Quality Assessment above
Fisheries impact assessment	• Fish health (commercial, recreational and aquaculture) - Laboratory analysis of biopsies or fish carcasses • Fitness for human consumption - Seafood taint assessment and laboratory analysis of biopsies	<u>Fish health indicators and biomarkers including:</u> • Liver detoxification enzymes (EROD activity) • Polycyclic aromatic hydrocarbon (PAH) biliary metabolites • Oxidative deoxyribonucleic acid (DNA) damage

Scientific Monitoring Plan	Sampling Methods	Parameters/Metrics
	• Changes in fish resource stocks (commercial and recreational) – stock assessments • Water and sediment quality analysis (chemical analysis)	• Serum sorbitol dehydrogenase (SDH) activity. *Hydrocarbon/chemical contamination and physiological impacts of exposure including:* • Condition factor (CF) • Liver somatic index (LSI) • Gonado-somatic Index (GSI) • Gonad histology • Total weight • Total length • Parasites • Any other abnormalities <u>Fitness for human consumption - Seafood taint assessment and laboratory analysis of biopsies</u> • Sensory assessment (taste, smell etc.) • Chemical analysis of muscle tissue and gut contents: o Total petroleum hydrocarbons (TPH) o Polycyclic aromatic hydrocarbons (PAH) o Benzene, toluene, ethylbenzene and xylene (BTEX) o Paraffins, Isoparaffins, Aromatics, Napthenes, and Olefins (PIANO) o Metabolites of aromatic compounds by high performance liquid chromatography (HPLC) or gas chromatography-mass spectroscopy (GC-MS). <u>Changes in fish resource stocks (commercial and recreational) – stock assessments</u>

Scientific Monitoring Plan	Sampling Methods	Parameters/Metrics
		• To be conducted in consultation with relevant fisheries – requires catch and effort and relevant settlement data collected by fisheries <u>Chemical sampling</u> • Refer to SMP: Water Quality Assessment and SMP: Sediment Quality Assessment above
Heritage features assessment	Potential methods: • Archaeological sites plans and creating photo-mosaics for each shipwreck to discern how the sites change over time; • Conducting ROV video surveys of the shipwrecks and their resident biota for comparison with pre-spill ROV video footage; • Collecting 3D sonar scans of diagnostic features on the shipwrecks to monitor site formation processes and potential degradation over time; • Obtaining sediment, water, coral, wood, and metal (including rusticle) samples for a microbiological and molecular ecological study of shipwreck communities, a comprehensive physical and geochemical analysis, and a corrosion study across the shipwrecks in differentially spill-impacted and unimpacted areas; and • Deploying experiment platforms for short term studies of in situ biofilm recruitment and corrosion processes.	To be developed in consultation with subject matter experts and the relevant Jurisdictional Authorities
Social impact assessment	Potential methods: • Economic impact analysis	To be developed in consultation with subject matter experts and the relevant Jurisdictional Authorities

Scientific Monitoring Plan	Sampling Methods	Parameters/Metrics
	• Ecosystem valuation methods (e.g. travel cost method, cost-based method, contingent valuation method, hedonic pricing method)	

Appendix D: Subsea dispersant injection monitoring

1. Aim/Objective

To evaluate the effectiveness of subsea chemical dispersant application to help inform operational response decision making.

2. Rationale

Dispersants are a valuable response tool during oil spill events, but the overall benefit of applying them needs to be weighed up against the potential exposure effects on the oil-affected environment.

Subsea dispersant injection (SSDI) is an oil spill response strategy designed to be used during a loss of source control (well blowout) on the ocean floor. SSDI takes place at the subsea well, with dispersants injected directly into the flow of the release. SSDI aims to reduce oil droplet size and minimise oil rising to the sea surface.

The benefits of SSDI include:

- The reduction of volatile organic compounds (VOCs) coming to the surface near the wellsite, making it safer for source control operations;
- Requires less dispersant to break up the oil (approximately 5 times less the amount of dispersant than aerial spraying);
- Application can occur continuously (enables 24-hour operations);
- Can be applied in all but very severe weather conditions; and
- Application at source enables a high encounter rate.

Redistributing the oil into the water column can result in the increased exposure of subsurface organisms to hydrocarbons and this must be considered in deciding whether there is a net environmental benefit to subsea dispersant use. This must be considered as part of the net environmental benefit analysis (NEBA)/spill impact mitigation analysis (SIMA) process conducted by Titleholders during their oil spill preparedness phase.

This OMP helps the IMT to:

- Evaluate subsea dispersant efficacy;
- Characterise the nature and extent of subsea, or near surface, dispersed oil plumes; and
- Provide an initial assessment of potential ecological effects as they relate to operational response decision making.

3. Monitoring Design

The exact nature of monitoring activities will depend on nature and scale of the spill and environmental conditions; however prior to subsea dispersant application, Shell will prepare a Subsea Dispersant Injection Monitoring Plan and a Subsea Dispersant Operations Monitoring Plan, which will complement each other.

The following points should be considered during the preparation of the Monitoring Plan:

- Subsea dispersant injection monitoring should incorporate guidance from the Industry Recommended Subsea Dispersant Monitoring Plan (American Petroleum Institute (API, 2013), which includes the following phases:
    - Phase 1: Assessment of subsea dispersant effectiveness and reduction in surface VOCs
    - Phase 2: Characterisation of dispersed oil concentrations in the water column
    - Phase 3: Assessment of potential for ecological effects
- Subsea dispersant injection monitoring should also incorporate guidance from Environmental Monitoring for Atypical Dispersant Operations (US EPA, 2013).
- Finalising monitoring design for this OMP requires judgements to be made about scope, methods, data inputs, and outputs that are specific to the incident. These judgements must balance the operational needs of the response with the logistical and time constraints of gathering and processing information, and the level of certainty needed.
- Monitoring objectives for this OMP may change throughout the different phases of the response and therefore, the monitoring design needs to be able to adapt to the potential change in objectives.
- Dispersant efficacy has been performed on Prelude condensate. Whilst this provides an indication on the types of dispersants that may be effective on this hydrocarbon product, it should not be treated as a conclusive test on how effective the dispersant would be in the environment. This can only be determined via field observations and testing.
- Water quality sampling should be conducted prior to the application of any chemical dispersant, so that background levels of hydrocarbons may be sampled. This should include subsurface sampling to determine levels under any surface slick present. Refer to OMP: Water Quality Assessment for detail on design, parameters and standard operating procedures for water quality assessment.
- 3D numerical underwater plume and oil spill computer modelling may be used to support monitoring to determine fate and effects. All dispersant application activities should be numerically modelled and calibrated with actual readings of dispersed oil hydrocarbon from the field monitoring. Computerised hydrocarbon plume monitoring does not replace the physical monitoring of dispersant operations but provides additional information to inform the response and any relevant scientific monitoring programs

4. Capability

Shell subscribes to the OSRL Subsea Well Intervention Services (SWIS) Capping Stack Membership, enabling access to OSRL's agreement with CSA Ocean Sciences. This membership provides access to specialised equipment and trained personnel.

4.1 Equipment

Equipment is stored in two mobile 8 ft × 20 ft containers certified for offshore use by Det Norske Veritas and the American Bureau of Shipping. They are maintained and kept at Trendsetter, Houston. Shell is responsible for making the logistical arrangements from the nominated port (likely to be George Bush Intercontinental/Houston Airport) to the incident location.

Designed for deepwater deployments, water column characterisation, water sampling, and monitoring during subsea dispersant injection. The equipment, instruments, and consumables incorporated into each container are industry standard, commercial grade, and mobilisation ready. Equipment includes:

Real-time, in situ data collection in water column

- Conductivity-Temperature-Depth (CTD) instrumentation
- Dissolved oxygen instrumentation
- Fluorometers (CDOM, ECO-FLNTU)
- Turbidity meters

Water sampling and handling

- GO-FLO bottles triggered at depth
- Glassware and chemicals
- Refrigeration and Sub-80 freezer

Other instrumentation

- In situ particle size analyser (LISST-DEEP, LISST-100X)
- HD Video for ROV integration
- Mobile GC/MS for benchtop VOC analysis

A portable Launch and Recovery System consists of a combined winch, A-frame, and 3,500 m custom cable is included, which enables the deployment of instruments in deep water from a suitable vessel such as platform supply ship.

Shell is responsible for arranging a suitable vessel and runner boat, with the specifications below:

- Type – Light Construction Vessel (LCV); selection driven largely by personnel needs for 24-hour operations, light crane for transfer of collected samples to runner boat, USBL capability, and an optional ROV as a backup to the LARS;
- Length – Minimum 150 ft;
- Power = 480 VAC, 3 PH, 150 Amp service, 60 Hz
- Dynamic Positioning (DP);
- Deck crane;
- One optional work class Remotely Operated Vehicle (ROV) (to serve as a backup for the LARS and rosette);

- High-bandwidth internet (minimum specification of 1024 x 1024);
- Ultra-short baseline (USBL);
- Differential global positioning system (dGPS);
- Personnel accommodations for a minimum of 12 CSA personnel (for 12-hour operations) plus additional representatives (more if 24-hour operations);
- Generators (2) – Stand-alone generator and a backup are required (150 kW) – Two generators and transfer switches from National Oilwell Varco (NOV) in Larose, Louisiana are provided as an example. Items should be sourced in-country;

Requirements for the runner boat are listed below.

- Type – Fast crew or supply boat;
- Deck crane to facilitate transfer of samples and supplies between the water column monitoring vessel and the runner boat;
- Refrigerated storage or container to accommodate samples in transit (in multiple large coolers);
- Note that water-cooled vessels typical of crew boats cannot risk intake of oiled water into systems.

4.2 Personnel

Numbers of field staff required on the offshore vessel are calculated to be up to 12 staff for 12 hour operations and up to 18 staff for 24 hour operations. Staff numbers may be customised for the region and specific incident.

5. Data Analysis

[Monitoring Provider is to provide a description of the data analysis proposed that are specific to the needs of the incident, including a list of the relevant benchmarks (e.g. ANZECC, OSPAR etc.) that should be used to contextualise the results. For data analysis, Monitoring Provider shall engage a reputable laboratory to undertake analysis using NATA accredited methods (where available) and/or demonstrated best practice in accordance with Australian Standards and industry guidelines. The LOR should be low enough to allow comparison against benchmark levels.]

All data analysis methods should be clearly described as part of any reporting. The methods should be sufficiently detailed such that the analysis can be independently replicated and the same results obtained by a competent third party unfamiliar with the monitoring program. All laboratory results should be reviewed upon receipt and any anomalous values discussed with the laboratory as part of the Quality Assurance/Quality Control (QA/QC) process.

6. Reporting and QA/QC

[Monitoring Provider is to review and finalise reporting and QA/QC requirements including a description of the proposed content, indicative delivery timeframes etc.]

Reporting and QA/QC for this OMP should align to the Industry Recommended Subsea Dispersant Monitoring Plan (American Petroleum Institute (API, 2013) and Environmental Monitoring for Atypical Dispersant Operations (US EPA, 2013).

Reporting and QA/QC should be confirmed in the Subsea Dispersant Injection Monitoring Plan and a Subsea Dispersant Operations Monitoring Plan.

7. References

American Petroleum Institute (API) 2013. Industry Recommended Subsea Dispersant Monitoring Plan. Version 1.0. API Technical Report 1152. Accessed 30th May 2020 - http://www.oilspillprevention.org/~/media/Oil-Spill-Prevention/spillprevention/r-and-d/dispersants/api-1152-industry-recommended-subsea-dis.pdf

United States Environmental Protection Agency (US EPA) 2013. Environmental Monitoring for Atypical Dispersant Operations: Including Guidance for Subsea Application and Prolonged Surface Application. Accessed 30th May 2020 - https://www.nrt.org/sites/2/files/NRT_Atypical_Dispersant_Guidance_Final_5-30-2013.pdf