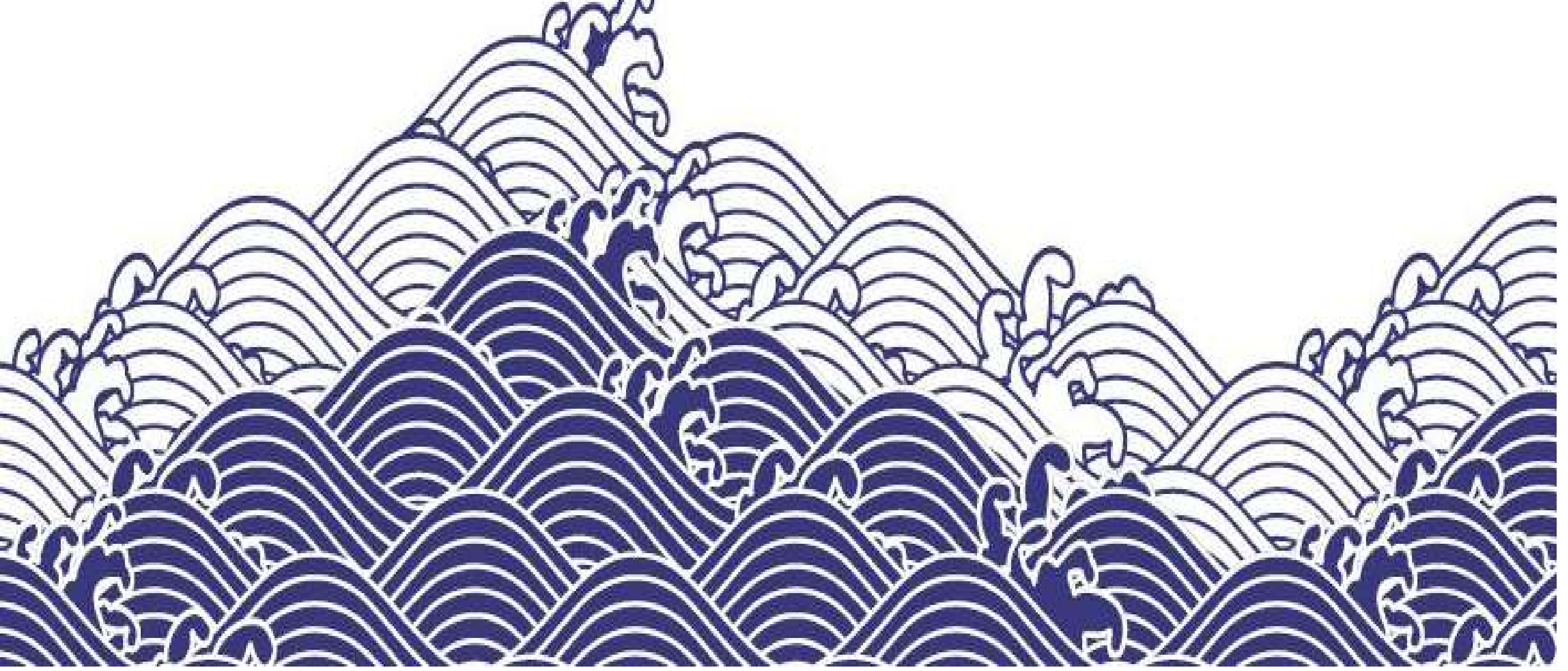
Browse Regional Oil Pollution Emergency Plan

And supporting documents
(Basis of design)
(IMT capability assessment)
(Strategic Spill Impact Mitigation Assessments)



INPEX Australia – Browse Regional Oil Pollution Emergency Plan

Plan

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0	09/11/2021	IFU	D Hazell	J Prout	R Finch	V Ee
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RECORD OF AMENDMENT

Revision	Section	Amendment
1	All	Updated in accordance with NOPSEMA RFFWI Accepted by NOPSEMA on 05 May 2022
2	Table I-1-2	Updated final column to include clarification regarding 'first strike' actions conducted prior to AMSA IMT standing up.
	Throughout	Change DAWE to DCCEEW throughout Change DIIS to DISR throughout Amended WA DBCA WA Oiled Wildlife Response Plan to reflect latest version (2022 revisions)
	Throughout	Changed Surveillance, Monitoring and Visualisation to Surveillance, Modelling and Visualisation (to align with IPIECA terminology).
3	Throughout	Updated to incorporate WA DoT consultation comments
3	Appendix C	Updated Marine Parks map
3	Table I-1-1 & I-1-2	Updated vessel dispersant spray rows to provide better clarification
4	2.2.1	Clarification of NT Control Agency Clarification of NOPSEMA reporting obligations
4	Throughout	Updated to incorporate NT Government and WA DoT consultation comments (Dec 2022)
4	Section 3.7 and Table I-1-1 and I-1-2	Clarification of NOPSEMA information expectations during a spill
4	Section 4.8	Included VOC/LFL risks associated with oil types in HSE section
4	Table 2-4	Included relevant persons identified who wish to be notified in the event of a spill
5	Table 2-4	Included WAFIC and Northern Land Council as relevant persons identified who wish to be notified in the event of a spill

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I. INITIAL RESPONSE REQUIREMENTS

An overview of the initial response requirements for Facility spills (where INPEX is the Control Agency) is provided in Table I-1 and vessel spills (where AMSA is the Control Agency) is provided in Table I-2.

Table I-1 and Table I-2 have been developed to guide response personnel through the key steps of this INPEX Australia Browse Regional Oil Pollution Emergency Plan (BROPEP) during a Level 2 or Level 3 spill (defined in Section 2.1).

The tables contain cross-references to other sections of this BROPEP, which provide additional information to guide the response.

Table I-1-1 : Initial response requirements – facility spill (CPF/FPSO/GEP/MODU, AOP etc.)

Action by			**Spill from a facility (INPEX Control Agency Scenario)** Definitions for 'Action by' persons are as follows: **CSSR** – Contractor Senior Site Representative. **ISSR** – INPEX Senior Site Representative. **IMT** – Incident Management Team (INPEX). CSSR includes: (Onboard CPF/FPSO – Contractor most senior representative), (Onboard MODU - Contractor OIM), (Onboard vessel conducting activity as a Facility/AOP – Vessel Master). ISSR includes: (Onboard CPF/FPSO – INPEX OIM), (Onboard MODU – INPEX Drilling Supervisor), (Onboard vessel conducting activity as a Facility/AOP – INPEX Client Site Representative).		
CSSR	ISSR	IMT	Immediate Response Actions	Information/Resources	Comments
■	■		ALL - report the spill to relevant CSSR/ISSR. If safe to do so - stop the source of the spill (CSSR from a Contractor operated facility, or ISSR from an INPEX operated facility).	Activate facility/vessel shipboard oil pollution emergency plan (SOPEP)/emergency response plans.	
■	■		CSSR to alert the ISSR.	See Section 2.3.1 Internal notification.	
	■	■	ISSR to notify Incident Management Team (IMT) Leader via INPEX Emergency Call Centre. IMT Leader notify INPEX Crisis Management Team (CMT) Leader. IMT Leader to activate IMT.	Activate via INPEX Emergency Call Centre. See Section 2.3.1 Internal notification. Table 2-2: Jurisdictional Boundaries, Jurisdictional Authority and Control Agencies. INPEX Emergency Contact Directory (C075-AH-LIS-10002).	INPEX is the Control Agency for spills from the Facility in Commonwealth Waters. INPEX is required to coordinate the response to the spill in accordance with this BROPEP. INPEX Emergency Call Centre 24-hour activation numbers are: 1800 305 789. +61 8 6213 6350 +61 439 694 175
	■	■	ISSR and IMT Leader to classify the spill incident level.	See Section 2.1 Spill classification. See Table 2-1: Incident classification.	This BROPEP is only activated if the spill is a Level 2 or 3 spill. (NOPSEMA 2hr notification not required, if not a Level 2/3 spill.)
	■	■	ISSR (or IMT Leader at request of ISSR) to verbally notify the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) of Level 2 or Level 3 spills.	Section 2.3.2 External agencies notification. Table 2-2: Jurisdictional Boundaries, Jurisdictional Authority and Control Agencies. INPEX Emergency Contact Directory (C075-AH-LIS-10002).	NOPSEMA is the Jurisdictional Authority for spills from Facilities in Commonwealth Waters. Complete verbal notification to NOPSEMA within two hours of spill occurrence. NOPSEMA's 24-hour incident notification phone number is +61 8 6461 7090. NOPSEMA are to remain updated in accordance with Section 3.7.
■	■		CSSR (from a Contractor operated facility), or ISSR (from an INPEX operated facility) to verbally notify AMSA.	Section 2.3.2 External agencies notification. Table 2-2: Jurisdictional Boundaries, Jurisdictional Authority and Control Agencies. Table 2-4: External notifications matrix. INPEX Emergency Contact Directory (C075-AH-LIS-10002).	AMSA is required to be notified for all Facility spills. Notification of AMSA will be through the incidents through the AMSA Rescue Coordination Centre (RCC) Australia on +61 2 6230 6811.
■	■		CSSR (from a Contractor operated facility), or ISSR (from an INPEX operated facility) prepare marine pollution report (POLREP), submit to AMSA. ISSR to forward copy of POLREP to IMT Leader.	POLREP. (See Section 2.5 and Table 5-1: Oil Spill Response Forms).	
		■	IMT Leader to establish contact with AMSA RCC and confirm AMSA has received POLREP. As required, discuss any NatPlan capability AMSA may offer to support the response.	POLREP. (See Section 2.5 and Table 5-1: Oil Spill Response Forms).	Notification of AMSA will be through the incidents through the AMSA Rescue Coordination Centre (RCC) Australia on +61 2 6230 6811. If a vessel is the source of the spill, and the vessel was classified as a 'Facility, or Associated Offshore Place' at the time of event, INPEX is the Control Agency. As INPEX is the Control Agency, the INPEX IMT Leader can formally (verbally, or written on the POLREP) request AMSA to activate/mobilise oil spill response resources available under the National Plan for Maritime Environmental Emergencies. If the vessel was not a Facility or Associated Offshore Place at the time of the incident, refer to Table I-2 below.

Action by			Spill from a facility (INPEX Control Agency Scenario) Definitions for 'Action by' persons are as follows: **CSSR** – Contractor Senior Site Representative. **ISSR** – INPEX Senior Site Representative. **IMT** – Incident Management Team (INPEX). CSSR includes: (Onboard CPF/FPSO – Contractor most senior representative), (Onboard MODU - Contractor OIM), (Onboard vessel conducting activity as a Facility/AOP – Vessel Master). ISSR includes: (Onboard CPF/FPSO – INPEX OIM), (Onboard MODU – INPEX Drilling Supervisor), (Onboard vessel conducting activity as a Facility/AOP – INPEX Client Site Representative).		
CSSR	ISSR	IMT	Immediate Response Actions	Information/Resources	Comments
		■	Activate Australian Marine Oil Spill Centre (AMOSC) IMT support for all Level 2/3 spills – to commence immediate integration within the INPEX IMT.	INPEX Emergency Contact Directory (C075-AH-LIS-10002).	AMOSC will provide support and guidance to the IMT during any Level 2 or Level 3 spill event. AMOSC 24-hour mobile number; +61 (0) 438 379 328 Email: amosc@amosc.com.au Telephone call and e-mail confirmation to AMOSC required for mobilisation of response personnel and equipment. All INPEX IMT Leaders have the call-out authority to activate AMOSC. AMOSC will email a service contract which must be completed with the requested resources/personnel required from AMOSC and must be signed by the IMT Leader. IMT Leader must email competed form back to AMOSC to complete the mobilisation process.
		■	Notify Oil Spill Response Limited (OSRL) of all Level 2/3 spills. Consider the need for additional mobilisation of OSRL IMT/Field Response support as required.	INPEX Emergency Contact Directory (C075-AH-LIS-10002).	A notification to OSRL should be conducted for any Level 2/3 spill event. OSRL 24-hour notification number; +65-6266-1566 Email: dutymanager@oilspillresponse.com OSRL will establish their Emergency Operations Centre and provide technical advice/support, with a team of 5 personnel, for up to 5 days (at zero cost). Should additional support be required, (longer term in-field and/or IMT resources support) OSRL mobilisation must be via the INPEX IMT Leader(s), who are persons authorised under the INPEX/OSRL contract, to mobilise OSRL.
		■	Notify additional regulators and stakeholders.	See Section 2.3.2 External agencies notification. Table 2-4: External notifications matrix. INPEX Emergency Contact Directory (C075-AH-LIS-10002).	External agencies contact information is available in the INPEX Emergency Contacts Directory (C075-AH-LIS-10002). Mandatory notification required to WA DoT in event of a loss of well containment or if spill may move towards/into WA state waters/shorelines. WA DoT Maritime Environmental Emergency Response 24-hour contact number is (08) 9480 9924.
		■	Develop and maintain situational awareness.	See Section 3.1 Gain situational awareness.	During the initial phase of a spill, obtaining and communicating information to allow the establishment of situational awareness is critical.
		■	Activate oil spill trajectory modelling.	See Section 4.4.1 Surveillance, modelling and visualisation (SMV). Oil Spill Response Forms Register (C075-AH-LIS-10006).	Oil Spill Trajectory Modelling should be activated as soon as possible. RPS modelling request activated via 24/7 duty phone – 0408 477 196, followed by email of modelling request form to response@rpsgroup.com.au
	■	■	ISSR, in consultation with the IMT, to coordinate visual surveillance activities. Initiate Surveillance, Monitoring and Visualisation - aerial & vessel/facility visual surveillance.	See Section 4.4.1 Surveillance, modelling and visualisation (SMV).	Obtain visual spill observations from any nearby facilities/vessels Utilise any available crew change helicopters for visual surveillance IMT to coordinate longer term fixed wing aerial surveillance
	■	■	ISSR, in consultation with the IMT, to coordinate the deployment of oil spill satellite tracking buoys.	See Section 4.4.1 Surveillance, modelling and visualisation (SMV). **SAFETY ALERT** – there are safety considerations for deployment of satellite tracking buoys. Refer Section 4.4.1 for more details.	The location of satellite tracking buoys is maintained in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002), available on the INPEX document management system. 1 x CPR Emergency Response Base 1 x FPSO Emergency Response Base 1 x Go Koi 3 x Drilling AHTs/PSV Others – Broome/Darwin Logistics bases and other vessels (refer to Register)

Action by			**Spill from a facility (INPEX Control Agency Scenario)** Definitions for 'Action by' persons are as follows: **CSSR** – Contractor Senior Site Representative. **ISSR** – INPEX Senior Site Representative. **IMT** – Incident Management Team (INPEX). CSSR includes: (Onboard CPF/FPSO – Contractor most senior representative), (Onboard MODU - Contractor OIM), (Onboard vessel conducting activity as a Facility/AOP – Vessel Master). ISSR includes: (Onboard CPF/FPSO – INPEX OIM), (Onboard MODU – INPEX Drilling Supervisor), (Onboard vessel conducting activity as a Facility/AOP – INPEX Client Site Representative).		
CSSR	ISSR	IMT	Immediate Response Actions	Information/Resources	Comments
	■		**GROUP IV (Intermediate / Heavy Fuel Oil) SPILLS ONLY** ISSR to facilitate identification of most suitable vessel for dispersant operations. **ISSR permitted to authorise initial dispersant test spray and report on effectiveness to the IMT Leader.**	See Section 2.5 Immediate (first strike) response measures. See Section 4.5.4 Surface (vessels and aerial) dispersant.	ISSR (FPSO OIM) to deploy the FPSO dispersant capability and **commence** test spray; • 16 m^3 of dispersant on FPSO can be deployed onto PSVs or OSV (MMA Brewster, MMA Plover and Go Koi, which all have dispersant spray equipment and trained personnel onboard). • If no INPEX contracted dispersant equipment vessels available, additional vessel dispersant capability available (best endeavours) via Prelude tugs. Request access via Ichthys OIM to Prelude OIM. • Last resort – deploy FPSO 16 m^3 dispersant, AFEDO dispersant spray system and FPSO dispersant trained personnel onto any other available support vessel. **Ongoing operational dispersant spraying only under direction from IMT Leader**.
		■	**GROUP IV (IFO/HFO) SPILLS ONLY** Commence activation of Containment and Recovery (C&R), and Fixed Wing Aerial Dispersant (FWAD) Capabilities.	See Section 2.5 Immediate (first strike) response measures. See Section 4.5.4 Surface (vessels and aerial) dispersant. See Section 4.5.5 At-sea containment and recovery.	IMT to notify AMOSC to move C&R equipment from Broome stockpile to Broome Wharf. IMT to identify primary C&R vessel (large vessel with rolled stern – E.g., Anchor Handing Tug) and second support vessel (small or large) to assist with boom deployment and towing Notify AMOSC to activate FWAD Capability Contract – AT-802 air-tractor(s) from Batchelor and/or Jandakot – prepare to mobilise to nominated airfield (E.g., Lombadina). Capabilities can be de-activated later if Operational SIMA determines response strategies are not required.
		■	IMT to request satellite imagery for large Level 2 and all Level 3 spills.	See Section 4.4.1 Surveillance, modelling and visualisation (SMV).	AMOSC, OSRL and AMSA have ability to provide satellite imagery acquisition/support. Typically, will take a few days to acquire the satellite imagery.
		■	Obtain long-term weather forecasts.	For weather forecast service provider see the INPEX Emergency Contact Directory (C075-AH-LIS-10002).	Site–specific, long-term weather forecasts are available through the INPEX subscription to the Bureau of Meteorology (BOM).
		■	Identify protection priorities.	See Section 3.3 Protection priorities. See Appendix C – Environmental Values and Sensitivities Maps	
		■	Complete Operational spill impact mitigation assessment (SIMA) template to generate Operational SIMA; select response strategies.	See Section 3.4 Operational SIMA.	
		■	Develop Incident Action Plan (IAP).	See Section 3.5 Incident action plan. Appendix B: INPEX Incident Action Plan template.	Spill response strategy capability descriptions, activation arrangements and implementation processes are provided in Section 4 Spill Response Resources. Utilise this information during the development of the IAP.
		■	Implement IAP.	See Section 4 Oil Spill Response Strategy Implementation Guide.	
		■	Use spill surveillance and reconnaissance data (OM03) to update oil spill trajectory modelling (OM01) outputs.	See Section 4.4.1 Surveillance, modelling and visualisation (SMV). Section 4.7 Operational and scientific monitoring.	
		■	Use operational monitoring (OM) program data for scientific monitoring (SM) activation.	See Section 4.7.2 Scientific monitoring and Appendix A.	
		■	Terminate response.	See Section 3.6 Response termination and Section 4.	General response termination considerations are provided in Section 3.6. Response strategy specific termination criteria considerations are provided in Section 4. OMs and SMs termination criteria are provided in Appendix A.

Table I-1-2: Initial response requirements – vessel spills

Action by			**Spill from vessel (AMSA Control Agency)** Definitions for 'Action by' persons are as follows: **CSSR** – Contractor Senior Site Representative. **ISSR** – INPEX Senior Site Representative. **IMT** – Incident Management Team (INPEX). CSSR includes: (Onboard vessel – Vessel Master). ISSR includes: (Onboard vessel – INPEX Client Site Representative).		
CSSR	ISSR	IMT	Immediate Response Actions	Information/Resources	Comments
■			ALL - report the spill to relevant CSSR/ISSR. If safe to do so - stop the source of the spill (CSSR from a Contractor operated facility, or ISSR from an INPEX operated facility).	Activate vessel shipboard oil pollution emergency plan (SOPEP).	
■	■		CSSR to alert the ISSR.	See Section 2.3.1 Internal notification.	
	■	■	ISSR to notify IMT Leader via INPEX Emergency Call Centre. IMT Leader notify INPEX Crisis Management Team (CMT) Leader. IMT Leader to activate IMT.	Activate via INPEX Emergency Call Centre. See Section 2.3.1 Internal notification Table 2-2: Jurisdictional Boundaries, Jurisdictional Authority and Control Agencies. INPEX Emergency Contact Directory (C075-AH-LIS-10002).	INPEX is the Control Agency for spills from the Facility in Commonwealth Waters. INPEX is required to coordinate the response to the spill in accordance with this BROPEP. INPEX Emergency Call Centre 24-hour activation numbers are: 1800 305 789. +61 8 6213 6350 +61 439 694 175
■	■	■	Classify the spill incident level.	See Section 2.1 Spill classification. See Table 2-1: Incident classification.	This BROPEP is only activated if the spill is a Level 2 or 3 spill. (NOPSEMA 2hr notification not required, if not a Level 2/3 spill.)
■			CSSR to verbally notify AMSA.	See Section 2.3.2 External agencies notification. Table 2-2: Jurisdictional Boundaries, Jurisdictional Authority and Control Agencies Table 2-4: External notifications matrix. INPEX Emergency Contact Directory (C075-AH-LIS-10002).	AMSA is the designated Control Agency for oil spills from vessels within Commonwealth jurisdiction and are to be notified immediately of all ship-sourced incidents through the AMSA Rescue Coordination Centre (RCC) Australia on +61 2 6230 6811. Upon notification of an incident involving a ship, AMSA will assume control of the incident and respond in accordance with AMSA's National Plan for Maritime Environmental Emergencies.
	■	■	ISSR (or IMT Leader at request of ISSR) to verbally notify the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) of Level 2 or Level 3 spills.	See Section 2.3.2 External agencies notification. Table 2-2: Jurisdictional Boundaries, Jurisdictional Authority and Control Agencies. INPEX Emergency Contact Directory (C075-AH-LIS-10002).	NOPSEMA is the Jurisdictional Authority for spills from Facilities in Commonwealth Waters. Complete verbal notification to NOPSEMA within two hours of spill occurrence. NOPSEMA's 24-hour incident notification phone number is +61 8 6461 7090. NOPSEMA are to remain updated in accordance with Section 3.7.
■	■		CSSR prepare marine pollution report (POLREP), submit to AMSA. ISSR to forward copy of POLREP to IMT Leader.	POLREP. (See Section 2.5 and Table 5-1: Oil Spill Response Forms).	
		■	IMT Leader to establish contact with AMSA Confirm AMSA has received POLREP. IMT to confirm Control Agency status (AMSA for vessel spills).	POLREP. (See Section 2.5 and Table 5-1: Oil Spill Response Forms).	If the vessel was classified as a 'vessel' at the time of event, AMSA is the Control Agency. AMSA and INPEX acknowledge that AMSA retains Control Agency responsibility for all ship sourced marine pollution incidents. INPEX agrees to provide all available support to AMSA in AMSA's performance of its Control Agency responsibilities under the National Plan for Maritime Environmental Emergencies. All resources and capabilities within this BROPEP can be implemented upon AMSAs request.

Action by			Spill from vessel (AMSA Control Agency) Definitions for 'Action by' persons are as follows: **CSSR** – Contractor Senior Site Representative. **ISSR** – INPEX Senior Site Representative. **IMT** – Incident Management Team (INPEX). CSSR includes: (Onboard vessel – Vessel Master). ISSR includes: (Onboard vessel – INPEX Client Site Representative).		
CSSR	ISSR	IMT	Immediate Response Actions	Information/Resources	Comments
			If AMSA are Control Agency, IMT to offer support as per INPEX/AMSA memorandum of understanding (MOU). ISSR and IMT to mobilise 'first strike' capabilities.		AMSA position is that INPEX should activate all INPEX 'first strike' capabilities, where there is no 'risk' of additional environmental harm, associated with the mobilisation/activation of that capability. INPEX mobilised capabilities can be 'turned-off' at any time, as directed by AMSA. Whilst initially mobilised by the INPEX IMT, operational control of these capabilities will be taken over by AMSA as the Control Agency, as the scenario evolves and IMT's become established. Transfer of control of INPEX mobilised capabilities to AMSA will occur via consultation between the INPEX IMT and the AMSA IMT. INPEX IMT to maintain communications with AMSA IMT including the mobilisation/activation and continuous operational feedback for each response capability, until such time as operational control is transferred to the AMSA IMT.
		▪	Activate oil spill trajectory modelling.	See Section 4.4.1 Surveillance, modelling and visualisation (SMV). Oil Spill Response Forms Register (C075-AH-LIS-10006).	Oil Spill Trajectory Modelling should be activated as soon as possible. RPS modelling request activated via 24/7 duty phone – 0408 477 196, followed by email of modelling request form to response@rpsgroup.com.au
	▪	▪	ISSR, in consultation with the IMT, to coordinate visual surveillance activities. Initiate Surveillance, Monitoring and Visualisation - aerial & vessel/facility visual surveillance.	See Section 4.4.1 Surveillance, modelling and visualisation (SMV).	Obtain visual spill observations from any nearby facilities/vessels Utilise any available crew change helicopters for visual surveillance IMT to coordinate longer term fixed wing aerial surveillance
	▪	▪	ISSR, in consultation with the IMT, to coordinate the deployment of oil spill satellite tracking buoys.	See Section 4.4.1 Surveillance, modelling and visualisation (SMV). **SAFETY ALERT** – there are safety considerations for deployment of satellite tracking buoys. Refer Section 4.4.1 for more details.	The location of satellite tracking buoys is maintained in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002), available on the INPEX document management system.
	▪	▪	**GROUP IV (IFO/HFO) SPILLS ONLY** ISSR to facilitate identification of most suitable vessel for dispersant operations. ISSR to mobilise dispersant equipment and **PREPARE** for dispersant test spray. Activate test spray **ONLY** when **authorised** by **AMSA**. IMT Leader may be required to assist with Operational SIMA justification to AMSA to support dispersant test spray decision.	See Section 2.5 Immediate (first strike) response measures. See Section 4.5.4 Surface (vessels and aerial) dispersant.	ISSR (FPSO OIM) to deploy the FPSO dispersant capability and **prepare** for test-spray. • 16 m^3 of dispersant on FPSO can be deployed onto PSVs or OSV (MMA Brewster, MMA Plover and Go Koi, which all have dispersant spray equipment and trained personnel onboard). • If no INPEX contracted dispersant equipment vessels available, additional vessel dispersant capability available (best endeavours) via Prelude tugs. Request access via Ichthys OIM to Prelude OIM. • Last resort – deploy FPSO 16 m^3 dispersant, AFEDO dispersant spray system and FPSO dispersant trained personnel onto any other available support vessel. **Initial test spray and ongoing operational dispersant spraying only under direction from AMSA.**
		▪	**GROUP IV (IFO/HFO) SPILLS ONLY** Commence activation of Containment and Recovery (C&R). (Note, FWAD capability will be mobilised by AMSA directly).	See Section 2.5 Immediate (first strike) response measures. See Section 4.5.4 Surface (vessels and aerial) dispersant. See Section 4.5.5 At-sea containment and recovery.	IMT to notify AMOSC to move C&R equipment from Broome stockpile to Broome Wharf and identify/mobilise suitable Core-Group personnel for boom deployment. IMT to identify primary C&R vessel (large vessel with rolled stern – E.g., Anchor Handing Tug) and second support vessel (small or large) to assist with boom deployment and towing.

II. ABBREVIATIONS AND ACRONYMS

Abbreviation/acronym	Meaning
AFEDO	Ayles Fernie Even Drop Out
AFR	Aerotech First Response Ltd
AIMS	Australian Institute of Marine Science
AIS	automatic identification system
AHT	anchor handing tugs
ALARP	as low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
AOP	associated offshore place
ARP	applied research program
ASV	accommodation support vessel
AT	air tractor
BACI	before–after, control–impact
BIA	biologically important area
BOM	Bureau of Meteorology
BROPEP	INPEX Australia Browse Regional Oil Pollution Emergency Plan (X060-AH-PLN-70009)
CMT	crisis management team
COP	common operating picture
CPF	central processing facility
CSSR	contractor senior site representative

Abbreviation/acronym	Meaning
Cwlth	Commonwealth
C&R	containment & recovery
DBCA	Department of Biodiversity, Conservation and Attractions (WA)
DCCEE	Department of Climate Change, Energy, the Environment and Water
DEPWS	Department of Environment, Parks and Water Security (NT)
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications (Cwlth)
DWER	Department of Water and Environmental Regulation (WA)
DISR	Department of Industry, Science and Resources (Cwlth)
DIPL	Department of Planning, Infrastructure and Logistics (NT)
DNP	Director of National Parks (Cwlth)
DoT	Department of Transport (WA)
DPaW	Department of Parks and Wildlife (WA) now WA DBCA
DWER	Department of Water and Environment Regulation (WA)
EEZ	exclusive economic zone
EMBA	environment that may be affected
EP	environment plan
EPA	Environment Protection Authority (NT)
EPBC	Environment Protection and Biodiversity Conservation
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EPO	environmental performance outcome
EPS	environmental performance standard
ERT	emergency response team
ESP	environmental service provider

Abbreviation/acronym	Meaning
ESTB	Electronic surface tracking buoys
E&P	exploration and production
FLNG	floating liquified natural gas
FOB	forward operating base
FWAD	Fixed wing dispersant application
GEP	gas export pipeline
GIS	geographic information system
GPS	global positioning system
Group I	condensate
Group II	MGO/diesel
Group IV	IFO/HFO/LSHFO
HFO	heavy fuel oil
HMA	Hazard Management Agency
HSE	health, safety and environment
IAP	incident action plan
IBC	intermediate bulk container
IC	Incident Controller
IFO	Intermediate Fuel Oil
I-GEM	Industry–Government Environmental Metadata
IMG	incident management guide
IMT	incident management team
IOT	Indian Ocean Territories
ISSR	INPEX senior site representative
JPDA	Joint Petroleum Development Area
JSCC	Joint Strategic Coordination Committee

Abbreviation/acronym	Meaning
KEF	key ecological feature
LAT	lowest astronomical tide
LSHFO	low sulphur heavy fuel oil
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973/1978
MGO	marine gas oil
MNES	matter of national environmental significance
MODU	mobile offshore drilling unit
MOP	Marine Oil Pollution
MoU	memorandum of understanding
NATA	National Association of Testing Authorities
NatPlan	National Plan for Maritime Environmental Emergencies
NAXA	Northern Australia Exercise Area
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority (Cwlth)
nm	nautical mile
NT	Northern Territory
NT OSCP	Northern Territory Oil Spill Contingency Plan
OM	operational monitoring
OIM	Offshore Installation Manager
OPEP	oil pollution emergency plan
OPGGS (E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cwlth)
OSCA	oil spill control agent
OSCP	oil spill contingency plan
OSMP	operational and scientific monitoring program

Abbreviation/acronym	Meaning
OSRL	Oil Spill Response Limited
OSRO	Oil spill response organisation
OSTM	oil spill trajectory modelling
OSV	offtake support vessel
OWR	oiled wildlife response
PaWC	Parks and Wildlife Commission (NT)
PEARS	People, Environment, Assets, Reputation and Sustainability
PEZ	potential exposure zone
POLREP	marine pollution report
PPE	personal protective equipment
PSV	platform support vessel
PTW	permit to work
P&D	protection and deflection
RCC	Rescue Coordination Centre
ROV	remotely operated underwater vehicle
SAR	synthetic aperture radar / search and rescue
SCAT	shoreline clean-up and assessment technique
SFRT	subsea first response toolkit
SHP-MEE	State Hazard Plan – Maritime Environmental Emergencies
SIMA	spill impact mitigation assessment
SITREP	situation report
SM	scientific monitoring
SMV	surveillance, modelling and visualisation
SOPEP	shipboard oil pollution emergency plan
SSDI	subsea dispersant injection

Abbreviation/acronym	**Meaning**
State/Territory Waters	The waters 3 nautical miles seaward of the territorial sea baseline.
TMPC	Territory marine pollution coordinator
UXO	unexploded ordnance
VOC	volatile organic compound
WA	Western Australia
WCSS	Worst Credible Spill Scenario

1 INTRODUCTION

1.1 Purpose

In accordance with Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations), the implementation strategy for an environment plan (EP) must include an oil pollution emergency plan (OPEP).

This INPEX Australia Browse Regional Oil Pollution Emergency Plan (BROPEP) has been developed specifically to respond to emergency conditions as described and defined in INPEX Australia's Environment Plans (EPs).

The scope of this BROPEP is related to INPEX Australia's exploration and production (E&P) activities in Australian commonwealth waters, between waters offshore (west) of Broome/Dampier Peninsula (Western Australia (WA)) and waters offshore (north and west) of Darwin (Northern Territory (NT)) and out to the boundary of the Australian Exclusive Economic Zone (EEZ)/international maritime boundaries. This includes the Canning, Browse and Bonaparte petroleum basins, hereafter referred to as BROPEP region (Refer to Figure 1-2).

The purpose of this BROPEP is to:

- describe the oil spill emergency response capabilities and arrangements that are in place for INPEX Australia's petroleum activities being undertaken within the Browse Basin and adjacent Commonwealth waters.
- provide high level guidance and process support for the INPEX Incident Management Team (IMT)
- demonstrate that the intent of Regulation 14 (and associated sub-regulations) of the OPGGS (E) Regulations has been met.

The inter-relationship of this document to other BROPEP documentation is presented in Figure 1-1 and Table 1-1.

Note, the implementation strategy for the INPEX Australia – Browse Regional Oil Pollution Emergency Plan suite of documents, is described in the INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment Report (X060-AH-REP-70016).

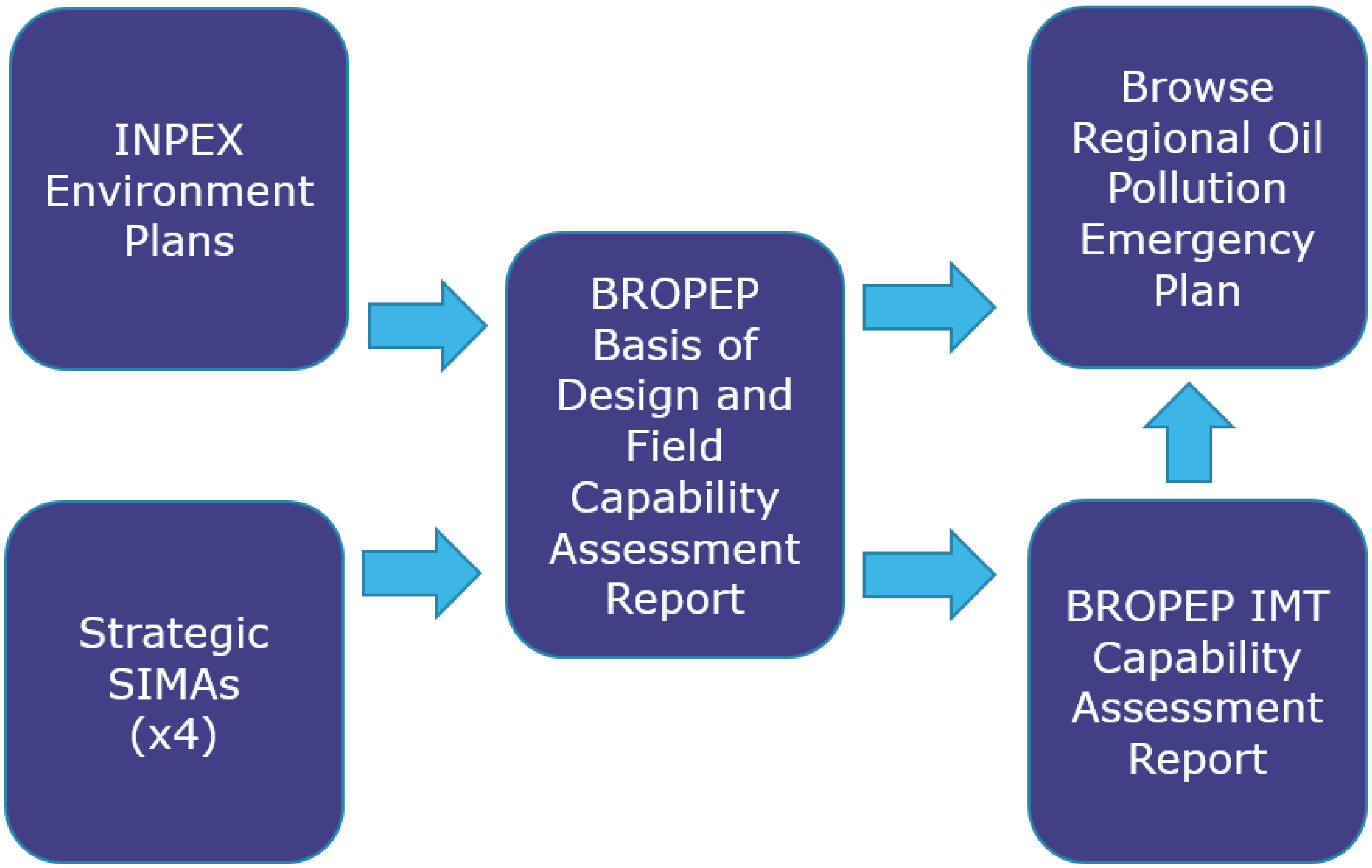


Figure 1-1: BROPEP document structure

Table 1-1: BROPEP documentation overview

Document Title	Document Number	Document Purpose
INPEX Environment Plans	N/A	All INPEX EPs contain a detailed activity description, activity specific oil spill hazard identification, including potential release rates, volumes, locations, hydrocarbon types etc, activity specific oil spill modelling, used to inform environmental risk assessments, risk assessment of oil spills on environmental values and sensitivities and evaluations of controls to prevent oil pollution from the described activity. The WCSS from all INPEX EPs are included in the BROPEP Basis of Design.
Strategic Spill Impact Mitigation Assessment (SIMA)s. Condensate spill – instantaneous surface release MGO/diesel spill – instantaneous surface release Intermediate/heavy fuel oil spill – instantaneous surface release Condensate/gas well or pipeline blowout – long duration subsea release	X060-AH-LIS-60031 X060-AH-LIS-60032 X060-AH-LIS-60033 X060-AH-LIS-60034	The four INPEX Strategic SIMA documents are pre-spill planning tools used to facilitate response option selection by identifying and comparing the potential effectiveness and impacts of the various oil spill response strategies on a range of environmental values and sensitivities. The Strategic SIMAs utilise a semi-quantitative process to evaluate the impact mitigation potential of each response strategy. This method provides a transparent decision-making process for determining which response strategies are most likely to be effective at minimising oil spill impacts. The SIMA process includes environmental considerations as well as a range of shared values such as ecological, socio-economic and cultural aspects.
INPEX Australia - Browse Region Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment	X060-AH-REP-70016	This document presents an overview of all INPEX Australia's offshore (Browse/Bonaparte basin) petroleum exploration and production activities and associated oil spill risks. This document evaluates modelling outcomes from a series of selected worst credible spill scenarios (WCSSs) and presents an oil spill response field capability analysis. This document also presents the EPOs and EPSs associated with the preparedness and environmental risk assessment of field response capability and arrangements.
INPEX Australia BROPEP – Incident Management Team Capability Assessment	X060-AH-REP-70015	The document utilises the field capability assessments as inputs to evaluate the size and structure of the INPEX IMT necessary to mobilise and maintain the field capability. The document also presents the EPOs and EPSs associated with the INPEX IMT capability and arrangements.

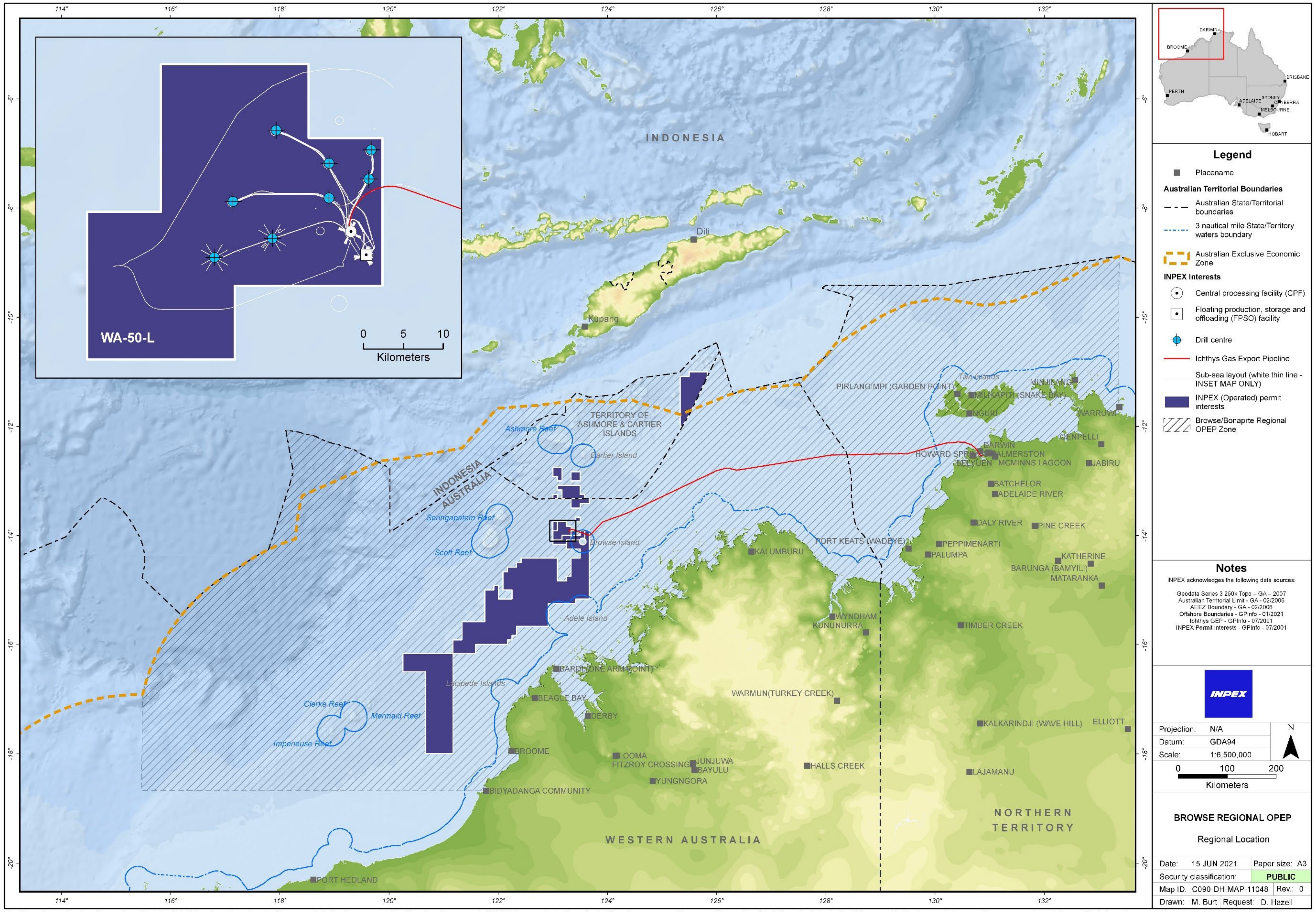
Document Title	Document Number	Document Purpose
INPEX Australia Browse Region - Oil Pollution Emergency Plan (this document)	X060-AH-PLN-70009	This document is the tool which will be utilised by the INPEX IMT during any impending/actual oil spill event. This document assists/guides the IMT through the process of notifications, gaining/maintaining situational awareness, response strategy evaluation and incident action plan (IAP) development, and mobilisation of field response capabilities. The document provides EPOs and EPSs related to the implementation of response strategies.

1.2 Plan scope

INPEX defines an Emergency Condition as:

'A hazardous situation (or threat of a hazardous situation) where Company standard operating procedures will not resolve the situation safely or prevent harm to the people, environment or assets. Successful management of an emergency will require coordinated action to control the event, correct the consequences and return the function to a safe condition.'

INPEX's offshore petroleum E&P permits/licence areas in and around the BROPEP region, and the types of petroleum activities and potential sources of oil spills managed under this BROPEP are presented in Figure 1-2 and Table 1-2.



The information contained on this map is confidential and for information only, and must not be communicated to other persons without the prior written consent of INPEX. Any unauthorised use of such information may expose the user and the provider of that information to legal risk. While every effort has been made to ensure the accuracy and completeness of the information presented, no guarantee is given nor responsibility taken by INPEX for any errors or omissions. INPEX accepts no liability for any use of the said information or reliance placed on it.

Figure 1-2: Geographical coverage of this BROPEP and INPEX Australia offshore petroleum permit/licence areas

Table 1-2: INPEX Commonwealth water E&P activities – Potential Level 2/3 spill source

Activity Type	Potential Level 2/3 Spill Sources				
	Well blowout	**Vessel collision (MGO)**	**Vessel Collision (IFO/HFO)**	**Topside facility (CPF/FPSO etc) loss of containment (condensate)**	**Pipeline/flowline rupture (condensate)**
2D / 3D seismic surveys		X			
Exploration/appraisal/production drilling, including well workovers, plug and abandonment.	X	X			
Geophysical/geotechnical survey		X			
Subsea/topside infrastructure installation & commissioning		X	X		
Operation of production facilities including production wells	X	X	X	X	
Operation of subsea production systems & pipelines		X	X		X

1.3 Key INPEX Locations

The below is a list of key INPEX locations:

- Incident Control Centre – INPEX IMT Room - Level 15, 100 St Georges Terrace, Perth, W.A.
- Ichthys CPF Explorer – Ichthys Field
  - 13º 56’ 22.5” S, 123º 17’ 52.1” E
  - -13393958 S, 123.2978 E
- Ichthys FPSO Venturer – Ichthys Field
  - 13º 57’ 34.6” S, 123º 18’ 53.2” E
  - -13.96541 S, 123.3148 E
- Forward Operating Base - Toll Marine/INPEX Drilling Logistics Base – Lot 514 Port Drive, Broome W.A.
- Forward Operating Base – Toll Energy/INPEX Offshore Logistics Base – 21 O’Sullivan Circuit, East Arm, Darwin, N.T.

1.4 Worst Credible Spill Scenarios Summary

The below is a list of worst credible spill scenarios for INPEX Australia offshore activities/operations:

- Condensate well blowout
  - Hydrocarbon type – reservoir condensate
  - Volume – Up to 255,475 m^3 (3,200 m^3/day)
  - Duration – up to 80 days
- Condensate offtake tanker collision
  - Hydrocarbon type – intermediate or heavy fuel oil
  - Volume – Up to 776 m^3
  - Duration – hours to days
- FPSO condensate tank rupture
  - Hydrocarbon type – reservoir condensate
  - Volume – Up to 5700 m^3
  - Duration – hours to days
- Gas export pipeline rupture
  - Hydrocarbon type – CPF processed gas and condensate
  - Volume – Up to 12,600 m^3
  - Duration – 4 days (shorter release duration/quicker depressurisation in shallower water)
- Support vessel collision
  - Hydrocarbon type – marine diesel
  - Volume – Up to 500 m^3
  - Duration – hours to days

2 SPILL CLASSIFICATION, RESPONSIBLE AGENCIES AND INITIAL ACTIONS

2.1 Spill classification

Under the National Plan for Maritime Environmental Emergencies (AMSA 2020a) (here-after referred to as the NatPlan), marine hydrocarbon spills and their response requirements are categorised into three levels, based on a combination of factors:

- the known or inferred spill size, scale and complexity
- the likely fate of the spill
- environmental and socioeconomic values within the vicinity
- the capability of equipment in the field regarding the spill, and the level of support required to respond.

Table 2-1 summarises the hydrocarbon spill level response models adopted for this BROPEP. This model is aligned with the Nat Plan.

In the event of a spill occurring where effective response is considered beyond the immediate response capabilities of INPEX (i.e. a spill above Level 1), the response will be escalated immediately to the next level. Spill volumes are a guide only and not to be strictly applied.

Table 2-1: Incident classification

Incident level	Spill volume (m^3)	Description
1	<10	Generally, can be resolved through the application of local or initial response resources (first strike response). (refer Section 2.6 for further information).
2	10 to 1000	Typically, more complex in size, duration, resource management and risk than Level 1 incidents. May require deployment of resources beyond the first strike response.
3	>1000	Characterised by a high degree of complexity, requiring strategic leadership and response coordination. May require national and international response resources.

2.2 Jurisdictional authority and control agency

The NatPlan defines the State/Territory and Commonwealth agencies in the following terms.

Jurisdictional Authority

Any agency which has jurisdictional or legislative responsibilities for maritime environmental emergencies is obligated to work closely with the Control Agency to ensure that incident response actions are adequate.

Control Agency

The organisation that directs and manages the spill response (with response assistance provided by other parties under the direction of the Control Agency). The Control Agency responsibility does not always coincide with that of a Jurisdictional Authority. The Control Agency has the operational responsibility to act in order to respond to an oil spill in the marine environment in accordance with the relevant contingency plan.

Table 2-2 defines the Jurisdictional Authority and Control Agency responsibilities within relevant jurisdictions.

Control Agency in Commonwealth Waters

The NatPlan specifies that for spills in Commonwealth waters, resulting from a 'Facility' (including a vessel operating as a 'Facility' or 'Associated Offshore Place' (AOP), the Operator (INPEX) shall become the Control Agency. Where the spill is not from a Facility (i.e. a vessel spill), AMSA will become the Control Agency.

The Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act), Schedule 3, Clause 4 provides high level definitions of whether a vessel is acting as a 'Facility' or as an AOP. More specific definitions are provided in the OPGGS (Safety) Regulations 2009, Regulations 1.6 and 1.7.

In the instance that AMSA is the control agency, INPEX has committed, under Clause 7 of a memorandum of understanding (MoU) between INPEX and AMSA, that INPEX: "agrees to provide all available support to AMSA in AMSA's performance of its Combat (Control) Agency responsibilities" (AMSA & INPEX 2013).

The MoU further states that for ship-sourced marine pollution events:

- AMSA is the designated Combat (Control) Agency for oil spills from vessels within the Commonwealth jurisdiction. Upon notification of an incident involving a ship, AMSA will assume control of the incident and respond in accordance with AMSA's Marine Pollution Response Plan.
- AMSA's Marine Pollution Response Plan is the operational response plan for the management of ship-sourced incidents.
- AMSA is to be notified immediately of all ship-sourced incidents through RCC Australia on +61 2 6230 6811.

2.2.1 Cross jurisdictional arrangements

Incidents involving an oil spill response could result in more than one agency having jurisdictional control across the oil spill response area. This situation is possible where a significant spill (Level 2 or 3) originates from a Petroleum Activity in Commonwealth waters (where INPEX is the Control Agency) and transitions into (or threatens) WA/NT State/Territory waters/shorelines.

Cross jurisdictional spill arrangements for WA and NT are described below.

Western Australia

The WA DoT Maritime Environmental Emergency Response 24-hour reporting number is (08) 9480 9924.

Detailed cross jurisdiction arrangements are available in the *WA State Hazard Plan - Maritime Environmental Emergencies* (SHP-MEE) (WA DoT 2021) and the described in the WA DoT Marine Oil Pollution: Response and Consultation Arrangements (WA DoT 2020).

Cross Jurisdictional arrangements described in these documents are summarised as follows:

- WA DoT will only assume the role of Controlling Agency for that portion of the response that occurs within State waters as per its jurisdictional responsibilities. This will occur under the coordination of WA DoT and the WA State Marine Pollution Coordinator, under delegation of the Hazard Management Agency (HMA) for the Marine Oil Pollution (MOP) hazards in State waters.
- WA DoT will response in accordance with the WA State Oil Spill Contingency Plan (WA DoT. 2015).
- WA DoT nominating a WA DoT Liaison Officer and Media Liaison Officer to facilitate aligned communications, share situation awareness and coordinate response actions with the INPEX IMT.
- WA DoT also establishing an Incident Control Centre in Fremantle and INPEX providing a number of emergency management support personnel to work within the WA DoT IMT (the INPEX IMT would still function and lead the response in Commonwealth waters and liaise with WA DoT IMT).
- A Joint Strategic Coordination Committee (JSCC) will be established between Controlling Agencies and their respective IMT's. The role of the JSCC is to ensure appropriate coordination between the respective IMTs established by multiple Controlling Agencies (e.g., INPEX and WA DoT).
- WA DoT may provide a liaison officer to INPEX where State waters may be impacted by a spill event.

The Response and Consultation Arrangements (WA DoT 2020) provides a series of tools to facilitate the interface between the WA DoT and a Petroleum Titleholder IMT. These include:

- Incident Control Transfer Checklist (State Water)
- IMT Functions and "Lead IMT Designations
- Initial DoT IMT Personnel Requirements upon Petroleum Titleholders
- Initial Petroleum Titleholder CMT/IMT Personnel Requirements upon DoT
- MOP Incident Notification Flowchart.

INPEX has prepared, in consultation with the WA DoT, a *Browse Island Oil Spill Incident Management Guide* (IMG) (X060-AH-GLN-60015).

The IMG provides details of how INPEX would support WA DoT in managing a spill in State waters and demonstrates how the INPEX IMT would integrate into the WA DoT IMT, in accordance with the SHP-MEE (WA DoT 2021) and the Response and Consultation Arrangements (WA DoT 2020), including detailed organisational charts and roles and responsibilities descriptions for the INPEX IMT during a cross jurisdictional response.

This document also provides specific guidance on planning, logistics, health and safety and specific response strategies/tactics for responses at Browse Island, or other similar offshore island locations in the Browse Basin or other remote northwest or northern Australian remote coastlines and islands.

Details of WA DoT MEER capability can be accessed via the WA DoT website:

HMA Maritime Environmental Emergencies (transport.wa.gov.au)

Northern Territory

Cross jurisdictional arrangements with the Northern Territory government were clarified via consultation (01 Dec 2022).

A review of the NT OSCP was triggered by change to Departmental structure and change to legislative authority. At the time of writing this document (Rev4, Feb 2022) the NT OSCP steering committee had not allocate roles under the NT OSCP across NT government. The revised NT OSCP, once endorsed, will be a sub-plan under the 'all-hazards' Territory Emergency Plan. This will align with Territory emergency management arrangements and the National Plan. Until such time as the NT OSCP is endorsed, and a Hazard Management Authority is appointed by the Territory Emergency Management Committee (TEMC), the emergency decision making authority remains with the Commissioner of Police, as the Territory Emergency Controller (TEC), under the Territory Emergency Management Plan (TEMP).

For a spill originating from an INPEX activity, as soon as possible, and in any case, within 24 hours of INPEX becoming aware of an incident/spill that could reach in NT waters, INPEX will notify the NT Pollution Response Hotline and the NT Commissioner of Police, in their role as the TEC.

Upon notification, the TEC will appoint an NT Incident Controller (NT IC), who in turn will call on competent personnel to form an incident management team appropriate to the scale of the incident. This may include the NT IC calling upon support from that National Response Team.

For all Level 2/3 spills from petroleum facilities that enter NT waters, the NT IC will assume the role of Control Agency. An NT IMT will be established in Darwin, made up of staff from across NT Government. The NT IMT will be supported by existing NT emergency response arrangements, as defined in the NT *Emergency Management Act 2013*, through the TEMC and the NT Government Functional Groups.

The NT IC with advice from NT Environment, Scientific & Technical advisors will work with the INPEX IMT (Perth) to agree protection priorities and determine the most appropriate response in NT waters.

INPEX will provide support to the NT IMT, from the INPEX IMT (Perth and Darwin), and support from an INPEX forward operating base and other INPEX resources in Darwin.

The INPEX IMT will provide support, including drafting of operational taskings or Incident Action Plans (IAPs), to the NT IC for approval prior to their release/implementation.

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

To facilitate coordination between NT IMT and INPEX IMT during a response, the NT IMT and INPEX forward operating base (FOB) will be established to ensure alignment of objectives and provide a mechanism for de-conflicting priorities and resourcing requests directly between the INPEX IMT in Perth and NT IMT in Darwin. The lines of communication between the INPEX and the NT Government are shown in Figure 2-1.

As part of consultation on 30 June 2021, it was confirmed that the NT Government is planning to utilise the *Northern Territory Oiled Wildlife Response Plan* (AMOSC 2019) as the basis for their determination of protection priorities and shoreline response planning. This has been reflected throughout this document.

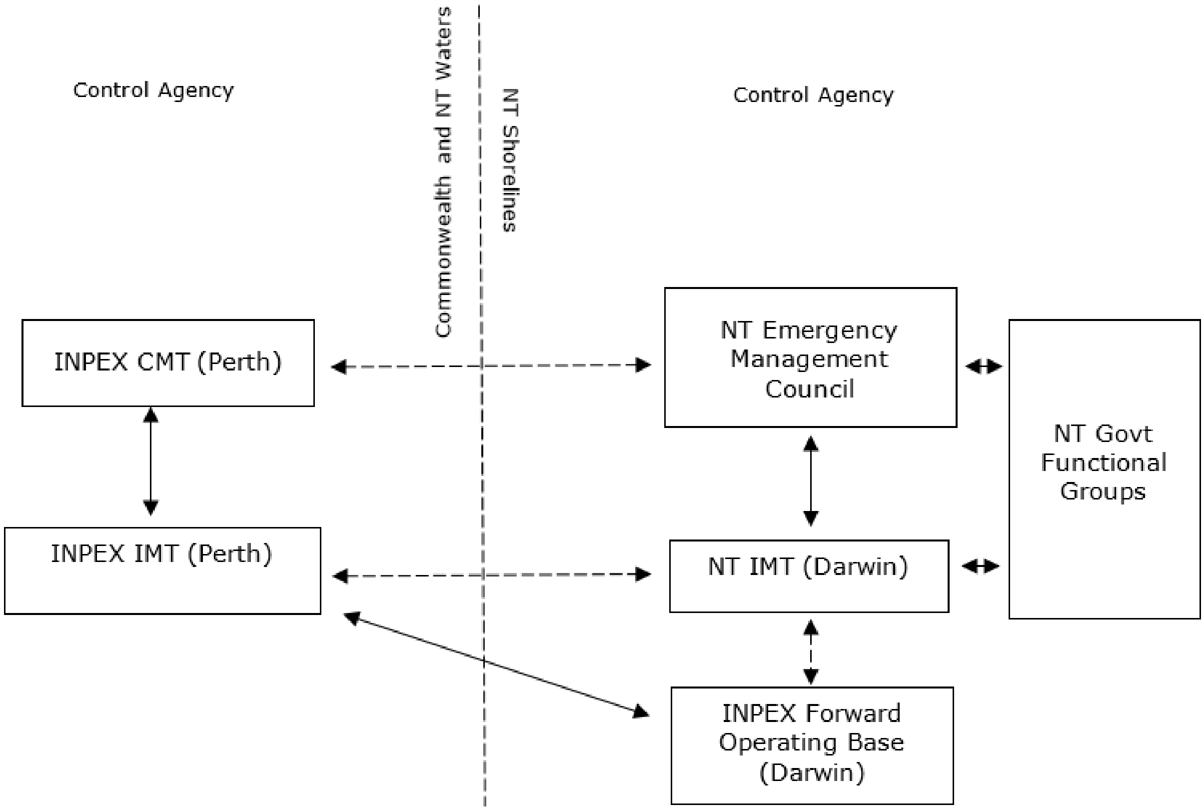


Figure 2-1: Lines of communication between INPEX and NT Government

Table 2-2: Jurisdictional Boundaries, Jurisdictional Authority and Control Agencies

Jurisdictional Boundary	Spill source	Jurisdictional Authority	Control Agency			Relevant documentation
			Level 1	Level 2*	Level 3*	
Commonwealth waters (3 to 200 nautical miles from territorial sea baseline).	Facility (e.g., CPF, FPSO, subsea pipeline or MODU) conducting a petroleum activity within a petroleum permit or licence area.	NOPSEMA	INPEX Level 1 spill response from Facility, with support provided by Facility ERT/Contractor.	INPEX With support from AMOSC and AMSA if required.	INPEX With support from AMOSC, AMSA and Oil Spill Response Limited (OSRL), if required.	Facility/MODU Shipboard Oil Pollution Emergency Plan (SOPEP) and this INPEX BROPEP.
	MODU or other Facility whilst in transit.	AMSA	AMSA With support from MODU/Facility contractor and INPEX if required.	AMSA With support from MODU/Facility contractor and AMOSC and OSRL if required.	AMSA With support from MODU/Facility contractor, AMOSC and OSRL if required.	MODU/Facility SOPEP and Nat Plan.
	Vessel within a petroleum permit or licence area conducting an activity as a 'Facility' or 'AOP'.	NOPSEMA	INPEX Level 1 spill response from support vessels.	INPEX With support from AMOSC and OSRL RL and AMSA if required.	INPEX With support from, AMOSC, AMSA and OSRL if required.	(This) INPEX BROPEP.
	Vessel within a petroleum permit or licence area, not conducting an activity as a 'Facility' or 'AOP'.	AMSA	AMSA With support from vessel contractor and INPEX if required.	AMSA With support from vessel contractor, INPEX (including AMOSC and OSRL) if required.	AMSA With support from vessel contractor, INPEX and AMOSC and OSRL if required.	Vessel SOPEP, NatPlan and (this) INPEX BROPEP
Northern Territory (NT) waters (territorial sea baseline to 3 nautical miles and some areas around offshore atolls and islands (i.e. Tiwi Islands)).	Facility/MODU or vessel conducting an activity as a 'Facility or AOP'; spill from Commonwealth waters travelling into NT waters.	NT Government	INPEX with support from NT Government.	NT Government With support from INPEX (including AMOSC and OSRL), if required.	NT Government With support from INPEX (including AMSA, AMOSC and OSRL) if required.	NT OSCP, and any support as requested by NT Government from the INPEX BROPEP.
	MODU/Facility in transit, or vessel not conducting an activity as a 'Facility or AOP'; spill from Commonwealth waters travelling into NT waters.	NT Government	INPEX with support from NT Government.	NT Government With support from INPEX (including AMOSC and OSRL), if required.	NT Government With support from INPEX (including AMSA, AMOSC and OSRL), if required.	NT OSCP, and any support as requested by NT Government from the INPEX BROPEP.
WA waters and shoreline/waters (territorial sea baseline to 3 nautical miles and some areas around offshore atolls and islands (i.e. Browse Island)).	Facility/MODU or vessel conducting an activity as a 'Facility or AOP'; spill from Commonwealth waters travelling into WA waters.	WA DoT	INPEX with support from WA DoT†	WA DoT† With support from INPEX (including AMOSC and OSRL), if required.	WA DoT† With support from INPEX (including AMSA, AMOSC and OSRL), if required.	WA DoT SHP-MEE, and any support as requested by WA DoT from the INPEX BROPEP.

Jurisdictional Boundary	Spill source	Jurisdictional Authority	Control Agency			Relevant documentation
			Level 1	Level 2*	Level 3*	
	MODU/Facility in transit, or vessel not conducting an activity as a 'Facility or AOP'; spill from Commonwealth waters travelling into WA waters.	WA DoT	INPEX with support from WA DoT†	WA DoT† With support from INPEX (including AMOSC and OSRL), if required.	WA DoT† With support from INPEX (including AMSA, AMOSC and OSRL), if required.	WA DoT SHP-MEE, and any support as requested by WA DoT from the INPEX BROPEP.

*AMOSC and government agencies may assist the relevant Control Agency for Level 2 and Level 3 spills, as appropriate to the spill characteristics.

† WA's DoT has advised that, in the event of a spill, under the *Emergency Management Act 2005*, it has the power to take over the role of Control Agency. Under the State Hazard Plan – Maritime Environmental Emergencies (SHP-MEE), the DoT will not have the full support from all agencies unless the DoT is the Control Agency.

2.3 Incident notification and IMT activation

2.3.1 Internal notification and IMT activation

The internal notification and IMT activation process is as follows:

- The spill observer shall raise the alarm and act to stop the spill, if safe to do so.
- The Contractor Senior Site Representative (CSSR), such as a Contractor vessel master/MODU OIM etc., will notify the INPEX Senior Site Representative (ISSR) (as relevant to Contractor vessels/facilities).
- The ISSR associated with the activity will notify the IMT Leader via the INPEX Emergency Call Centre, by the. The ISSR's include:
  - Client Site Representative associated with vessel activities.
  - Drilling Supervisor associated with drilling activities.
  - Offshore Installation Manager (OIM) associated with an INPEX production facility.
- The IMT Leader shall consult with the CMT (crisis management team) Leader, and jointly determine whether to activate only the IMT or both the IMT and the CMT.

Once the INPEX IMT has been activated, it shall become responsible (as Control Agency for spills from a Facility (including vessels which are classified as a 'Facility' or 'Associated Offshore Place' (AOP) for implementing spill response control measures, interaction with regulatory authorities and support agencies, monitoring, reporting and response termination.

Alternatively, the INPEX IMT will provide all available support to AMSA, as Control Agency for vessels spills.

For any Level 2/3 oil spill event, oil spill response organisation (OSRO) personnel will be required to support the INPEX IMT. OSRO support includes the following:

- AMOSC IMT personnel will become an integrated part of the INPEX IMT.
- OSRL may also provide IMT support, if required.

Notification/activation of OSRO/mutual aid arrangements are detailed in Table 2-4.

Example IMT structures for two WCSSs (condensate well blow-out and Group IV spill) are provided in Figure 2-2 and Figure 2-3.

Guidance on which roles are likely to be fulfilled exclusively by INPEX IMT personnel, compared with roles which may or will be partially or exclusively fulfilled by OSRO/mutual aid IMT capabilities is provided in Table 2-3.

Further information regarding the INPEX emergency and crisis management organisation can be found within the BROPEP IMT Capability Assessment Report (X060-AH-REP-70015).

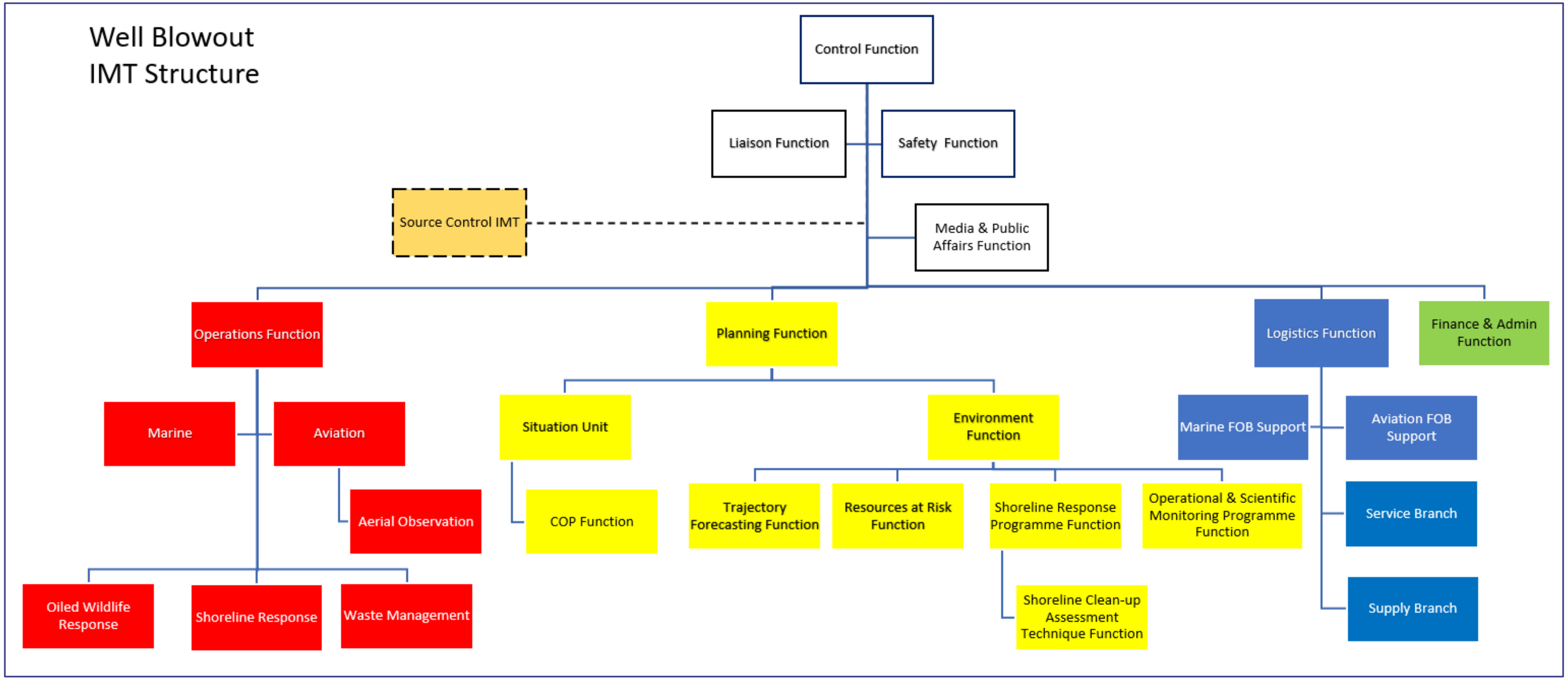


Figure 2-2: Example IMT structure – condensate well blowout scenario

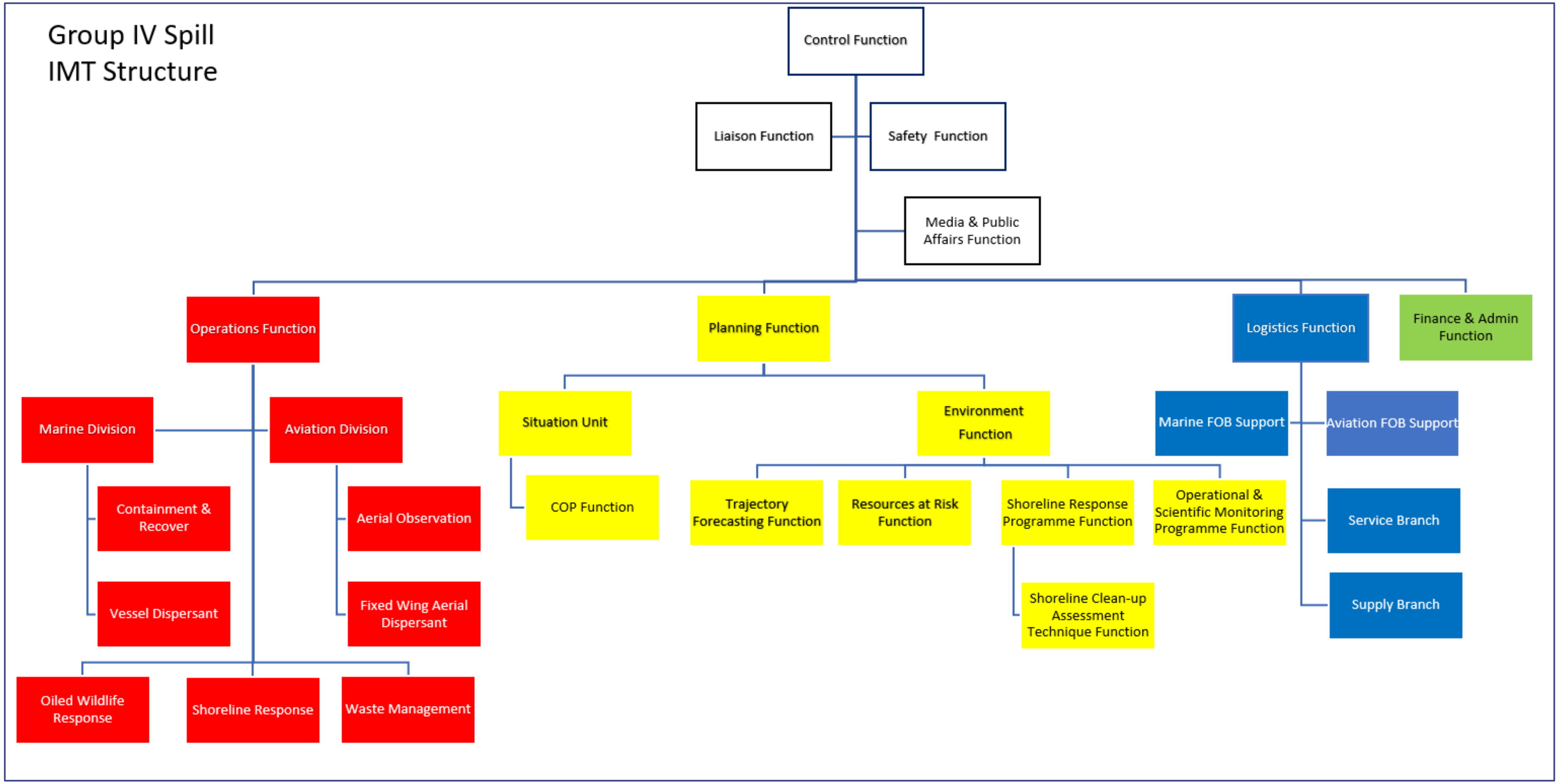


Figure 2-3: Example IMT structure – Group IV spill scenario

Table 2-3: INPEX and OSRO IMT functions

Function	INPEX	OSRO
Control / Leadership Function	Provided by INPEX IMT Leaders.	Additional/supporting capability provided as required.
Liaison Function	Provided by INPEX IMT Leaders.	Additional/supporting capability provided as required.
Safety Function	Provided by INPEX IMT Safety personnel.	Additional/supporting capability provided as required.
Media & Public Affairs Function	Provided the INPEX External Affairs/Joint Venture (EA/JV) Function.	Not applicable.
Operations Function	Provided by INPEX IMT Operations Function Leads.	Additional/supporting capability provided as required.
Operations Marine Function	Provided by INPEX IMT Operations Function personnel.	Additional/supporting capability provided as required.
Operations Aviation Function	Some capability provided by INPEX IMT Operations Function personnel.	Majority of capability provided by OSRO - especially if Fixed Wing Aerial Dispersant (FWAD) capability activated.
Operations Protection of Sensitive Resources Function	Not provided by INPEX IMT.	Capability provided by OSRO.
Operations Shoreline Response Function	Not provided by INPEX IMT.	Capability provided by OSRO.
Oiled Wildlife Response Function	Not provided by INPEX IMT.	Capability provided by OSRO.
Planning Function	Provided by INPEX IMT Planning Function Leads.	Additional/supporting capability provided as required.
Environment Function	Provided by INPEX IMT Environment Function personnel.	Additional/supporting capability provided as required.
Trajectory/Forecasting Function	Provided by INPEX IMT Environment Function personnel.	Additional/supporting capability provided as required.

Function	INPEX	OSRO
Resources at Risk Function	Provided by INPEX IMT Environment Function personnel.	Additional/supporting capability provided as required.
Shoreline Clean-up Assessment Technique Function	Not applicable.	Capability provided by OSRO.
Shoreline Response Programme Function	Not applicable.	Capability provided by OSRO.
Operational & Scientific Monitoring Programme Function	Provided by INPEX IMT Environment Function personnel.	Not applicable.
Situation Unit Function	Provided by INPEX IMT Situation Unit personnel.	Additional/supporting capability provided as required.
Common Operating Picture Function	Provided by INPEX IMT Situation Unit personnel.	Additional/supporting capability provided as required.
Logistics Function (and sub-functions)	Provided by INPEX IMT Logistics Function Leads.	Additional/supporting capability provided as required.
Finance and Admin Function	Provided by INPEX IMT Finance and Admin Function Leads.	Not applicable.

2.3.2 External agencies notification

The CSSR, ISSR and IMT Leader (as relevant) shall provide verbal notifications of Level 2 or Level 3 spill events from Vessel, Facility or AOP, to the organisations listed in Table 2-4.

The IMT Leader, (in consultation with AMSA for vessel spills), should consider additional stakeholder notifications, based on values and sensitivities affected or potentially at risk.

If written forms are required as part of a notification, access to forms can be found in Table 5-1 of this BROPEP.

If activated, the IMT shall notify AMOSC of the spill event. AMOSC shall provide IMT personnel and other technical support to assist and shall also provide access to oil spill response equipment and field response personnel, as required.

OSRL should also be notified/put on stand-by in the event of any Level 2/3 spill.

Details of oil spill response strategy capabilities and arrangements are provided in Section 4 of this BROPEP.

Event reporting is described in Section 9 of INPEX EPs; however, notifications are dependent on the activity being undertaken and the Control Agency status. Jurisdictional Authority and Control Agency status is discussed in Section 2.2 of this BROPEP.

2.3.3 INPEX Australia Emergency Contacts Directory

All relevant contact details (as applicable to this BROPEP) are contained within the INPEX Australia Emergency Contacts Directory (C075-AH-LIS-10002).

The INPEX Australia Emergency Contacts Directory is reviewed at least annually to check all relevant call-off contracts, described in sections 4.1 and 4.2, are included and all contact numbers are kept up to date.

Some key emergency contact numbers, required for initial notifications, are also listed within this BROPEP.

Table 2-4: External notifications matrix

Contact	Comments	Method	Timing	Responsibility
Spill in any location				
AMOSC (will assist as integrated part of the INPEX IMT).	For all Level 2/3 spills - activate as integrated part of INPEX IMT.	Phone call and email. Service contract with AMOSC to be signed by IMT Leader. Refer to Table 5-1.	As soon as practicable.	IMT Leader or delegate.
OSRL (may assist as a support response agency).	For all Level 2/3 spills - provide initial notification/stand-by alert. Activate if spill response escalates in order to mobilise both IMT and field response resources.	Phone call and email. Service contract with OSRL to be signed by IMT Leader. Refer to Table 5-1.	As soon as practicable.	IMT Leader or delegate.
Oil spill modelling service provider.	Provide POLREP and any other relevant event information to enact real-time spill modelling as soon as practicable.	Initial phone call followed by email of modelling request form. Spill modelling request / activation forms. Refer to Table 5-1.	As soon as practicable (must be activated within 2 hours of IMT formation)	IMT Leader or delegate.
Spill in Commonwealth waters				
AMSA duty officer.	Notification is required as soon as possible after the occurrence of the event. If AMSA has already been notified by the vessel ERT, IMT to confirm situational awareness and Control Agency responsibility with AMSA.	Phone call, within two hours. From vessel, the message must begin with the code word "POLREP", then the vessel name, the IMO number and the call sign of the ship. Written report within 24 hours of a request from AMSA, via POLREP form. Refer to Table 5-1. Written update via SITREP as required, via SITREP form. Refer to Table 5-1.	Verbally, within two hours. Written POLREP, within 24 hours. SITREP as required.	INPEX Senior Site Representative.
NOPSEMA	Notification of reportable incidents is required under OPPGS (E) Regulations 2009, Regulations 26, 26A and 26AA.	Phone call, as soon as possible and not later than 2 hours after the occurrence of a Level 2 or Level 3 event only. Written report within three days. Use NOPSEMA report form Report of an accident, dangerous occurrence, or environmental incident (FM0831). Refer to Table 5-1.	Verbally, within 2 hours. Written within three days.	INPEX Senior Site Representative or INPEX IMT Leader (or delegate).
Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).	Notification is required in cases where matters of national environmental significance (MNES) are at risk including not only listed species but also heritage properties and Ramsar wetlands, and/ or where there is death or injury to protected species. Permits from DCCEEW are required to enter and undertake activities in Australian marine parks (AMPs), heritage properties or Ramsar wetlands.	Phone call notification within 24 hours of becoming aware of the incident or non-conformance resulting in impacts to MNES. Written / email report within 3 days.	Verbally, within 24 hours. Written, within 3 days.	IMT Leader (or delegate).
Spill within or heading towards an Australian Marine Park				
Director National Parks (DNP).	Notification is required for any oil/gas pollution incidences within or likely to impact an Australian marine park (AMP) as soon as possible. INPEX to confirm details of the time and location of the event, any marine parks that are likely to be impacted and will confirm proposed response arrangements to be implemented and provide contact details for the IMT. It is acknowledged that some of the information requested by the DNP may not be available at the point of the initial verbal notification and therefore updates will be ongoing throughout the duration of any response that may impact on a marine park.	Phone call to the DNP 24-hour Marine Compliance Duty Officer: 0419 293 465. The notification should include: • titleholder details • time and location of the incident (including name • of marine park likely to be affected) • proposed response arrangements as per the Oil • Pollution Emergency Plan (e.g., dispersant, • containment, etc.) • confirmation of providing access to relevant • monitoring and evaluation reports when • available; and • contact details for the response coordinator.	Verbally, as soon as possible and prior to action being taken within an AMP.	IMT Leader or delegate (as relevant).

Contact	Comments	Method	Timing	Responsibility
Administrator of the Australian Indian Ocean Territories (IOT).	The Australian Government, through the Department of Infrastructure, Transport, Regional Development, Communications and the Arts, administers the IOTs, which include Ashmore Reef, Cartier Island, Christmas Island and Cocos (Keeling) Islands, outside of National Marine Reserve/Park boundaries. Consultation with DITRDC will be required during any spill response in the IOT.	Phone call, as soon as practicable to DITRDC once it is identified a spill is moving towards/into the IOTs.	As required.	IMT Leader or delegate (as relevant).
Spill heading towards WA State waters (e.g., Browse Island, Kimberley coastline)				
WA Department of Transport (WA DoT).	Jurisdictional Authority and Control Agency for spills in WA waters. Notification is required in the event of a hydrocarbon spill which is predicted to enter WA State waters.	Phone call to WA DoT Maritime Environmental Emergency Response (MEER) pollution hotline. Written notification by POLREP. Written update via SITREP, as required. Refer to Table 5-1.	Verbally, within two hours. Written POLREP, within 24 hours. SITREP, as required.	IMT Leader or delegate.
WA Department of Water and Environment Regulation (DWER).	Contact in the event of a hydrocarbon spill which is predicted to cause contamination of shorelines.	Phone call, as soon as practicable. Email: pollutionwatch@dwer.wa.gov.au Written report within 21 days.	As required.	IMT Leader or delegate.
WA Department of Biodiversity and Conservation and Attractions (DBCA)	Contact the Kimberley office in the event of a hydrocarbon spill which is predicted to cause contamination of WA state waters and/or shorelines	Phone call, as soon as practicable.	As required.	IMT Leader or delegate.
Spill heading towards NT waters (e.g., Tiwi islands)				
NT Government	Jurisdictional authority for spills in NT waters. Notification is required as soon as practicable in the event of a hydrocarbon spill which is predicted to enter NT waters. The NT OSCP operates within the framework of the NatPlan and consists of the NT Marine Oil Pollution Manual, the NT OSCP and supporting port OSCPs.	Phone call, as soon as practicable by calling the marine pollution coordinator (TMPC). Written notification by POLREP. Written update via SITREP, as required. Refer (Table 5-1).	Verbally, as soon as practicable. Written POLREP, within 24 hours. SITREP, as required.	IMT leader or delegate.
NT Government	The NT Government, supported by the NT environmental science coordinator/EPA in the NT, and would provide advice to the incident controller during any spill response in the NT. Notification is required as soon as practicable in the event of a hydrocarbon spill which is predicted to enter NT waters.	Phone call and email.	Verbally and by email, as soon as practicable.	IMT Leader or delegate.
Spill heading towards defence areas e.g., Northern Australia Exercise Area (NAXA)				
Department of Defence.	Notification is required as soon as practicable in the event of a hydrocarbon spill which is predicted to enter defence areas such as NAXA, Yampi Sound or any other defence area. Notification may be required if significant vessel mobilisations or activities are required within the defence areas to ensure response vessels have clearance to access any currently active Defence Practice Areas. Notification may also be required regarding access restrictions within defence areas in relation to hazardous zones such as unexploded ordnance (UXO).	Phone call to Department of Defence – Defence Switchboard. Relevant contacts: Director General Maritime Operations, Headquarters Joint Operations Command. Assistant Secretary, Property Management Branch.	As soon as practicable.	IMT Leader or delegate.
Spill heading towards Indonesia or East Timorese waters				
Department of Industry, Science and Resources (DISR).	In the event that a spill is predicted to enter Indonesian or East Timorese waters, or the Joint Petroleum Development Area (JPDA), the Australian Government is required to notify foreign governments. DISR will notify the Department of Foreign Affairs and Trade, who will notify the relevant foreign government.	Phone call to DISR.	As soon as practicable.	IMT Leader or delegate, in consultation with CMT.
Relevant persons identified who have requested notification in the event of a spill				

Contact	Comments	Method	Timing	Responsibility
Ardyaloon Incorporated	Identified as relevant persons and requested to be notified in the event of a spill regardless of whether shoreline contact has been predicted to occur on their land/sea country. INPEX will provide a courtesy notification however any formal notifications would be issued by the relevant State or Territory control agency.	Email	Where modelling indicates potential for the spill to enter State or Territory waters adjacent to their area of interest within the next 48 hours (unless notifications have already been made by the State or Territory control agency)	IMT Leader or delegate.
Djarindjin Aboriginal Corporation		Email		
Lombadina Aboriginal Corporation		Email		
Northern Land Council	Identified as a relevant persons and requested to be notified if a spill has the potential to impact coastal environments in the NT. INPEX will provide a courtesy notification however any formal notifications would be issued by the relevant state or territory control agency.	Email		
Western Australian Fishing Industry Council (WAFIC)	Identified as relevant persons and requested to be notified in the event of a spill that may impact on WA fisheries. INPEX would utilise WAFIC's fee for service to contact commercial fishing licence holders in the event of an emergency scenario.	Email	Within 24 hours	IMT Leader or delegate.

2.4 Pollution report (POLREP)

A marine pollution report (POLREP) is required to be sent to AMSA for any vessel-based or facility-based spill.

The POLREP should also be sent to the IMT, as it contains the relevant information necessary for the IMT to gain initial situational awareness.

The following information shall be included in the POLREP regarding any vessel spill for reporting and response planning purposes:

- the name of vessel
- the date and time of the spill
- the location of the spill
- details of the spilled material
- the source and cause of the spill
- an estimated volume of the spill
- the vessel status (stability, condition of the ship, etc.)
- the estimated rate of release and maximum credible volume if the spill is ongoing
- the condition of the spill, i.e. stopped/ongoing, contained/uncontained
- the meteorological conditions:
  - air temperature
  - wind speed and direction
  - visibility
- the oceanographic conditions:
  - sea temperature
  - current speed and direction
  - Beaufort sea state.

See Table 5-1 for further information regarding POLREP template and submission timeframes.

2.5 Immediate (first strike) response measures

In accordance with Table 2-1, a Level 1 event should be managed by first strike response measures, utilising only the resources available to the Emergency Response Team (ERT) in the field.

As such, within the context of a spill in the Browse/Bonaparte Basin, where a small spill (<10 m^3) would be highly unlikely to result in any significant environmental impact to any shoreline, the 'first strike' measures associated with a Level 1 event only include the following:

- visual surveillance from vessels and facilities
- visual surveillance from opportunistic crew-change helicopters.

If these are the only resources required to visually monitor a spill, until the spill has evaporated or is confirmed to no longer present a risk to the environment, then this would be classified as a Level 1 spill, and the INPEX IMT and this BROPEP would not be activated.

However, in accordance with Table 2-1, should the nature/complexity of the spill require support from the IMT, the spill would be classified as a Level 2/3 event, and this BROPEP would be activated.

All Level 2/3 spills

The immediate response actions which need to be undertaken by the IMT for all Level 2/3 spill events is the activation of Surveillance, Modelling and Visualisation (SMV), as detailed in Section 4.4.1 of this BROPEP.

Group IV spill only

Group IV products include the following:

- Intermediate Fuel Oil (IFO)
- Heavy Fuel Oil (HFO)
- Low Sulphur Fuel Oil (LSHFO).

In the event of a Group IV spill, the additional immediate/first-strike response actions to be undertaken, (as described in Table I-1), are the following:

- Vessel dispersant
  - Ichthys Field Manager/FPSO OIM to facilitate identification of the most suitable vessel for dispersant operations, conduct dispersant test spray and report on effectiveness to the IMT Leader.
  - IMT Leader to authorise ongoing vessel dispersant, by using the Dispersant Application Decision Matrix (refer Table 4-11).
- At-sea containment and recovery
  - IMT to commence activation of at-sea containment and recovery by notifying AMOSC to move containment and recovery (C&R) equipment from Broome stockpile to Broome Wharf.
  - IMT to identify primary C&R vessel (large vessel with rolled stern – (E.g., anchor handling tug) and second support vessel (small or large) to assist with boom deployment and towing
- Fixed Wing Aerial Dispersant (FWAD)
  - Notify AMOSC to activate FWAD Contract; air-tractor from Batchelor and/or Exmouth – to prepare to mobilise to a nominated airfield (E.g., Lombadina or Truscott).

Details of surface dispersant and at-sea containment and recovery response strategies, capabilities and arrangements are provided in Section 4.5.4 and Section 4.5.5 respectively.

Note, the vessel dispersant, FWAD and C&R capabilities can be rapidly de-activated if the Operational SIMA determines one or more of the response strategies are not required.

3 INCIDENT ACTION PLAN (IAP) DEVELOPMENT

The process for identifying appropriate IAPs is illustrated in Figure 3-1.

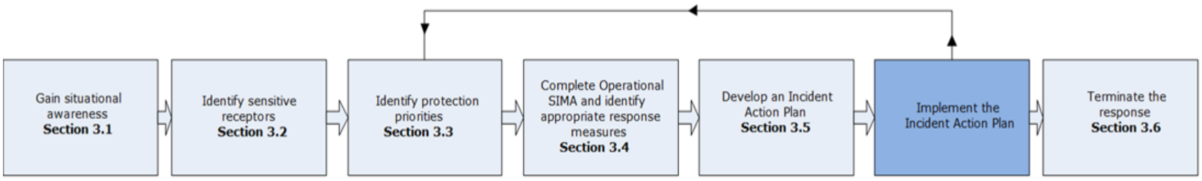


Figure 3-1: Typical response procedure

3.1 Gain situational awareness

The IMT will gain situational awareness from all available sources including:

- surveillance, modelling and visualisation data
- POLREP
- ongoing updates from the facilities/MODU/vessels in the vicinity of the spill
- long-term weather forecast
- other operators' activities.

3.2 Identify sensitive receptors

Particular values and sensitivities with the potential to be exposed/impacted by activity oil spill events are described within Section 4 of each activity specific EP.

Appendix C contains maps of the environmental values and sensitivities of the BROPEP region.

The INPEX GIS is pre-loaded with the spatial layers of these values and sensitivities maps, to enable rapid overlay of oil spill trajectory modelling (OSTM) outputs and other SMV data, to evaluate known and/or potentially affected values and sensitivities.

Table 3-1 presents the seasonal abundance associated with particular values and sensitivity which have been identified within the BROPEP geographic region.

Table 3-1: Seasonality of values and sensitivities within the BROPEP region

Values and sensitivities	Example Locations	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coral spawning (offshore reefs)	• Browse Island, Kimberley/NT coast, Rowley Shoals, Scott Reef, Seringapatam Reef, Rowley Shoals, Hibernia Reef												
Green turtle breeding and hatching	• Browse Island and Scott Reef (Sandy Islet)*												
	• 80 Mile Beach, Adele Island, Lacepede Islands, Cassini Island**												
	• Ashmore Reef and Cartier Island*												
Turtle foraging	• Turtle foraging BIA												
Hawksbill turtle nesting	• Ashmore Reef and Scott Reef*												
Olive ridley turtle nesting	• Kimberley coast*												
	• Tiwi Islands*												
Flatback Turtle Nesting	• Buccaneer, Bonaparte Archipelago**												
	• Lacapede Islands and 80 Mile Beach*												
	• Tiwi Islands*												
	• Cassini Island and Maret Islands*												
Humpback whale migration	• Kimberley coast							Northern then southern migration					
Humpback whale calving	• North-west Commonwealth Marine Reserves Network, Lalang-garram / Camden Sound Marine Park and humpback whale Biologically Important Areas (BIA)**							Whales present in calving grounds					
Blue whale and pygmy blue whale migration	• Open ocean (approx. 500 m depth contour)				Northern migration					Southern migration			
Whale shark	• Whale shark BIA												
Dugong and Inshore Dolphins	• WA coast, Ashmore Reef **												
Seabird feeding, aggregation and breeding	• Marine avifauna BIA (e.g. Ashmore Reef Ramsar site), Cartier Island, Scott Reef, Adele Island). Nationally Important Wetland at Mermaid Reef.				Breeding and foraging								
Shorebird migration	• Migratory birds present in coastal habitats				Northern migration					Southern migration			
Shorebird breeding	• Marine avifauna BIA and WA/NT coastline												
Indonesian traditional fishing	• Offshore islands and reefs located within the traditional fishing MoU area.												
Recreational fishing	• Open ocean and WA/NT coastline												

Values and sensitivities	**Example Locations**	**Month**											
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Commercial fishing	• Throughout entire BROPEP region												
Legend													
	Peak occurrence/activity (reliable and predictable)												
	Intermediate occurrence/activity (less reliable and less predictable)												
	Low occurrence/activity (may vary from year to year)												
	No occurrence												

* Source: DEE (2017).

** Source: Waples et al. (2019)

3.3 Protection priorities

In the event of a spill, the primary aims of the response will be aligned with the NatPlan (AMSA 2020a) and the INPEX People, Environment, Assets, Reputation and Sustainability (PEARS) model and include protection of the following, in descending order of priority:

- human health and safety
- habitat and cultural resources (environmental sensitivities)
- rare and/or endangered flora and fauna (environmental sensitivities)
- commercial resources
- amenities.

Within offshore/deep Commonwealth waters, there are no specific locations which can be classified as protection priorities.

Shallow submerged habitats or intertidal habitats (banks, shoals, reefs, islands etc.) are typically associated with increased biological diversity and abundance, and are typically habitats utilised by EPBC listed species such as marine mega-fauna (such as turtles marine avifauna), for foraging/feeding, inter-nesting, aggregation, etc. Therefore, these locations are considered as key the protection priorities under the BROPEP.

Whilst the WA/NT Control Agencies are responsible for the determination of the protection priorities within State/Territorial waters, and therefore responsible for the final decisions on protection priorities and response strategies, INPEX considers the following offshore locations as the protection priorities for the BROPEP region.

- Browse Island (WA state waters)
- Scott/Seringapatam Reef (WA state waters)
- Rowley Shoals (WA state waters & Commonwealth waters)
- Adele Island (WA state waters)
- Lacapede Islands (WA state waters)
- Ashmore Reef (Indian Ocean Territories)
- Cartier Island (Indian Ocean Territories). **Note, due to UXO risk – nearshore/shoreline response is not considered safe at this location.)**
- Bare Sand Island (NT territorial waters)

Additional planning tools which would be used during a response to determine protection priorities include the zoning within the various WA Marine Parks (refer Appendix C) and the Advisian (2018) report *Provision of Western Australian Marine Oil Pollution Risk Assessment - Protection Priorities Protection Priority Assessment for Zone 1: Kimberley - Draft Report.*

If a single species (marine turtles) was selected as the major OWR protection priority, key locations, based upon INPEX baseline studies (Comrie-Greig and Abdo 2014) of turtle breeding in the Kimberley, would be, in order of priority;

1. Lacapede Islands
2. Cassini Island
3. Maret Islands (especially the south beach on South Maret Island).

Protection priorities for WA Kimberley coastline/NT coastline would need to be determined in consultation with WA/NT Control Agencies and other relevant stakeholders, at the time of the event, discussed further below.

For a more comprehensive list of environmental sensitivities, refer to Appendix C: Environmental values and sensitivities maps.

In the event of a spill, the INPEX IMT is responsible for providing all available SMV data to the relevant Control Agency, to enable the Control Agency to determine the protection priorities, in accordance with the WA SHP-MEE / WA OSCP / NT OSCP.

Western Australia

For any oil spill entering or within WA State waters/shorelines, the WA Control Agency is the ultimate decision maker regarding identification and selection of protection priorities.

The WA Control Agency will utilise their internal processes which typically includes the following:

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

The WA Controlling Agency will adjust/amend their internal processes to suit the spill situation at the time.

Northern Territory

Within the Northern Territory, it is expected that priority protection areas will be selected by the NT Government by utilising a similar process as described for the WA Control Agency, with guidance taken from the *Northern Territory Oiled Wildlife Response Plan* (AMOSC 2019).

Indian Ocean Territories

For any spill entering the Indian Ocean Territories, (including Ashmore Reef, Cartier Island, Christmas Island and Cocos (Keeling) Islands), consultation will be undertaken (as per Table 2-4) to agree protection priorities and associated response strategies and tactics.

Note, Cartier Island has substantial Unexploded Ordinance Risk, and near-shore/shoreline response is not proposed, due to these hazards. Refer Table 4-24 for further information.

3.4 Operational SIMA

Strategic spill impact mitigation assessments (SIMAs) outcomes for the well blowout and vessel collision spill scenarios are summarised in Section 5 of the BROPEP BOD and Field Capability Assessment Report.

This BROPEP provides a single Operational SIMA Template (Table 3-2), for all worst credible Group I, II and IV spill scenarios.

The Operational SIMA template includes a summary of key points from the Strategic SIMAs as well as ALARP/implementation considerations. IMT Planning and Environment shall evaluate and complete the Operational SIMA Template, and it should then be endorsed by the IMT Leader. The outcome of the Operational SIMA will be as the basis for response strategy selection, for inclusion in the development of the IAP.

During the review of the Operational SIMA, the IMT will need to consider the specific conditions of the spill event, such as the oil type, spill location, trajectory and fate of the oil, long-range weather forecast, environmental values and sensitivities (and any associated seasonality factors), all of which may have a bearing on the effectiveness and feasibility of implementing various response strategies.

Consultation with relevant State/Territory Control Agencies may also be required if the spill is anticipated to enter State/Territory waters.

The Operational SIMA(s) shall remain as a record of the reasoning behind the selection or elimination of various response strategies at various points in time during an actual event.

The Operational SIMA should be re-evaluated frequently during the response (e.g., as new SMV data or response strategy effectiveness/monitoring data becomes available), to ensure the selected response strategies and IAP remain appropriate for the scenario and response strategy effectiveness at the time.

In summary, the IMT should:

- evaluate the validity of the assumptions of the Strategic SIMA
- review all available situational awareness information (including any available SMV data at the time)
- evaluate the ALARP/implementation considerations
- consult with AMOSC/OSRL as required
- complete the comments section – to provide operational justifications related to the decision to active/not activate each response strategy
- ensure IMT Leader sign-off is achieved (digital/email endorsement considered acceptable if operating in 'remote' IMT setting)
- review/revise the Operational SIMA, as necessary.

Table 3-2: Operational SIMA Template

Incident Name		**IMT Planner Name**		**IMT Leader Name**	
Operational SIMA Review Date/Time	(dd/mm/yy) ___/____/ 20___ (___:___ hrs)	**IMT Environment Name**		**IMT Leader Signature (endorsement)**	

Response Strategy	**Spill Source Applicability**	**Strategic SIMA Summary**	**Operational Considerations**	**Operational SIMA comments**
Surveillance, Modelling and Visualisation (SMV)	Group I surface YES Group I subsurface YES Group II YES Group IV YES	SMV will provide timely information to the IMT, enabling situational awareness to assist with IAP development, implementation and termination of oil spill response strategies. Operational monitoring and evaluation shall be implemented for any Level 2/3 spill.	In the event of any Level 2/3 spill, the IMT should prioritise the activation of the following activities: Oil spill trajectory modelling Activate within 2 hours of IMT formation for all Level 2/3 spills. Visual surveillance: Aerial surveillance is the primary/preferred method of visual surveillance. Any available crew change helicopters should also be used for aerial surveillance, provided the crew change helicopters are not required for other emergency tasks (target timeframe <5 hours). Longer-term aerial surveillance operations should utilise fixed-wing aircraft and trained aerial observers. Where possible, obtain additional visual surveillance from nearby vessels and facilities, especially during early stages of a spill. Vessel and/or facility-based surveillance is less efficient than aerial surveillance. Data from opportunistic vessels/facilities can be collected, but this should not be a primary strategy for visual observations of slicks over longer term. Electronic surface tracker buoys (ESTBs): When deploying ESTBs, preferably deploy 3 during the initial stages (hours) of the spill, in close proximity to each other at leading edge of the slick. Additional three at end of daylight hours. Consider the atmospheric risks and VOC exposure for any ESTB deployments (refer Section 4.4.1). Satellite Imagery: • Consider satellite imagery acquisition to complement longer-term aerial surveillance programs and support OSTM validation.	
At Sea Containment and Recovery (C&R)	Group I surface spill NO Group I subsurface NO Group II NO Group IV YES	Generally, oil needs to be Bonn Code 4/5 (minimum thickness of >100 g/m^2, (O'Brien 2002) to feasibly corral oil with a boom and achieve any significant level of oil recovery (reasonable level of efficiency) with the skimmers. In general, this strategy is not appropriate for any Group I/condensate spills (surface/subsurface) or surface Group II /diesel spills due to the very rapid spreading and high VOC risks associated with spills of these products. For a Group IV (IFO/HFO/LSHFO) spill, where the slick is typically persistent, with low volatility, and likely to be present on the sea surface at appropriate concentrations (>100 g/m^2) for an extended period of time, a C&R operation may be possible. The deployment of booms and skimmers to recover Group IV oil spills is generally a suitable response strategy in a sheltered environment with non-emulsified heavy oils. Therefore, this strategy's effectiveness may sometimes be limited by the prevailing sea state conditions of the BROPEP region.	In event of a Group IV spill, the IMT should, as soon as reasonably practicable. request AMOSC to commence mobilisation of C&R equipment from Broome AMOSC stockpile (or Darwin AMSA stockpile as back-up location) identify available large support vessels with rolled/open sterns, suitable for deployment of offshore booms. Preferably select vessels closest to Broome (or Darwin as back-up location) Containment and recovery equipment and personnel to operate the equipment is available through AMOSC, with stockpiles of equipment located in Broome, Exmouth and other locations throughout Australia. Darwin stockpile available upon request via AMSA. A period of relatively calm sea-states and an oil amendable to recovery with skimmers would be required to undertake a successful response – ideally average wind speeds <20 knots. The final decision to undertake C&R activities in Commonwealth waters should be undertaken by the INPEX IMT in consultation with AMOSC, using available SMV/situation awareness data, confirm a positive outcome could be achieved by the activation of this response strategy (otherwise de-active the response strategy). The WA/NT Control Agency will make the final decision to undertake C&R activities in WA/NT waters.	

Response Strategy	Spill Source Applicability	Strategic SIMA Summary	Operational Considerations	Operational SIMA comments
		The strategy is relatively labour intensive when the effort is considered against overall effectiveness in reducing the volume of floating oil (i.e. it only covers a small area of spill with 1 or 2 vessels deploying booms, plus numerous personnel). Other limitations include reduced effectiveness at >0.7 to 1 knot current speeds (IPIECA 2015a) (these current speeds are often experienced in the BROPEP region); ineffectiveness in adverse sea states (>20 knots/1.8m wave height, routinely experienced during dry season and monsoonal conditions in the Timor Sea); skimmer reduced effectiveness in open ocean and with emulsified oils; and logistical issues associated with recovered waste at sea (IPIECA 2015a). As such, containment and recovery will remain a challenging response strategy against Group IV spills in the Timor Sea. Weather conditions permitting, if SMV data indicates a positive outcome could be safely achieved it may be possible undertake a C&R operation.		
Surface dispersant (vessel and/or aerial based)	Group I surface NO Group I subsurface NO Group II NO Group IV YES	Due to high natural entrainment rates, surface dispersant will not result in any benefit against Group I or Group II spills. Group IV floating slicks have a high viscosity and will not rapidly spread into sheens. Dispersant can be effective at reducing the surface expression of Group IV hydrocarbons, under specific circumstances (IPIECA 2015b). The reduction in the surface expression of Group IV spills would reduce the risk of contact with shoreline or intertidal sensitivities and would therefore also benefit the values and sensitivities such as marine avifauna, marine megafauna (particularly air-breathing animals), turtles (particularly nesting activities), intertidal corals, and intertidal traditional fisheries. Dispersants have an inherent level of toxicity. In addition, chemically dispersed hydrocarbons may, in certain instances, have a higher level of toxicity to benthic biota than the hydrocarbons themselves. Dispersant use results in increased entrainment in the water column increasing the bioavailability of the hydrocarbon. Monitoring undertaken after the Montara oil spill demonstrated dispersant application resulted in entrained hydrocarbons concentrating in the top 25 m of the water column (AMSA 2010). Values and sensitivities potentially suffering from a negative impact from dispersant application to Group IV spills (that would otherwise not have been exposed to the surface slick) include: pelagic species – transient populations or individuals, particularly those using the upper reaches of the water column, including subtidal protected species (whales, whale sharks etc) subtidal corals and benthic primary producer habitat in the top 25 m of the water column.	In event of a Group IV spill, the IMT should, as soon as reasonably practicable. Request the Field Manager to coordinate the identification and deployment of dispersant capabilities in the Ichthys Field, or request dispersant capability support via Prelude OIM. Request AMOSC commence mobilisation of FWAD capability. The Dispersant Application Decision Matrix (Table 4-11) must be completed and signed by the IMT Leader before dispersant application can commence. Chemical dispersant using aerial and/or vessel spraying can be undertaken on fresh (non-weathered, non-emulsified) Group IV slicks only. Vessel-based dispersant can be rapidly mobilised using the following: • INPEX FPSO 16 m^3 dispersant stockpile • OSV and 2 x PSVs fitted with dispersant spray systems and trained crew • FPSO AFEDO dispersant spray system and trained personnel (the FPSO AFEDO system and trained personnel can be moved to any other available support vessel). • The Prelude FLNG support tugs are an additional vessel-based dispersant capability, activate via Prelude OIM. • Additional vessel-based dispersant spray equipment and stockpiles are in Darwin and Broome – access via AMOSC. The 'window of opportunity' for effective dispersant application is generally from a few hours to a day before the viscosity threshold for effective dispersant application is exceeded. However, for ongoing spill scenarios (e.g., a vessel slowly leaking a Group IV oil), both longer duration vessel-based dispersant, and FWAD capability (day 2 onwards) could be used. Vessel-based dispersant application is limited to daylight hours, good visibility and Beaufort seas-state of 2 – 7 (ideal conditions Beaufort 3-6). The FWAD capability (crop-duster aircraft) located in Batchelor (NT) and Exmouth (WA) can be mobilised through AMOSC. For FWAD in the Browse Basin; The most likely 'nominated airbase' would be Lombadina or Mungalalu/Truscott airport The mobilisation of FWAD capability to the 'nominated airbase', including all required support personnel, air attack supervisor, air attack aircraft, ancillary equipment and dispersant stockpile, would take at least 24 hours The FWAD aircraft are limited to dispersant spraying during daylight operations only	

Response Strategy	Spill Source Applicability	Strategic SIMA Summary	Operational Considerations	Operational SIMA comments
		All values and sensitivities deeper than 25 m are unlikely to be exposed to dispersant or the dispersed hydrocarbons, as noted in AMSA (2010). The negative impacts to benthic primary producer habitat would be minor if dispersant is applied at significant distance from the reef/shoal. In view of this, values and sensitivities unlikely to be impacted by dispersant or the dispersed hydrocarbons include: • Australian Martine Parks (AMPs) • Key Ecological Features (KEFs) • all banks and shoals deeper than 25 m • demersal commercial fisheries.	INPEX/AMOSC IMT are required to complete a FWAD Operations Plan and provide the air attack aircraft (crew-change helicopter) and SAR platform (helicopter or vessel-based), and any additional resources required by AMSA/AMOSC to activate the FWAD capability. SAFETY ALERT Fixed facilities with shallow/hull mounted seawater intakes may potentially be impacted by dispersant/dispersed oil (E.g., a MODU or Prelude FLNG facility). If a fixed facility may be exposed, ensure the relevant facility OIM is aware that exposure to very high concentration of entrained/dispersed oil may potentially require: • monitoring of quality of RO/desalination water. Additional cleaning of RO/desalination filters may be required. • monitoring of operability of cooling water system. Additional cleaning of heat exchange plates may be required. Note – not a credible risk unless thick oil being dispersed very close (within a few hundred metres) of the facility.	
Dispersant subsea	Group I surface NO Group I subsurface YES Group II NO Group IV NO	Atmospheric modelling (RPS 2019) of several worst-case well-blowout scenarios indicates that VOC concentrations would routinely be expected to exceed the 500 ppm VOC 15-minute short-term exposure threshold, resulting in the shut-down of any vessel activities near the well blowout location. This VOC risk would therefore potentially stop 'source control' activities, such as debris clearance or capping stack installation, potentially prolonging the duration of a well blowout and associated surface and entrained oil exposures. If SSDI were used during a well blow-out, for the time that SSDI was applied, modelling (RPS 2019) indicates the rates of entrainment would increase and rates of evaporation would decrease. With SSDI application, during light wind conditions, ~70% of the condensate would entrain in the shallow water column (top 3m), with evaporation (and associated atmospheric VOC exposure) reducing to ~30%. Under increased wind conditions (>6 knots), evaporation becomes close to zero (RPS 2019). Therefore, SSDI will cause a reduction in atmospheric VOC concentration, enabling a safe debris clearance/capping stack installation. Any impacts to the environment, associated with the use of SSDI to achieve a successful well-kill using a capping stack are offset by the significant reduction in the overall duration of the blow-out (and net reduction in entrained hydrocarbons) compared to a relief well-kill scenario. The increase in entrainment from SSDI is similar to normal levels of entrainment expected to occur under higher wind conditions, and the effects of increased entrainment due to SSDI are partially offset due to a reduction in oil droplet size, resulting in a significant increase in biodegradation rates (up to 50%).	Should a condensate well blow-out have occurred, and debris clearance/capping stack installation are required, SSDI may be required, to ensure the safety of vessel-based personnel undertaking source control activities. VOC modelling and in-field monitoring of VOCs at surface from the subsea release is required, to determine requirement for SSDI activation. An SSDI spread is maintained by AMOSC as part of the subsea first response toolkit (SFRT). The SFRT is located in Fremantle, WA and includes 500 m^3 of Slick-Gone-NS dispersant and injection wands. Vessels with work-class ROVs, and topside (vessel deck mounted) dispersant pumping spread and downlines will be required to be provided by INPEX Source Control IMT.	

Response Strategy	Spill Source Applicability	Strategic SIMA Summary	Operational Considerations	Operational SIMA comments
Protection of Sensitive Resources	Group I surface NO Group I subsurface NO Group II YES Group IV YES	Booms can be used to protect and deflect (P&D) spills away from sensitive habitats or capture oil within natural collection points to protect adjacent areas. This technique is most likely to be more effective against Group II and Group IV slicks. However, the strategic SIMA found that it was unlikely to result in a tangible benefit against low concentration, weathered condensates. P&D is less effective in areas of high wave energy or strong currents, which are seasonally prevalent at offshore islands in the Browse & Bonaparte Basins and along the outer islands of the Kimberley/NT coastline (calmer periods more likely during transition months, generally March-May and Sept-Nov). Given the size of the offshore island shorelines (e.g., Browse Island intertidal zone is 3 km in diameter, and is one of the smallest offshore islands), substantial numbers of booms would need to be deployed to protect the offshore island shorelines. Anchoring of booms would most likely result in additional damage to the subsurface environment (coral reef) which surround most offshore islands. Booms could potentially be held in place by vessels. However due to widths of shorelines requiring protection, this would most likely require an unfeasibly large number of vessels. Booms themselves would also move around on the coral intertidal reef during periods of lower tides, potentially resulting in significant physical damage to the benthos of the reef platform. If a slick were potentially reaching a more sheltered location such as the Kimberley or NT coastlines, shoreline booming may be a more appropriate strategy, on sheltered sandy beaches (not mangrove systems or rocky headlands), however the extreme tidal ranges (+7m) and presence of estuarine crocodiles in all Kimberley/NT sheltered coastal waters present very significant challenges. Therefore, if a tangible, positive outcome could be demonstrated and with the right weather conditions a resource protection operation may be possible.	The WA/NT Control Agencies will make the final decision to undertake P&D activities in WA/NT waters/shorelines. If SMV data demonstrated a tangible, positive outcome, and with weather conditions permitting (<1m sea-state) and conducive to a resource protection operation, there is the potential to undertake this response activity within a nearshore/intertidal environment. Protect and deflect equipment and personnel to operate the equipment is available through AMOSC, with stockpiles of equipment located in Broome, Exmouth and other locations throughout Australia. P&D equipment transport to and from the shoreline would be by small vessels. Low sea-states and calm weather are required for use of vessels for intertidal / nearshore activities. Tide forecasts should also be consulted to ensure appropriate and safe vessel activities. A large support vessel (with a helicopter pad, if relevant) would need to be used as the accommodation and logistics base for response personnel. In general, to reduce wildlife disturbance on small, offshore remote locations, a longer duration response with minimum numbers of response personnel may be appropriate.	
SCAT & Shoreline clean-up	Group I surface YES Group I subsurface YES Group II YES Group IV YES	The shoreline clean-up assessment technique (SCAT) should be used to evaluate the likely success of shoreline clean-up activities. Shoreline clean-up has been consistently found to not enhance ecological recovery of oiled coastlines (Sell et al. 1995) but it may protect other resources in the area, such as birds, marine mammals or subtidal habitats including coral reefs or fish farms (CSIRO 2016). Choosing a particular clean-up technique is dependent on factors such as shoreline type, exposure, sensitivity, amount of oil, persistence of oil, toxicity of oil and rate of natural oil removal (IPIECA 2015c). The clean-up of Group I or II spills on a shoreline is likely to be difficult, generating high volumes of waste in comparison to the volume of oil recovered.	The WA/NT Control Agencies will make the final decision to undertake SCAT and shoreline clean-up activities in WA/NT waters/shorelines. Utilise SMV and SCAT data to determine the likely success of any shoreline clean-up response compared to allowing natural weathering to occur. Shoreline clean-up techniques should focus on manual clean-up techniques, such as the use of rakes and shovels. Mechanical clean-up equipment (graders, loaders etc) should not be used to physically collect oil. However, small mechanical aids (e.g., rubber tracked bob cats or 'dingo') can be used to assist in moving collected oily waste around a remote shoreline. Careful planning of track routes is required to avoid disturbance of any turtle/bird nesting sites. Low sea-states and calm weather are required for use of vessels for shoreline landings. Tide forecasts should also be consulted to ensure appropriate and safe vessel activities. A large support vessel or Facility (with a helicopter pad, if relevant) would need to be used as the accommodation and logistics base for shoreline response personnel at remote locations.	

Response Strategy	Spill Source Applicability	Strategic SIMA Summary	Operational Considerations	Operational SIMA comments
		Most offshore island shorelines would be expected to 'self-clean' any accumulated Group I or II oils, due to the lack of adhesiveness of these oil types, the coarse substrate, the high wave energy and high tidal regime, and generally high temperatures and UV exposures. Weathered Group IV oils (including emulsions) have relatively high viscosity and are expected to form a thick adhesive layer on a shoreline. Due to the high viscosity, adhesiveness, and persistence of Group IV oils, they may contaminate the shoreline for a long period (weeks to months). Therefore, shoreline clean-up should be considered depending on the quantity of oil on the shore. The clean-up of Group IV spills on a shoreline is likely to generate high volumes of waste in comparison to the volume of oil recovered. Sensitive shorelines with lower energy, such as mudflats and mangroves on the WA/NT coastline and any coral reefs would likely be damaged by the physical activities associated with shoreline clean-up, and therefore clean-up at these locations should be evaluated for overall benefit vs risk of creating further damage.	Upon successful clean-up of the shoreline, bulka bags/intermediate bulk containers (IBCs) containing oily contaminated waste would be transferred by helicopter or landing barge to a support vessel, for further transport to the mainland for appropriate disposal with a licenced waste contractor. To reduce wildlife disturbance at offshore/remote shorelines, a longer duration response with minimum numbers of response personnel required to achieve the IAP objective may be desired.	
Pre-contact oiled wildlife response (OWR)	Group I surface YES Group I subsurface YES Group II YES Group IV YES	Group I and II hydrocarbons are not likely to generate a thick surface layer on the ocean surface or on a shoreline. Therefore, there is reduced potential to coat adult nesting turtles or turtle hatchlings as they transit to the ocean, or coat large numbers of seabirds. However, Group IV oils are likely to generate a thick surface layer on the ocean surface and on a shoreline. Therefore, there is a high potential to coat adult nesting turtles and turtle hatchlings as they transit the intertidal zone, or coat large numbers of seabirds. Wildlife hazing can be an effective control measure when deployed across a limited geographical area and against specific wildlife population, where the surface oil resulting from a spill is largely contained, e.g., at a beach/specific shoreline. Capture and translocation of turtles (adults and hatchlings) from a shoreline to an area away from the slick may provide an environmental benefit, however minimising the time during which turtles (especially hatchlings) are in captivity is critical to success of the operation. Wildlife hazing in the open ocean is inherently unlikely to be effective due to a number of limitations, including numbers of vessels required and associated safety issues, ongoing spread and movement of the slick and hazed animals moving into adjacent areas of the slick.	The relevant WA/NT Control Agencies will make the final decision to undertake wildlife response activities in WA/NT waters/shorelines, including the practicalities, likely success and risks associated with a wildlife response operation. Wildlife hazing or wildlife capture and translocation in the open ocean should only be considered when SMV/situational awareness data clearly indicates that a positive outcome could be achieved. The merits of wildlife hazing or wildlife capture and translocation at a shoreline should be considered by the IMT when SMV data indicates that populations of wildlife on a shoreline may be at risk of an inbound spill and conditions are suitable for this activity to occur. There are significant manual handling risks associated with translocating adult turtles, (adult green turtles are often >100 kg), which need to be evaluated and managed if this activity is to occur. Therefore, translocation of turtle hatchlings is more likely to be successful. Wildlife response personnel and equipment transport to and from the shoreline would be by small utility helicopter and/or vessels. Low sea-states and calm weather are required for use of vessels for shoreline landings. Tide forecasts should also be consulted to ensure appropriate and safe vessel activities. A large support vessel (with a helicopter pad, if relevant) would need to be used as the accommodation and logistics base for shoreline response personnel. To reduce wildlife disturbance at offshore/remote shorelines, a longer duration response with minimum numbers of response personnel required to achieve the IAP objective may be desired.	

Response Strategy	Spill Source Applicability	Strategic SIMA Summary	Operational Considerations	Operational SIMA comments
		Attempting to capture large numbers (or an entire flock) of healthy seabirds would be very challenging, if not impossible (DPaW & AMOSC 2014), especially at a remote shoreline location (e.g., Browse Island). There is no practicable method to capture healthy seabirds at sea (DPAW & AMOSC 2014). Potential harm to healthy seabirds could occur during the capture process. Any seabirds released would likely fly back to the shoreline from which they originally were captured. Long term veterinary care (e.g., feeding) would be required for any successfully captured birds, until spill weathering or remediation has occurred, and it was safe to release the animals. Animals would be under stress while in veterinary care/rehabilitation facilities and potentially exposed to human and zoonotic diseases, which could be spread to wild populations upon their release.		
Post-contact OWR	Group I surface YES Group I subsurface YES Group II YES Group IV YES	Group I and II hydrocarbons are relatively non-adhesive compared to crude oils, and generally not considered an oil product that would 'coat' the feathers of birds, requiring a full wildlife cleaning response on a shoreline. They are also not likely to generate a thick surface barrier on a shoreline which would coat adult nesting turtles or turtle hatchlings as they transit to the ocean. However, Group IV oils are likely to generate a thick surface layer on the ocean surface and on a shoreline. Therefore, there is a high potential to coat adult nesting turtles and turtle hatchlings as they transit the intertidal zone, or coat large numbers of seabirds. Capture, relocation, assessment, cleaning and rehabilitation of oiled wildlife has the ability to increase the survival of individuals (IPIECA 2017). ITOPF (2011) note that there are many cases where oiled turtles have been cleaned successfully and returned to the water. Once oiled, it is generally agreed (DBCA pers. Comms 2021) that the bird species present in the BROPEP Region will have very low survival rates, even when rescue and cleaning is attempted. Any seabirds captured, cleaned and released are at risk of flying back to the shoreline from which they were originally captured. Therefore, long-term veterinary care (e.g., rehabilitation, feeding, etc.) would be required for any successfully captured birds, until spill weathering or remediation had occurred, and it was safe to release the seabirds. Animals would be under stress while in veterinary care/rehabilitation facilities and potentially exposed to human and zoonotic diseases, which could be spread to wild populations upon their release.	The WA/NT Control Agencies will make the final decision to undertake wildlife response activities in WA/NT waters/shorelines, including the practicalities, likely success and risks associated with a wildlife response operation. Oiled wildlife capture in the open ocean should only be considered when SMV/situational awareness data clearly indicates that a positive outcome could be achieved. The recommended method for capture of oiled birds at sea is with the use of hand nets (DPaW & AMOSC 2014). Due to the general size of vessels to be used offshore, manoeuvring close to oiled birds and successful capture would be difficult and present significant HSE hazards to response personnel. The launching and use of small vessels, especially for wildlife capture in the open ocean also presents significant HSE risks, and therefore any attempt for open ocean capture of oiled wildlife would require significant evaluation of the environmental benefit of the activity against the HSE risks to personnel. The West Kimberly Oiled Wildlife Response Plan (DPaW & AMOSC 2015), Appendix 7 (Rowley Shoals and Offshore Island Nature Reserves), focuses the post-contact wildlife response purely on capture and rehabilitation of wildlife at, or near, shorelines, rather than searching and attempting open-ocean oiled wildlife response. The merits of wildlife capture, cleaning and rehabilitation at a shoreline should be considered by the IMT when SMV/situational awareness data indicates that populations of wildlife on a shoreline have been impacted by the spill and conditions are suitable for this activity to occur. Wildlife response personnel and equipment transport to and from the shoreline would be by small utility helicopter and/or vessels. Low sea-states and calm weather are required for use of vessels for shoreline landings. Tide forecasts should also be consulted to ensure appropriate and safe vessel activities. A large support vessel or facility (with a helicopter pad, if relevant) would need to be used as the accommodation and logistics base for shoreline response personnel, including temporary oiled wildlife stabilisation facility. To reduce wildlife disturbance at offshore/remote shorelines, a longer duration response with minimum numbers of response personnel required to achieve the IAP objective may be desired.	
In-situ burning	Group I surface NO	The SIMA evaluations found that in-situ burning was not an appropriate response strategy for any of INPEX's WCSS.	N/A.	

Response Strategy	Spill Source Applicability	Strategic SIMA Summary	Operational Considerations	Operational SIMA comments
	Group I subsurface NO Group II NO Group IV NO	Group I & II (condensate and marine diesel) spread very rapidly, and therefore would require booming to corral the oil to a thickness where it could potentially ignite. However, having personnel working on back decks of vessels, deploying booms to concentrate fresh volatile slicks, potentially in highly flammable environments is not considered a safe operation. Therefore ISB is not considered appropriate for these oil types. Group IV oils would likely emulsify relatively rapidly after spilling, preventing the use of ISB. There are no fire-retardant booms or trained personnel in Australia, therefore it is not considered practicable to attempt ISB of Group IV spills from vessels.		

3.5 Incident action plan

The IMT must commence the development of an IAP once it has gained accurate and reliable situational awareness, reviewed protection priorities and completed the Operational SIMA.

An IAP must be prepared for response activities beyond the immediate response measures (first strike) timeframes.

The IAP must:

- establish the overall incident response objectives and strategies – determine what is to be achieved, where, when and by whom
- ensure continuity of incident control to ensure objectives, decisions and actions to be undertaken are recorded and cascaded through operational teams
- provide for the coordinated and effective use of resources.

The IAP shall be the mechanism for oil spill management from the moment it comes into force through to the termination of the response.

The IAP will be used to direct response operations while ensuring that all response personnel are aware of response objectives and priorities, and are undertaking appropriate actions to control any identified risks. Therefore, the IAP must:

- provide response personnel with clear statements of objectives, strategies and detailed task assignments/briefs
- supply information on the resources, methods and protocols to be used in order to maintain and monitor/report response effectiveness
- provide documentation regarding the decisions, strategies, safety controls, plans and other key pieces of information critical to achieving the incident response objectives.
- be the document referred to when dealing with post-incident analysis on issues such as cost and legal requirements, as well as the overall effectiveness of the response and its personnel.

The IAP will be in-force for its defined operational period (start/end - date/time). The IAP shall be reviewed, updated and communicated to field teams prior to the next operational period.

The basic steps for IAP development are provided in Table 3-3.

A blank INPEX IAP templates are available here: INPEX IAP.

A copy of the IAP template is also provided in APPENDIX B:.

As part of the IMT Capability Assessment Report (X060-AH-REP-70015), a number of example spill response objectives were prepared, for three initial operational periods. These example objectives are duplicated, as Table 3-4, for the IMT to utilise (as appropriate to the spill situation) as part of IAP development.

Also, to assist with delegation of responsibilities and tasks between the INPEX IMT personnel and mutual aid IMT personnel, an indicative set of responsibilities/tasks was prepared, in relation to each response strategy. This has been duplicated in Table 3-5.

Table 3-3: IAP development

Incident Action Planning Process				
	What	***Who***	***When***	***How***
IAP Development	Develop Strategies & Tasks: Strategies are the general plan or direction selected to accomplish Objectives Tasks are the short-term specific actions taken to complete the strategy that will satisfy the Objective	Function Leads Planning Function to endorse strategies IMT Leader must approve strategies prior to task development.	Function Planning Sessions	Discussion and population of Objectives Planning status board Planning / Situation Unit to ensure tasks are captured on Tasks Summary Board
	Identify what resources will be required to successfully execute Strategies & Tactics	Individual functions Logistics function	Planning Session	
	Coordinate financial tracking against resource planning	Logistics function Finance function	Planning Session	
	Confirm that Strategies & Tactics have been assigned for action	IMT Leader Planning Function	Planning Session Summation	
	Record tasks in Action Tracking system	Planning Function (Log Keeper)	Planning Session Summation	
Prepare & Issue the IAP	Compile the IAP	Planning function		Use IAP Template to transcribe information from electronic status board, displays and/or whiteboards
	Approve the IAP	IMT Leader		
	Distribute the IAP to all IMT members	Planning function		
	Distribute the IAP to Incident Commander	Operations function		Verbal and written. Proposed ERT actions will be incorporated into IAP.
	If requested, provide a copy of the IAP to external response organisations who have statutory responsibilities for event	Liaison Officers *(EA&JV Function must be consulted on information to be released)*		IMT Leader to discuss any external release of information to agencies with CMT Leader.
Implement & Review	Implement Plans and monitor for effectiveness. Make corrective actions as needed through consultation with the Incident Commander and CMT Leader	All	IMT Update Briefings	
	If incident operations are required beyond the current operational period, the Incident Action Plan process begins again.	All	New planning cycle	Return to the beginning of the process.

Table 3-4: Example spill response objectives for initial operational periods

Operational Period	IMT Spill Response Objectives
0 – 24 Hours	1. Establish/maintain an IMT with appropriate oil spill response trained personnel including mutual aid capabilities for specialist oil spill roles 2. Gain situational awareness of spill trajectory, weathering, and potential environmental impact (use of response strategies/tactics including; oil spill trajectory modelling (OSTM), visual surveillance, satellite imagery and SCAT. Use of IMT tools including; Operational SIMA, resources at risk evaluation, and Common Operating Picture (COP). 3. Establish Forward Operational Bases (FOBs)/Staging Areas for aviation, shore and marine response strategies (E.g., establish FOBs at Broome Airport, Darwin Airport, Broome Port, Darwin Port as required) 4. Pre-deploy shoreline assessment/response capabilities including SCAT, OWR, resource protection and shoreline clean-up resources to FOB in anticipation of future deployment. 5. (Group IV spill only) – Mobilise/activate at sea response strategies, including: • Activate in-field vessel-based dispersant, test spray and commence dispersant spraying • Mobilise FWAD capability to a nominated airfield along Kimberley coastline • Mobilise C&R capability at Broome/Darwin port 6. (Well blow-out only) – Mobilise SSDI spread to FOB. 7. Undertake risk assessments and develop HSE plan(s).
24 – 72 Hours	1. Establish/maintain an IMT with appropriate oil spill response trained personnel including mutual aid capabilities for specialist oil spill roles 2. Maintain situational awareness of spill trajectory, weathering, and potential environmental impacts. 3. Support the mobilisation/deployment of response strategies/field capabilities through FOBs 4. Continue the pre-deployment of shoreline assessment/response capabilities including SCAT, OWR, resource protection, and shoreline clean-up resources to FOB in anticipation of future deployment. 5. (Group IV spill only) – Mobilise/activate at sea response strategies, including: • Continue in-field vessel-based dispersant spraying • Continue mobilisation and/or commence FWAD dispersant spraying from a nominated airfield along Kimberley coastline

Operational Period	IMT Spill Response Objectives
	• Continue mobilisation of C&R capability from Broome/Darwin port – commence operations in the field if possible. 6. (Well blow-out only) – Mobilise SSDI spread to FOB. 7. Review hazard assessments and execute HSE plans for operational activities.
72 – onwards	1. Establish/maintain an IMT with appropriate oil spill response trained personnel including mutual aid capabilities for specialist oil spill roles 2. Maintain situational awareness of spill trajectory, weathering, and potential environmental impacts. 3. Support the mobilisation/deployment of response strategies/field capabilities through FOBs 4. Continue the pre-deployment of shoreline assessment/response capabilities including SCAT, OWR, resource protection and shoreline clean-up resources to FOB in anticipation of future deployment. As directed by relevant State/Territory Control Agency - commence deployment of shoreline assessment/response capabilities into the field. 5. (Group IV spill only) – Mobilise/activate at sea response strategies, including: • Continue in-field vessel-based dispersant spraying • Continue mobilisation and/or commence FWAD dispersant spraying from a nominated airfield along Kimberley coastline • Commence/continue with C&R activities in the field 6. (Well blow-out only) – Mobilise subsea dispersant injection (SSDI) spread to FOB. 7. Review hazard assessments and execute HSE plan for operational activities.

Table 3-5: Indicative INPEX and OSRO IMT responsibilities for each response strategy

Response strategy	INPEX IMT responsibilities	OSRO assistance tasks
Aerial surveillance	IAP/operational tasking document development Provision of aerial surveillance platforms (rotary wing and fixed wing). Provision of aviation FOB.	Assist INPEX IMT with IAP / operational tasking document development. Coordination of trained aerial observers (including AMOSC Core-Group and other industry mutual aid trained aerial observers). Review and interpretation of aerial surveillance reports. Communication of key aerial surveillance report information to INPEX IMT Planning team.
Vessel surveillance	Identification and tasking of opportunistic vessel/facility surveillance platforms.	Review and interpretation of vessel/facility surveillance reports. Communication of key vessel surveillance report information to INPEX IMT Planning team.
OSTM	Activate OSTM contractor. Facilitate information flow between OSTM contractor and any other relevant organisations.	Assist INPEX IMT with review of OSTM results, in consideration of resource protection priorities and response strategies selection (Operational SIMA).
Satellite tracker buoys	Activate satellite tracker buoy deployments. Access INPEX tracker buoy data and provide to OSTM contractor.	Coordination of additional satellite tracker buoys from AMOSC or other mutual aid sources. Access AMOSC/other tracker buoy data and provide to OSTM contractor via INPEX IMT.
Satellite imagery	Request satellite imagery acquisition via AMOSC, AMSA and/or OSRL.	Facilitate provision of satellite imagery from third-party satellite imagery providers. Assist with interpretation of the satellite imagery information, as related to response planning.
Vessel Dispersant	Authorise/activate initial vessel-based dispersant activities in Ichthys Field.	Provision of vessel dispersant re-supply stockpiles. Provision of ongoing operations support during vessel-based dispersant operations.
FWAD	Provision of FWAD air attack aircraft and SAR platform.	Provision of broader FWAD capability, and operational oversight of the FWAD activity.
SSDI	Not applicable – managed by Source Control IMT.	Not applicable.

Response strategy	INPEX IMT responsibilities	OSRO assistance tasks
At Sea Containment and Recovery	Provision of support vessels with open/rolled stern, and other vessels as required. Overall supervision of at sea C&R activities.	Provision of C&R trained personnel. Provision of C&R equipment from OSRO stockpiles. Provide operational oversight of the in-field at sea C&R activities.
SCAT	Not applicable.	Support as requested by the relevant Control Agency. Provision of SCAT specialist.
Protection of Sensitive Resources	Provision of labour-hire personnel for remote protection and deflection (P&D) activities. Support as requested by the relevant Control Agency.	Provision of specialist P&D personnel.
OWR	Provision of labour-hire personnel for remote OWR activities.	Provide OWR Function specialist personnel. Support as requested by the relevant Control Agency. Provision of labour-hire personnel for remote OWR activities. Provision of OWR equipment from OSRO stockpiles.
Waste management	Provision of logistical support (vessels) to transport waste from at sea or remote shoreline locations, to port. Provision of land-based licenced waste contractor capability for onshore treatment/disposal of oily waste.	Provision of planning advice regarding likely waste volumes likely to be generated. Provision of at sea and shoreline waste management equipment and consumables.
Remote response support	Provision of multiple small support vessels for remote SCAT activities. Provision of multiple floating remote response platforms for large remotes shoreline clean-up/OWR/P&D activities.	Assist with selection of suitable vessels for remote response operations.

3.6 Response termination

The termination of a response to a Level 2 or Level 3 spill within Commonwealth waters shall be only when the following conditions have been fulfilled, as determined by the IMT Leader, in consultation with AMSA, DCCEEW and AMOSC:

- when the source of the spill has been stopped
- when the objectives of the Incident Action Plans have been met

- when there are no further practicable steps that can be taken to respond to the spill (e.g., no further improvement/positive environmental outcomes are expected by continuing the response).

The termination of response strategies associated with a spill which has entered WA/NT waters will be the responsibility of the WA/NT Control Agency, and would typically be undertaken in accordance with the guidance provided in the National Plan Response Assessment Termination of Cleaning for Oil Contaminated Foreshores (AMSA 2015).

Relevant factors to consider for termination of each response strategy is provided within each strategy sub-section in Section 4.

Termination criteria for the Operational and Scientific Monitoring Programs (OSMP) are detailed in Appendix A.

3.7 NOPSEMA information requirements during spill

At time of preparation of Rev4 of this document, NOPSEMA had released a draft version of a document titled *Oil pollution incidents – regulatory response & requirements*. A summary of key information required to be provided to NOPSEMA, in accordance with their draft document during a spill event is as follows:

- Situational awareness – access to latest situational awareness information through the common operating picture (or other suitable information sources)
- Access to common operating picture, either virtually, or physical access.
- Key documentation including:
    - Situation reports/updates
    - Spill volume and discharge rate estimates
    - Spill observation and surveillance reports (aerial, vessel, SCAT)
    - Oil spill modelling reports
    - Operational SIMA
    - Incident Action Plans

NOPSEMA's expectation is that the above information is provided/updated as new information becomes available.

4 OIL SPILL RESPONSE STRATEGY IMPLEMENTATION GUIDE

4.1 Support vessel capability and arrangements

INPEX maintain a range of support vessel call-off contracts with various support vessel providers. Call-off contracts allow for mobilisation of available support vessels, including for oil spill response.

Support vessel contracts range from small ~10–40 m support vessels and landing barges for coastal/nearshore, or light weight equipment activities offshore, to larger ~50–130 m offshore support vessels capable of long duration responses activities.

Large offshore support vessels can be used as accommodation support vessels, for shoreline response activities. Large vessels with helicopter pads will facilitate faster, more efficient crew changes, which could be required during long duration response activities, or support a light utility helicopter, if required for shoreline response activities.

INPEX requires all vessels to comply with the INPEX Marine Standard (0000-AG-STD-60002) and Vessel Inspection Work Instruction (0000-AG-WIN-60029), which includes processes to enable rapid inspection and approval for use of vessels in emergency situations. In an emergency event where a vessel may be required immediately and is unable to meet marine inspection procedure requirements, the Marine Manager or delegate shall perform a suitable audit of the vessel, which may be performed as a desktop exercise.

Contact details to activate the available support vessel contractors are listed in the INPEX Emergency Contacts Directory (C075-AH-LIS-10002).

An environmental risk assessment associate with spill response has been completed in the BROPEP BOD and Field Capability Assessment Report (X060-AH-REP-70016). The relevant environmental performance outcomes and standards associated with use of vessels during spill response is presented in Table 4-1.

Table 4-1: EPOs and EPSs to manage risks from vessels during spill response

Environmental performance outcome	Environmental performance standard	Measurement criteria
Risks of impacts to the environment from vessel discharges during oil spill response activities will be reduced and maintained at ALARP and acceptable levels.	All vessels involved in oil spill response activities will conduct sewage disposal activities in accordance with MARPOL 73/78, Annex IV.	Emergency event response records.
	All vessels involved in oil spill response activities will conduct food scrap disposal activities in accordance with MARPOL 73/78, Annex V.	Emergency event response records.
No inappropriate disposal of waste to the marine environment from vessels during spill response.	All vessels involved in oil spill response activities will conduct garbage management in accordance with MARPOL 73/78, Annex V.	Emergency event response records.

Environmental performance outcome	Environmental performance standard	Measurement criteria
No incidents of loss of hydrocarbons to the marine environment as a result of a vessel collision during oil spill response.	Vessels will be fitted with lights, signals, AIS transponders and navigation equipment as required by the Navigation Act 2012.	Emergency event response records.
No disturbance/injury/ mortality of cetaceans, whale sharks or turtles resulting from interactions with vessels undertaking spill response activities.	Interactions between support vessels and cetaceans will be consistent with EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.05) Interacting with cetaceans (modified to include turtles): • Spill response vessels will not travel faster than 6 knots within 300 m of a cetacean or turtle (caution zone) and minimise noise. • Spill response vessels will not approach closer than 50 m to a dolphin or turtle and/or 100 m for a whale (with the exception of bow riding). If a cetacean shows signs of being disturbed, support vessels will immediately withdraw from the caution zone at a constant speed of less than 6 knots.	Records of event reports if vessel strike occurs during spill response.
	Interactions between spill response vessels and whale sharks will be consistent with the Whale Shark Wildlife Management Program no. 57 (DPaW 2013); specifically, spill response vessels will not travel faster than 8 knots within 250 m of a whale shark (exclusive contact zone) and not approach closer than 30 m of a whale shark.	Records of breaches of whale shark code of conduct are documented.
	Premobilisation visual inspections of vessels and equipment before mobilisation to an island location and recorded on quarantine inspection checklists.	Emergency event response records.

Environmental performance outcome	Environmental performance standard	Measurement criteria
No introduction of terrestrial exotic pests to island ecosystems or introduction and establishment of introduced marine species of concern to State/Territory or Commonwealth marine parks during response activities.	No de-ballasting within State, Territory or Commonwealth marine parks during oil spill response activities.	
Risks of impacts to transient, EPBC-listed species, (marine turtles) and intertidal habitats from a shoreline response are reduced and maintained to ALARP and acceptable levels.	In the event of a shoreline response, a vessel-specific lighting plan will be prepared, for vessels supporting remote shoreline response operations, adjacent to identified turtle nesting beaches, during turtle nesting season. The plan will address specific issues including: • minimum lighting required for navigation • permitted/restricted activities on deck at night, and the minimum lighting requirements for the safe conduct of those permitted activities. The vessel specific lighting plans will be developed by the Vessel's bridge crew, in consultation with AMOSC, Department of Climate Change, Energy, the Environment and Water (DCCEEW) (for response on Cwlth shorelines), and WA/NT Control Agencies and wildlife agencies for responses on WA/NT shorelines.	Emergency event response records.

4.2 Aviation asset capability and arrangements

INPEX maintains a range of aviation support call-off contracts with various fixed-wing aircraft, helicopter providers and unmanned aerial vehicles (UAV)/drones. These call-off contracts allow for mobilisation of available aviation assets, including for oil spill response.

Crew change helicopters can be used for:

- aerial surveillance
- Air Attack Supervisor platforms, in support of FWAD activities
- routine crew change activities for remote shoreline response, to approved helicopter pads (E.g., helicopter pads on accommodation support vessels)

Fixed wing aircraft with good all-around visibility are best suited to ongoing aerial observations.

Light utility helicopters can be mobilised for specific tasks such as mobilisation of personnel and equipment and removal of waste from remote shoreline locations, or for operational monitoring and evaluation at remote shorelines, where close inspection is required. Offshore islands/remote locations of the Kimberley/NT coastline are not typically equipped with landing pads suitable for the INPEX fleet of crew change helicopters. Therefore, only a light utility helicopter would be suitable to provide logistical access to all remote shorelines within the BROPEP region.

UAVs/drones are useful for aerial surveillance, vessel based activities such as dispersant application and containment and recovery operations, and supporting remove shoreline operations.

The INPEX membership of AMOSC provides access to the fixed wing aerial dispersant aircraft managed by AMSA.

All aircraft used during spill response should to comply with the INPEX Aviation Standard (Doc. No. 0000-AG-STD-60003). In an emergency event where an aircraft may be required and is unable to meet the INPEX Aviation Standard, the Aviation Manager or delegate shall perform a desktop risk assessment, taking into account the nature of the proposed activity and its urgency, before making any exemption.

Contact details for the available aviation asset contractors are listed in the INPEX Emergency Contacts Directory (C075-AH-LIS-10002).

A summary of the process used to activate INPEX aviation capabilities for spill response is provided in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002).

An environmental risk assessment associate with spill response has been completed in the BROPEP BOD and Field Capability Assessment Report (X060-AH-REP-70016). The relevant environmental performance outcomes and standards associated with use of aviation assets during spill response is presented in Table 4-2.

Table 4-2: EPOs and EPSs to manage risks from aircraft during spill response

Environmental performance outcome	Environmental performance standard	Measurement criteria
No introduction of terrestrial exotic pests to island ecosystems or introduction and establishment of introduced marine species of concern to State/Territory or Commonwealth marine parks during response activities.	Premobilisation visual inspections of helicopters and equipment before mobilisation to an island location. Inspection date/time/outcome to be recorded on aircraft technical log.	Emergency event response records.

Environmental performance outcome	Environmental performance standard	Measurement criteria
No disturbance/injury/ mortality of cetaceans, whale sharks or turtles resulting from interactions with vessels and aircraft undertaking spill response activities.	Interactions between spill response aircraft and cetaceans will be consistent with EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.07) - aircraft/cetacean separation requirements (500m altitude and radius for helicopters, 300m altitude and radius for fixed wing aircraft).	Emergency event response records.

4.3 INPEX oil spill preparedness and response tools

4.3.1 Oil spill preparedness and response register

INPEX maintains an internal Oil Spill Preparedness and Response Register (X060-AH-LIS-70002). This register is maintained on INPEX's document management system.

It can be accessed during any spill event and includes the following information:

- Report of INPEX IMT personnel trained in oil spill response
- INPEX oil spill satellite tracking buoy details, including tracker buoy current location, servicing schedule and log-in details to the satellite tracking website
- Log-in to AMOSC website, to enable access to AMOSC stockpile equipment lists
- INPEX oil spill aviation activation processes.

4.3.2 Oil Spill Forms Register

The Oil Spill Forms Register (C075-AH-LIS-10006) provides a consolidated list of forms which may be utilised by the IMT during a spill response. A copy of this register is provided in Section 5 of this document. It contains forms such as:

- notification and reporting forms (such as POLREP/SITREPs)
- modelling activation forms
- mutual aid activation forms (e.g. AMOSC/OSRL)
- wildlife disturbance permits.

4.3.3 Oil Spill Observation and Dispersant Guide

The INPEX Australia Oil Spill Observation and Dispersant Guide (0000-AH-GLN-60054) provides guidance on estimating type, size and minimum/maximum volume of a spill, to any person conducting oil spill observation activities (from any platform, vessel or aircraft).

This tool also provides guidance on the use of surface dispersants, including the following:

- typical PPE for vessel dispersant application
- process for field to IMT interface for dispersant spraying approvals
- vessel dispersant dosage rates/calculations
- vessel dispersant spray boom configuration options and considerations

- visual dispersant effectiveness monitoring
- dispersant effectiveness monitoring forms/reporting templates.

4.3.4 Oil Spill Surface Volume Calculator

The INPEX Australia Oil Spill Surface Volume Calculator (X060-AH-CAL-70001) is a Microsoft Excel sheet which assists with calculating minimum/maximum oil spill thickness estimates, based of visual observations. This tool should be used in conjunction with the INPEX Australia Oil Spill Observation and Dispersant Guide, as it significantly reduces the likelihood of manual errors in the oil spill thickness estimation calculations.

4.4 Immediate (first strike) response capability and arrangements

A detailed description of first strike capability requirements is provided in Section 2.6.

The immediate response actions which need to be undertaken by the IMT for all Level 2/3 spill events is the activation of Surveillance, Modelling and Visualisation (SMV), as detailed in Section 4.4.1.

Note – in the event of a Group IV spill vessel dispersant (test-spray), and commencement of mobilisation of FWAD and at-sea containment and recovery capabilities should also be undertaken. The vessel dispersant, FWAD and at-sea containment and recovery capabilities can be de-activated if the Operational SIMA determines one or more of the response strategies are not required.

Detailed descriptions of surface (vessel/aerial) dispersant, and at-sea containment and recovery capabilities and arrangements are provided in Section 4.5.4 and Section 4.5.5 respectively.

4.4.1 Surveillance, modelling and visualisation (SMV)

Response Objective

SMV data will be acquired and utilised to enable informed and timely IMT decision making during a response.

Response Strategy Summary

SMV does not in itself control or reduce the impacts of a spill; however, it allows IMT to maintain situational awareness. This is vital in a number of respects as it:

- addresses some of the key information requirements necessary for spill management:
  - where is the spill?
  - how big it is?
  - where is it going?
  - what is happening to it over time (weathering)?
  - how long it will take to get there?
  - what will it make contact with?
- facilitates internal and external initial notification and subsequent reporting
- provides information critical for identifying sensitive receptors under threat, identifies protection priorities, and informs Operational SIMA and IAP development
- identifies the trajectory of the spill and thereby defines the potential stakeholders and environment that may be affected (EMBA) or potential exposure zone (PEZ) by

the oil. This will inform any subsequent scientific monitoring and recovery phase actions.

Depending on the spill type and volume, SMV tactics that may be used to gain situational awareness could include:

- oil spill trajectory modelling (OSTM)
- electronic surface tracking buoy(s)
- aerial surveillance
- vessel surveillance
- satellite imagery analysis.

The SMV program overlaps with the OSMP (specifically Oil Spill Trajectory Modelling (OM01) and Oil Spill Surveillance and Reconnaissance (OM03)). Additional details of the OSMP are provided in Section 4.7 and Appendix A.

Activation

SMV should be activated in accordance with the timeframes presented in Table 4-3 for all Level 2/3 spills.

Aerial surveillance summary

Aerial observation is a very effective way of establishing the location and extent of a spill and verifying predictions of its movement and fate. The INPEX Oil Spill Observation and Dispersant Application Guide provides additional guidance on estimating extent and volume of the spill. Key considerations associated with this activity are as follows:

- flights shall be made regularly and where possible timed at the beginning or end of each day so that results can be used by the IMT and other response agencies.
- flight paths and timetables should be coordinated
- weather conditions can affect visibility and may therefore make surveillance flying impractical.

Aerial surveillance personnel

Aerial observers should ideally be trained, experienced and able to reliably detect, recognise and record oil pollution at sea.

AMOSC core-group provides a pool of trained aerial observers – typically available within 48 hours.

OSRL can provide additional trained aerial observers for a longer duration event.

Preferably, there should be a consistency of at least one observer throughout a series of flights, so that variations in reports reflect changes in the state of oil pollution and not differences between the perceptions of observers.

Aerial surveillance tools/equipment/plans

The INPEX Oil Spill Observation and Dispersant Guide and the INPEX Oil Spill Surface Volume Calculator should be used by personnel undertaking observations from crew change helicopters or any other fixed wing surveillance platforms, until trained aerial observers are available.

The AMOSC Air Operations Plan (AMOSC 2020a) should be used to guide the development of aerial surveillance operations.

Aerial surveillance logistics

Aircraft used for aerial observation should preferably feature good, all-round visibility.

Crew change helicopters should be used for initial observations.

Over the open sea, the use of fixed-wing aircraft (rather than helicopters) is preferable, due to their superior speed and range. The extra margin of safety afforded by a twin engine or multi-engine aircraft is essential. However, helicopter observations may be required to allow for closer inspection of shorelines, or along more complex shorelines such as the Kimberley/NT coastlines and islands.

The minimum deployment time of fixed wing surveillance aircraft is typically 24 hours.

UAVs/drones can be operated from large vessels (E.g. C&R and vessel dispersant operations), or as part of remote shoreline SCAT and remote shoreline response vessels.

Vessel surveillance summary

Oil spill surveillance can be carried out from vessels (or near-by facilities), although its practicality is limited by the availability vessels, their other emergency response priority activities and the scale of the spill.

For smaller spills, the slick dimensions, direction of travel, colour and state of weathering can be reasonably well estimated and reported. For large spills, it would be difficult to accurately estimate the size of a slick from the bridge of a vessel because sight is limited to the horizon. However, it would be possible to determine what is happening to the oil slick, such as its colour, thickness, weathering and the direction of travel.

As such, aerial surveillance is the preferred method of visual surveillance in the BROPEP region.

Vessel surveillance personnel

All INPEX contracted vessel Emergency Response Team (ERT) personnel are provided with an oil spill induction, which includes training in the INPEX Oil Spill Observation and Dispersant Guide and the INPEX Oil Spill Surface Volume Calculator.

CPF and FPSO HSE personnel are also required to complete Oil Spill Observation training, including in the INPEX Oil Spill Observation and Dispersant Guide and the INPEX Oil Spill Surface Volume Calculator.

Vessel surveillance tools/equipment/plans

The INPEX Oil Spill Observation and Dispersant Guide and the INPEX Oil Spill Surface Volume Calculator should be used by personnel undertaking observations from a vessel/facility.

Vessel surveillance logistics

Vessels on contract (or INPEX owned/contracted facilities) which are in the vicinity of a spill should be requested to undertake surveillance activities, and report observation to the IMT.

Vessels would not normally be specifically contracted to undertake vessel surveillance activities, as aerial surveillance is the optimal visual surveillance platform in the BROPEP region.

Oil spill trajectory modelling summary

Oil spill modelling can be used to forecast the trajectory and fate of oil plumes resulting from surface or subsurface releases. It can be initiated almost immediately and provides rapid results. However, its accuracy depends on the spill estimates and the predicted metocean data, as well as the reliability of forecasts of wind speed and direction.

Oil spill trajectory modelling is an iterative process, whereby real-time observations from vessel/aerial surveillance, electronic surface tracking buoy data and/or satellite imagery, is used to refine modelling predictions, using both hindcast and forecasting techniques.

INPEX maintain a contract with an oil spill trajectory modelling provider, which enables 24 hour per day access to real-time oil spill modelling capability. Contact details for the provider are contained in the INPEX Emergency Contacts Directory (C075-AH-LIS-10002) and oil spill trajectory modelling activation forms can be accessed via the INPEX Oil Spill Forms Register (C075-AH-LIS-10006) (Table 5-1).

Electronic surface tracking buoy summary

Electronic surface tracking buoys (ESTBs) can be rapidly deployed at, or near to, the site of a spill, from support vessels or helicopters. Thereafter, they drift with the surface currents (their design minimises wind influence). The buoys transmit their global positioning system (GPS) location in near real time, and the data is delivered to an online data management portal. The ESTBs enable the trajectory of surface oil to be tracked.

When deploying ESTBs, preferably three should be deployed during the initial stages (hours) of the spill, in close proximity to each other as their dispersion over time will assist with longer term model validation. Note that ESTBs are not able to provide information on the direction or strength of subsurface currents, nor the trajectory of dissolved and entrained oil resulting from a subsurface spill.

INPEX maintains ten ESTBs to be strategically placed across various work activities, as follows:

- During production within WA-50-L - maintain 3 x ESTBs, one on each of the CPF, FPSO and Offtake Support Vessel.
- During exploration/production drilling – maintain 3 x ESTBs onboard drilling support vessels.
- During vessel-based activities outside of WA-50-L, minimum one ESTB onboard the main activity vessel.

Occasionally, a ESTB will be out of circulation, for biannual servicing.

Location and servicing schedule of ESTBs is maintained in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002).

FOR IMT AWARENSS - the following **SAFETY ALERT** text is attached (hard-copy) to the pelican-case of all INPEX ESTBs:

- Not intrinsically safe – do not deploy into fresh oil spill
- Allow slick to weather:
  - condensate – minimum 3 hours before deployment
  - diesel/IFO/HFO – minimum 1 hour before deployment

- Do not drop from height
  - deploy close to water from deck of vessel
  - if no vessel, lower and release with rope
- If possible – best practice is to deploy 3 buoys together at leading edge of the slick

Satellite imagery analysis

Satellite-based remote sensors can be used to detect oil on water. Because satellite images cover extensive sea areas, they can provide a comprehensive picture of the overall extent of pollution from a spill. The sensors used include those operating in the visible and infrared regions of the spectrum, and synthetic aperture radar (SAR).

Optical observations of oil require clear, daylight skies, thereby severely limiting the application of such systems. SAR, on the other hand, is not limited by the presence of cloud and, since it does not rely on reflected light, remains operational at night. However, radar imagery often includes a number of anomalous features, or false positives, such as algal blooms, wind shadows and rain squalls, which can be mistaken for oil. Consequently, the imagery requires expert interpretation.

Information gained from satellite imagery would be used in combination with other controls such as visual surveillance and OSTM, to enable informed and timely IMT decision making during a response.

Access to satellite imagery is limited due to the continuous movement and orbit of satellites around the globe. Typically, imagery can only be obtained a few days after the initial request is made to the satellite imagery from service providers.

The delays are not considered as a risk to reducing the IMT's situational awareness, as during the first few days of a spill, the slick will remain in a small geographic area, and other techniques including vessel and aerial surveillance should provide sufficiently accurate information, to inform IMT decision making.

If the spill was 'Level 2', with a slick which will be easily monitored via air surveillance, and no significant or complex shoreline contacts are expected, satellite imagery may not be required. However, satellite imagery would be required for any Level 3 event, where monitoring of a significantly large or dispersed slick is required, or complex/multiple shoreline contacts in remote areas are anticipated, and therefore satellite imagery would help support OSTM validation, impact predictions and response strategy/tactical planning.

Termination criteria

Termination of SMV tactics will be determined by the IMT in collaboration with relevant stakeholders. This decision will take into consideration factors such as whether:

- the source of the spill has been stopped
- the objectives of the IAPs have been met
- there are no longer any practicable response strategies/tactics that can be implemented to further reduce the risk to the environment from the spill
- termination criteria for Operational Monitoring (OM) program have been met and processes have been established to transition to a Scientific Monitoring (SM) program.

Capability, arrangements and performance outcomes and standards

The arrangements and capabilities as described in the subsections above are summarised in Table 4-3.

The EPOs and EPSs related to the implementation of SMV are provided in Table 4-4.

Table 4-3: Arrangements and capabilities – surveillance, modelling and visualisation

Technique	Resource capability and availability	Implementation time	Activation guidance
Oil spill trajectory modelling (OSTM)	INPEX maintain a contracted spill modelling service provider for 24-hour support.	OSTM contractor activated within 2 hours of IMT formation.	IMT via the INPEX Emergency Contacts Directory (C075-AH-LIS-10002). Trajectory modelling activation forms in Table 5-1.
Aerial surveillance	Crew change helicopters are the initial aerial surveillance capability. Fixed wing aircraft can also be mobilised for longer term aerial surveillance activities.	Crew-change helicopters commence surveillance activities at the spill location within 5 hours of IMT activation (daylight hours only). Fixed wing aircraft should be utilised from second daylight period onwards for the duration of the spill. Additional fixed wing aircraft required as necessary, based on spill size/trajectory.	IMT (aviation operations) to coordinate use of crew-change helicopters (or any other available aircraft) to commence initial aerial surveillance. Fixed wing aircraft provider contact details available through INPEX aviation team and also the INPEX Emergency Contacts Directory (C075-AH-LIS-10002). A summary of the process used to activate INPEX aviation capabilities for spill response is provided in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002). Trained aerial observers to be accessed via AMOSC. AMOSC and OSRL notification/activation forms available in the Oil Spill Forms Register (refer Section 5).
	Trained aerial observers to be sourced via AMOSC (or OSRL) and mobilised to selected airbase.	Trained aerial observers to commence aerial observation task from Broome/Darwin (or other selected airbase) within 48 hours.	
	UAV/drone capability, to be sourced via INPEX UAV contractor in Darwin (SkyMax).	Not defined, based determined on an 'as-needs' basis.	Via INPEX contract with SkyMax, based in Darwin.
Vessel/facility surveillance	Conduct visual surveillance using opportunistically available vessels/facilities in the vicinity of the spill. (aerial surveillance will become the primary form of visual surveillance).	As soon as practicable following the initial spill event.	IMT (Operations) to request all vessels and facilities in the vicinity of the spill to provide visual surveillance (provided this does not impact other safety related emergency response activities underway by the relevant ERT).
Electronic surface tracking buoy(s)	INPEX has several surface tracking buoys positioned in offshore including the following: CPF, FPSO, OSV, 3 x Drilling support vessels. Additional buoys will be on other vessels and located at Broome/Darwin logistics bases.	Deploy initial tracker buoys (deployment from vessels) as soon as safety practicable. • condensate – minimum 3 hours before deployment • diesel/IFH/HFO – minimum 1 hour before deployment.	Tracking buoy locations and satellite tracking website/passwords available in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002). Tracking buoys deployed from vessels, as directed by the OIM or IMT.
Satellite imagery analysis	Sourced via OSRL, AMOSC and/or AMSA third party satellite imagery providers.	IMT to request satellite imagery within 6 hours of IMT formation (Level 3 event only).	IMT to request satellite imagery via AMOSC, OSRL and/or AMSA. AMOSC and OSRL notification/activation forms available in the Oil Spill Forms Register (refer Section 5).

Table 4-4: EPO, EPS and measurement criteria for the activation and implementation of surveillance, modelling and visualisation

Environmental performance outcome	Environmental performance standard	Measurement criteria
SMV data will be acquired and utilised to enable informed and timely IMT decision making during a response.	For any Level 2/3 spill event, the IMT will activate SMV capability, as described in Table 4-3.	Emergency event response records.
	Initial visual surveillance (e.g., helicopter, vessel or facility) will be undertaken utilising the INPEX Oil Spill Observation and Dispersant Guide and the INPEX Oil Spill Surface Volume Calculator.	Emergency event response records.
	SMV data will be utilised by the IMT to maintain situational awareness and inform ongoing review of the Operational SIMA and IAP, including consideration of the various SMV tactics against the response termination criteria.	Emergency event response records.

4.5 Secondary response measures capability and arrangements

This section provides the details of the capabilities and arrangements for the following response strategies:

- SCAT and shoreline clean-up
- oiled wildlife response
- protection of sensitive resources
- surface (vessel/aerial) dispersant
- at-sea containment and recovery
- waste management.

4.5.1 SCAT and shoreline clean-up

Response Objective

Shoreline clean-up assessment technique (SCAT) will be implemented to systematically collect data about the location, nature and degree of shoreline oiling including at risk and/or impacted wildlife, to inform shoreline treatment and oiled wildlife response planning.

Shoreline clean-up will be implemented to reduce the volume of oil on shoreline, to reduce the likelihood/consequence of impacts on the values and sensitivities of the shoreline and promote/increase the speed of the natural recovery of the shoreline to its pre-oiled state.

Response strategy summary

SCAT involves the visual assessment of the scale/extent of oil on shorelines, using data collection templates (paper based or computer applications). Drones may also be used to assist the SCAT team in remote or logistically challenging locations. SCAT activities also typically include evaluation of risks to wildlife. SCAT data is used to support shoreline response and oiled wildlife response (OWR) planning.

A shoreline clean-up would most likely involve the mobilisation of personnel and manual cleaning equipment such as rakes and shovels, to remove the oil from the shoreline. Manually collected oily contaminated solid waste must be stored in impermeable/lined bulka-bags or other similar lined/impermeable waste collection containers. The oily waste containers would then most likely be backloaded to a staging area and then be transported to a licenced waste management facility for appropriate disposal.

Shoreline clean-up operations are often considered in three stages;

- Stage 1 - bulk oil is removed from the shore to prevent remobilisation
- Stage 2 - removal of stranded oil and oiled shoreline material which is often the most protracted part of shoreline clean-up
- Stage 3 - final clean-up of light contamination and removal of stains, if required.

Depending upon the nature of the contamination, progression through each of these stages may not be required, depending on the termination criteria set by the IMT.

Activation

The WA/NT Control Agencies are responsible for the final decision to activate SCAT and shoreline clean-up activities on State/Territory shorelines.

If a shoreline clean-up response is required at a Commonwealth shoreline (e.g., Ashmore Reef or Cartier Island), the activation and response strategies/tactics selection will occur in consultation relevant Government agencies (refer Table 2-4).

The IMT shall consider all SMV data to determine potential or actual shoreline contacts, to assist in determining SCAT locations.

SMV and SCAT data will be used to inform shoreline clean-up planning and activation/mobilisation.

The IMT will need to consider the practicalities, likely success and risks associated with any SCAT and shoreline clean-up operation, (including comparison of response compared with allowing stranded oil to naturally weather).

Remote SCAT operations would typically require activation within a minimum of 48 hours, to enable the initial response personnel, equipment and vessels to prepare for mobilisation, and final location/operation specific HSE and emergency response planning to be completed.

Remote shoreline clean-up operations would typically require activation within a minimum of 6 days, to enable the initial response personnel, equipment and vessels to prepare for mobilisation, and final location/operation specific HSE and emergency response planning to be completed.

Personnel

There are significant logistical constraints and HSE risks with flying personnel in light utility helicopters to remote offshore locations or operating out of small vessels at remote offshore locations. Also, there is the potential to disturb wildlife populations on small islands by landing large numbers of response personnel. Therefore, the number of shoreline response personnel working in remote locations at any one time will be agreed in consultation with the WA/NT Control Agency.

In accordance with stakeholder consultation in July 2021 with the WA DoT (WA Control Agency) and WA Department of Biodiversity, Conservation and Attractions (DBCA)[1], the recommended personnel/team compositions for remote SCAT and remote shoreline operations have been defined as follows:

- Remote SCAT team (4 persons)
  - 2 x SCAT trained personnel
  - 1 x OWR trained personnel
  - 1 x local government or parks advisor/aboriginal heritage advisor (person with local knowledge of the area)
- Remote shoreline response unit (44 persons)
  - sector command team (10 personnel – 2 x leader/deputy, 3 x admin, 2 x HSE, 2 x paramedic, 1 x multi-media/communications).
  - SCAT team (4 personnel – 2 x SCAT, 1 x OWR, 1 x local ranger)
  - Shoreline clean-up team (21 personnel - 4 leadership, 17 labour hire)
  - OWR wildlife collection/rescue and preventative actions team (5 personnel)
  - OWR intake (TRIAGE, first aid or other response) (3 personnel including 1 vet)

It is expected the relevant State/Territory Control Agency will provide some government appointed personnel to oversee/lead the remote shoreline response operation. INPEX would be required to provide the additional field response personnel.

However, should the Control Agency request/require additional remote shoreline response personnel, or INPEX is the Control Agency (e.g., Ashmore Reef or Cartier Island) INPEX plus mutual aid capability (AMOSC/OSRL) and labour hire, will provide the full shoreline response personnel capability.

Additional labour hire personnel (e.g., general additional shoreline clean-up personnel, who would receive on the job training) are available via INPEX existing labour hire agreements.

In a typical shoreline response, a worker is expected to clean between 1 to 2 m^3 of oily waste per day.

Depending on the planned duration of the remote shoreline clean-up operations, this may require the establishment of a one or two week on/off roster system, drawing on trained personnel from AMOSC and other mutual aid capabilities, and other labour hire sources, until the response is terminated.

[1] Personal communication, Department of Biodiversity, Conservation and Attractions, and WA Department of Transport, Fremantle, pers. comm. 27 July 2021

Tools/equipment/plans

SCAT data recording systems are generally developed by State/Territory Control Agencies, and any shoreline response should utilise the State/Territory Control Agency SCAT data collection system.

However, should a situation arise where no specific SCAT data recording system is available (e.g., a shoreline response at the Indian Ocean Territories), the AMOSC SCAT data recording system and tools can be utilised (available on AMOSC intranet/member portal).

Drones may be utilised to assist in in remote or logistically challenging locations.

Shoreline clean-up is expected to be predominantly undertaken on sandy beaches (not on rocky headlands/cliffs or mangroves) using manual tools such as rakes, shovels.

Large mechanical equipment such as graders would not be appropriate for remote shoreline clean-up (risk of secondary contamination and general difficulty in mobilising this equipment). However, smaller machines such as rubber tracked bobcats could be used to help transport collected oily waste and other response equipment around the shoreline.

The relevant WA/NT Control Agency may choose to mobilise their own shoreline clean-up equipment. WA Control Agency spill response trailers are located in Karratha, Fremantle and Albany.

The AMOSC Broome stockpile and AMSA Darwin stockpiles also includes additional shoreline clean-up equipment.

Additional AMOSC shoreline clean-up equipment stockpiles are located at Exmouth, Fremantle and Geelong.

Key reference documents/tools to be used when planning and executing SCAT and shoreline clean-up include the following:

- The IPIECA (2015c) A guide to shoreline clean-up techniques Good practice guidelines for incident management and emergency response personnel provides additional guidance regarding shoreline response operations.
- AMOSC – Shoreline Treatment Recommendations and SCAT document (AMOSC internal tool)
- Browse Island Oil Spill Incident Management Guide (IMG) (X060-AH-GLN-60015) provides BROPEP regional information which will also support remote shoreline response planning.
- The NT Oiled Wildlife Response Plan (AMOSC 2019) includes extensive mapping, receptor prioritisation and logistics information for NT shoreline sectors.

Logistics

There are several logistical options available to conduct remote SCAT and remote shoreline clean-up operations.

For remote SCAT operations, supporting the 4-person SCAT team plus vessel crew, a small (~20-30m) support vessel, with a small beach landing vessel/tender would be appropriate.

For a full remote shoreline response operation, supporting the 44-person remote shoreline response team and equipment (plus vessel crew), a large accommodation support vessel (ASV), plus beach landing vessels/tenders/barges will be required. Another logistical support vessel (for consumables resupply and waste backload) may also be required.

If weather conditions or other factors preclude the use of small landing craft, light utility helicopters, launched from an ASV helideck would be required.

For the full remote shoreline response operation, response personnel/crew changes could occur via vessel or crew change helicopter, depending on the situation.

A decontamination staging post would be established at the shoreline clean-up location, or on the deck of the ASV, to enable decontamination of equipment and personnel before demobilisation at the end of each day.

All contaminated equipment and personal protective equipment (PPE) would be backloaded from the location to the mainland for cleaning or appropriate disposal.

More detailed planning regarding a remote shoreline clean-up and logistics is available in the Browse Island Oil Spill Incident Management Guideline (X060-AH-GLN-60015).

Waste management will be a key consideration for a shoreline clean-up operation. A waste management plan would be developed in consultation with AMOSC, prior to commencement of the activity (refer to Table 4-21).

Response effectiveness monitoring

During any SCAT and/or shoreline clean-up, daily reports will be provided by the response team to the IMT team regarding the effectiveness of the activity. The report shall include, as a minimum:

- date(s), time(s) and location(s) of SCAT/shoreline clean-up activities
- SCAT reports for all sectors assessed (using State/Territory or AMOSC data recording processes, as necessary)
- the volume of oily waste generated and stockpiled at staging area for each shoreline clean-up sector
- the overall effectiveness of SCAT/shoreline clean-up activities (including photographic evidence, where possible).

Termination Criteria

Termination criteria outline when continuing SCAT and shoreline clean-up activities may be detrimental to recovery as well as costly (Ecosystem Management and Associates 2008). Termination of response will be determined by the IMT in collaboration with relevant stakeholders and will consider factors including the following:

- the safety of responders
- the current effectiveness of the response (or phase of the response)
- deteriorating weather conditions (including wind, visibility and sea conditions).

ITOPF (2002) suggest the use of three questions to determine when termination of the response should occur:

4. is the remaining oil likely to damage environmentally sensitive resources?
5. does it interfere with the aesthetic appeal and amenity use of the shoreline?
6. is this oil detrimental to economic resources or disrupting economic activities?

If the answers to the questions are no, then there is no rationale to continue shoreline clean up.

IPIECA-ITOF (2020) identify that there will be a wide range of completion or end-point criteria, at various stages throughout a shoreline clean-up. These criteria will need to be set at the time, in consultation with relevant oil spill experts, government agencies and other key stakeholders. Therefore, there is no single, appropriate end-point criteria or termination criteria which can be set prior to an event.

The final decision on whether to activate and terminate a shoreline clean-up response will remain with the WA/NT Control Agency for the WA/NT shorelines, and would typically be undertaken in accordance with the guidance provided in the National Plan Response Assessment Termination of Cleaning for Oil Contaminated Foreshores (AMSA 2015).

If a shoreline clean-up response is required at a Commonwealth shoreline (e.g., Ashmore Reef, Cartier Island), the response termination will occur in consultation with AMSA and other relevant Government agencies (refer Table 2-4).

Capability, arrangements and performance outcomes and standards

The arrangements and capabilities as described in the subsections above are summarised in Table 4-5. EPOs and EPSs for the implementation of SCAT and shoreline clean-up are provided in Table 4-6.

Table 4-5: Arrangement and capabilities summary – SCAT and shoreline clean-up

Technique	Resource capability and availability	Implementation time	Activation
SCAT and Shoreline Clean-up personnel	WA DoT/NT DEPWS (as Control Agency) may choose to mobilise their own SCAT assessment and initial shoreline clean-up personnel. Additional trained SCAT and shoreline response personnel would be available through AMOSC Core Group. Additional (Tier 3) capability also available via OSRL. Additional personnel, who would receive on the job training would be sourced from: • INPEX environmental service providers • INPEX general offshore labour hire contracts	First remote SCAT operations (4 personnel) required to be able to mobilise from port in 48 hours. (Pending Operational SIMA outcome – target time is two additional remote SCAT teams mobilised by day 7). Remote shoreline response unit team (total of 44 personnel, including SCAT, shoreline clean-up and OWR) required to be able to mobilise from port within 6 days. (Pending Operational SIMA outcome – target time is second remote shoreline response unit mobilised within 14 days, and third unit mobilised within 30 days).	AMOSC, OSRL & labour hire company contact details available via Emergency Contacts Directory (C075-AH-LIS-10002) AMOSC and OSRL notification/activation forms available in the Oil Spill Forms Register (refer Section 5).
Shoreline clean-up equipment	WA DoT SCAT/first-strike shoreline clean-up stockpiles are in Karratha, Fremantle and Albany. Additional shoreline clean-up equipment can be mobilised from the Broome or Darwin equipment stockpiles. Additional shoreline clean-up equipment can be mobilised through AMOSC/AMSA Tier 2/3 stockpiles, or it can be purchased/hired from retail outlets in Broome/Darwin.	6 days to mobilise equipment required for remote shoreline response unit.	
Helicopters	INPEX contracted crew transfer helicopters (for personnel transfer to designated landing zones only, not to remote shoreline beaches).	INPEX routine crew-change helicopters always available.	IMT to activate all helicopter assets. Helicopter provider contact details available in the Emergency Contacts Directory (C075-AH-LIS-10002) Aviation mobilisation processes also summarised in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002).
	Utility helicopters suitable for landing on remote shorelines are available via INPEX aviation call-off arrangements.	Commence mobilisation activities in Broome within 7 days.	
Vessels	Small support vessels (<40 m length) are available via INPEX marine call-off contract/framework arrangements to support remote SCAT operations.	Single small support vessel plus tender to support 4-person remote SCAT team, required within 48 hours. (Pending Operational SIMA outcome – target time is two additional remote SCAT teams mobilised by day 7).	IMT to active all support vessels. Vessel provider contact details available via the Emergency Contacts Directory (C075-AH-LIS-10002).
	Large support vessels/accommodation support vessels are available via INPEX marine call-off contract/framework arrangements, to support remote shoreline response unit operations.	Single ASV and associated support vessels, mobilised with 44-person remote response team, and all equipment, within 6 days. (Pending Operational SIMA outcome – target time is second remote shoreline response unit mobilised within 14 days, and third unit mobilised within 30 days).	

Table 4-6: EPO, EPS and measurement criteria for SCAT and shoreline clean-up

Environmental performance outcome	Environmental performance standard	Measurement criteria
SCAT activities will systematically collect data about the location, nature and degree of shoreline oiling, (including at risk/impacted wildlife), to inform shoreline treatment and oiled wildlife response planning. Shoreline clean-up activities will reduce the volume of oil on shoreline, to reduce the likelihood/consequence of impacts on the values and sensitivities of the shoreline and promote/increase the speed of the natural recovery of the shoreline to its pre-oiled state.	Based on the outcome of the Operational SIMA and in consultation with the relevant State/Territory Control Agencies, the IMT will activate SCAT/Shoreline Clean-Up using the capabilities/arrangements as described in Table 4-5.	Emergency event response records.
	Monitoring of response effectiveness for SCAT and shoreline clean-up will be undertaken as described in Section 4.5.1. Response effectiveness monitoring data will be utilised as part of ongoing IAP review and response termination criteria.	Emergency event response records.
Risks of impacts to transient, EPBC-listed species, (marine turtles) and intertidal habitats from a shoreline response are reduced and maintained to ALARP and acceptable levels.	In the event of a shoreline response, an HSE plan will be prepared, in consultation with AMOSC and WA/NT wildlife agencies (via relevant WA/NT Control Agency) or DCCEEW (for Commonwealth lands) which addresses potential impacts to turtle nesting including: • personnel and equipment movement on turtle-nesting beaches • light-spill (if night-time activities are required).	Emergency event response records.

4.5.2 Oiled wildlife response (OWR)

Response objective

OWR will be implemented to minimise the impacts of an oil spill on wildlife by both prevention of oiling where possible and mitigating the effects on individuals when oiling has taken place.

Response Strategy Summary

SMV data of the spill would provide data regarding spill trajectory and potential wildlife that may be affected by the spill. SCAT activities will also include observations regarding risks to wildlife.

Under specific circumstances, pre-contact oiled wildlife response (OWR) could potentially be used to prevent or reduce the impacts of a spill on populations of seabirds and turtles. It is most suitable when used on wildlife affected by persistent oily slicks such as Group IV spills; however, it may also be considered for residuals from Group I or Group II spills.

Wildlife hazing can be an effective control measure when deployed across limited geographical areas and against specific populations, where the surface oil resulting from a spill is largely contained. Hazing could potentially be used to deter marine fauna, seabirds, and shorebirds from entering a spill area. It is not an effective measure against volatile spills which rapidly evaporate, nor does it have application against dissolved or dispersed oils.

Wildlife hazing techniques include:

- human disturbance (the simple presence of people in the wildlife habitat)
- vehicular disturbance (e.g., terrestrial vehicles, boats and aircraft)
- visual disturbance (e.g., lights, reflectors, flags, effigies, vessels etc.)
- auditory disturbance (e.g., noise generators)
- physical structures (e.g., fences) to prevent wildlife accessing contaminated sites.

Oiled wildlife capture at sea is theoretically possible; however, it would present significant challenges. The capture and relocation of turtle nests/eggs prior to oil arrival or following oil arrival onshore to prevent oiling of emerging hatchlings could be achieved using translocation and release. Onshore incubation and release of hatchlings at alternative locations away from the oil spill is possible, as noted in the Gulf of Mexico oil spill where personnel successfully relocated and incubated approximately 25,000 turtle eggs and successfully released approximately 15,000 turtle hatchlings (which is roughly the same proportion as natural hatchling success) (Gaskill 2010).

Helicopter transport is preferred over vessel transport due to the latter being more likely to disturb egg orientation.

An option that is easier, cheaper and less logistically challenging than nest relocation is using drift fencing above high tide line to fence off potential nesting areas, then monitoring fences (particularly at dawn, following night-time hatching events) to capture and relocate hatchlings out of oiled areas (informed by modelling to determine the best locations for release).

Under specific circumstances, post-contact OWR (wildlife capture, cleaning and rehabilitation) could potentially be used to prevent or reduce the impacts of a spill on populations of seabirds and potentially other marine megafauna. It is most suitable when used on wildlife affected by persistent oily slicks; however it may also be considered for residuals from Group I and II spills.

WA DBCA (previously DPaW) (DPaW pers. comm. 2016)[2] indicates that shore-based response priorities would generally consider the following fauna:

- Priority 1: birds endangered, threatened or protected by treaty
- Priority 2: common birds
- Priority 3: adult nesting female turtles (wipe down only)
- Priority 4: turtle hatchlings (potential translocation).

[2] Personal communication, Mr Brad Daws, Department of Parks and Wildlife, Oil Spill Response Wildlife Management Course, Fremantle, pers. comm. 24-26 May 2016

Response priorities at the time will be finalised in consultation with the WA DBCA/NT Parks and Wildlife Commission (PaWC) 'oiled wildlife adviser'.

Stakeholder consultation with WA DBCA[3] has confirmed that based on the WCSS modelling and wildlife species most likely to be impacted by shoreline oil in the BROPEP region, a full oiled wildlife remote cleaning operation and/or transport and mainland rehabilitation program would be unlikely to be required. The relevant State/Territory Control Agency would make the decision based on OWR information available at the time.

Therefore, mobilisation of oiled wildlife containers is not anticipated to be required as part of floating remote shoreline response units. However, if oiled wildlife containers were required, they are available for use via AMOSC mutual aid arrangements.

Activation

SMV and SCAT data would be utilised to determine requirement to activate OWR response.

The INPEX IMT shall consult, via WA DoT, a WA DBCA 'oiled wildlife adviser' to provide support to for any wildlife response activities, including obtaining permits to conduct an OWR in WA State waters and/or Commonwealth waters, as stated above. OWRs along the WA shoreline areas are managed under the West Kimberley Region Oiled Wildlife Response Plan (DPAW & AMOSC 2015), and the WA OWR Plan and OWR Manual (DBCA 2022a; DBCA 2022b).

The INPEX IMT shall consult, via NT DIPL, a NT PaWC 'oiled wildlife adviser' to provide support for any wildlife response activities, including obtaining permits to conduct a wildlife response in NT waters. OWRs along the NT shoreline areas are managed under the NT OSCP and the NT Oiled Wildlife Response Plan (AMOSC 2019).

The INPEX IMT shall consult AMOSC for advice regarding any wildlife response activities, as well as consult the DCCEEW (as the Jurisdictional Authority for wildlife in Commonwealth waters), for any risks from the spill to MNES (including oiled wildlife).

In the event that wildlife is oiled on Commonwealth islands (e.g., Ashmore Reef or Cartier Island), the activation and response strategies/tactics selection will occur in consultation with AMSA, and other relevant Government agencies (refer Table 2-4).

Remote OWR assessment (as part of SCAT operations) would typically require activation within a minimum of 48 hours, to enable the initial OWR response personnel, equipment and vessels to prepare for mobilisation, and final location/operation specific HSE and emergency response planning to be completed.

Remote OWR operations, as part of a full remote shoreline response unit, would typically require activation within a minimum of 6 days, to enable the initial response personnel, equipment and vessels to prepare for mobilisation, and final location/operation specific HSE and emergency response planning to be completed.

Personnel

In accordance with stakeholder consultation completed in June/July 2021 with the WA DoT (WA Control Agency), and WA DBCA, the recommended personnel/team compositions for remote SCAT and remote shoreline operations have been defined as follows:

- Remote SCAT team (4 persons)
  - 2 x SCAT trained personnel
  - 1 x OWR trained personnel

[3] Personal communication, Ms Simone Vitale, Department of Biodiversity, Conservation and Attractions, Fremantle, pers. comm. 27 July 2021

  - 1 x local government or parks advisor/aboriginal heritage advisor (person with local knowledge of the area)
- Remote shoreline response unit (44 persons)
  - sector command team (10 personnel – 2 x leader/deputy, 3 x admin, 2 x HSE, 2 x paramedic, 1 x multi-media/communications).
  - SCAT team (4 personnel – 2 x SCAT, 1 x OWR, 1 x local ranger)
  - Shoreline clean-up team (21 personnel - 4 leadership, 17 labour hire)
  - OWR wildlife collection/rescue and preventative actions team (5 personnel)
  - OWR intake (TRIAGE, first aid or other response) (3 personnel including 1 vet).

It is expected the relevant State/Territory Control Agency will provide some government appointed personnel to oversee/lead the remote shoreline response operation. INPEX would be required to provide the additional field response personnel.

However, should the Control Agency request/require additional remote shoreline response personnel, or INPEX is the Control Agency (E.g., Ashmore Reef/Cartier Island) INPEX plus mutual aid capability (AMOSC/OSRL) and labour hire, will provide the full shoreline response personnel capability.

Additional labour hire personnel (E.g., general additional shoreline clean-up personnel, who would receive on the job training) are available via INPEX existing labour hire agreements.

WA DBCA and AMOSC have collaboratively developed an OWR model (shown in Figure 4-1) that is based on a small number of OWR adviser(s) who receive specific training at an IMT level to manage an OWR. At a site-management level this is further broken into 'OWR Field Management' who are moderately trained to supervise field response, such as the WA DBCA oiled wildlife advisors and the AMOSC OWR team.

The Oiled Wildlife Rehabilitators Network (fauna care/rehabilitation volunteers, vets, zoo personnel, etc.) is a group of more than 100 Western Australian personnel who have been trained in physical oiled wildlife capture, cleaning, rehabilitation and using the dedicated OWR containers maintained by AMOSC and WA DoT. The Oiled Wildlife Rehabilitators Network personnel are available on a volunteer basis. The list of current personnel is maintained and activated by the WA DBCA. Oiled Wildlife Rehabilitators Network personnel from the Kimberley region could potentially be utilised to support OWR in the NT.

Philip Island Nature Park (Victoria) have over 100 personnel also trained in OWR. These personnel are available, under a 'best endeavours' MoU agreement with AMOSC.

'General Field Responders' are personnel who receive basic 'just in time training' to carry out tasks as directed by personnel with higher levels of OWR training. INPEX maintain service agreements with various environmental service providers and general labour hire companies who can provide personnel to assist as general field responders, who would receive on-the-job training to assist with wildlife response activities.

The OWR Division Coordinator (within the IMT) may engage with qualified veterinarian specialists to provide in-field expertise and technical support to the OWR Coordinator.

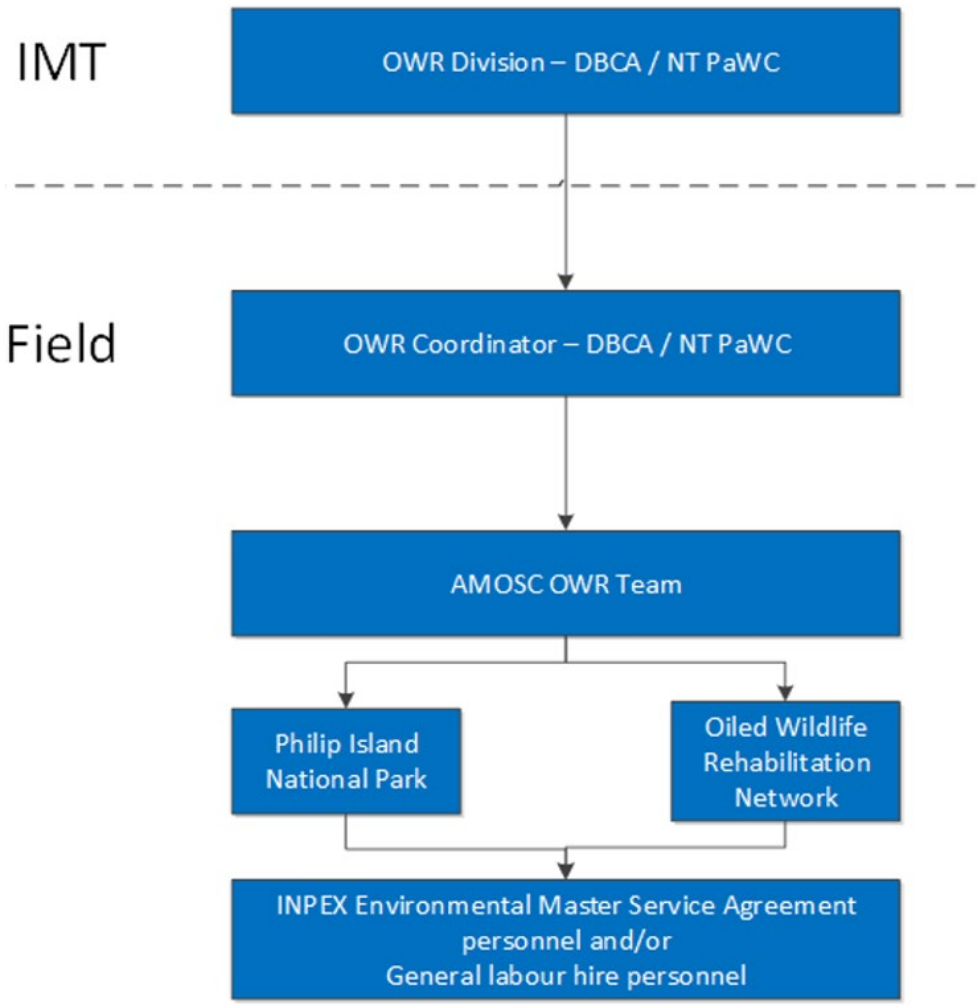


Figure 4-1: Oiled Wildlife Response Division model

Depending on the duration of the operations, this may require the establishment of a one or two week on/off roster system, drawing on trained personnel from AMOSC, OSRL, Oiled Wildlife Rehabilitators Network and government agency personnel until the response is terminated.

Tools/equipment/plans

The WA DBCA has recently prepared the following documents (in final draft at the time of preparation of this document):

- WA OWR Plan (DBCA 2022a)
- WA OWR Manual (DBCA 2022b)

These two documents are considered the most appropriate overarching documents which should be used to guide/manage all OWR activities, including OWR activities in NT and/or Commonwealth waters/shorelines.

Detailed shoreline sectors and oiled wildlife response priorities are also defined in the NT Oiled Wildlife Response Plan (AMOSC 2019) and the West Kimberley Region Oiled Wildlife Response Plan (DPaW & AMOSC 2015). These plans should also be utilised during the planning and execution of any wildlife response along the Kimberley/NT coastline.

AMOSC maintains an 'oiled wildlife response capability register' on behalf of industry to support OWRs. The AMOSC register maintains currency of potential resources, such as:

- equipment and the locations of stockpiles
- response personnel (including global OWR specialists such as Sea Alarm)
- training/exercise materials
- aid (national and international).

Oiled wildlife response kits (for wildlife collection) and container (for oiled wildlife cleaning) locations are shown in Figure 4-2.

AMOSC bird hazing/scarers are available from the AMOSC stockpiles.

Physical structures, such as drift-fences (e.g., wooden stakes and rolls of shade-cloth), could be set-up on remote beaches to capture emergent turtle hatchlings before they enter an oiled intertidal zone, and relocate/release the hatchlings to an area well away from the slick (informed by modelling etc for best locations for release). This type of equipment (and other visual disturbance type equipment) is readily available from gardening/hardware stores within the region.

Logistics

For a full remote shoreline response operation, supporting the 44-person remote shoreline response team and equipment (plus vessel crew), a large accommodation support vessel (ASV), plus beach landing vessels/tenders/barges will be required. Another logistical support vessel (for consumables resupply and waste backload) may also be required.

If weather conditions or other factors preclude the use of small landing craft, light utility helicopters, launched from an ASV helideck would be required.

For the full remote shoreline response operation, response personnel/crew changes could occur via vessel or crew change helicopter, depending on the situation.

A decontamination staging post would be established at the shoreline clean-up location, or on the deck of the ASV, to enable decontamination of equipment and personnel before demobilisation at the end of each day.

All contaminated equipment and personal protective equipment (PPE) would be backloaded from the location to the mainland for cleaning or appropriate disposal.

Waste management will be a key consideration for a OWR operation. A waste management plan would be developed in consultation with AMOSC, prior to commencement of the activity (refer to Table 4-21).

More detailed planning regarding a remote shoreline clean-up and logistics is available in the Browse Island Oil Spill Incident Management Guideline (X060-AH-GLN-60015).

Stakeholder consultation with WA DoT and WA DBCA [4] (July 2021) has confirmed that based on the WCSS modelling and wildlife species most likely to be impacted by shoreline oil in the BROPEP region, a full oiled wildlife remote cleaning operation and/or transport and mainland rehabilitation program would be unlikely to be required. The relevant State/Territory Control Agency would make the decision based on OWR information available at the time.

[4] Personal communication, Department of Biodiversity, Conservation and Attractions, and WA Department of Transport. Fremantle, pers. comm. 27 July 2021

Therefore, mobilisation of oiled wildlife containers is not anticipated to be required as part of remote shoreline response units. However, in the highly unlikely event that a full at-sea OWR response including use of OWR containers was required, they are available for use via AMOSC mutual aid arrangements.

According to DPAW & AMOSC (2015), an ideal 'on-water' OWR centre would:

- accommodate a minimum of 30 oiled wildlife responders
- have suitable deck space to house at least one 20 metre OWR sea container and air-conditioned holding containers
- have an ability to safely load/unload wildlife to and from adjacent vessels (i.e. through rescue hatches or by using a loading crane)
- be able to facilitate washdown of animals and can store oily waste or have an oil-in-water separator and holding tanks for waste oil.

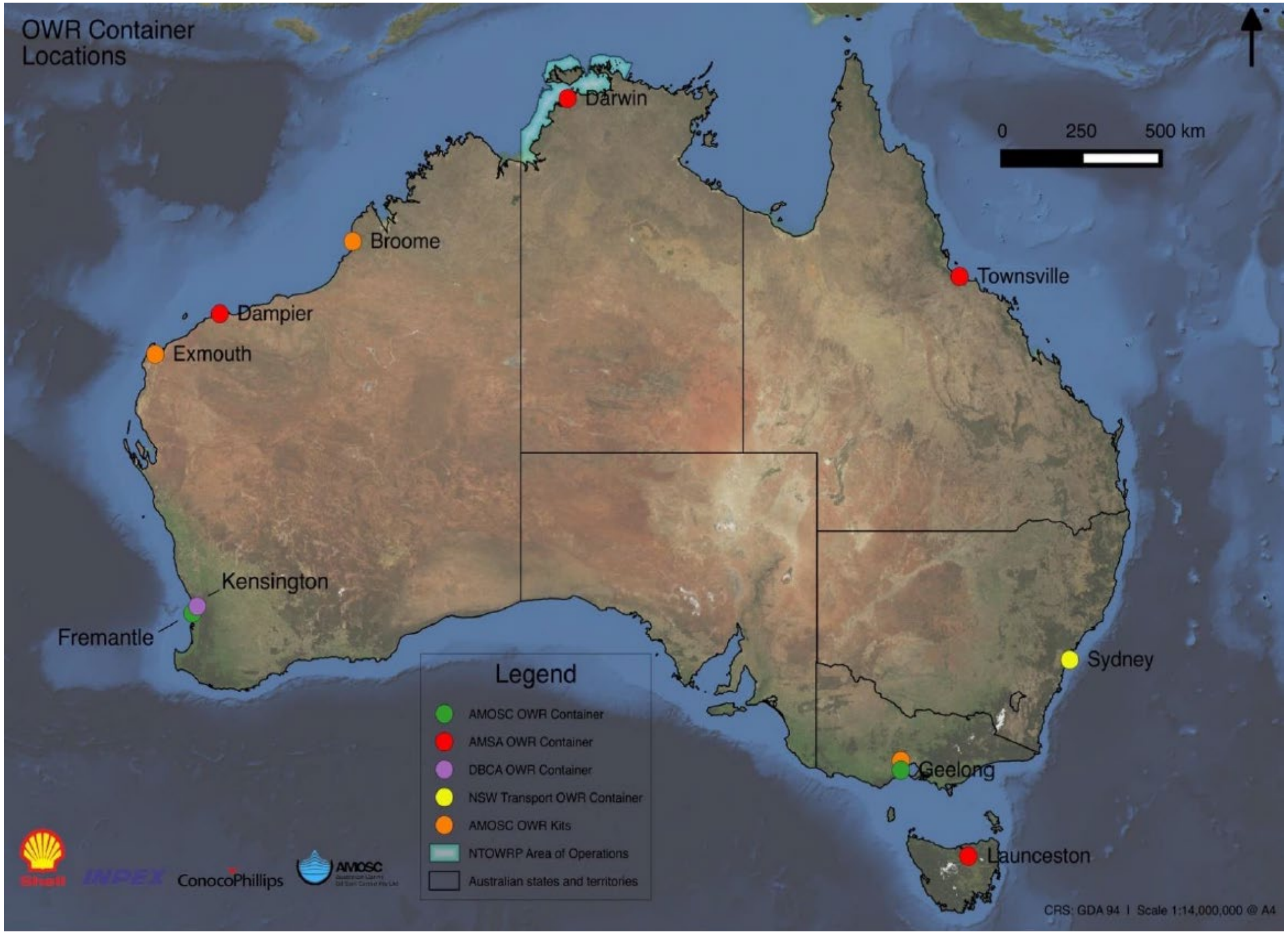


Figure 4-2: Oiled wildlife response kit and container locations

Response effectiveness monitoring

During any pre or post contact OWR activity, daily reports will be provided by the response team to the IMT regarding the effectiveness of the activity. The report shall include, as a minimum:

- date(s), time(s) and location(s) of wildlife capture and release activities
- statistics of daily and total number of wildlife capture, cleaning, rehabilitation, per species
- the overall effectiveness of wildlife response activities (including photographic evidence, where possible).

Termination Criteria

Termination of response will be determined by the IMT in collaboration with relevant stakeholders and will consider factors including the following:

- the safety of responders
- the current effectiveness of the response
- deteriorating weather conditions (including wind, visibility and sea conditions)
- habitats are deemed clear from risk of oiling
- lack of presence of oiled wildlife remaining in the affected area; or the numbers of affected wildlife being captured fall towards the agreed threshold for ceasing operations
- stabilisation and transportation of all captured wildlife, other appropriate welfare options have been effective
- collection and removal of carcasses has occurred.

The WA OWR Plan and OWR Manual (DBCA 2022a; DBCA 2022b) should be used to assist the IMT decide on response termination include setting an agreed threshold for ceasing operations, as well as thresholds for scaling back rescue operations.

The final decision on whether to terminate a shoreline wildlife response will remain with the relevant Control Agency for the WA/NT shorelines.

If a shoreline wildlife response is required at a Commonwealth shoreline (E.g., Ashmore Reef or Cartier Island), the response termination will occur in consultation with AMSA and other relevant Government agencies (refer Table 2-4).

Capability, arrangements and performance outcomes and standards

The arrangements and capabilities as described in the subsections above are summarised in Table 4-7.

The EPOs and EPSs related to the implementation of OWR are provided in Table 4-8.

Table 4-7: Arrangements and capabilities – Pre-contact and post-contact oiled wildlife response

Technique	Resource capability and availability	Implementation time	Activation
Oiled wildlife response personnel	WA DoT/NT DEPWS (as Control Agency) may choose to mobilise their own OWR personnel Additional OWR personnel are available through: • AMOSC Oiled Wildlife Response Team • OSRL • Oiled Wildlife Rehabilitators Network • Philip Island Nature Park Additional personnel, who would receive on the job training would be sourced from: • AMOSC core-group • INPEX environmental service providers • INPEX general offshore labour hire contracts.	First remote SCAT operations (including 1 x OWR personnel) required to be able to mobilise from port in 48 hours (based on Operational SIMA outcome). (Pending Operational SIMA outcome – target time is two additional remote SCAT teams mobilised by day 7). Remote shoreline response unit team (total of 44 personnel, including SCAT, shoreline clean-up and 8 x OWR personnel) required to be able to mobilise from port within 6 days. (Pending Operational SIMA outcome – target time is second remote shoreline response unit mobilised within 14 days, and third unit mobilised within 30 days).	AMOSC, OSRL & labour hire company contact details available via Emergency Contacts Directory (C075-AH-LIS-10002) AMOSC and OSRL notification/activation forms available in the Oil Spill Forms Register (refer Section 5).
Oiled wildlife response equipment	OWR kits, containers and hazing equipment available via AMOSC (refer Figure 4-2). Additional basic equipment can be purchased from hardware stored in Broome/Darwin etc.	6 days to mobilise equipment required for OWR as part of a remote shoreline response unit.	
Helicopters	INPEX contracted crew transfer helicopters (for personnel transfer to designated landing zones only, not to remote shoreline beaches).	INPEX routine crew-change helicopters always available.	IMT to activate all helicopter assets. Helicopter provider contact details available in the Emergency Contacts Directory (C075-AH-LIS-10002) Aviation mobilisation processes also summarised in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002).
	Utility helicopters suitable for landing on remote shorelines are available via INPEX aviation call-off arrangements.	Commence mobilisation activities in Broome within 7 days.	
Vessels	Small support vessels (<40 m length) are available via INPEX marine call-off contract/framework arrangements to support remote SCAT operations.	Single small support vessel plus tender to support 4-person remote SCAT team, required within 48 hours. (Pending Operational SIMA outcome – target time is two additional remote SCAT teams mobilised by day 7).	IMT to active all support vessels. Vessel provider contact details available via the Emergency Contacts Directory (C075-AH-LIS-10002).
	Large support vessels/accommodation support vessels are available via INPEX marine call-off contract/framework arrangements, to support remote shoreline response unit operations.	Single ASV and associated support vessels, mobilised with 44-person remote response team, and all equipment, within 6 days. (Pending Operational SIMA outcome – target time is second remote shoreline response unit mobilised within 14 days, and third unit mobilised within 30 days).	

Table 4-8: EPO, EPS and measurement criteria for oiled wildlife response

Environmental performance outcome	Environmental performance standard	Measurement criteria
OWR will be implemented to minimise the impacts of an oil spill on wildlife by both prevention of oiling where possible and mitigating the effects on individuals when oiling has taken place	Based on the outcome of the Operational SIMA and in consultation with the relevant State/Territory Control Agencies, the IMT will activate OWR using the capabilities/arrangements as described in Table 4-7.	Emergency event response records.
	Monitoring of response effectiveness for SCAT and shoreline clean-up will be undertaken as described in Section 4.5.2. Response effectiveness monitoring data will be utilised as part of ongoing IAP review and response termination criteria.	Emergency event response records.
Risks of impacts to transient, EPBC-listed species, (marine turtles, marine mammals and marine avifauna) from wildlife response activities are reduced and maintained to ALARP and acceptable levels.	OWR shall be undertaken in accordance with the relevant State/Territory OWR Plan and/or Manual, under direction from the relevant State/Territory Control Agency, or in consultation with the DCCEEW (Commonwealth waters and shoreline OWR). All necessary regulatory permits will be obtained prior to commencing wildlife response activities, and conditions will be implemented.	Emergency event response records.

4.5.3 Protection of sensitive resources

Response Objective

Protection of sensitive resources will be implemented to prevent and/or reduce the volume of oil on entering a sensitive habitat, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the values and sensitivities of the habitat.

Response Strategy Summary

Protection of sensitive resources (or protect and deflect/P&D) involves a combination of nearshore and shoreline response techniques, to prevent or reduce the volume of oil impacting a sensitive habitat (e.g., a wetland or creek-mouth). Typically, a combination of booms will be used to deflect oil away from a habitat, or deflect oil into a natural collection point, there-by reducing the total volume of oil impacting a sensitive resource.

A P&D operation in remote locations/shorelines would typically be mobilised as part of a broader shoreline response (e.g., as part of a remote shoreline clean-up and wildlife response unit).

P&D activities at exposed shoreline locations in the BROPEP region would be logistically challenging due to the general exposure to unfavourable sea conditions, large tidal range and shallow coral reef (generally P&D is limited to sheltered waters, not exposed reef/beach environments). Only with a long-term forecast for continued calm/low sea-states and appropriate tides would it be safe to conduct vessel activities to carry-out an effective P&D operation at remote offshore islands/shorelines.

Activation

The WA/NT Control Agencies are responsible for the final decision to activate P&D activities on State/Territory shorelines.

If a P&D response is determined to be required at a Commonwealth shoreline (E.g., Ashmore Reef), the activation and response strategies/tactics selection will occur in consultation with AMSA, and other relevant Government agencies (refer Table 2-4).

The IMT shall consider all SMV data and Operational SIMA outputs to determine potential or actual shoreline contact and potential impacts. The IMT will need to consider the practicalities, likely success and risks associated with any P&D, (including comparison of response within a sensitive habitat, where trampling of vegetation and disturbance to wildlife could also occur) compared with allowing stranded oil to naturally weather.

If required, remote P&D operations would typically require activation within a minimum of 6 days (as part of a broader remote shoreline response unit), to enable the initial response personnel, equipment and vessels to prepare for mobilisation, and final location/operation specific HSE and emergency response planning to be completed.

Personnel

A typical P&D strike-team, deployed to protect a single sensitivity, would consist of 1-2 trained personnel, and 3-5 supporting/labour hire personnel. Typically, at least one small vessel operator is required (could be one of the trained personnel). Within the context of the BROPEP region, consultation with the WA DoT (Control Agency) in July 2021 [5] confirmed that the P&D strike-team would be considered as part of the shoreline clean-up team within the broader remote shoreline response unit.

State/Territory Control Agencies may provide their own P&D team leaders/personnel.

However, if additional P&D trained personnel are required, these can be accessed via AMOSC and OSRL.

Additional labour hire personnel (e.g., personnel who would receive on the job training) are available via INPEX existing labour hire agreements.

Depending on the duration of the operations, this may require the establishment of a one or two week on/off roster system, drawing on trained personnel from AMOSC, and other labour hire sources, until the response is terminated.

Tools/equipment/plans

Typical equipment required for a P&D activity include:

[5] Personal communication, WA Department of Transport, Fremantle, pers. comm. 27 July 2021

- a combination of nearshore boom and shore-seal booms (including anchor kits, sandbags etc)
- skimmers and temporary waste storage may be required for collection of solid and liquid oily waste.
- small, shallow draft vessels are required for transporting and positioning booms and anchors.
- PPE and other shoreline equipment and decontamination areas etc would likely be set-up as part of a broader shoreline response.

Various stockpiles of oil spill response equipment, including P&D booms, skimmers etc are located around Australia. AMOSC stockpiles are in:

- Broome
- Exmouth
- Fremantle
- Geelong.

Logistics

P&D would be conducted as part of a broader remote shoreline response unit operation, typically as an additional element to remote shoreline clean-up operations.

For a full remote shoreline response operation, supporting the 44-person remote shoreline response team and equipment (plus vessel crew), a large accommodation support vessel (ASV), plus beach landing vessels/tenders/barges will be required. Another logistical support vessel (for consumables resupply and waste backload) may also be required.

If weather conditions or other factors preclude the use of small landing craft, light utility helicopters, launched from an ASV helideck would be required. The light utility helicopter could be utilised to transport personnel and protect and deflect equipment between the remote shoreline and nearby ASV. Slinging of equipment from nearby support vessel may be required for heavier equipment, and also for the back-loading of waste.

However, if weather conditions or other factors did preclude the use of small landing craft, this will mean limited P&D equipment could be deployed, due to lack of ability to use small/shallow draft vessels for nearshore boom/anchor deployment.

For the full remote shoreline response operation, response personnel/crew changes could occur via vessel or crew change helicopter, depending on the situation.

A decontamination staging post would be established at the shoreline clean-up location, or on the deck of the ASV, to enable decontamination of equipment and personnel before demobilisation at the end of each day.

All contaminated equipment and personal protective equipment (PPE) would be backloaded from the location to the mainland for cleaning or appropriate disposal.

Waste management will be a key consideration for P&D operations. A waste management plan would be developed in consultation with AMOSC and WA DoT, prior to commencement of the activity.

More detailed planning regarding a remote P&D response at an offshore island are available in the Browse Island Oil Spill Incident Management Guideline (X060-AH-GLN-60015). This document also provides guidance on response at any remote shorelines.

Waste management will be a key consideration for a P&D operation. A waste management plan would be developed in consultation with AMOSC, prior to commencement of the activity (refer to Table 4-21).

Response effectiveness monitoring

During any P&D activity, daily reports will be provided by the response team to the IMT regarding the effectiveness of the activity. The report shall include, as a minimum:

- date(s), time(s) and location(s) of the activities
- the volume of solid and liquid oily waste collected/generated
- the overall effectiveness of the protect and deflect activities (including photographic evidence, where possible).

Termination criteria

Termination of response will be determined by the IMT in collaboration with relevant stakeholders and will consider factors including the following:

- the safety of responders
- the current effectiveness of the response
- deteriorating weather conditions (including wind, visibility, sea conditions)
- sensitive habitats are deemed clear from risk of further oiling

IPIECA-IOGP (2015a) specifically references the following key operational limitations, which may influence termination criteria decision-making for booming operations;

- Current speed induced boom failure
- Splash-over failure
- Equipment maintenance and repair
- Logistical challenges affecting operational effectiveness including;
  - sailing time to and from spill location to port/waste backload location
  - crew changes
  - vessel logistics such as fuelling, welfare stores
  - waste management including available storage, backload time etc.

The final decision on whether to terminate a P&D response will remain with the relevant Control Agency for the WA/NT shorelines.

If a P&D response is required at a Commonwealth shoreline (e.g., Ashmore Reef), the response termination will occur in consultation with AMSA and other relevant Government agencies (refer Table 2-4).

Capability, arrangements and performance outcomes and standards

The arrangements and capabilities as described in the subsections above are summarised in Table 4-9.

The EPOs and EPSs related to the implementation of P&D are provided in Table 4-10.

Table 4-9: Arrangements and capabilities – protection of sensitive resources

Technique	Resource capability and availability	Implementation time	Activation
P&D personnel	WA DoT/NT DEPWS (as Control Agency) may choose to mobilise their own P&D personnel. Additional trained P&D and shoreline response personnel would be available through AMOSC Core Group. Additional (Tier 3) capability also available via OSRL. Additional personnel, who would receive on the job training would be sourced from: • INPEX environmental service providers • INPEX general offshore labour hire contracts	Remote shoreline response unit team (total of 44 personnel, including P&D/ shoreline clean-up personnel) required to be able to mobilise from port within 6 days. (Pending Operational SIMA outcome – target time is second remote shoreline response unit mobilised within 14 days, and third unit mobilised within 30 days).	AMOSC, OSRL & labour hire company contact details available via Emergency Contacts Directory (C075-AH-LIS-10002) AMOSC and OSRL notification/activation forms available in the Oil Spill Forms Register (refer Section 5).
P&D equipment	P&D equipment can be mobilised from the AMOSC Broome, Exmouth, Freemantle or Geelong stockpiles. AMSA Darwin and other NatPlan stockpiles also maintain P&D equipment.	6 days to mobilise equipment required for P&D as part of a remote shoreline response unit.	
Helicopters	INPEX contracted crew transfer helicopters (for personnel transfer to designated landing zones only, not to remote shoreline beaches).	INPEX routine crew-change helicopters always available.	IMT to activate all helicopter assets. Helicopter provider contact details available in the Emergency Contacts Directory (C075-AH-LIS-10002) Aviation mobilisation processes also summarised in the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002).
	Utility helicopters suitable for landing on remote shorelines are available via INPEX aviation call-off arrangements.	Commence mobilisation activities in Broome within 7 days.	
Vessels	Small support vessels including inshore tenders/landing barges are available via INPEX marine call-off contract/framework arrangements and would be used to transport and position P&D equipment nearshore.	Single ASV and associated support vessels, mobilised with 44-person remote response team, and all equipment, within 6 days.	IMT to active all support vessels. Vessel provider contact details available via the Emergency Contacts Directory (C075-AH-LIS-10002).
	Large support vessels/accommodation support vessels are available via INPEX marine call-off contract/framework arrangements, to support remote shoreline response unit operations.		

Table 4-10: EPO, EPS and measurement criteria for protection of sensitive resources

Environmental performance outcome	Environmental performance standard	Measurement criteria
Protection of sensitive resources response strategy will be implemented to prevent and/or reduce the volume of oil entering a sensitive habitat, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the values and sensitivities of the habitat.	Based on the outcome of the Operational SIMA and in consultation with the relevant State/Territory Control Agencies, the IMT will activate a protection of sensitive resources response using the capabilities/arrangements as described in Table 4-9.	Emergency event response records.
	Monitoring of response effectiveness for a protection of sensitive resources response will be undertaken as described in Section 4.5.3. Response effectiveness monitoring data will be utilised as part of ongoing IAP review and response termination criteria.	Emergency event response records.
Risks of impacts to intertidal habitats from nearshore/shoreline booming operations will be reduced and maintained to ALARP and acceptable levels.	In the event of a sensitive receptor protection response, an HSE plan will be prepared, in consultation with AMOSC relevant WA/NT Control Agency or DCCEEW (for Commonwealth lands) which addresses potential impacts to intertidal reefs and defines controls for nearshore/shoreline booming anchor layouts and other controls to limit impacts to intertidal ecosystems.	Emergency event response records.

4.5.4 Surface (vessels and aerial) dispersant

Response Objective

Surface dispersants will be implemented to reduce the volume of oil on the sea surface, by dispersing it into the water column, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines.

Response strategy summary

Dispersant application should be attempted (weather conditions permitting) for any Group IV oil spills (HFO/IFO/LSHFO).

Dispersant is not to be used on Group II (diesel) or Group I (condensate) spills.

Depending on sea-state, atmospheric conditions, weathering and emulsification of Group IV spills, the 'window of opportunity' for effective dispersant application is generally limited – from a few hours to a few days (ITOPF 2013; IPIECA-IOGP 2015b).

If a spill is ongoing, (i.e. leaking from a vessel over several days), the window of opportunity for dispersant application would be extended for the duration of the release (could be several days).

INPEX Ichthys FPSO and Offtake Support Vessel (OSV) and 2 x Platform Supply Vessels (PSVs) maintain a vessel dispersant capability for the Ichthys Field.

Shell Prelude FLNG support vessels are an additional (mutual aid) dispersant capability, which includes 3 x vessels fitted with dispersant spray systems, trained personnel and dispersants onboard. This capability can be requested (mutual aid) from INPEX Ichthys CPF/FPSO OIM directly to the Prelude OIM.

AMOSC maintain a contract for a Fixed Wing Aerial Dispersant (FWAD) capability with Aerotech First Response. The FWAD capability will be made available to INPEX (via AMOSC) for oil spills where INPEX is the Control Agency.

Depending on the weather conditions and duration of the spill, the FWAD capability from Batchelor could be available within the window of opportunity for spills within 510 km (280 nm) of Mungalalu-Truscott Airport or Lombadina Airport. However, it would typically take at least 24 hours to mobilise all aircraft, personnel and equipment to the nominated airbase. Therefore, typically an ongoing release would be required to justify the use of the FWAD capability.

Activation

During spill scenarios where AMSA is the Control Agency, or the spill is located within WA/NT waters, (under the control of the relevant State/Territory Control Agency), AMSA or the relevant WA/NT Control Agency may direct INPEX to undertake dispersant response activities.

During spill scenarios where INPEX is the Control Agency; specifically, a Group IV spill from a vessel conducting a Petroleum Activity (vessel classified as a Facility or Associated Offshore Place) within the Ichthys Field:

- the Ichthys Field Manger/FPSO OIM has the authority under this BROPEP to approve an initial test-spray of dispersant on Group IV oil spills in the Ichthys Field
- the INPEX IMT Leader has the authority under this BROPEP to approve ongoing dispersant use, via the completion of the IMT surface dispersant application decision matrix (Table 4-11).

The Ichthys Field Manager/FPSO OIM should prioritise activating the vessel dispersant ‘test-spray’ as early as safely and reasonably practicable during the emergency response, due to the potential for a limited window of dispersant effectiveness. The initial test spray results will be used to inform the Operational SIMA and support ongoing use (or otherwise) of surface dispersant.

Ongoing dispersant use shall only be authorised if the IMT Leader is satisfied a ‘Yes’ has been recorded for all of the conditions within Table 4-11.

Acceptable dispersant application zone

There is the potential for negative impacts to shallow, subtidal environmental values and sensitivities associated with the application of dispersant. Shallow subtidal biota could be negatively impacted due to increased bioavailability and toxicity of dispersed oils. AMSA (2010) identified that surface applied dispersant will likely only penetrate to depths shallower than −25 m at lowest astronomical tide (LAT).

RPS APASA (2014) conducted a wide range of modelling of dispersant applications on a 1000 m^3 Group IV spill at various locations along the Gas Export Pipeline (GEP) route. Based on the outcomes of this indicative modelling, 20 km has been determined as a suitable buffer to reduce the risk to ALARP of submerged values and sensitivities being exposed to entrained/dispersed oil above 500 parts per billion.

INPEX stakeholder consultation with WA DoT (WA Control Agency) has confirmed that the application of dispersant on a Group IV spill to protect the values and sensitivities of shorelines, such as seabird and turtle nesting/roosting, will be considered on the situations merits and this response action should be supported by an Operational SIMA.

Therefore, the 'Acceptable Dispersant Application Zone' has been defined in the following manner to denote locations where dispersant application can be undertaken:

- Dispersant use is permitted at any location >20 km from the −30 m LAT contour of any shoal, bank or reef which is wholly submerged at high tide.
- Dispersant use is permitted for any spill that have the potential to reach state waters, if there is a positive outcome for dispersant use based on the Operational SIMA, and relevant WA/NT Control Agency has been informed regarding the Operational SIMA.

A map demonstrating the Acceptable Dispersant Application Zone as related to the Ichthys Field is provided in Figure 4-3.

Whilst current INPEX activities do not include the use of Group IV oils outside of the Ichthys Field, Figure 4-4 and Figure 4-5 have been provided to show the Acceptable Dispersant Application Zone, to address the potential for the future Group IV fuel or other crude oil spill scenarios within the wider BROPEP region.

Table 4-11: IMT dispersant application decision matrix

Incident name		**Dispersant application decision matrix - review date & time**	(dd/mm/yy) ___/____/ 20___ (___:___ hrs)	**IMT Leader name**		**IMT Leader signature (endorsement)**	

Operational conditions (ALARP considerations)	Decision (Y/N)	Comments
Dispersant application capable vessels/aircraft are not required for higher priority emergency response activities (PEARS principle)		
Confirm Group IV oil to be dispersed. No dispersant application on Group I (condensate) or, Group II (MGO/diesel) spills.		
Initial vessel dispersant test-spray (coordinated by Ichthys Field Manager/FPSO OIM) demonstrated effective dispersant on the oil spill.		
Operational SIMA – positive outcome recorded for ongoing dispersant use		
For FWAD, AMSA satisfied with the 'Fixed-Wing Dispersant Operations Plan'.		
The area of the floating slick, where dispersant is to be applied, is located within the 'Acceptable Dispersant Application Zone' (refer Figure 4-3, Figure 4-4 and Figure 4-5). • Dispersant use within State/Territory waters is only permitted under approval from the relevant State/Territory Control Agency. • Dispersant use within an Australian Marine Park is only permitted following consultation with the Director of National Parks (or delegate). • Dispersant use is also permitted in areas <-30 m LAT and <20 km from an intertidal habitat, (but not within State/Territory waters) where the Operational SIMA indicates a positive outcome for dispersant use to protect MNES (E.g., turtle nesting/ seabird breeding), and the relevant State/Territory Control Agency has been notified and agrees with the Operational SIMA positive outcome. • Dispersant use is permitted at any location >20 km from the –30 m LAT contour of any shoal, bank or reef which is wholly submerged at high tide (E.g., Echuca Shoal, Heyward Shoal etc.). Note – the whole of Ichthys Field (WA-50-L) is located within the acceptable dispersant application zone.		
The following in-field conditions are suitable for dispersant application: • Beaufort scale sea states between 2 and 7 (with sea states between 3 and 6 being optimal) • daytime and good visibility.		
Confirm whether there are any fixed facilities with shallow/hull mounted seawater intakes likely impacted by concentrated dispersant/dispersed oil? (e.g., a MODU or Prelude FLNG very near the spill location?). If there are, ensure the relevant OIM is aware that exposure to very high concentration of entrained/dispersed oil may potentially require: 1. monitoring of quality of RO/desalination water. Additional cleaning of RO/desalination filters may be required. 2. monitoring of operability of cooling water system. Additional cleaning of heat exchange plates may be required. Note – not a credible risk unless thick oil being dispersed very close (within a few hundred metres) of the fixed facility.		
If spill is from a vessel which is NOT classified as a "Facility" or "Associated Offshore Place", ensure AMSA (as Control Agency for vessel spills), has authorised dispersant use, including test-spray and ongoing spray operations.		

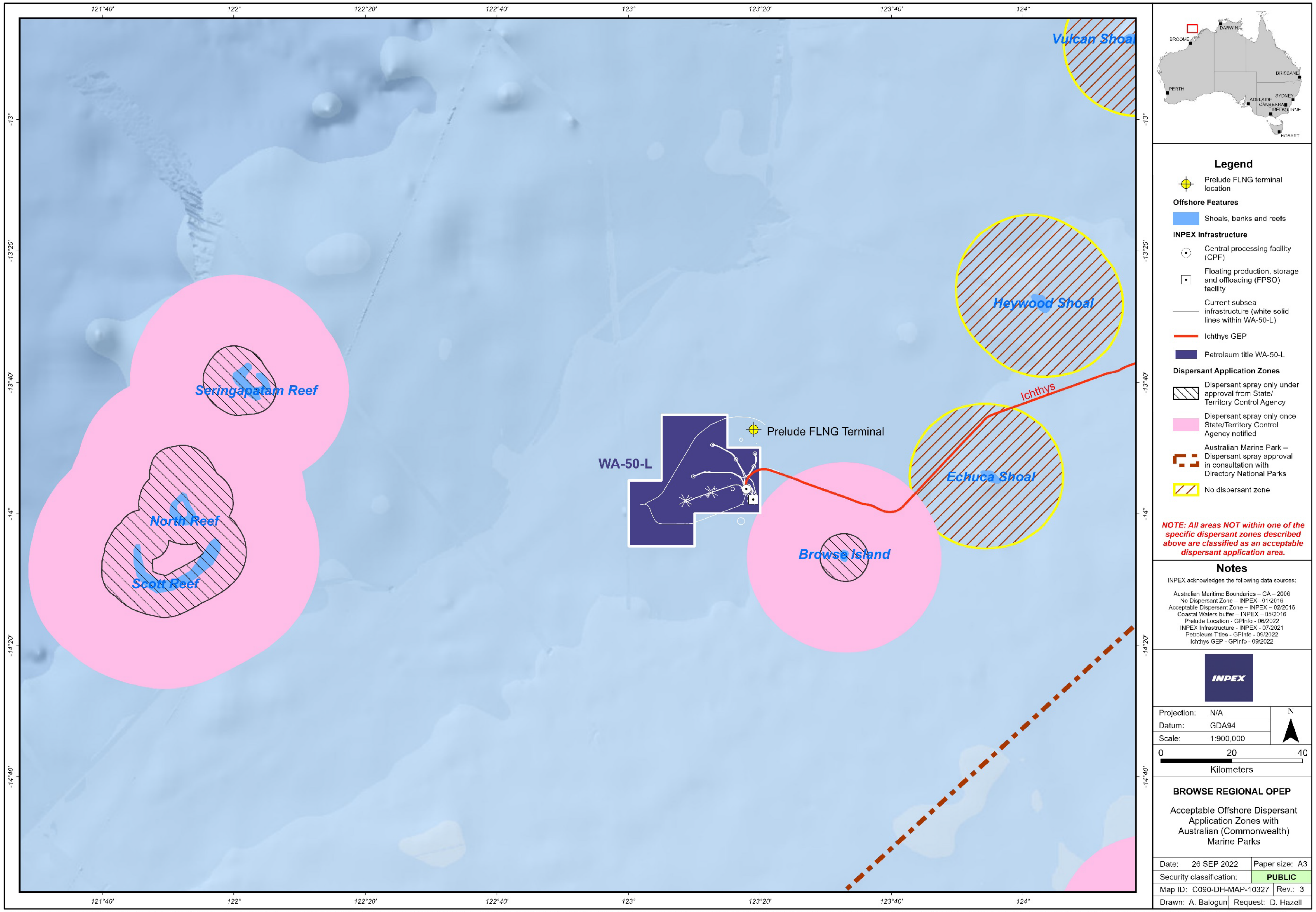


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Figure 4-3: Acceptable dispersant application zone near Ichthys Field

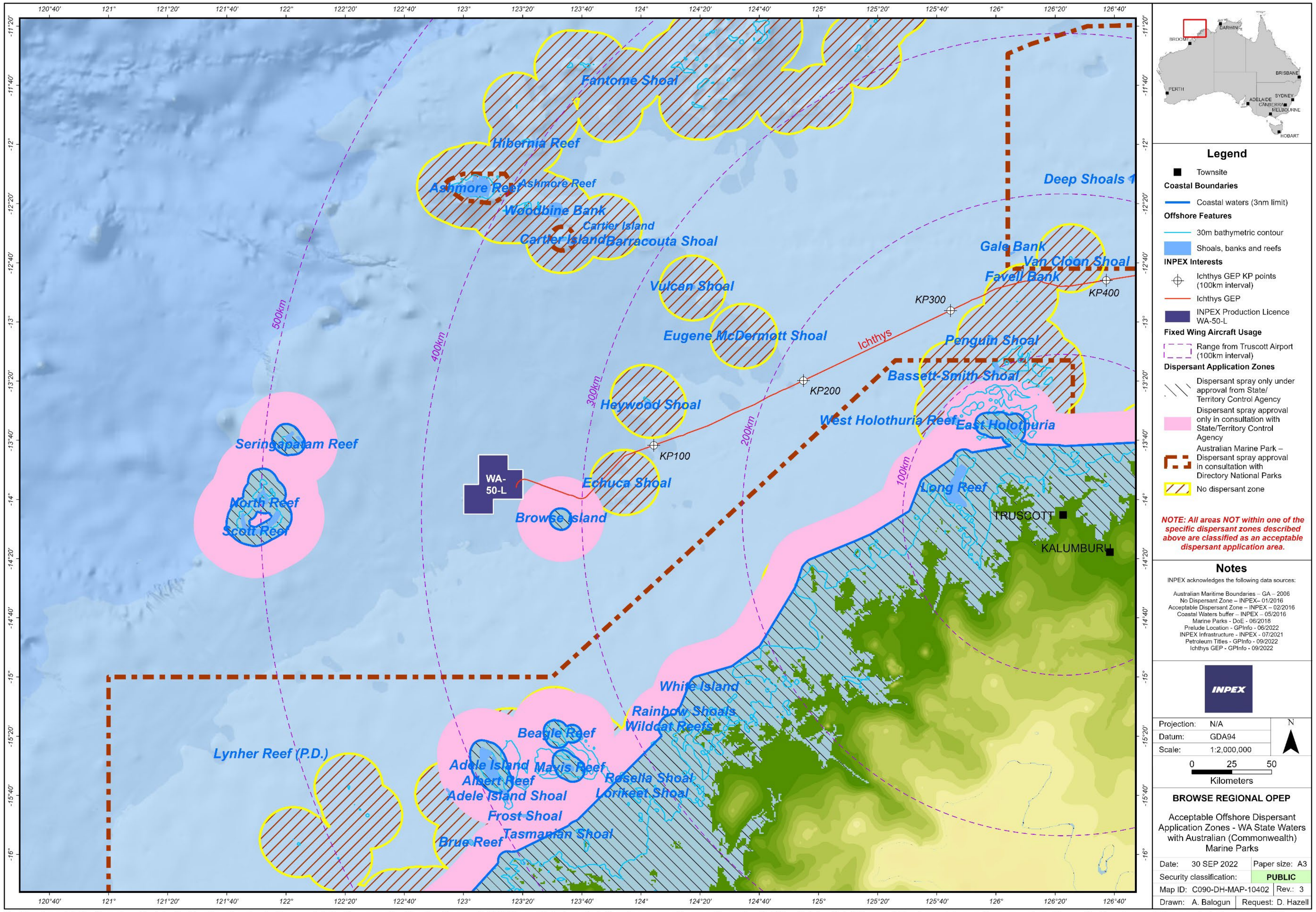

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Figure 4-4: Acceptable dispersant application zone – Western Kimberley Region

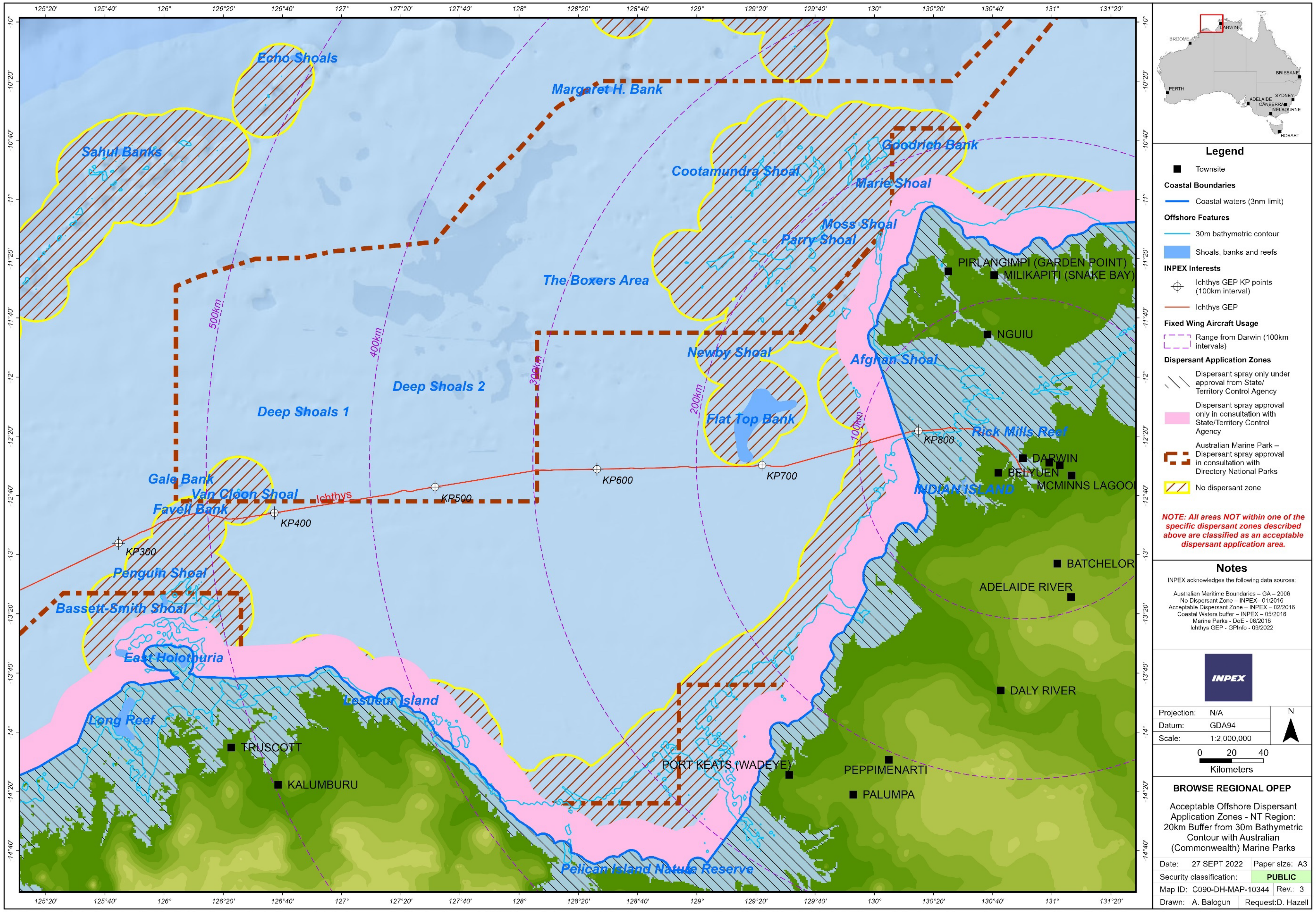

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Figure 4-5: Acceptable dispersant application zone – Eastern Kimberley / NT Region

Personnel – vessel dispersant

Personnel trained in vessel based dispersant application are present on the Platform Support Vessels (PSVs) and Offtake Support Vessel (OSV) and FPSO.

Additional vessel dispersant trained personnel (including support via remote assistance) can be provided by AMOSC and OSRL.

The Shell/Prelude FLNG support vessels also maintain dispersant trained personnel.

Personnel – FWAD

When triggered, the Fixed Wing Aircraft Dispersant Capability (FWADC) contract provides the following: Pilot(s) for the Air Tractor AT802, Aerotech First Response Liaison Officer, an Air Attack Supervisor, an Aircraft Loading Officer, and transportation for all to the nominated location.

A combination of commercial flights, and possibly charter flights, will be necessary to mobilise these personnel to the nominated airbase within 24 hours.

Section 5 of the AMOSC (2020b) *Aerial Dispersant Operations Plan for Oil Spills Off The Northern Coastline of Australia* (here-after referred to as the AMOSC FWAD Northern Operations Plan) provides the typical organisation chart required for FWAD activities.

Tools/equipment/plans – vessel dispersant

A stockpile of 16 m^3 of Slickgone NS dispersant and a portable AFEDO dispersant spray system (to be mobilised to available support vessels) is maintained in WA-50-L on the FPSO.

The INPEX operated PSVs and OSV are also equipped with dispersant spray equipment.

The INPEX Oil Spill and Dispersant Visual Observation Guide is available with the dispersant stockpile and mobile spray system in WA-50-L, and onboard all PSVs and the OSV.

The INPEX Oil Spill Observation and Dispersant Guide is described in Section 4.3.3. This guide shall be used by INPEX vessel-based dispersant application teams (OSV/PSV/FPSO trained personnel), to instruct them on how to monitor colour changes to oil once dispersant has been applied and assess the dispersant effectiveness. It also provides instructions to take photographs or video footage and provides dispersant effectiveness monitoring/reporting templates.

Tools/equipment/plans – FWAD

The AMOSC FWADC Contract with Aerotech First Response (AFR) provides the FWAD capability for Australia, including availability of 6 air-tractors (AT-802 aircraft), which are ‘wheels-up’ within 4 hours of activation.

For FWAD activities in the BROPEP region, the FWAD capability would be executed in accordance with the AMOSC FWAD Northern Operations Plan.

This document includes all necessary details to facilitate FWAD from the following airbases:

- Batchelor (NT)
- Darwin International Airport (NT)
- Broome International Airport (WA)
- Mitchell Plateau Airfield
- Mungalualu-Truscott Airfield.

INPEX also routinely operates crew change helicopters from Lombadina and could also utilise this location for FWAD operations.

Dispersant stockpiles

Dispersant stockpiles closest to Lombadina and Mungalalu-Truscott Airports are located in Darwin, Broome and Exmouth. These can be mobilised to the airport by air or road.

Table 4-12 presents the dispersant stockpile information for the BROPEP region, accurate at the time of preparation of this document (Rev0, August 2021).

Table 4-12: Dispersant stockpiles

Location	Dispersant stockpile and owner
Ichthys Field	16 m^3 (2 x 8 m^3 tote-tanks) –FPSO Ichthys Venturer
Prelude	(Prelude support tugs) – accessible as 'best-endeavours/mutual aid' via request from Ichthys OIM to Prelude OIM
Mungalalu-Truscott Airport	5 m^3 - Jadestone Energy (accessible via AMOSC mutual aid request)
Darwin	10 m^3 Slickgone EW – AMSA stockpile 9 m^3 Ardrox 6120 – AMSA stockpile 9 m^3 Slickgone LTSW – AMSA stockpile (**NOT on OSCA register**)
Broome	15 m^3 Ardrox 6120 – AMOSC stockpile
Exmouth	75 m^3 Slickgone NS – AMOSC stockpile

Logistics – vessel dispersant

The INPEX OSV and two PSVs are fitted with dispersant spray systems. All they require to become an operational vessel dispersant capability is to lift the FPSO dispersant stockpile onto any of these vessels.

Should the OSVs or PSVs not be available, the FPSO dispersant stockpile, AFEDO system and FPSO dispersant spray trained personnel can be lifted onto any other available support vessel, such as an Anchor Handling Tug (AHT), to create a vessel dispersant capability.

The Prelude tugs are an alternative/mutual aid (best endeavours) vessel dispersant capability.

Although not mandatory, for vessel based dispersant application to be most effective, it is desirable to use spotter aircraft to guide and coordinate spraying vessels. The crew of the spotter aircraft should be able to identify the heavier concentrations of oil, or the slicks posing the greatest threat to the environment. They need to have good communication with the vessels spraying the dispersant in order to guide them to the target. Spotter aircraft can also assist with judging the accuracy and effectiveness of the dispersant application (ITOPF 2013).

An additional observer should be mobilised in the aviation support (spotter) aircraft to monitor and report on the effectiveness of the dispersant application, using the INPEX Oil Spill and Dispersant Visual Observation Guide.

Any aviation support is to be arranged via the INPEX IMT.

Logistics – FWAD

Aerotech First Response (AFR) is the nominated contractor who provides the FWAD aircraft fleet (AT-802 air-tractors/crop-dusters), under the FWADC Contract.

AFR maintain six FWAD primary aircraft around Australia, the closest of which is at Batchelor Airfield in the Northern Territory. Another is located at Learmonth Airport (Exmouth) in WA.

Primary aircraft are available 24 hours a day, seven days a week (subject to visual flight rules) and will be 'wheels up' (mobilised) within 4 hours of activation.

AFR maintain twelve secondary FWAD aircraft, available if required to replace a primary aircraft in the event of a breakdown, or in the extreme circumstance that additional aircraft are required during an incident.

The AT-802 aircraft capabilities as summarised as follows:

- endurance – 240 minutes (4 hours)
- air speed – 290 km/hr (160 knots)
- maximum range – 1165 km (640 nm) operating range – 510 km (280 nm)
- maximum dispersant capacity – 3 m^3
- maximum dispersant capacity at 200 nm range – 3 m^3.

Mitchell Plateau Airfield, Mungalalu-Truscott Airfield, and potentially Lombadina airfield are the most likely base from which to launch the FWAD response for a spill in the Ichthys Field. Mungalalu-Truscott Airfield and Lombadina are the largest all-weather airports in the north Kimberley with sealed runways and the necessary lighting for night operations (E.g., dispersant resupply - not air-tractor spray sorties). There is reasonable road access to these airports; however, it may be restricted during the wet season.

Road access to Mitchel Plateau is more challenging, and Mitchel Plateau airfield is an unsealed airstrip, with no lighting.

Relevant distances and timings for the Batchelor and Exmouth (Learmonth) FWAD primary aircraft are presented in Table 4-13.

Table 4-13: FWAD primary aircraft distances and timings

From	To	Distance (km)	Distance (nm)	Flight time (hours) at 160 knots
Batchelor Airport (NT)	Mungalalu Truscott Airport (WA)	515	282	1 h, 45 min
Mungalalu Truscott Airport (WA)	Browse Island	306	168	1 h
Mungalalu Truscott Airport (WA)	Ichthys field management area	327	180	1 h, 5 min
Batchelor Airport (NT)	Lombadina Airport (WA)	955	524	3 h, 30 min
Jandakot Airport (WA)	Lombadina Airport (WA)	1800	990	6 h, 20 min
Lombadina Airport (WA)	Browse Island	271	148	55 min
Lombadina Airport (WA)	Ichthys Field management area	275	151	55 min

FWAD – Air Attack Supervisor platform

In accordance with the AMOSC (2020b) FWAD Northern Operations Plan, the Titleholder/Control Agency must provide the Air Attack Supervisor platform.

The purpose of this platform is to provide a bird's-eye view of any oil slick, to enable the Air Attack Supervisor to coordinate and direct the dispersant application by the AT-802 aircraft.

The platform can be either a fixed wing aircraft or a helicopter. INPEX should typically consider the use of a crew-change helicopter as the Air Attack Supervisor platform.

FWAD - Search and rescue (SAR) platform

In accordance with the AMOSC (2020b) FWAD Northern Operations Plan, the Titleholder/Control Agency must provide the SAR platform

The SAR platform can be an aircraft or vessel on standby near the proposed location of dispersant application.

INPEX has a SAR helicopter located in Broome. INPEX could also potentially utilise vessels as a SAR platform.

Response effectiveness monitoring

The INPEX Oil Spill and Dispersant Visual Observation Guide will be used by trained personnel during dispersant application. Relevant factors (ITOPF 2013) that need to be considered during dispersant application include:

- spill appearance
  - dispersant should only be applied to thick, fresh oil and target the thickest part of the slick
  - dispersant should not be applied to emulsified oil
  - dispersant should not be applied to thin sheens (silver/rainbow sheens).
- weather conditions
  - Beaufort scale sea states between 2 and 7 are suitable, with conditions between 3 and 6 being optimal, for dispersant application (i.e. Beaufort sea states between 3 and 6 are optimal dispersant application conditions; however, monitoring of effectiveness will ultimately determine continued dispersant application).
- visual monitoring of dispersant effectiveness
  - dispersant effectiveness should be undertaken continuously during application
  - dispersant application should be terminated (in consultation with AMOSC vessel dispersant experts) if the response is deemed no longer effective
  - changes in surface oil appearance should be noticeable shortly after dispersant application
  - no change in the appearance, or no reduction in oil coverage, indicate ineffective dispersant application
  - a milky white plume in the water indicates ineffective dispersant application.

During FWAD activities, an additional observer should be mobilised in the air attack supervisor platform to monitor and report on the effectiveness of the dispersant application. If an additional observer is not available, this reporting can be facilitated through the air attack supervisor.

During vessel based dispersant application, the vessel team will monitor and report on the effectiveness of the dispersant application (supported by aerial observation, if possible).

In accordance with the INPEX Oil Spill and Dispersant Visual Observation Guide, following dispersant application, a report will be provided by the aircraft/vessel observer to the IMT Leader regarding dispersant application. The report will include, as a minimum:

- date(s) and time(s) of dispersant application transects
- locations and track plots of dispersant application transects
- the volume of dispersant used per dispersant application transect
- the effectiveness of the dispersant application (including photographic evidence, where possible).

Termination criteria

Termination of response will be determined by the IMT in collaboration with relevant stakeholders and will consider factors including the following:

- the safety of responders
- the current effectiveness of the surface dispersant on the oil
- habitats/values and sensitivities remaining at risk
- deteriorating weather conditions (including wind, visibility, sea conditions).

For short duration surface dispersant activities, visual surveillance will likely be the only tool available. However, should a longer-term dispersant application program be required, termination criteria should include consideration of the outcomes of the operational and scientific monitoring program, specifically fluorometry results (refer IPIECA-IOGP 2015b; SMART protocol for judging operational effectiveness of dispersant application).

Capability, arrangements and performance outcomes and standards

The arrangements and capabilities as described in the subsections above are summarised in Table 4-14.

The EPOs and EPSs related to the implementation of surface dispersant are provided in Table 4-15.

Table 4-14: Arrangements and capabilities – surface dispersant application

Technique	Resource capability and availability	Minimum implementation time	Activation
Vessel-based dispersant application	FPSO maintains 16 m^3 dispersant, an AFEDO spray system and dispersant trained personnel. These can be mobilised onto any available support vessel. INPEX OSV/PSVs maintain dispersant spray systems and dispersant trained personnel. The FPSO can provide the 16 m^3 dispersant to these vessels. Shell Prelude FLNG support tugs are equipped with dispersant, spray systems and dispersant trained personnel. AMOSC/AMSA dispersant stockpiles (refer Table 4-12) can be mobilised by air or road to Broome wharf to resupply vessels.	Ichthys Field Manager/FPSO OIM; as soon as safely and reasonably practicable, mobilise a vessel dispersant capability in WA-50-L and conduct a test-spray (provided vessels are not required for other 'Safety/People' related tasks associated with the emergency event).	Field Manager is authorised to coordinate the initial test-spray of vessel-based dispersant. IMT Leader to authorise ongoing vessel-based dispersant spraying, in accordance with dispersant application decision matrix (Refer Table 4-11). The Prelude vessel dispersant capability can be requested/accessed through Ichthys OIM to Prelude OIM. AMOSC notification/activation forms available in the Oil Spill Forms Register (refer Section 5).
Fixed wing aerial dispersant application	Nominated airbases would likely be Mitchell Plateau, Lombadina or Mungalalu-Truscott airports. The FWAD capability would be requested to be activated through AMOSC. AFR would provide the FWAD spray aircraft. FWAD personnel would be obtained through AMOSC, AMSA and AFR. An air attack aircraft (preferably helicopter) must be provided by INPEX. A SAR platform (vessel/SAR helicopter) must be provided by INPEX. A Jadestone Energy owned dispersant stockpile (5 m^3) is located at Mungalalu-Truscott Airport (accessible via request through AMOSC/AMOS-Plan). AMOSC/AMSA dispersant stockpiles (refer Table 4-12) can be mobilised by air or road to the FWAD airbase.	IMT to notify AMOSC to activate FWADC Contract as soon as practicable. 24 hours required to mobilise dispersant stockpiles, FWAD aircraft, SAR platform and FWAD personnel required under the AMOSC (2020) FWAD northern operations plan, to a nominated airfield (E.g., Lombadina or Mungalalu Truscott Airport).	IMT Leader to activate FWAD capability through AMOSC. AMOSC notification/activation forms available in the Oil Spill Forms Register (refer Section 5). IMT Leader to authorise aerial dispersant spraying, in accordance with dispersant application decision matrix (Refer Table 4-11).

Table 4-15: EPO, EPS and measurement criteria for surface dispersant application

Environmental performance outcome	Environmental performance standard	Measurement criteria
Surface dispersants will be used to reduce the volume of oil on the sea surface, by dispersing it into the water column, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines	In the event of any Group IV spill, the Ichthys Field Manager (relevant CPF/FPSO OIM) shall coordinate a 'test-spray' of dispersant using the vessel-based dispersant capabilities/arrangements as described in Table 4-14; under the condition that potential dispersant spray vessels are not required for other 'safety/people' related tasks associated with the emergency event. Effectiveness of the test spray will be monitored, using the INPEX Oil Spill Observation and Dispersant Application Guide.	Emergency event response records.
	In the event of any Group IV spill, as soon as practicable, the IMT will notify AMOSC and request immediate activation of the Aerotech First Response FWADC Contract.	Emergency event response records.
	The IMT will utilise SMV data, the IMT dispersant decision matrix, results from the initial test-spray and Operational SIMA to inform the ongoing use of surface dispersants for all Group IV spills.	Emergency event response records.
	When determined by the Operational SIMA that surface dispersant application should be continued, the IMT will activate vessel-based dispersant and/or FWAD dispersant using the capabilities/arrangements as described in Table 4-14.	Emergency event response records.
	Monitoring of response effectiveness for surface dispersants will be undertaken as described in Section 4.5.4.	Emergency event response records.

Environmental performance outcome	Environmental performance standard	Measurement criteria
	The IMT will utilise response effectiveness monitoring data to inform the ongoing use of surface dispersants against the response termination criteria.	Emergency event response records.
Risks of impacts to marine water quality and shallow benthic communities from surface dispersant application are reduced and maintained to ALARP and acceptable levels.	Vessel and/or aerial dispersant applications will be undertaken in accordance with the IMT dispersant application decision matrix.	Emergency event response records.
	Only dispersants with high efficacy for dispersal of Group IV hydrocarbons which are listed on the AMSA oil spill control agent (OSCA) register will be used in the event of dispersant application.	Emergency event response records.

4.5.5 At-sea containment and recovery

Response Objective

At sea containment and recovery (C&R) will be implemented to reduce the volume of oil on the sea surface, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines

Response Strategy Summary

C&R is the controlled collection and recovery of floating oil from the water’s surface.

A minimum single offshore C&R operation would require a large anchor handling tug, or other similar large vessels with a rolled stern, able to deploy offshore boom from the back deck. The capability would also require deployment of suitable skimmers and some form of liquid oily waste storage capacity (E.g., inboard or deck tanks). For a single vessel operation, a boom-vane system would be required to maintain the booms configuration. If no boom-vane system was available, a second vessel (possibly slightly smaller) to tow the leading edge of the boom would also be required.

Alternatively, an advanced booming system (E.g., speed-sweep or current buster system), typically requiring 3-5 vessels could be used, which would be better for recovery of more fragmented spills, as the system can operate at higher speeds.

Regardless of the technique (traditional versus advanced) the encounter rates will vary significantly, depending on the oil behaviour. For example far higher encounter rate will occur if the oil is in very thick patches compared to if the oil has become spread-out into windrows. Chasing patches/windrows is very time consuming, due to slow vessel speeds (typically 0.7 to 1 knot over water for traditional, or 4-5 knots with advanced booming techniques).

In accordance with AMSA (2020b) *Maritime discharges of oil and oily water during emergency and response situations*, the normally tight MARPOL restrictions on oil/oily water discharge quality can be relaxed if it is necessary during a spill response to discharge oil/oily water to minimise the overall damage from pollution, and is approved by the relevant government.

In accordance with AMSA (2020b), the relevant government administrators include the following AMSA positions: the AMSA Local Manager; the Manager Marine Environmental Pollution Response; the General Manager, Marine Environment; and the General Manager, Ship Safety Division.

Some States/Territories may have processes for approval within their relevant jurisdiction, however if the State/Territory is silent on the issue, or in conflict with the MARPOL Regulation intent (to permit the discharge during spill response), then the Commonwealth legislation applies, as the means to implement the international/MARPOL obligation.

Note, the approvals are specified vessels for a particular spill response, and not as a general discharge approval.

There is no specific AMSA form for this application, however the applicant (IMT) should provide a full explanation to assist the person assessing the approval, and as a minimum, should provide the following information:

- who and why - the vessel, the incident and the applicant
- what - the planned response operations that require the oily water discharge
- how - the state and capability of the ship as a response platform
- result - the expected discharge volumes or rates.

Activation

The INPEX IMT shall consider all SMV data to determine potential effectiveness of C&R activities.

The INPEX IMT will need to consider, in consultation with AMOSC the practicalities, likely success and risks associated with a C&R operation.

Optimal sea-state for C&R activities is Beaufort sea-state of 1-4 (<20 knots).

The C&R operation should target oil slicks which are Bonn Code 4/5 (oil thickness >100 g/m^2).

Personnel

A typical C&R strike-team would consist of a minimum of 2 C&R trained personnel, and 3-5 supporting deck crew.

C&R trained personnel can be accessed via AMOSC and OSRL.

Deck crew personnel, who can receive on the job training would be available already onboard the vessels, or if additional personnel were required, would be available via INPEX existing labour hire agreements.

Tools/equipment/plans

Various stockpiles of oil spill response equipment, including offshore C&R booms, skimmers etc. are located around Australia.

Skimmers or other collection devices would be used to recover spilled oil. Storage of liquid oily waste would generally be in the inboard storage tanks of the support vessel, or on specially mobilised storage tanks on the decks of vessels.

The AMOSC Broome stockpile includes sufficient C&R equipment for a single traditional (J-boom) strike team.

Additional C&R equipment can be accessed via AMOSC stockpiles in Exmouth, Fremantle and Geelong.

A summary of additional equipment stockpiles, their custodian and locations are presented in Table 4-16.

Table 4-16: contain and recover equipment stockpiles

Level	Custodian	Location
Level 1	AMOSC	Broome
Level 2/3	AMOSC	Exmouth/Fremantle/Geelong
	WA DoT	Fremantle
	AMSA	Darwin
Level 3	OSRL	Singapore

Logistics

An offshore C&R operation would require the use of at least one or generally two support vessels, to conduct J-booming or other containment techniques.

An AHT or another similar vessel with rolled stern is required to deploy the offshore boom.

Advanced boom systems will typically require more vessels.

An additional logistics support vessel may also be required to transport recovered oil back to shore for treatment/disposal.

Waste management will be a key consideration for C&R operations. A waste management plan would be developed in consultation with AMOSC, prior to commencement of the activity (refer to Table 4-21).

Response effectiveness monitoring

During C&R activities, a report will be provided by the response team to the IMT Leader regarding the effectiveness of the activity. The report should include, as a minimum:

- date(s), time(s) and location(s) of the activities
- the volume of oily waste collected/generated and disposed of
- the overall effectiveness of the C&R activities (including photographic evidence, where possible).

Termination criteria

Termination of a C&R response will be determined by the IMT in collaboration with relevant stakeholders and will consider factors including the following:

- the safety of responders
- the current effectiveness of the surface dispersant on the oil
- habitats/values and sensitivities remaining at risk
- deteriorating weather conditions (including wind, visibility, sea conditions)

IPIECA-IOGP (2015a) specifically references the following key operational limitations, which may influence termination criteria decision-making;

- Current speed induced boom failure
- Splash-over failure
- Equipment maintenance and repair
- Logistical challenges affecting operational effectiveness including;
  - sailing time to and from spill location to port/waste backload location
  - crew changes
  - vessel logistics such as fuelling, welfare stores
  - waste management including available storage, backload time etc.

Capability, arrangements and performance outcomes and standards

The arrangements and capabilities for C&R are summarised in Table 4-17.

The EPOs and EPSs related to the implementation of C&R are provided in Table 4-18.

Table 4-17: Arrangements and capabilities – at-sea containment and recover

Technique	Resource capability and availability	Minimum implementation time	Activation
C&R personnel	AMOSC core group personnel, who can lead/manage a protect activity are available via the INPEX membership of AMOSC. INPEX has the ability to contract additional general field responders under short-term labour hire contracts. Vessel deck crews are also available to support the activities.	48 hours to mobilise personnel to the Ichthys Field to commence C&R on location.	AMOSC, OSRL & labour hire company contact details available via Emergency Contacts Directory (C075-AH-LIS-10002) AMOSC and OSRL notification/activation forms available in the Oil Spill Forms Register (refer Section 5).
C&R equipment	Contain and recover equipment can be mobilised from the various stockpiles including Broome/Darwin stockpiles to the relevant wharf. Additional equipment is located at various ports, as listed in Table 4-16. This equipment is accessible through AMOSC.	Activate AMOSC to move C&R equipment to Broome wharf as soon as practicable (first-strike action for any Group IV spill)	
Vessels	Smaller support vessel assets <40 m in length may be used to support C&R activities.	48 hours to mobilise vessels to the Ichthys Field to commence C&R on location.	IMT to active all support vessels. Vessel provider contact details available via the Emergency Contacts Directory (C075-AH-LIS-10002).
	AHTs or other large support vessels with rolled-stern required for safe deployment of booms from the back deck.	48 hours to mobilise vessel to the Ichthys Field to commence C&R on location.	

Table 4-18: EPO, EPS and measurement criteria for at sea containment and recovery

Environmental performance outcome	Environmental performance standard	Measurement criteria
At sea containment and recovery will be implemented to reduce the volume of oil on the sea surface, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines.	In the event of any Group IV spill in the Ichthys Field, the IMT will: • request AMOSC to mobilise C&R equipment from the Broome warehouse to Broome wharf • identify vessels potentially available to be used for C&R.	Emergency event response records.
	Based on the outcome of the Operational SIMA, the IMT will activate C&R, using the capabilities/arrangements as described in Table 4-17.	Emergency event response records.
	Monitoring of response effectiveness for at sea containment and recovery will be undertaken as described in Section 4.5.5. Response effectiveness monitoring data will be utilised as part of ongoing IAP review and response termination criteria.	Emergency event response records.
Risks of impacts to the environment from vessel discharges during oil spill response activities will be reduced and maintained to ALARP and acceptable levels.	Any vessel conducting containment and recovery activities in Commonwealth water will obtain a vessel specific approval from AMSA prior to conducting any decanting/discharge of oil/oily water mixtures.	Emergency event response records.

4.6 Waste management

Waste will be managed in accordance with the INPEX Waste Management Standard (0000-AH-STD-60047), MARPOL 73/78 Annex V – Garbage, relevant Commonwealth and State/Territory regulations regarding disposal of waste generated as a result of spill-response strategies.

As soon as the details of a spill become evident, a Waste Management Plan, developed in consultation with AMOSC and the relevant control agency shall be developed, to ensure the ongoing supply and backload of appropriate waste management equipment.

Based on the maximum credible spill scenarios modelled, oily waste volumes generated through a shoreline clean-up could be up to 5500 m^3. Waste storage on remote shorelines and support vessels can be manage with small, easily transportable waste receptacles.

All waste stored or transferred will be fully documented, including details of exact volume and nature of the waste, date and time, receiver of the waste and destination of the waste, in accordance with vessel Garbage Management Plans and the onshore licenced waste contractor's waste tracking process.

Capability, arrangements and performance outcomes and standards

Table 4-19 outlines the waste storage, disposal and treatment options available for the various oily waste streams.

The arrangements and capabilities for waste management are summarised in Table 4-20.

The EPOs and EPSs related to the implementation of waste management are provided in Table 4-21.

Table 4-19: Waste storage, disposal and treatment options for hydrocarbon-contaminated waste

Waste category	On-site storage option	Transport and disposal options	Location of waste management capabilities	End destination
Solid wastes, including oily residue (e.g., waxy residual diesel and HFO; oiled organic materials such as sand and seagrass).	Impermeable bulka bags Lined skips Oil drums 1 m^3 IBCs Industrial waste bags	Oily waste containers will be backloaded by tender or light utility helicopter to the support vessel for temporary storage offshore, prior to transport to shore. The waste would then transport to shore for appropriate disposal: • recovery and recycling • bioremediation • land farming • incineration • landfill	Onboard vessels INPEX Broome Drilling Logistic Base INPEX Darwin Offshore Logistics Base	Licensed waste contractor – Broome and/or Darwin.
Solid wastes, including oiled man-made materials (e.g., PPE, booms and sorbent pads).	Impermeable bulka-bags Lined skips Oil drums 1 m^3 IBCs Industrial waste bags	Oily waste containers will be backloaded by tender or light utility helicopter to the support vessel for temporary storage offshore, prior to transport to shore. The waste would then transport to shore for appropriate disposal: • recovery and recycling • incineration • landfill		
Liquid wastes.	Oil drums 1 m^3 IBCs ISO-tanks Slops tanks on vessels	Oily waste containers will be backloaded by tender or light utility helicopter to the support vessel for temporary storage offshore, prior to transport to shore. The waste would then transport to shore for appropriate disposal: • recovery and recycling • incineration Alternatively, a support vessel may use its MARPOL compliant oily water treatment system to treat and dispose of oily water offshore.		
Biological oiled waste (e.g., euthanised oiled wildlife).	Impermeable bulka bags Oil drums 1 m^3 IBCs Industrial waste bags	Oily waste containers will be backloaded by tender or light utility helicopter to the support vessel for temporary storage offshore, prior to transport to shore. The waste would then transport to shore for appropriate disposal: • incineration • landfill		

Table 4-20: Arrangements and capabilities – Waste management

Technique	Resource capability and availability	Implementation time	Activation
Waste receptacles	MARPOL compliant vessel oily water storage/treatment systems.	Already onboard vessel.	IMT via the INPEX Emergency Contacts Directory (C075-AH-LIS-10002) and the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002).
	Provided by licenced waste contractor • Impermeable bulka bags • Lined skips • Oil drums • Industrial waste bags • 1 m^3 IBCs • Oil barges • Flexible bladders	Available from licenced waste contractor, to be delivered to Broome/Darwin supply bases within 24 hours.	
Waste disposal	Undertaken by a licensed waste contractor in Broome and/or Darwin. Waste disposal includes: • recovery and recycling • bioremediation • land farming • incineration • landfill • water treatment and discharge.	N/A.	IMT via the INPEX Emergency Contacts Directory (C075-AH-LIS-10002) and the Oil Spill Preparedness and Response Register (X060-AH-LIS-70002).

Table 4-21: EPO, EPS and measurement criteria for waste management

Environmental performance outcome	Environmental performance standard	Measurement criteria
Waste management will be implemented to limit the environmental impacts including secondary contamination associated with the transport and disposal of the collected oily waste products.	Based on the outcome of the Operational SIMA and in consultation with the relevant State/Territory Control Agencies and AMOSC, the IMT will activate waste management using the capabilities/arrangements as described in Table 4-20.	Emergency event response records.
No secondary ocean or shoreline contamination due to inappropriate waste management during the implementation of spill response strategies.	Waste management plan(s) will be developed in consultation with AMOSC, and as necessary, the relevant State/Territory Control Agency. Waste management plans will include consideration of: • methods to eliminate, reduce and re-use materials to reduce the overall volume of waste generated • waste storage, transport and disposal arrangements • decontamination stations and other relevant processes to prevent secondary contamination.	Emergency event response records.

Note: EPS related to decanting oily water during containment and recovery is defined in Table 4-18.

4.7 Operational and scientific monitoring

In 2011, an Operational and Scientific Monitoring Program (OSMP) was developed by the Environment Group Browse Basin (of which INPEX is a member). The program encompasses a number of individual Operational Monitoring (OM) and Scientific Monitoring (SM) programs to guide a spill response, assess potential environmental impacts and inform any remediation activities. The OSMP described in this BROPEP has been reviewed and refined for the emergency conditions described in Section 8 of INPEX EPs. The OSMP is presented in Appendix A, with a division of the OM and SM programs, as follows:

- Operational monitoring is to commence as soon as a spill occurs and aims to characterise the nature and scale of the spill for the duration of the spill. Monitoring is designed to collect information on the predicted spread of the oil and the locations it may impact and in turn, the OM informs and supports a secondary oil spill response, such as wildlife hazing, as well as the scientific monitoring.
- Scientific monitoring is the longer-term investigation component which assesses the overall impact and recovery of the ecosystems which have been exposed to hydrocarbons and response activities, as informed by the OM program. SM does not

necessarily commence immediately after a spill, and may continue long after primary clean up and OM activities have ceased.

The OM and SM programs are summarised in sections 4.7.1 and 4.7.2 with further program specific details, including objectives and triggers for activating and terminating each OM and SM, provided in Appendix A.

Each OM/SM will be tailored, activated and terminated as appropriate to the characteristics, nature and scale of the spill under the supervision of the INPEX IMT Leader, in consultation with:

- the INPEX IMT Environment function
- AMOSC
- environmental service providers
- AMSA (for vessel based spills)
- environmental science coordinators (WA DoT/NT EPA) for spills entering WA/NT waters, or DCCEEW/Director of National Parks for spills entering the Indian Ocean Territories.

INPEX will maintain a contract with an environmental service provider (ESP) to allow the timely implementation of the OM/SM programs following notification of a Level 2 or Level 3 spill. Details of the ESP Operational and Scientific Monitoring programs will be maintained in the ESP Project Execution Plan.

This contract ensures the timely activation of field surveys and delivery of results from survey activities/studies. Results arising from OSMP will be technically reviewed by subject matter experts as determined by the ESPs project manager and technical lead prior to submission to the INPEX environment team.

The monitoring programs will be designed to be repeatable so that in the event of a Level 2 or Level 3 spill there is continuity throughout all monitoring phases to detect potential impacts and subsequent recovery. This will include the use of before–after, control–impact (BACI) design or gradient design monitoring programs for impact detection, as appropriate. However, it is important to note that the actual OSMP design will be dependent on the outcomes and any recommendation from baseline and OM monitoring; receptors potentially to be impacted and the nature and scale of the spill. Further details on baseline information are provided in Section 4 of the activity specific INPEX EPs.

While AMSA is responsible for monitoring in instances where AMSA is the Control Agency (i.e. vessel-based spills), INPEX will provide support to AMSA in accordance with the MoU between AMSA and INPEX (2013).

The person responsible for activating and terminating the OSMP is the INPEX IMT Leader (in consultation with those personnel listed above), as shown in Figure 4-6. Consultation with relevant regulatory authorities, regarding progress and outcomes of the OSMP, will occur as part of ongoing notifications and reporting during a Level 2 or Level 3 spill.

All scientific report outputs associated with this OSMP will undergo timely peer review by appropriate subject matter experts; for example, those from contracted ESPs.

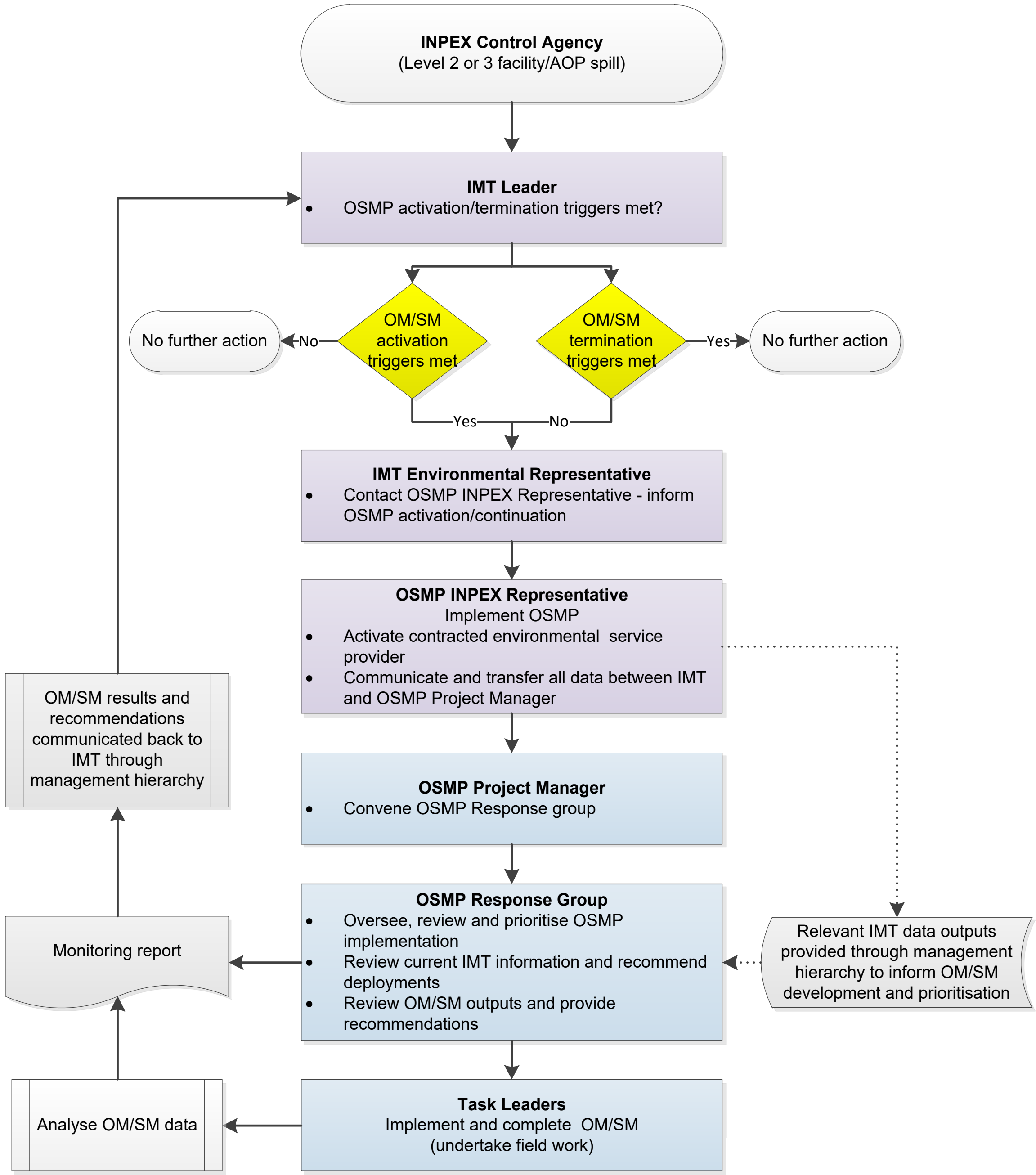

Figure 4-6: OM and SM activation, termination and communication flowchart

4.7.1 Operational monitoring

The focus of the OM program is to assist the IMT to maintain situational awareness by providing information regarding the nature and scale of a spill, and the values and sensitivities at risk.

Information from the OM program also drives the response strategy with regards to triggering and monitoring the effectiveness of secondary response measures, such as wildlife hazing (if required). The data outputs will also be used to trigger the longer-term SM programs (as required).

An overview of the OM programs is provided in Table 4-22. In summary, OM03 and OM01 will be supported by OM04 and OM06. OM04 and OM06 require analysis of water and sediment quality (e.g., laboratory analysis of samples, calibrated field instruments) and will be completed as soon as it is practical to mobilise vessels to the area (nominally seven days). Surface slicks tracked or modelled as part of OM03 and OM01 respectively, may provide an initial indication of the location of any entrained or dissolved hydrocarbons. This will then drive the desktop review of key areas and environmental sensitives at risk from the spill (OM05). Additional details of each OM program are provided in Appendix A.

Table 4-22: Summary of operational monitoring programs

OM #	Monitoring program	Monitoring method(s)	Data output
OM01	Oil Spill Trajectory Modelling	Forecast and hindcast modelling.	Forecast and hindcast modelling of movement and weathering of oil. This enables the identification of values and sensitivities that may be impacted and drives the response strategy with regards to any secondary response measures and scientific monitoring that may be implemented.
OM03	Oil Spill Surveillance and Reconnaissance	Vessel and aerial surveillance, satellite imagery and satellite tracking buoys.	Assess the colour, consistency, distribution and locations of the surface slicks. Identify values and sensitivities likely to be impacted by the spill. This assists in validation of the model.
OM04	Operational Monitoring of Oil Properties, Behaviour and Weathering at Sea	Vessel-based water sampling.	Assess hydrocarbon physical and chemical properties, as well as the spatial and temporal extent. This assists in validation of the model and identifies any scientific monitoring that may be implemented.
OM05	Pre-emptive Desktop Assessment of Sensitive Resources	Desktop analysis of baseline data.	Detailed analysis of values and sensitivities that may be impacted. Identifies any secondary response measures and scientific monitoring that may be implemented.
OM06	Assessment of the Presence and Quantity of Petroleum Hydrocarbons in Water and Sediments	Vessel-based water and sediment sampling.	Assess hydrocarbon physical and chemical properties, as well as the spatial and temporal extent in water and sediment. This assists in validation of the model and identifies any scientific monitoring that may be implemented.

4.7.2 Scientific monitoring

The SM programs do not directly inform spill response operations directed by the INPEX IMT. However, the SMs assess the overall impact and subsequent recovery of the identified values and sensitivities to hydrocarbon exposure and oil spill response activities.

SM will only be undertaken in the event of a Level 2 or Level 3 spill and where the information obtained through the OM program indicates values and sensitivities are predicted to be impacted or have been impacted.

SM will be consistent with the nature and scale of the spill and sufficient to inform any remediation activities, where appropriate. It may begin before the termination of similar OM activities. Additional details on the SM programs are provided in Appendix A.

As discussed in Section 8 of the activity specific INPEX EPs, any wind driven entrained components of a Group II and Group IV surface spill, including dispersed oils, will remain within the top 30 m (with the vast majority in the top 10 m) of the water column, however Group I condensate spills (especially well blowouts) have potential to entrain at deeper depths. Therefore, SMs relating to water quality (SM05), sediment quality (SM06) and intertidal and benthic environments (SM07 and SM08) will be activated based on assessment of the results of the OM programs.

All Level 2 and Level 3 spills have the potential to impact planktonic communities. Therefore, SM09 has been included.

All spills could potentially impact marine megafauna such as cetaceans, dugongs, turtles, whale sharks and marine avifauna. Therefore, SM10 and SM11 have been included in order to monitor for potential impacts and recovery of MNES within Biologically Important Areas (BIAs) or other identified populations.

As commercial, recreational and traditional fishing occur within the BROPEP region and may be affected by spills, SM12 has been included to understand potential impacts to this sensitivity.

In the event of an HFO spill, where chemical dispersant is applied, monitoring of residual dispersant concentrations in the water column, to validate impact predictions provided in Section 8 of relevant activity specific EPs, will be implemented via activation of SM04.

Note that limited information is presented in Appendix A with respect to timings for implementation of the SM program. Unlike OM programs, in order to implement an effective SM program, thorough planning is required to ensure the correct data is collected with respect to confirming potential lasting impacts from a spill. This relies on data outputs generated from OM programs and therefore the planning stage may take additional time. Mobilisation times for specific SM programs will be as soon as practicable given the context of the area and mobilisation will generally commence within 7 days of receipt of notification.

Table 4-23: EPO, EPS and measurement criteria for OSMP

Environmental performance outcome	Environmental performance standard	Measurement criteria
The OSMP will be implemented to monitor risks and impacts from a spill, and to monitor the recovery of the natural environment.	In the event of a spill, the OSMP will be activated in accordance with Figure 4-6, using the activation triggers and within the mobilisation timeframes defined in Appendix A	Emergency event response records.
	For the duration of the spill event, the IMT and OSMP contractor will monitor SMV data against the OSMP activation triggers. For the duration of the spill OSMP data will be evaluated against the OSMP objectives, until such time as the termination criteria have been met.	Emergency event response records.

4.7.3 Baseline data to support the OSMP

A range of data has been used to establish the environmental baseline in the BROPEP region. This includes information collected during various environmental surveys completed by INPEX (2006-2009) and the Applied Research Program (ARP). The ARP was a tri-party agreement between INPEX on behalf of the Ichthys LNG Joint Venture Partners, Shell Australia and the Australian Institute of Marine Science (AIMS) with the objective of collecting environmental baseline data to fill key knowledge gaps for the Browse Basin. The ARP (2014–2018) included the following research:

- review of hydrocarbon sampling methodologies (water and sediment), laboratory analytical methods and instruments that could potentially improve sampling efficiency
- water and sediment sampling to characterise baseline hydrocarbons concentrations in the Browse Basin
- Browse Basin ocean current model validation
- evaluating the vulnerability and effects of hydrocarbon exposure on non-avian marine wildlife
- the status and spatial variability of commercially and ecologically important finfish for the Browse Basin, including biochemical markers and indicators of hydrocarbon exposure of key commercial species
- evaluating the effects of hydrocarbon exposure on breeding and foraging seabird species in the Browse Basin
- the status of, and natural temporal variability in sessile benthic biota and associated fish communities at Browse Island, Echuca and Heywood Shoals
- condensate ecotoxicology studies using tropical species relevant to the Browse Basin

In addition to INPEX collected data, INPEX is also a member of the Industry Government Environmental Metadata (I-GEM) project. The pilot I-GEM project was completed in 2014 and contains accessible metadata from industry, research institutes and government organisations Australia wide, which were uploaded to the Australian Ocean Data Network portal (https://portal.aodn.org.au/). Metadata searches can be conducted via the Australian Ocean Data Network portal and the standalone I-GEM website which contain data sets from the Abrolhos Islands to the Timor Sea, out to the extent of Australia's exclusive economic zone.

Published monitoring reports from the Montara spill augment this data both spatially and temporally. Further to this, extensive multi-year monitoring programs have been undertaken by other operators (e.g., Woodside and Shell) in the Browse Basin, which also augment the INPEX data, spatially and temporally, for physical and biological aspects of the environment.

Research institutes and organisations such as AIMS, the Western Australian Museum and Monash University have also conducted long-term monitoring programs in the Browse Basin. This data further increases the environmental understanding of the region. INPEX has also formalised an agreement with WA DBCA which confirms WA DBCA will supply environmental data (including Western Australian Marine Science Institution data (C075-PAW-IPX-LE-00001)) to INPEX Australia in the event of an incident or oil spill in the nearshore/coastal waters of the region.

Information collected from these surveys, as well as the ARP program, provide a substantial baseline on the marine flora, fauna and habitats which may be referenced in the event of a Level 2 or Level 3 spill event.

In addition, the Index of Marine Surveys for Assessments (IMSA) is an online portal to information about marine-based environmental surveys in Western Australia. IMSA is a project of the Department of Water and Environmental Regulation for the systematic capture and sharing of marine data created as part of an environmental impact assessment.

The current states of knowledge for receptors in the BROPEP region are described in Section 4 of the activity specific INPEX EPs.

4.8 Health and safety

Health and safety considerations will be incorporated into any spill response.

INPEX health and safety objectives are to:

- adhere to the INPEX PEARS philosophy as detailed in the INPEX Emergency and Crisis Management Standard (0000-AH-STD-60051)
- provide a safe working environment and prevent workplace incidents by managing risks to ALARP
- eliminate, or minimise all environment and community risks to ALARP and ensure any impacts are neither serious nor long lasting
- ensure the security of INPEX personnel, assets and information.

The IMT should develop a Safety Management Plan.

Key reference documents including:

- *National Plan Guidance on Marine Oil Spill Response Health and Safety* (AMSA 2018)
- *Oil spill responder health and safety* (IPIECA-IOGP 2012)
- *AMOSC HSSE Assurance and Management Plan* (AMOSC 2021).

Contractors are responsible for the development of site-specific risk assessments before undertaking any activities.

The safety of personnel is the primary concern in a spill incident. An individual risk assessment, such as a job hazard analysis (JHA), will always be conducted by a response contactor or other appointed or responsible personnel, such as the HSE manager or supervisor.

If the response is conducted by a Control Agency other than INPEX (i.e. AMSA), that agency is expected to adhere to stringent safety procedures as outlined in their respective oil spill response plans (i.e. the NatPlan).

Table 4-23 provides examples of hazards and risks that may be encountered during a response to a spill.

The Browse Island Oil Spill Incident Management Guide (X060-AH-GLN-60015) contains completed HAZID reports for helicopter, vessel and shoreline response activities. These HAZID reports should be used to generate HSE plans and associated JHAs for shoreline response activities at remote locations/offshore islands.

Table 4-24: Examples of health and safety risks from spill response

Hazards	Risks	Prevention and mitigation considerations
Inadequately trained personnel carrying out the response	Lack of appropriate training	Prior to any response being implemented, a HSE Plan must be prepared, and will identify induction/on-the-job training requirements, and associated JHAs, etc. All personnel must complete the induction/on-the-job training and sign onto the JHA prior to commencing work. Appropriately qualified personnel, such as AMOSC core-group members, will be appointed as field response team leaders, and will provide on-the-job supervision and training (as required) to other response team members.
Atmospheric risk from evaporating hydrocarbons	Fire and explosion Inhalation, ingestion or contact with skin or eyes leading to dermal irritation or illness.	Firefighting capacity of INPEX-contracted vessels and their tenders as per flag state requirements and INPEX standards.
		Permit to work (PTW) system and JHAs applied to all activities.

		Air quality monitoring equipment, to monitor and protect the health of oil spill responder personnel is required for the following activities:
		• Vessel-based dispersant spraying
		• OSMP vessels (water quality, close to hydrocarbon release site)
		• Source control vessels (e.g., ROV survey/SSDI etc during well-control event)
		• SCAT / shoreline clean-up activities
		The following equipment should be mobilised to each vessel exposed to VOCs;
		• Passive VOC monitoring badges (e.g., ~10 badges per vessel, to cover 3-5 days operations)
		• Active VOC monitors (e.g., 1 x Ultra-ray 3000 per vessel)
		Vessels exposed to potential explosion risk (E.g., source control site survey vessel or SSDI vessel) also require;
		• Personal Gas monitors (e.g., Drager 5000 / 7000)
		At the time of preparation of this plan, the following equipment was available:
		• FPSO & CPF & Ichthys LNG Plant:
		    • Passive VOC monitoring badges
		    • Active VOC monitors (E.g., Ultra-ray 3000)
		    • Personal gas monitors (E.g., Drager 3000 / 5000)
		• AMOSC equipment

Hazards	Risks	Prevention and mitigation considerations

		• Geelong, Victoria:
		  ▪ 6 x Gas Alert Monitors (Microclip) (gas detection)
		• Fremantle, WA
		  ▪ 2 x Gas Alert Monitors (Microclip) (gas detection)
		  ▪ 2 x AreaRae (gas detection)
		  ▪ 2 x UltraRae 3000 (personnel VOC monitors)
		• Shell / Prelude – potential additional VOC and gas monitoring equipment – available under best endeavours agreement via INPEX/Shell MoU
		• Additional passive VOC monitoring badges available through routine suppliers including Airmet (Victoria) and AE Solutions (WA).

		PPE including coveralls, gloves, glasses, boots and barrier gels, to be provided to all personnel working on the response.
		Clean-up area provided for responders to decontaminate and remove soiled clothing. Ample quantity of clean PPE available. Respiratory protection should be assessed on an activity specific basis, and if required, used in conjunction with passive/active VOC and gas monitoring equipment.
		Group I / Condensate spills – very high LFL and VOC risks. No response activities/tracker buoy deployments near Group I spills until the slick within the area of response has weathered for at least 3 hours. Group II / Diesel spills – low LFL risk, moderate VOC risks. No response activities/tracker buoy deployments near Group II spills until the slick within the area of response has weathered for at least 1 hours. Group IV spills – very low LFL and low VOC risks. Generally no atmospheric risks from Group IV spills, however monitoring with PGMs/VOC should still be implemented when spending extended periods of time in the slick, e.g. vessel based dispersant operations.
Manual handling	Manual handling injuries	Use of cranes, or large teams of trained personnel, to lift response materials as required.

Hazards	**Risks**	**Prevention and mitigation considerations**
Slips, trips and falls	General injury	Hydrocarbon waste and used absorption equipment will have dedicated waste receptacles. Additional supply of absorption material to be located at access and egress points from vessels and/or in and out of offices, to mitigate the additional risk of slipping on oily surfaces, and to minimise the spread of hydrocarbons.
		Designated and separate, clean and contaminated work areas and movement routes in all work areas.
Working over water	Drowning	Mandatory use of lifejackets when working over water and independent sentry posted to monitor activity. "Man overboard" procedures clearly defined and included in personnel inductions and ongoing training. PTW from vessel master to be in place for personnel working over water.
Dangerous marine fauna	Bites, stings and other injury from marine fauna	No personnel are permitted in the water. Sentry in place whenever personnel are working over the water and to watch for fauna. All work will be done under a PTW from a response contractor. Any personnel retrieving equipment or wildlife from the water will be alert to marine animals. All personnel working to retrieve equipment or wildlife from the water will be equipped with gloves and protective clothing, and all retrieved equipment will be washed to remove any marine life.
Working from helicopters	Helicopter downed	As a minimum, any helicopter working for an INPEX response must meet the INPEX minimum aviation standards. Any personnel working from a helicopter over water must have a completed Tropical Basic Offshore Safety Induction and Emergency Training certificate or equivalent.
Excessive working hours	Fatigue	Personnel will work under the applicable working-hour limitations. As a minimum, the INPEX fitness-for-work standard will be used as a template for all INPEX employees. There will be monitoring of fatigue and personnel fitness by work supervisors. A roster will be established to allow change-out of personnel as required, depending on the nature and duration of the spill response.
Weather	Dehydration, heatstroke	The INPEX fitness-for-work standard and the fatigue guidelines will be used as minimum requirements.

Hazards	Risks	Prevention and mitigation considerations
Quarantine	Human communicable diseases	Browse Island and other locations within the traditional fishing MoU box have the potential for contact between spill response personnel and Indonesian fishermen. Communicable diseases, such as tuberculosis can be transmitted from human to human. Inductions need to communicate that no contact with Indonesian fishermen is permitted, and appropriate controls will be implemented to mitigate this risk.
Unexploded Ordnance (Cartier Island)	Multiple fatality and significant asset damage.	Cartier Island and the surrounding marine area within a 10 km radius was a gazetted Defence Practice Area up to 2011. Although the site is no longer an active weapons range there is a SUBSTANTIAL RISK that UXO remains in the area. Due to the risk posed by UXO, landing on Cartier Island or anchoring anywhere within the Cartier Island Commonwealth Marine Reserve is strictly prohibited without express, prior written approval. If anchoring is unavoidable due to an emergency (e.g., extreme weather conditions), great care should be taken to ensure anchoring is on sand and that anchors do not drag. Any metal objects or suspicious objects found in the reserve should not be touched or disturbed and reported immediately to the police and the Parks Australia Work Health and Safety Advisor on (02) 6274 2369 or parks.healthandsafety@awe.gov.au Based on these risks, INPEX risk assessment concludes that it is not safe to conduct any nearshore booming (which would require shallow water anchoring), or any form of shoreline response, due to the UXO risks.

5 INPEX OIL SPILL FORMS REGISTER

Table 5-1 has been copied from the Oil Spill Forms Register (C075-AH-LIS-10006).

If a link is not working, please access the latest version of the Oil Spill Forms Register via the INPEX Document Control System or search relevant government website for the latest link to the relevant form.

Table 5-1: Oil Spill Response Forms

Appendix	Form type	Form title	Purpose	Reporting timeframe	Applicable to oil spills in				Document reference (INPEX document management system or URL)
					Darwin Harbour	NT	WA	Cwlth Waters	
-		NT EPA Pollution Reporting Online Form	Notify the following external parties of an oil spill in NT waters: • Darwin Port for spills inside Darwin Port limits • NT Department of Transport (NT DoT) – Marine Safety Branch for spills inside Territory waters (but outside Darwin Port limits) • NT Environment Protection Authority (NT EPA) for spills inside Territory waters and/or Darwin Port limits • (IMT Environment to complete).	< 2hrs	✓	✓			https://ntepa.nt.gov.au/waste-pollution/hotline
-		NT Incident update report (SITREP) – as per NT OSCP	Notify the following external parties of an oil spill in NT waters: • Darwin Port for spills inside Darwin Port limits • NT Department of Transport (NT DoT) – Marine Safety Branch for spills inside Territory waters (but outside Darwin Port limits) • NT Environment Protection Authority (NT EPA) for spills inside Territory waters and/or Darwin Port limits (NOTE: The NT SITREP is a modified version of AMSA's Marine Pollution Situation Report (SITREP) available at www.amsa.gov.au)	Daily, or as situation changes significantly	✓	✓			https://dipl.nt.gov.au/__data/assets/pdf_file/0006/165462/northern-territory-oil-spill-contingency-plan.pdf (The SITREP is available as NT OSCP Appendix D, Form No. REP 02)
-		AMSA harmful substances report (POLREP)	Facility OIM / Vessel master to report marine pollution incidents in Commonwealth waters to the Australia Maritime Safety Authority (AMSA (IMT Environment to obtain copy)	< 2hrs				✓	https://www.amsa.gov.au/forms/harmful-substances-report-polrep-oil
-		WA Department of Transport - POLREP WA Department of Transport - SITREP	Facility OIM / Vessel master to report marine pollution incidents, which **may** threaten WA waters / lands to WA Department of Transport (WA DoT). (IMT Environment to obtain copies of POLREP/SITREP).	Immediately			✓		https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
-		WA Department of Environment Regulation (DER) - Online Pollution Report	Pollution onto WA land (i.e. oil contacting WA shoreline) is to be reported online. (IMT Environment to complete).	< 12 hrs			✓		http://www.der.wa.gov.au/your-environment/reporting-pollution/report-pollution-form
-	Notify & Report	Offshore occurrence report form (Western Australian Department of Mines & Petroleum DMP)	Report to DMP for marine incidents within the 3 nautical mile limit (WA state waters) by INPEX IMT Leader. This includes reporting oil spill incidents that originated in Commonwealth or NT waters, but moved into WA state waters. (IMT Environment to complete).	< 3 days			✓		https://www.dmp.wa.gov.au/Documents/Safety/PGS_F_OffshoreOccurrenceReport.pdf

Appendix	Form type	Form title	Purpose	Reporting timeframe	Applicable to oil spills in				Document reference (INPEX document management system or URL)
					Darwin Harbour	NT	WA	Cwlth Waters	
-		Report of a known or suspected contaminated site (Contaminated Sites Act 2003 (WA))	Report to WA DER of a contaminated site on land, shoreline or seabed within WA state waters. (IMT Environment to complete).	< 21 days			✓		https://www.der.wa.gov.au/your-environment/contaminated-sites
-		NOPSEMA Report of an accident, dangerous occurrence or environmental incident (FM0831)	Report to NOPSEMA offshore incidents in accordance with BROPEP (only required for Level 2 or 3 spills). (INPEX IMT Leader to issue report) NOTE: NOPSEMA must be verbally notified within 2 hours after becoming aware of the Level 2/3 incident (or potential Level 2/3 incident).	< 3 days				✓	https://www.nopsema.gov.au/assets/Forms/N-03000-FM0831-Report-of-an-Accident-Dangerous-Occurrence-or-Environmental-Incident-Rev-8-Jan-2015-MS-Word-2010.docx
-	Situational Awareness	Oil Spill Observation and Visual Dispersant Guide for Aircraft and Vessels	Provide guidance to vessel and aircraft operators on oil spill observation, slick volume estimate, and dispersant application processes and reporting of oil spill observation and dispersant activities to the IMT. (Field personnel to prepare)	Ongoing during emergency	✓	✓	✓	✓	0000-AH-GLN-60054
A		RPS Search and Rescue Request Form	Form to activate RPS to conduct search and rescue trajectory modelling (IMT H&S or Environment to request)	< 2 hrs	✓	✓	✓	✓	C075-AH-FRM-10001
B		RPS Response Oil Spill and Vapour Modelling Request Form	Form to activate RPS to conduct oil spill and vapour trajectory modelling	< 2 hrs	✓	✓	✓	✓	C075-AH-FRM-10002
C	Modelling	RPS Response Chemical Spill and Vapor Modelling Request Form	Form to activate RPS to conduct oil spill and vapour trajectory modelling (IMT Environmental to request)	< 2 hrs	✓	✓	✓	✓	C075-AH-FRM-10004
D		AMOSC mobilisation and authorisation form	In order to mobilise AMOSC, a service contract must be completed by the IMT Leader to identify AMOSC requirements for equipment; consumables; personnel; advice and estimated duration. (IMT Leader to sign)	> Level 2 incident	✓	✓	✓	✓	0000-AH-FRM-70020
E		OSRL notification form	To notify Oil Spill Response Limited of an incident that may requires support under the terms of the Agreement (ORSL #129). (IMT Environmental to request)	> Level 2 incident	✓	✓	✓	✓	C075-AH-FRM-10005
F	AMOSC/ OSRL	OSRL mobilisation form	To authorise activation of Oil Spill Response Limited and its resources in connection with an incident under the terms of the Agreement (ORSL #129). (IMT Environmental to request)	> Level 2 incident	✓	✓	✓	✓	C075-AH-FRM-10006

Appendix	Form type	Form title	Purpose	Reporting timeframe	Applicable to oil spills in				Document reference (INPEX document management system or URL)
					Darwin Harbour	NT	WA	Cwlth Waters	
	Wildlife Permit	Permit to interfere with EPBC listed species	General permit application for interfering with threatened species and ecological communities, migratory species, whales and dolphins and listed marine species (IMT Environmental to prepare)	As required	NA	NA	NA	✓	https://www.environment.gov.au/system/files/pages/88de03b0-1a95-427b-9e24-0306b89eeaa2/files/species-application-form.pdf
	WA DoT Cross Jurisdiction Spill	IMT Handover Checklist (cross jurisdictional arrangements)	For use by IPX IMT-Leader, to check handover of relevant incident information to WA DoT IMT-Leader, when INPEX spill moved into WA Waters	As required, in consultation with WA DoT incident controller.			✓		Appendix 1 of the WA DoT Marine Oil Pollution: Response and Consultation Arrangements Rev5 https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_Westplan_MOP_OffshorePetroleumIndGuidance.pdf
-	WA DoT Cross Jurisdiction Spill	IMT Functions and Lead IMT Designations (cross jurisdictional arrangements)	For use by IPX IMT-Leader, and WA DoT IMT-Leader, to define each IMT 'lead' roles, when INPEX spill moved into WA Waters and a cross jurisdictional spill response is underway.	As required, in consultation with WA DoT incident controller.			✓		Appendix 2 of the WA DoT Marine Oil Pollution: Response and Consultation Arrangements Rev5 https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_Westplan_MOP_OffshorePetroleumIndGuidance.pdf

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APPENDIX A: OPERATIONAL AND SCIENTIFIC MONITORING PROGRAM

The decision-making process for termination of the OM and SM is undertaken by the INPEX IMT Leader, in consultation with AMOSC and the designated ESP. In addition, relevant jurisdictional agencies, including AMSA, WA DoT and WA DBCA (via WA DoT), as relevant to the nature and scale of the spill, will be consulted.

Within State/Territory waters, the WA/NT Control Agency are ultimately responsible for termination of OSMPs.

The termination decision-making process includes the following steps:

- Step 1: Review the data collected by the OM and SM against the OM and SM objectives.
- Step 2: Evaluate whether the OM and SM objectives have been achieved and provide the evaluation to the INPEX IMT Leader.
- Step 3: Reach agreement with the INPEX IMT Leader that the termination criteria have been satisfied.
- Step 4: Sign-off for termination of the OM and SM by the INPEX IMT Leader.

Code	Title	Aim of the plan	Key objectives	Activation triggers	Termination criteria	Mobilisation time	Service provider
OM01	Oil Spill Trajectory Modelling	To use computer-based forecasting methods to predict oil-spill movement and guide the management and execution of oil spill response strategies to maximise the protection of environmental and other resources at risk.	Provide forecasting of the movement and weathering of spilled oil (and oil with dispersant applied, where applicable). Assist in identifying values and sensitivities that are at risk of contamination.	All Level 2 and Level 3 spills	The oil discharge has ceased and spill modelling outputs (as verified by OM03, OM04 and OM06, where applicable) show no additional values and sensitivities are at risk of oil spill contact.	<2 hours	Oil spill modelling provider (Refer to Table 5-1).
OM03	Oil Spill Surveillance and Reconnaissance	To provide regular, ongoing oil spill surveillance in the event of a spill (aerial, vessel, satellite imagery, oil spill tracking buoys), as appropriate. Identify key breeding/ aggregation/ foraging areas for wildlife groups that may be at risk from the oil spill.	To assess the colour, consistency, distribution and locations of the surface slick. To identify values and sensitivities likely to be impacted by the spill.	All Level 2 and Level 3 spills	Upon completion of the oil spill response operations (Refer to Section 4.5) AND Spill surveillance indicates (and is supported by OM01 outputs) no additional values and sensitivities are at risk of oil spill contact.	<48 hours	Aircraft providers Vessel providers AMOSC/OSRL satellite imagery provider INPEX oil spill tracking buoys.
OM04	Operational Monitoring of Oil Properties, Behaviour and Weathering at Sea	To provide in-field information on the properties, behaviour, extent and weathering of the spilled oil.	Establish the case-specific situation for the released oil, including: • surface and subsurface extent • density • viscosity • wax and asphaltene content • water content (as water-in-oil emulsion) • proportion of residual hydrocarbons over time • proportion of volatile hydrocarbons • proportion of soluble hydrocarbons. Monitor the evolution of these oil properties through time and assess the rate of their reduction or increase.	All Level 2 and Level 3 spills	Monitoring of the evolution of the oil properties indicates that the released oil has undergone weathering to reach a steady weathered state*. *Steady weathered state is defined as <10% change in percentage of mass for weathering processes for 3 consecutive days (measured weathering rates compared with weathering curves for the spilled product, generated through the US National Oceanic and Atmospheric Administration oil spill weathering model ADIOS).	Preparation to deploy field personnel and equipment will commence on notification from INPEX that this OM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Environmental service provider under contract for duration of activities. NATA laboratory for sample analysis.

Code	Title	Aim of the plan	Key objectives	Activation triggers	Termination criteria	Mobilisation time	Service provider
OM05	Pre-emptive Desktop Assessment of Sensitive Resources	To undertake a rapid desktop assessment of the broad character and ecological integrity of sensitive receptors at risk of impact from a moving oil slick.	Undertake a desktop assessment, to obtain all relevant information in relation to the values and sensitivities that may be affected by the spill. Note: Values and sensitivities for OM05 are defined as those described in Section 4 of the EP, including islands, reefs, shoals and banks, and areas of conservation significance, and BIAs associated with MNES.	All Level 2 and Level 3 spills.	Completion of the desktop assessment of values and sensitivities that were identified by Operational Monitoring (OM01, OM03, OM04 and OM06) as being potentially impacted or contacted by the oil spill.	24 hours	Environmental service provider under contract for duration of activities.
OM06	Assessment of the Presence and Quantity of Petroleum Hydrocarbons in Water and Sediments	To provide a rapid assessment of the presence, type, quantity and character of hydrocarbons in the water and marine sediments to assess the extent of the impact and verify impact predictions for other monitoring plans.	Detect the presence of oil and oil-derived (petrogenic) hydrocarbons in the water column and marine sediments. Determine, if possible, the source of these (i.e. the slick or some other sources). Determine the spatial and temporal distribution of the hydrocarbons. Distinguish between petrogenic and non-petrogenic (natural background) hydrocarbons that are present. Determine the concentrations of the hydrocarbons. Benchmark the level of individual hydrocarbons against trigger levels of concern for aquatic life and human health.	All Level 2 and Level 3 spills	Upon completion of the oil spill response OR Rapid assessment of the hydrocarbons in water and marine sediments has been completed and the operational monitoring has been superseded by relevant SM programs.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that this OM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Environmental service provider under contract for duration of activities.
SM02	Detailed Characterisation of the Oil Properties and Ecotoxicological Assessment	To provide a toxicological assessment of the spilled oils. To assess the risks posed by short-term exposure (acute effects) or longer term exposure (chronic effects), or both, to potentially impacted values and sensitivities.	Determine the chemical characteristics of the spilled oil throughout a spill response and the character of residual oils as they continue to weather, post-response. Determine the potential adverse effects on values and sensitivities of exposure to fresh, weathered and chemically dispersed oil, based on the chemical and physical character of the oil.	Other scientific monitoring programs are triggered that require information on the ecotoxicity of hydrocarbons in the water column and sediments (SM07, SM08, SM10, SM11 and SM12).	Laboratory results have defined the chemical characteristics of fresh and weathered oil (which has reached a steady weathered state, as defined in OM04); AND Results have provided contextual information for the potential adverse effects on values and sensitivities exposed to be quantified.	Laboratory testing only; using water and sediment samples collected from OM04, SM05 and SM06.	Environmental service provider under contract for duration of activities.
SM04	Impact of Dispersant Operations	To determine and quantify the impacts of dispersant operations on values and sensitivities.	Monitor the initial and longer term spatial and temporal distribution, concentration, and breakdown (fate) of dispersed oil to determine the potential acute and chronic exposures of values and sensitivities to dispersed oil.	When any chemical dispersants are applied to an oil spill.	Monitoring results have determined the spatial and temporal distribution, persistence and fate of dispersed oil and indicate no further shoreline, intertidal or shallow subtidal receptors will be contacted; AND Monitoring results have quantified the potential acute and chronic exposures of values and sensitivities to dispersed oil.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Environmental service provider under contract for duration of activities.

Code	Title	Aim of the plan	Key objectives	Activation triggers	Termination criteria	Mobilisation time	Service provider
SM05	Monitoring for Hydrocarbons in Marine Waters	To quantify presence and extent, as well as the longer term weathering, persistence and toxicity of hydrocarbon compounds in marine waters, and to assess and verify predicted impacts on values and sensitivities for other SM.	Quantify the temporal and spatial distribution and concentration of hydrocarbon compounds in marine waters in relation to background or reference levels, e.g., ANZG (2018) Determine the sources of any identified hydrocarbons in the water column, e.g., natural, pyrogenic, or petrogenic spill sources. Provide samples to enable toxicity of the hydrocarbon compounds in marine waters to be assessed under SM02.	All Level 2 and Level 3 spills from subsea production system OR For surface spills, OM indicates oil contact within 2 km of a shallow, subtidal (−30 m LAT or above) or intertidal location or BIAs associated with MNES; OR Other Scientific Monitoring programs (SM07, SM08, SM09, SM10, SM11 and SM12) are triggered that require information on the presence, extent and toxicity or persistence of hydrocarbons in the water column.	Monitoring results have confirmed the temporal and spatial distribution, concentration and source of hydrocarbons in the water column; AND OM indicates no further values and sensitivities are likely to be contacted; AND Monitoring results have determined petrogenic hydrocarbon concentrations in marine waters are consistent with background or reference levels e.g., ANZG (2018); AND Water samples have been provided for SM02.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Mobilisation of field personnel and equipment within 7 days of receipt of notification.	Environmental service provider under contract for duration of activities.
SM06	Monitoring for Hydrocarbons in Subtidal and Intertidal Sediments	To understand the behaviour, persistence and fate of hydrocarbons in sediments to provide data to assist in assessing and verifying predicted impacts on key habitats and sensitive receptors.	Determine the distribution (spatial and temporal extent) of oil in shallow, subtidal and intertidal sediments in relation to background or reference levels, e.g., ANZG (2018) Determine the sources of any identified hydrocarbons in sediment, e.g., natural, pyrogenic or petrogenic spill sources. Provide samples to enable toxicity of the hydrocarbon compounds in marine sediments to be assessed under SM02.	All Level 2 and Level 3 spills from subsea production system; OR For surface spills, OM indicates oil contact within 2 km of a shallow, subtidal (−30 m LAT or above) or intertidal location; OR Other Scientific Monitoring programs (SM07, SM08, SM12) are triggered that require information on the presence, extent and toxicity or persistence of hydrocarbons in benthic sediments.	Monitoring results have confirmed the temporal and spatial distribution, concentration and source of hydrocarbons in the sediments; AND OM indicates no further values and sensitivities are likely to be contacted; AND Monitoring results have determined petrogenic hydrocarbon concentrations in sediments are consistent with background or reference levels e.g., ANZG (2018); AND Sediment samples have been provided for SM02.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Mobilisation of field personnel and equipment within 7 days of receipt of notification.	Environmental service provider under contract for duration of activities.
SM07	Monitoring of Shoreline and Intertidal Benthos to Determine Impacts of Oil Spill and Recovery	To determine and monitor the potential impact of a hydrocarbon spill or response activities and recovery of intertidal benthos and associated organisms.	Collect quantitative data on intertidal habitats and organisms that are at risk from, or have been exposed to, oil and/or dispersant and activities. Detect and quantify lethal or sublethal impacts of the spill on intertidal habitats and organisms and monitor recovery to baseline or reference levels.	OM indicates oil contact within 2 km of an intertidal location where sensitive organisms are known to occur.	Impacts to shoreline and intertidal benthos have been quantified and monitoring results indicate no further shoreline and intertidal coastal habitats and organisms are at risk from, or have been exposed to, oil and/or dispersant; AND Impacted intertidal benthos indicators have returned to baseline or reference levels.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Mobilisation of field personnel and equipment within 7 days of receipt of notification.	Environmental service provider under contract for duration of activities.

Code	Title	Aim of the plan	Key objectives	Activation triggers	Termination criteria	Mobilisation time	Service provider
SM08	Monitoring of Subtidal Marine Benthos to Determine Impacts of Oil Spill and Recovery	To determine and monitor the potential impact of a hydrocarbon spill or response activities and recovery of shallow, subtidal benthos and associated organisms.	Collect quantitative data on shallow subtidal habitats and organisms that are at risk from, or have been exposed to, oil and/or dispersant and activities. Detect and quantify lethal or sublethal impacts of the spill on intertidal habitats and organisms and monitor recovery to baseline or reference levels.	All Level 2 and Level 3 spills from subsea production system; OR For surface spills, OM indicates oil contact within 2 km of a shallow, subtidal (−30 m LAT or above) location where sensitive organisms are known to occur.	Impacts to shallow, subtidal benthos have been quantified and monitoring results indicate no further shallow subtidal benthos and organisms are at risk from, or have been exposed to, oil and/or dispersant; AND Impacted subtidal benthos indicators have returned to baseline or reference levels.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Mobilisation of field personnel and equipment within 7 days of receipt of notification.	Environmental Service Provider under contract for duration of activities.
SM09	Determine Impacts of Oil Spill on Plankton Populations and Recovery	To investigate the possible scale of impacts to plankton and the degree to which hydrocarbons may accumulate in populations as a result of a spill event.	Quantify plankton in the vicinity of a spill and at reference sites in the wider region. Determine if there are oil-derived hydrocarbons in plankton. Evaluate the potential for impacts to plankton by the oil spill or response activities. If possible, detect and quantify lethal and, where appropriate, sublethal effects to plankton.	There is a plankton community in the spill vicinity (identified during the course of remote sensing undertaken in OM03) that is likely to support the regionally important natural or commercial resources in the area, or is an important source of recruitment for plankton communities; AND The nature (composition) and magnitude of the spill (volume, area of impact, components, etc.) are sufficient to present a significant risk of exposure and lethal impacts to plankton communities (identified in OM03); OR Use of dispersants in proximity to plankton communities identified above; OR A mass spawning event has taken place or is likely to occur within the area of impact.	Plankton communities in the vicinity the spill and at reference sites in the wider region have been quantified. Oil-derived hydrocarbon presence in plankton has been determined. Impacts to plankton by the oil spill or response activities have been evaluated. Lethal and sublethal effects to plankton have been quantified.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Mobilisation of field personnel and equipment within 7 days of receipt of notification.	Environmental Service Provider under contract for duration of activities.
SM10	Determine Impact of Oil Spill on Seabirds and Shorebird Populations and Recovery	To assess potential impacts on seabird and shorebird populations within the marine avifauna BIAs, or populations identified by OM01 and/or OM03, which may have been affected by the oil spill or response activities.	Quantify and assess potential impacts to seabirds and coastal bird populations (in particular known breeding colonies) by the spill, and associated response activities, including abundance, mortality, sublethal effects, sickness and oiling. Determine whether oil or response activities were the cause of observed impacts. Monitor the recovery of key behaviour and breeding activities of seabirds and coastal bird populations over time, with regard to reference or baseline levels. Provide information to feed into any restoration or remediation activities that need to be implemented for marine avifauna.	OM indicates oil contact within 2 km of an intertidal location or within a marine avifauna BIA; OR Likely spill contact with any other identified marine avifauna population.	Monitoring results have quantified the lethal or sublethal impacts to seabirds and shorebirds as a result of the oil spill and indicate no new populations are at risk from, or have been exposed to, oil or response activities; AND Key seabird and shorebird behaviour and breeding activities or habitat have been measured and are comparable to baseline or reference levels.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Mobilisation of field personnel and equipment within 7 days of receipt of notification.	Environmental Service Provider under contract for duration of activities.

Code	Title	Aim of the plan	Key objectives	Activation triggers	Termination criteria	Mobilisation time	Service provider
SM11	Determine Impact of Oil Spill on Non-Avian Marine Megafauna and Recovery	To assess potential impacts on non-avian marine megafauna within their relevant BIAs, or populations identified by OM01 and/or OM03, which may have been affected by the oil spill or response activities.	Quantify and assess impacts of the spill and associated response activities on non-avian marine megafauna, including abundance, mortality, sublethal effects, sickness and oiling. Determine whether oil or response activities were the cause of observed impacts. Monitor the recovery of key behaviour and breeding activities of non-avian marine megafauna over time, with regard to baseline or reference levels. Provide information to feed into any restoration or remediation activities that need to be implemented for non-avian marine megafauna.	OM indicates oil contact within 2 km of an intertidal location or within a non-avian marine megafauna BIA; OR Likely spill contact with any other identified non-avian marine megafauna population.	Monitoring results have quantified the lethal or sublethal impacts to non-avian marine megafauna to the oil spill and indicate no new populations are at risk from, or have been exposed to, oil or response activities; AND Key non-avian marine megafauna behaviour and breeding activities or habitat have been measured and are comparable to baseline or reference levels.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Mobilisation of field personnel and equipment within 7 days of receipt of notification.	Environmental Service Provider under contract for duration of activities.
SM12	Determination of the Impact of the Oil Spill on Commercial, Traditional and Recreational Fisheries	To monitor potential impacts of the oil spill and response activities on commercial, traditional and recreational fisheries and subsequent recovery.	Determine the potential impacts of the oil spill and response activities on commercial, traditional and recreational fisheries and follow their recovery in relation to baseline or reference levels. Evaluate the type and severity of physiological or biochemical changes (as measured by biomarkers of fish health) in commercial, traditional and recreational fisheries species affected by the spill, including the identification of potential reproductive impairment. Determine whether oil or response activities were the cause of observed impacts.	For surface spills, OM indicates oil contact within 2 km of a shallow, subtidal (–30 m LAT or above) or intertidal location; OR For Level 2 and Level 3 spills from the subsea production system; AND OM predicts contact is possible to commercial, traditional or recreational fisheries species; OR Advice has been provided to government to restrict, ban or close a fishery. SM12 will commence to provide data for government to enable decisions to be made on when a fishery can be reopened; OR Declarations of intent by commercial fisheries or government agencies to seek compensation for alleged or possible damage.	Monitoring results have quantified the physiological or biochemical changes and sublethal impacts of the oil spill and clean-up methods on, commercial, traditional and recreational 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, traditional or recreational fisheries from reference levels; OR The physiological and biochemical parameters in the studied species have returned to baseline levels.	Preparation to deploy field personnel and equipment will commence on notification from INPEX that the SM has been triggered. Mobilisation of field personnel and equipment within 7 days of receipt of notification.	Environmental Service Provider under contract for duration of activities.

APPENDIX B: INPEX INCIDENT ACTION PLAN TEMPLATE

<table>
<tr><td colspan="6">INPEX – Incident Action Plan</td></tr>
<tr><td>IAP Sequence #</td><td></td><td colspan="2">IAP Issue Date / Time</td><td colspan="2"></td></tr>
<tr><td colspan="2">Incident Name</td><td colspan="4">Operational Period</td></tr>
<tr><td colspan="2"></td><td>From</td><td></td><td>to</td><td></td></tr>
<tr><td colspan="3">IAP Developer - Planning Function Lead</td><td colspan="3">IAP Approver - IMT Leader</td></tr>
<tr><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td colspan="2">Mission Statement</td><td colspan="4">Responsible: IMT Leader</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="2">Situation</td><td colspan="4">Responsible: IMT Leader/Operations
Information from: Incident Status Board</td></tr>
<tr><td colspan="2">Incident Level:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Incident Location</td><td colspan="4"></td></tr>
<tr><td colspan="2">Status:</td><td colspan="4">Is incident contained, escalating, under control</td></tr>
<tr><td colspan="2">Incident Commenced</td><td colspan="4">Time /Date</td></tr>
<tr><td colspan="2">Incident Commander Contact Details:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Brief Description of Incident</td><td colspan="4"></td></tr>
<tr><td colspan="2">Actions Completed</td><td colspan="4"></td></tr>
<tr><td colspan="2">Current Situation</td><td colspan="4"></td></tr>
<tr><td colspan="2">Actions Underway</td><td colspan="4"></td></tr>
<tr><td colspan="2">Predicted Situation
(at end of operational period)</td><td colspan="4"></td></tr>
<tr><td colspan="2">Safety Message / Risks</td><td colspan="4">Responsible: H&S Advisor</td></tr>
<tr><td colspan="6">Key message to prevent further injury or hazard exposure for responders plus key risk areas over the operational period</td></tr>
</table>

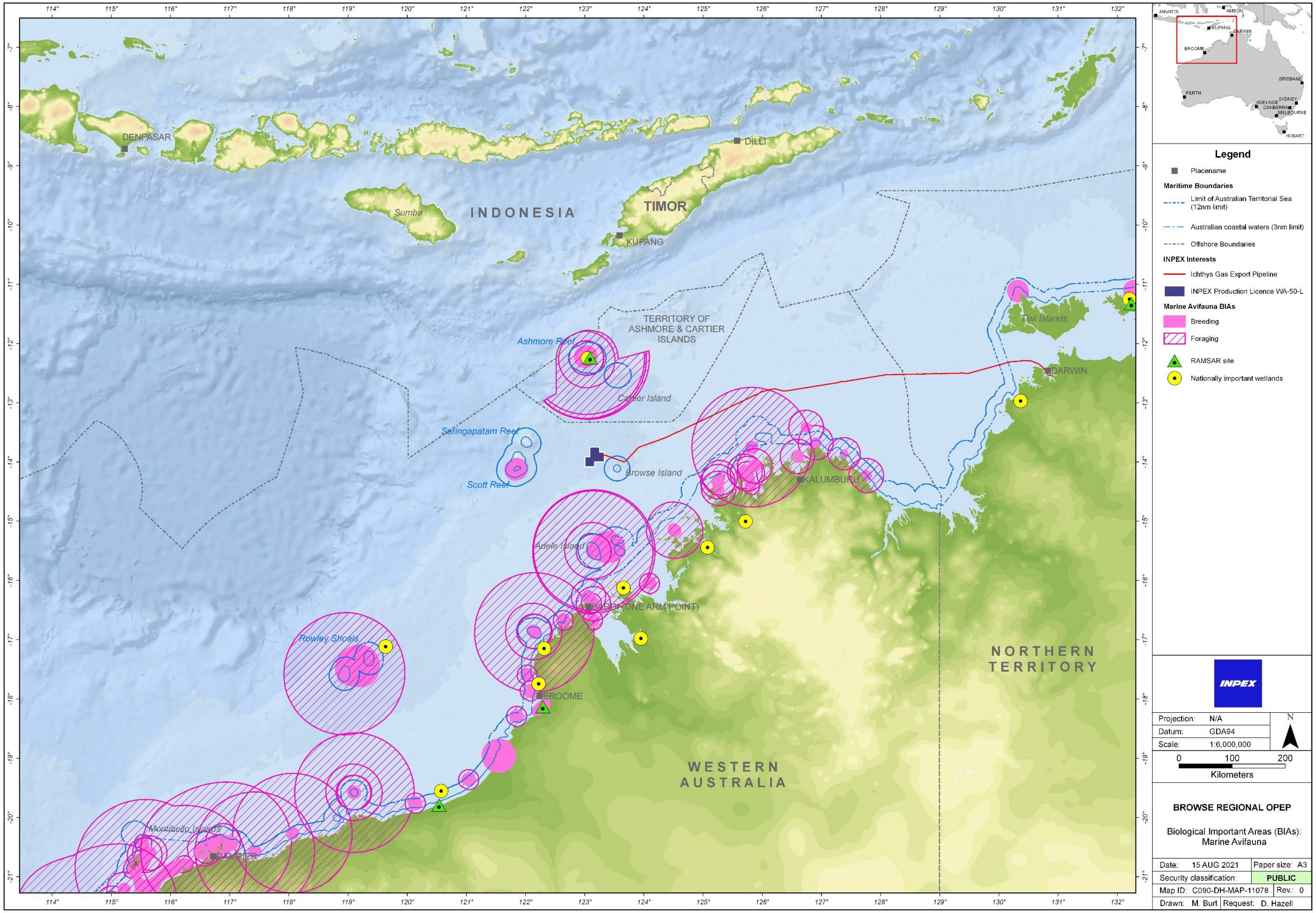
	Ref	People	Ref	Environment	Ref	Assets	Ref	Reputation	Ref	Sustainability
Incident Objectives	PO 1		EO 1		AO 1		RO 1		SO 1	
	PO 2		EO 2		AO 2		RO 2		SO 2	
	P0 3		EO 3		AO 3		RO 3		SO 3	
	PO 4		EO 4		AO 4		RO 4		SO 4	
Strategies	PO1		EO 1		AO 1		RO 1		SO 1	
			EO 2		AO 2		RO 2		SO 2	
	PO2									
	PO3									
Tasks		IMT Function responsible		IMT Function responsible		IMT Function responsible		IMT Function responsible		IMT Function responsible

Resources	*Responsible:* *Logistics Function*	*Information from:* *Resources Summary Board*
A summary of resources required and being used during Operational period ETD and ETA are to be included.		
Medical Plan	*Responsible:* *HR Function*	*Information from:* *Medical Planning Board*
A summary of casualties, medevacs and medical facilities		
Communications Plan	*Responsible:* *IMT Leader (EA&JV Function can assist if activated by P-CMT Leader)*	*Information from:* *Stakeholder Management Board*
A summary of key stakeholder deadlines and planned engagements or updates required during Operational Period		
Key Timings	*Responsible:* *IMT Leader/Planning*	
A summary of key timings within this Operational Period such as next IMT Update Briefing, Shift Change, etc.		
Administration	*Responsible:* *All*	
Additional specialist functions activated to support incident management. *A summary of administrative arrangements such as feeding, accommodation, security, travel etc.*		

APPENDIX C: ENVIRONMENTAL VALUES AND SENSITIVITIES MAPS

Particular values and sensitivities with the potential to be exposed/impacted by activity oil spill events are provided within Section 4 of each activity specific EP.

The figures below present the environmental values and sensitivities of the BROPEP region based on the WCSSs presented in the BROPEP Basis of Design and Field Capability Assessment Report (X060-AH-REP-70016).



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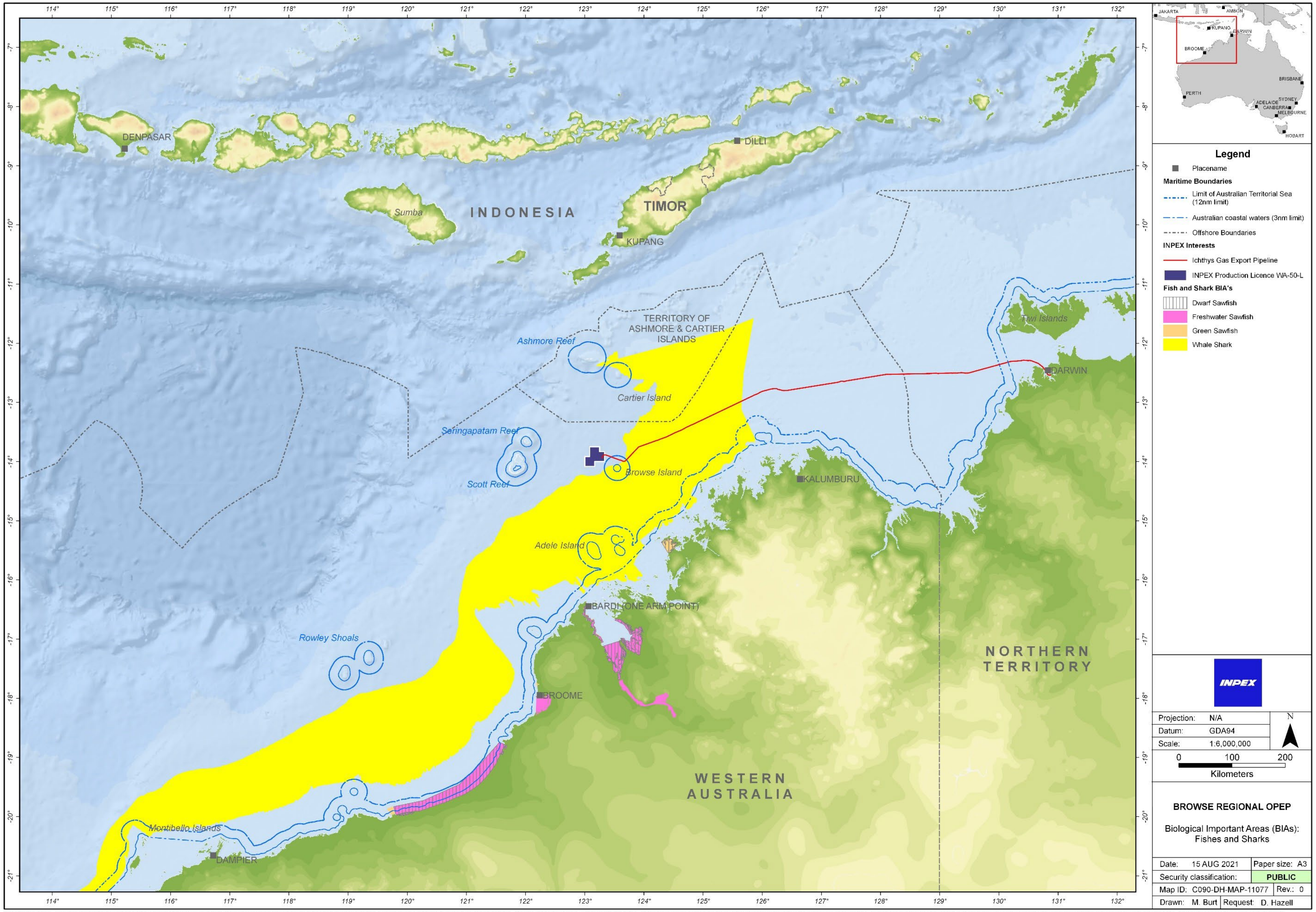

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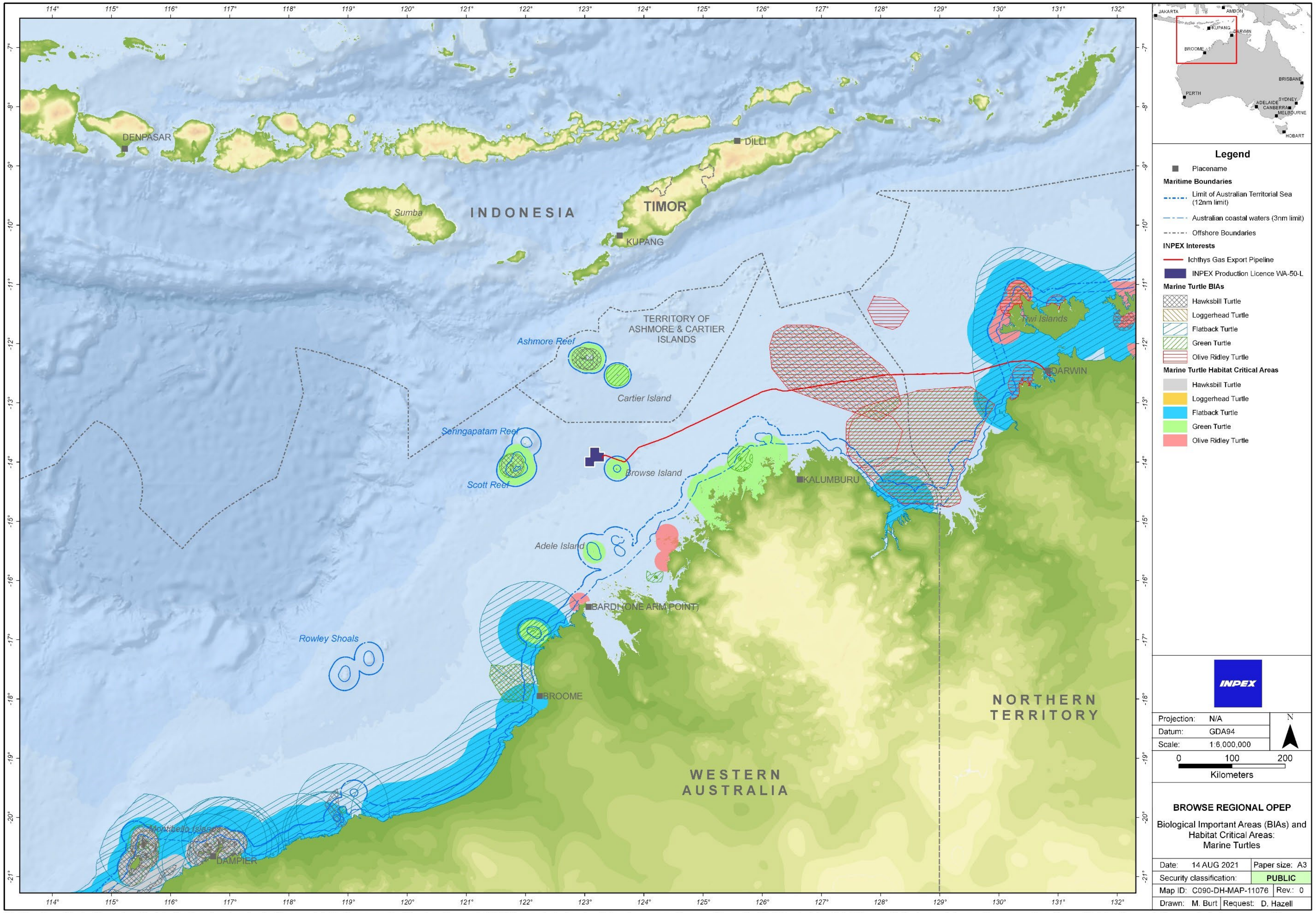
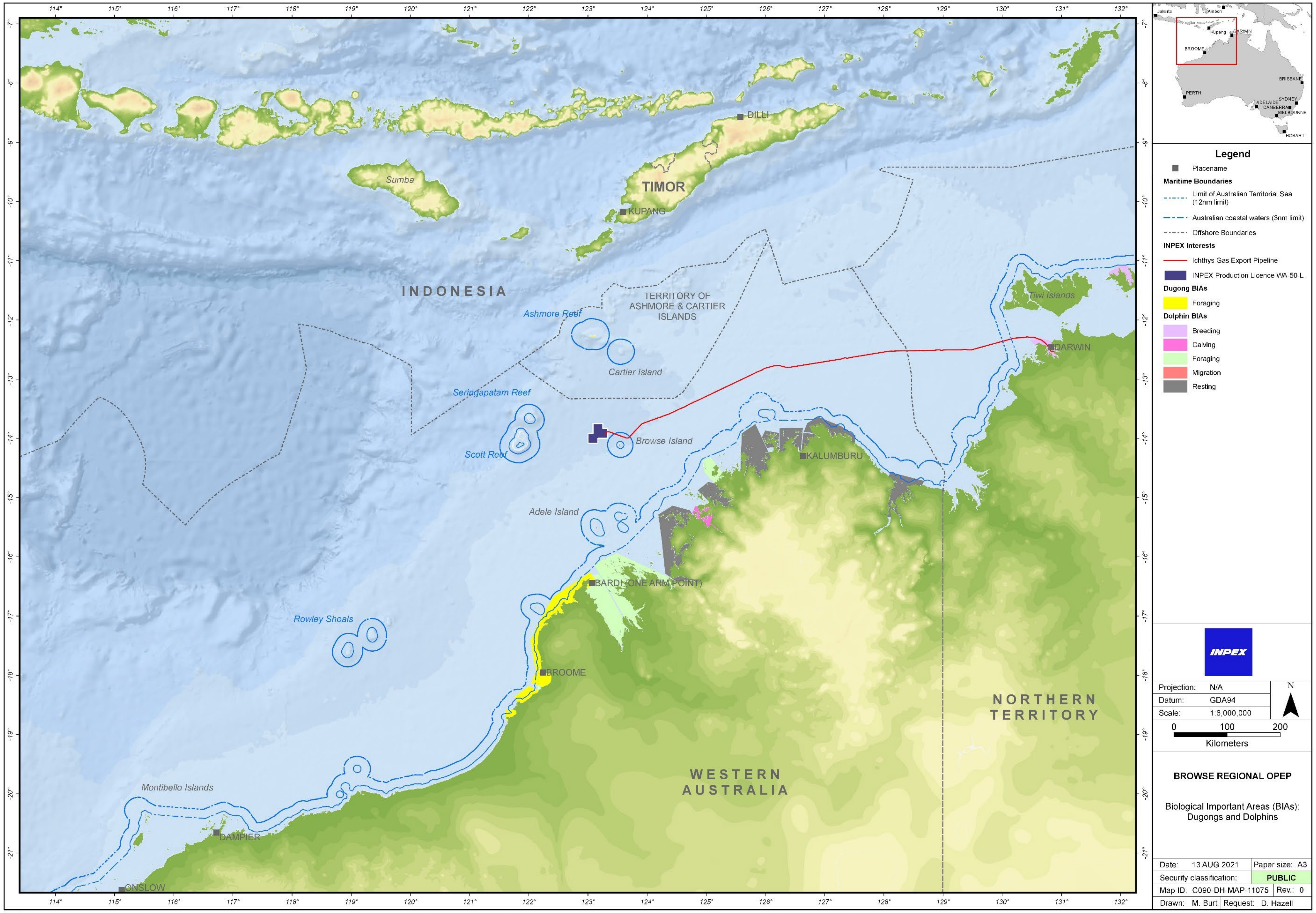

INDONESIA
TIMOR
Sumba
DENPASAR
DILLI
KUPANG
TERRITORY OF ASHMORE & CARTIER ISLANDS
Ashmore Reef
Cartier Island
Seringapatam Reef
Scott Reef
Browse Island
Adele Island
Rowley Shoals
KALUMBURU
BARDI (ONE ARM POINT)
BROOME
DAMPIER
Montebello Islands
Tiwi Islands
DARWIN
WESTERN AUSTRALIA
NORTHERN TERRITORY
Legend
Placename
Maritime Boundaries
Limit of Australian Territorial Sea (12nm limit)
Australian coastal waters (3nm limit)
Offshore Boundaries
INPEX Interests
Ichthys Gas Export Pipeline
INPEX Production Licence WA-50-L
Marine Turtle BIAs
Hawksbill Turtle
Loggerhead Turtle
Flatback Turtle
Green Turtle
Olive Ridley Turtle
Marine Turtle Habitat Critical Areas
Hawksbill Turtle
Loggerhead Turtle
Flatback Turtle
Green Turtle
Olive Ridley Turtle
INPEX
Projection: N/A
Datum: GDA94
Scale: 1:6,000,000
0 100 200
Kilometers
BROWSE REGIONAL OPEP
Biological Important Areas (BIAs) and Habitat Critical Areas: Marine Turtles
Date: 14 AUG 2021
Paper size: A3
Security classification: PUBLIC
Map ID: C090-DH-MAP-11076
Rev.: 0
Drawn: M. Burt
Request: D. Hazell



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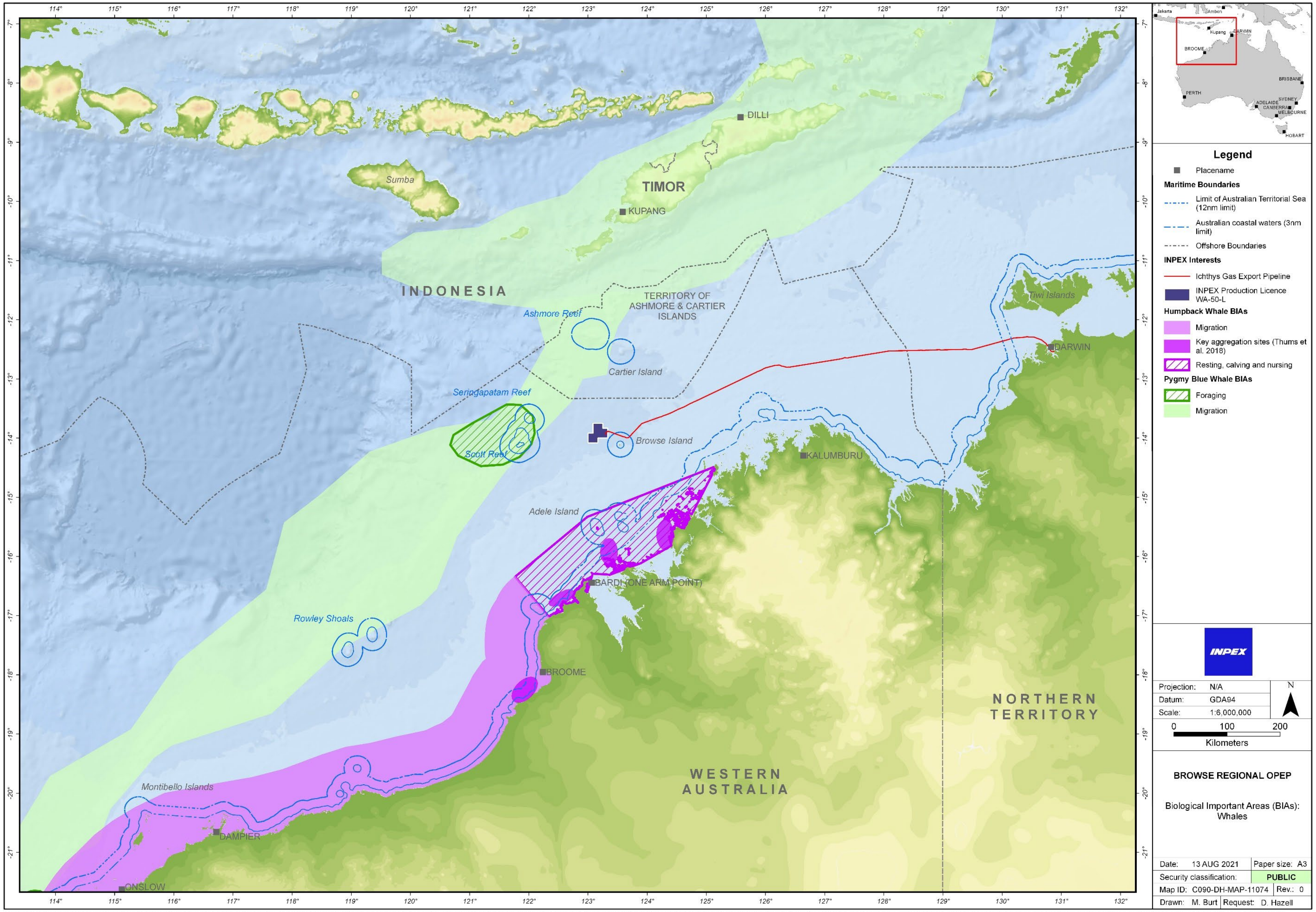

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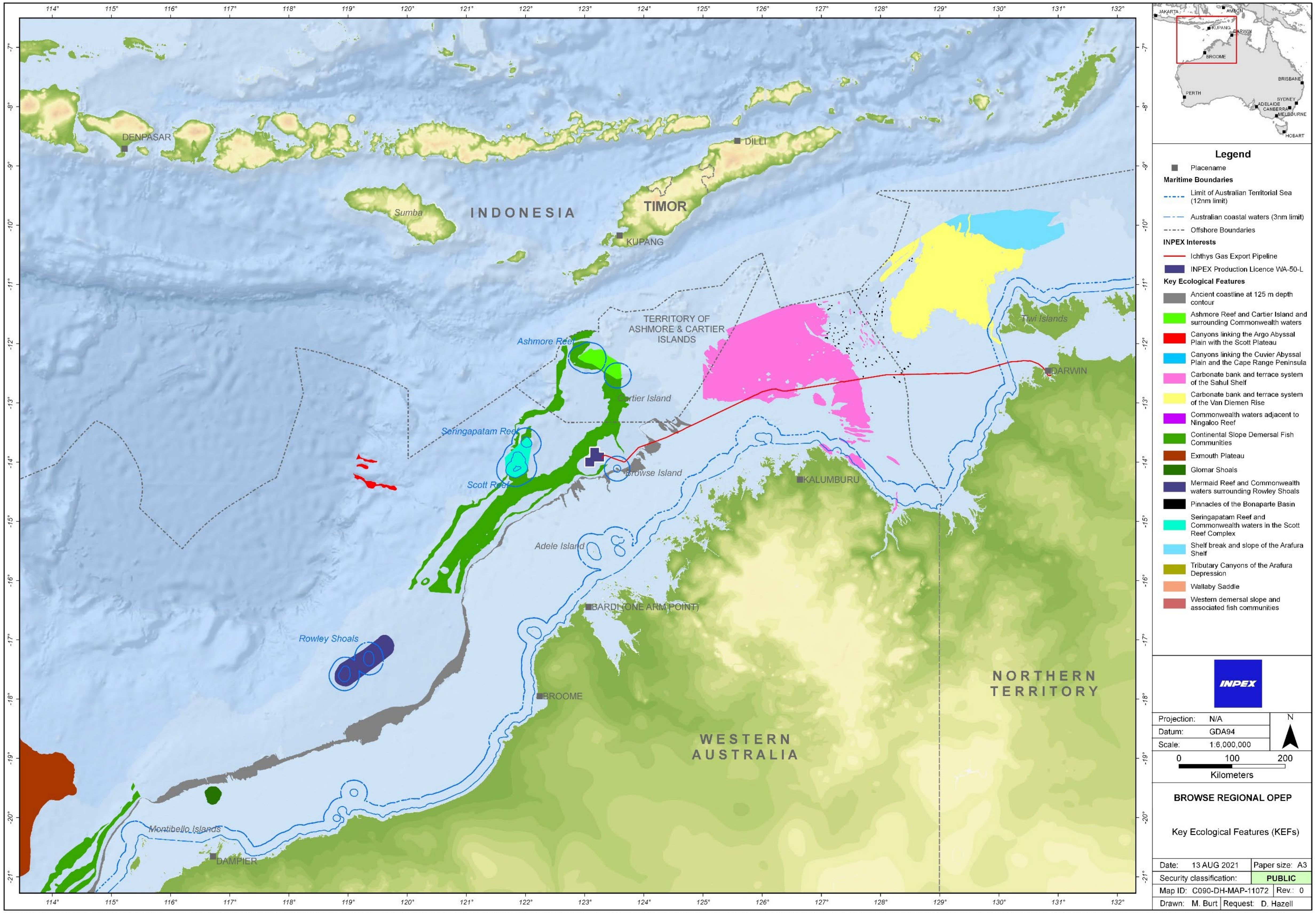

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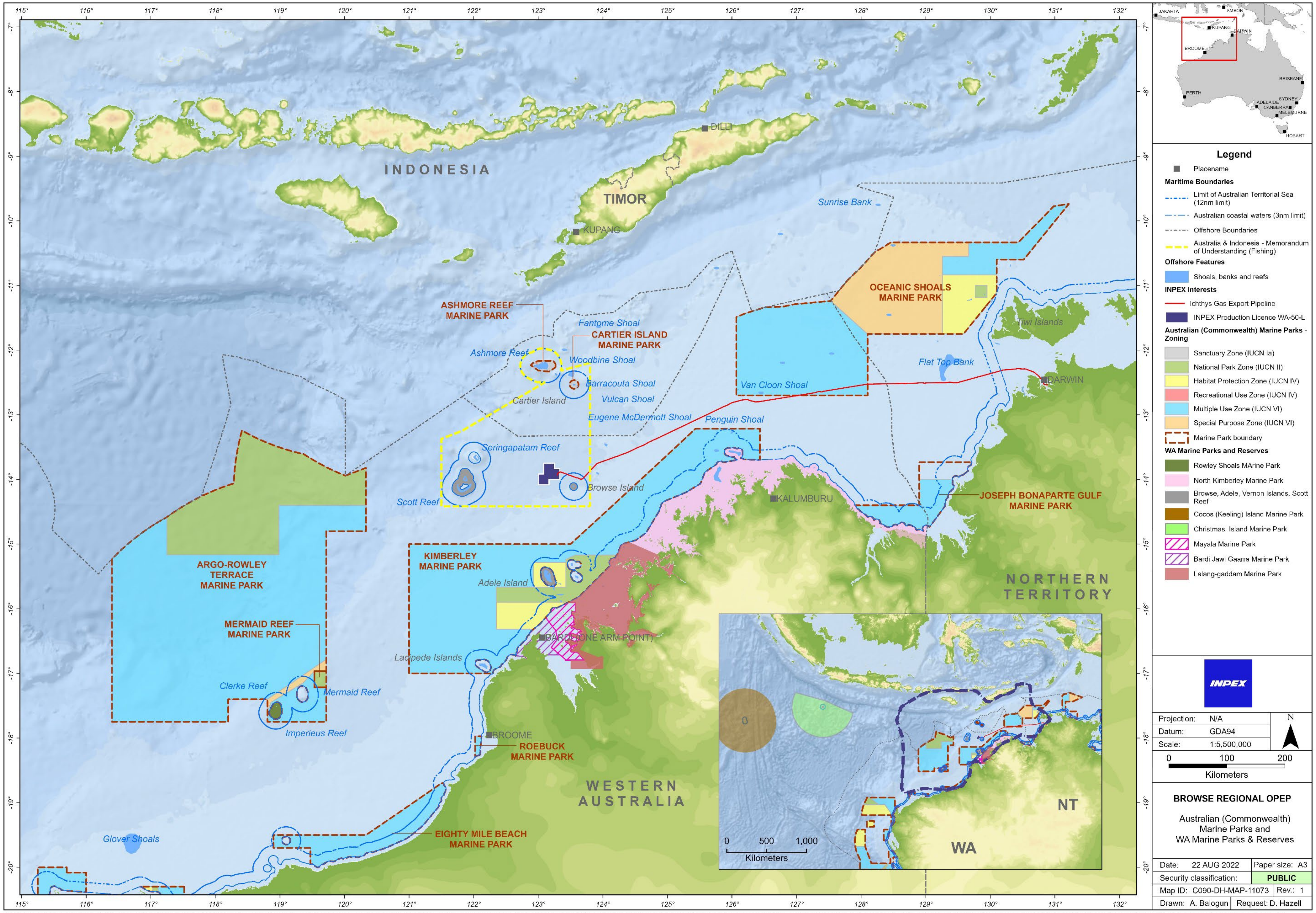

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INPEX Australia – Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment

Report

Document No.: X060-AH-REP-70016

Security Classification: Unrestricted

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2	30/03/2023	Issued for Use	Dan Hazell			

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NOTICE

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Acronym, abbreviation, or term	Meaning
AFEDO	Ayles Fernie Even Drop Out
AIS	automatic identification system
AHT	anchor handing tugs
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority (Cwlth)
APPEA	Australian Petroleum Production and Exploration Association
ASV	accommodation support vessel
AUD/year	Australian dollars per year
AT	air tractor
BAOAC	Bonn Agreement Oil Appearance Code
BIA	Biologically Important Area
BROPEP	INPEX Australia Browse Regional Oil Pollution Emergency Plan (X060-AH-PLN-70009)
BROPEP BOD/FCA	INPEX Australia BROPEP Basis of Design (BOD) and Field Capability Assessment Report (X060-AH-REP-70016)
BROPEP IMTCA	INPEX Australia - Browse Regional Oil Pollution Emergency Plan – Incident Management Team Capability Assessment (X060-AH-REP-70015)
BOD	Basis of Design
C&R	containment & recovery
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
CG	Core-Group
CPF	central processing facility

Acronym, abbreviation, or term	Meaning
DAWE	Department of Agriculture, Water and the Environment (Cwlth)
DBCA	Department of Biodiversity, Conservation and Attractions
DoT	Department of Transport
EEZ	Exclusive Economic Zone
EP	Environment Plan
EPBC	Environment protection and biodiversity conservation
EPO	environmental performance outcome
EPS	environmental performance standard
ERT	emergency response team
ESI	environmental sensitivity index
ESTB	electronic surface tracker buoys
E&P	exploration and production
FLNG	floating liquified natural gas
FOB	forward operational base
FPSO	floating production storage and offloading facility
ft	foot
FWAD	fixed wing aerial dispersant
g	gram
GEP	gas export pipeline
GERB	gas export riser base
GPS	global positioning system
Group I	condensate
Group II	MGO/diesel

Acronym, abbreviation, or term	Meaning
Group IV	IFO/HFO/LSHFO
HFO	heavy fuel oil
HSE	health, safety and environment
IAP	incident action plan
IBC	intermediate bulk container
ICAO	International Civil Aviation Organization
IFO	Intermediate Fuel Oil
IMR	inspection maintenance and repair
IMT	incident management team
ISB	in-situ burning
IT	Information Technology
JET A1/AVGAS	aviation fuel
km	kilometre
LNG	liquified natural gas
LSHFO	Low sulphur heavy fuel oil
m	metre
MGO	marine gas oil
mm	millimetre
MMscf	Million standard cubic feet
MoC	management of change
MODU	mobile offshore drilling unit
MSRC	Marine Spill Response Corporation
N/A	not applicable
NEBA	Net Environmental Benefit Analysis

Acronym, abbreviation, or term	Meaning
nm	nautical mile
NatPlan	National Plan for Maritime Environmental Emergencies
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority (Cwlth)
NRT	National response team
NT	Northern Territory
NWMR	North West Marine Region
OLGA	dynamic phase flow simulator modelling
OPEP	oil pollution emergency plan
OPGSS (E) regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cwlth)
OSCA	oil spill control agent
OSCP	oil spill contingency plan
OSMP	operational and scientific monitoring program
OSRL	Oil Spill Response Limited
OSTM	oil spill trajectory modelling
OSV	offtake support vessel
OWR	oiled wildlife response
PLR	pig launcher receiver
ppb	parts per billion
PPE	personal protective equipment
psia	pounds per square inch - absolute pressure
PSV	platform support vessel
P&D	protection and deflection
ROV	remote operated vehicle

Acronym, abbreviation, or term	Meaning
SAR	search and rescue
SCAT	shoreline clean-up assessment technique
SFRT	subsea first response toolkit
SIMA	spill impact mitigation assessment
SMV	surveillance, monitoring and visualisation
SPS	subsea production system
SSDI	subsea dispersant injection
URF	umbilicals risers and flowlines
µm	micrometre
VOC	volatile organic compound
WA	Western Australia
WCSS	Worst Credible Spill Scenario
%	percent

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to:

1. Present a summary of INPEX Australia's exploration and production (E&P) activities in Australian commonwealth waters, between waters offshore (west) of Broome/Dampier Peninsula (Western Australia (WA)) and waters offshore (north and west) of Darwin (Northern Territory (NT)) and out to the boundary of the Australian Exclusive Economic Zone (EEZ) / international maritime boundaries. This includes the Canning, Browse and Bonaparte petroleum basins, hereafter referred to as the Browse Regional Oil Pollution Emergency Plan (BROPEP) region.
2. Present a summary of the worst credible spill scenarios (WCSS) which could occur from the E&P activities and associated spill sources.
3. Provide stochastic modelling outputs for each of the WCSS. This forms the Basis of Design (BOD) to inform the field capability assessment.
4. Provide a summary of the Strategic Spill Impact Mitigation Assessment (SIMA) outcomes for response strategies considered for each of the WCSSs.
5. Assess which WCSSs are appropriate for detailed field response planning and provide the detailed oil spill response field capability analysis, for the selected WCSSs.
6. Define environmental performance outcomes (EPO) and environmental performance standards (EPS) for the oil spill response field capabilities and arrangements (preparedness), and the risk assessment of the implementation of the response strategies.
7. Provide an implementation strategy for this BROPEP BOD and Field Capability Assessment Report (BROPEP BOD/FCA), including management of change processes and compliance reporting requirements. Note, this implementation strategy section is appliable to all other BROPEP documents.

This process is aligned with the oil spill response planning processes defined in IPIECA-IOGP (2013) Oil spill risk assessment and response planning for offshore installations). Specifically, IPIECA-IOGP (2013) requires:

- Oil Spill Risk Assessment context – addressed in Section 2 of this document
- Hazard and consequence identification – addressed in Sections 3 and 5 of this document (as well as activity specific Environment Plans (EPs)
- Identify and describe release scenarios, including release rates/volumes, durations, modelling fate/trajectory, consequences/risk – addressed in Section 4 of this document
- Define release scenarios chosen for response planning – addressed in Section 6 of this document
- Assess response strategies/NEBA/SIMA – addressed in Section 5 of this document
- Define tactics (equipment, personnel, deployment, limitations etc) – addressed in Section 6 of this document
- Define response tiers, response resources, mobilisation/deployment times etc. – addressed in Sections 6, 7 and 8 of this document.

1.2 Limitations/ Out of scope

This document does not include planning and response capability/arrangements associated with the following:

- Environmental risk assessment and spill prevention/control
  - The following elements are contained within each activity specific EP:
    - detailed activity description
    - activity specific oil spill hazard identification, including potential release rates, volumes, locations, hydrocarbon types etc.
    - activity specific oil spill modelling, used to inform environmental risk assessment
    - description and risk assessment of oil spills on environmental values and sensitivities
    - evaluation of controls to prevent oil pollution from the described activity.
- Operational and scientific monitoring programs (OSMP)
  - The full OSMP capability requirement is addressed within the INPEX Australia Browse Regional Oil Pollution Emergency Plan (BROPEP) (X060-AH-PLN-70009 – Appendix B); however this document does address water quality monitoring, as related to supporting/informing at sea response strategies.
- Evaluation of controls to stop the flow of oil from a spill. For example;
  - Emergency shut-down systems, leak detection systems from production assets, pipelines etc are described in relevant production/operations EPs.
  - Shipboard Oil Pollution Emergency Plans are described/evaluated in all EPs which include vessel activities.
  - Well blow-out source control activities, including Incident Management Team (IMT) and field capabilities and arrangements are described/evaluated within the INPEX Australia Environment Plans Source Control Capability and Arrangements Report [D021-AH-REP-70000], including;
    - site survey
    - debris clearance
    - blow out preventer manual/remote intervention
    - capping stack deployment
    - relief well drilling.

Note, sub-sea dispersant injection, which can be utilised as both an environmental and safety control is within the scope of this document.

The inter-relationship of this document to other BROPEP documentation is presented in Table 1-1 and displayed in Figure 2-1.

Table 1-1 BROPEP documentation overview

Document title	Document number	Purpose
INPEX Environment Plans		All INPEX EPs contain a detailed activity description and activity-specific oil spill scenarios. Specifically, INPEX EPs include the following: • a description of the activity-specific spill scenarios (including the potential release rates, volumes, locations, hydrocarbon types, etc.) • activity-specific oil spill modelling (used to inform environmental risk assessments) • an assessment of oil spills risks/impacts on environmental values and sensitivities • evaluations of controls to prevent oil pollution from the specific activity. The WCSS from all INPEX EPs are included in the INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment.
Strategic Spill Impact Mitigation Assessments (SIMAs): • Condensate spill – instantaneous surface release • Marine gas oil (MGO)/diesel spill – instantaneous surface release • Intermediate fuel oil (IFO)/heavy fuel oil (HFO) spill – instantaneous surface release • Condensate/gas well or pipeline blowout – long duration subsea release	X060-AH-LIS-60031 X060-AH-LIS-60032 X060-AH-LIS-60033 X060-AH-LIS-60034	The four INPEX Strategic SIMA documents are pre-spill planning tools. These are used to facilitate response option selection by identifying and comparing the potential effectiveness and impacts of the various oil spill response strategies on a range of environmental values and sensitivities. The Strategic SIMAs utilise a semi-quantitative process to evaluate the impact mitigation potential of each response strategy. This method provides a transparent decision-making process for determining which response strategies are most likely to be effective at minimising oil spill impacts. The SIMA process includes environmental considerations as well as a range of shared values such as ecological, socio-economic and cultural aspects.
INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment (BROPEP BOD/FCA) (this document)	X060-AH-REP-70016	The BROPEP BOD/FCA presents an overview of all of INPEX Australia's offshore petroleum exploration and production activities and associated oil spill risks. It includes an evaluation of modelling outcomes from a series of selected WCSSs and presents an oil spill response field capability analysis.

Document title	Document number	Purpose
		The BROPEP BOD/FCA includes the EPOs and EPSs relevant to the preparedness and environmental risk assessment of field response capability and arrangements and the broader BROPEP implementation strategy (i.e. reviews, management of change process, etc.).
INPEX Australia - Browse Regional Oil Pollution Emergency Plan – Incident Management Team Capability Assessment (BROPEP IMTCA)	X060-AH-REP-70015	The BROPEP IMTCA utilises the field capability assessments as inputs to evaluate the size and structure of the INPEX IMT necessary to mobilise and maintain the field capability. The BROPEP IMTCA outlines the EPOs and EPSs relevant to INPEX IMT capability and arrangements.
INPEX Australia - Browse Regional Oil Pollution Emergency Plan (BROPEP)	X060-AH-PLN-70009	The BROPEP is the tool which will be utilised by the INPEX IMT during any impending/actual oil spill event. This document assists/guides the IMT through the process of notifications, gaining/maintaining situational awareness, response strategy evaluation and incident action plan (IAP) development, and mobilisation of field response capabilities. The BROPEP outlines the EPOs and EPSs related to the implementation of response strategies.

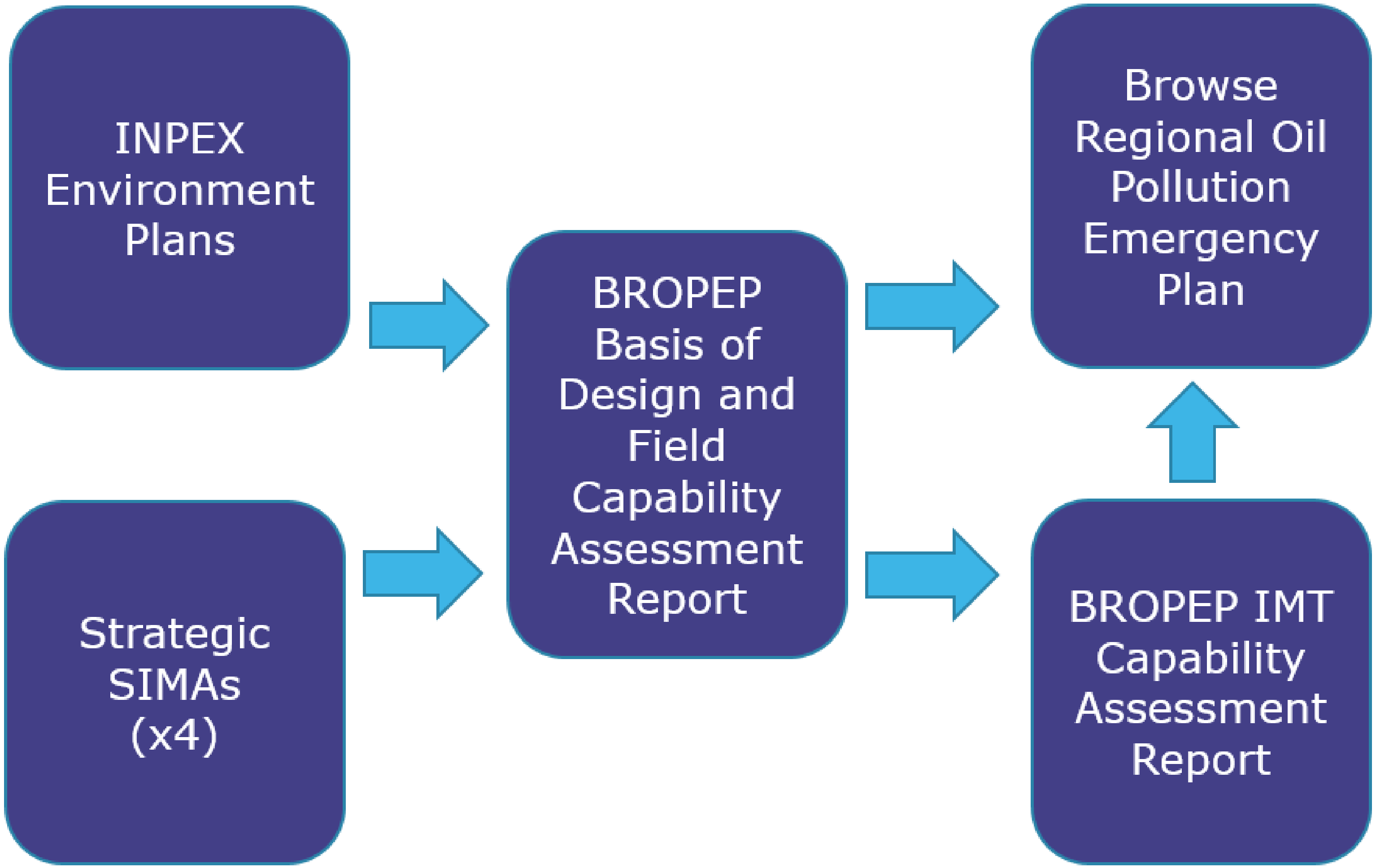


Figure 1-1 BROPEP document structure

2 INPEX AUSTRALIA EXPLORATION AND PRODUCTION ACITVIITES OVERVIEW – BROPEP REGION

INPEX Ichthys Pty Ltd, on behalf of the Ichthys Upstream Unincorporated Joint Venture Participants, is developing the Ichthys Field in the Browse Basin off the north west coast of Western Australia to produce condensate offshore for export to markets in Japan and elsewhere, and export gas for further processing at the Ichthys liquefied natural gas (LNG) plant in Darwin.

Initial development wells were drilled and the Ichthys LNG offshore facilities were installed and commissioned from 2014 through to 2018. The assets commenced production in July 2018 and now routinely ship cargoes of condensate from the FPSO to international customers and send gas to the Darwin plant via the Gas Export Pipeline.

The existing facilities consist of a subsea production system (SPS) (E.g., xmas trees, manifolds, subsea control systems and umbilicals, risers and flowlines (URF), and the gas export riser base (GERB), which connect the wells to the Central Processing Platform (CPF) Ichthys Explorer and Floating Production Storage Offtake – (FPSO) Ichthys Venturer

The CPF/FPSO, GEP and onshore Ichthys LNG plant are collectively referred to as the Ichthys Project.

INPEX Australia's offshore exploration activities (seismic and drilling) are focused on identification of additional petroleum reserves to tie-back into the Ichthys Project, either at the CPF/FPSO, or onto any of the five hot-tap-tees along the length of the GEP, within the Canning, Browse and Bonaparte basins. Therefore, exploration activities are generally located within the same geographic area as the Ichthys Project in Commonwealth waters between Broome and Darwin.

Typical petroleum activities undertaken by INPEX Australia in the Commonwealth waters offshore of northern WA and the NT may include:

- 2D / 3D seismic exploration surveys
- exploration, appraisal and production drilling, including completions and plug and abandonment of wells
- geophysical and geotechnical surveys
- subsea/topside infrastructure installation, commissioning, maintenance and repair
- operation and maintenance of topside/floating production facilities including condensate offtakes to tankers in the Ichthys Field
- operation of subsea production systems and pipelines

A map of INPEX's petroleum permits/licence areas and petroleum activities (current at the time of preparation of this document, Rev0, August 2021) are displayed in Figure 2-1.

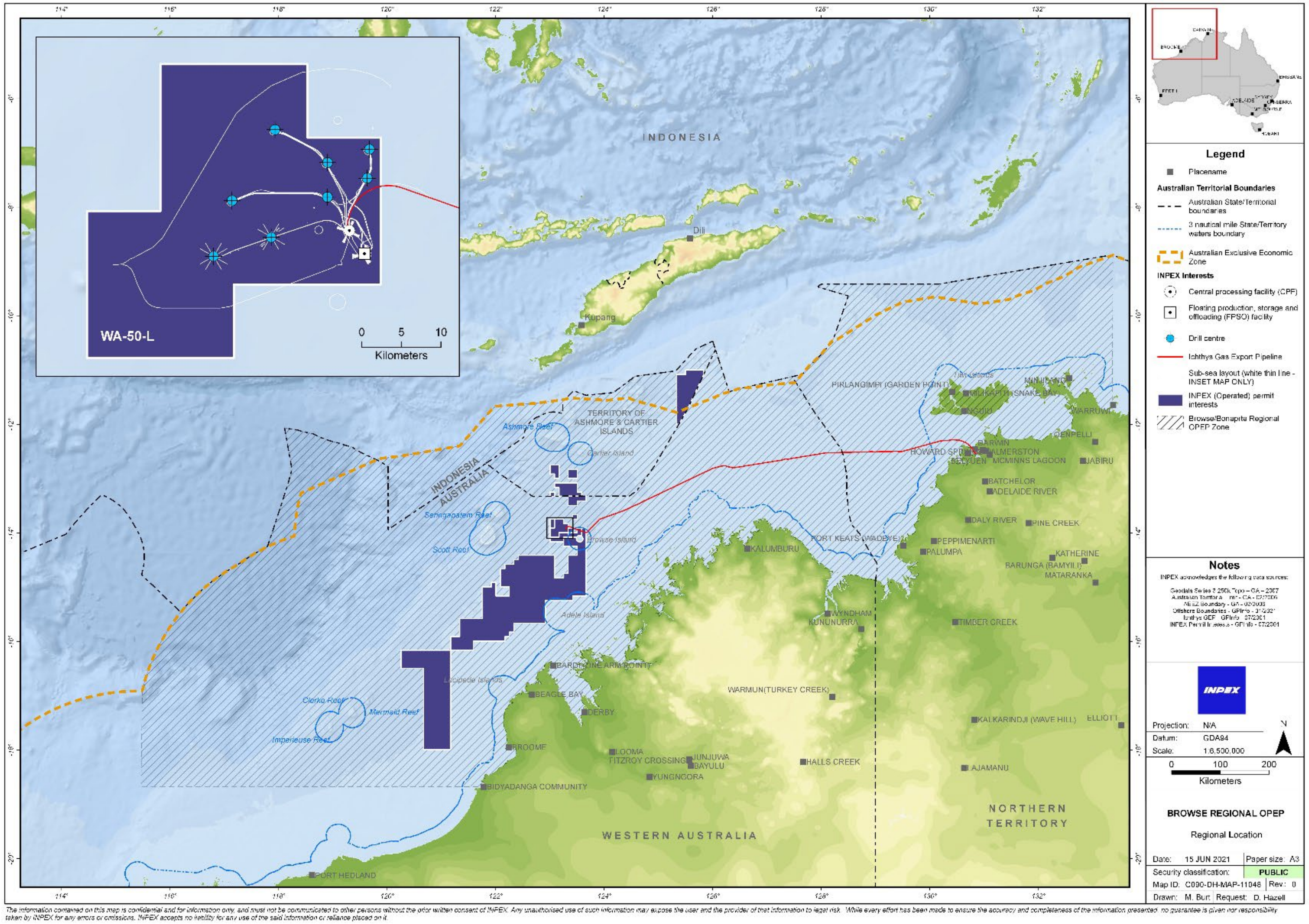


Figure 2-1 Geographical coverage of this BROPEP and INPEX Australia offshore petroleum activities.

3 WORST CREDIBLE SCENARIOS

To facilitate regional response planning, an evaluation of INPEX's petroleum activities undertaken in the region, and the associated potential Level 2/3 spill sources was undertaken (refer to Section 6.5 for definitions of 'tiers/levels').

Once all potential Level 2/3 spill sources were identified, a process was undertaken to evaluate and determine the WCSS for each Level 2/3 spill source.

For each WCSS, parameters were defined include:

- spill source (facility/vessel)
- oil/hydrocarbon type
- release volume
- release rate & duration
- spill location(s)

The parameters are then used as inputs to spill modelling for the WCSSs. The spill modelling outputs are presented and evaluated in Section 4, to inform regional response planning.

Justifications have been provided to demonstrate why the WCSSs parameters are representative of the WCSS for the spill sources/activities in the region. For example, simple metrics include the most persistent oil type, largest release volume or fastest release rate etc.

Where a spill source may be mobile (E.g., seismic survey or pipeline inspection vessels), modelling of multiple vessel spill scenarios at a variety of locations close to sensitive receptors may be warranted. This allows a titleholder, to acquire sufficient data to characterise worst credible oil spill outcomes across the range of values and sensitivities of the region.

Where activities such as exploration/production drilling are focused on a specific reservoir, modelling of well blowout at a location within the reservoir closest to sensitive receptors will likely provide the worst-case oil spill outcome. However, comparison with other well blowout data to verify the worst-case impact prediction may also be appropriate.

Table 3-1 presents a matrix of the INPEX Australia's petroleum activities in Commonwealth waters/Browse region, and the associated potential sources of Level 2/3 spill scenarios for each petroleum activity type.

Table 3-2 presents the WCSSs parameters and justifications.

Note, smaller spills, such as loss of day-tanks on topside infrastructure, hydraulic line releases or bunkering spills are not considered Level 2/3 spills. These spills are all smaller in volume than the selected WCSS's and therefore are not described within Table 3-1. Risk assessments and associated controls for these types of smaller spills are described within relevant activity specific EPs.

Table 3-1 INPEX Commonwealth Waters E&P Activities – Potential Level 2/3 spill sources

Activity Type	Potential Level 2/3 Spill Sources				
	Well blowout	**Vessel collision (MGO)**	**Vessel Collision (IFO/HFO)**	**Topside facility (CPF/FPSO etc.) loss of containment (condensate)**	**Pipeline/flowline rupture (condensate)**
2D / 3D seismic exploration surveys		X			
Exploration/appraisal/production drilling, including well workovers, plug and abandonment.	X	X			
Geophysical/geotechnical survey		X			
Subsea/topside infrastructure installation & commissioning		X	X		
Operation of production facility including production wells	X	X	X	X	
Operation of subsea production system & pipelines		X	X		X

Table 3-2 BROPEP WCSS Details and Justifications

WCSS	Release parameters	Justification
Well blow-out	**Oil Type** Group I - Brewster reservoir condensate **Release rate and volume** 3193 m^3/day over 80 days. Total release volume of 255,475 m^3 **Release location** Location 38 km west-north-west of Browse Island	INPEX's exploration and production drilling activities are centered the Browse Basin. Exploration drilling's focus is to identify additional reserves to tie-into the existing production infrastructure are ongoing. Therefore, exploration drilling activities tend to be focused on near-by Brewster and Plover reservoir targets, in close proximity to the Ichthys Field. For a WCSS well-blowout, Brewster and Plover condensates are similar in composition. However, Brewster reservoir has approximately twice the condensate flowrate compared to the Plover reservoir. Therefore, Brewster scenarios are considered to represent the WCSS. A location on the south-east corner of the Brewster reservoir, known as the Holonema-B location, was selected as this is the closest location of that reservoir to the nearest shoreline receptor (Browse Island). The selection of this location should result in the fastest time to shoreline contact and greatest volume of oil ashore, during the wet season, which is dominated by westerly wind-flow. The Holonema-B location is therefore considered to be the WCSS for any exploration/production drilling activities of the Brewster and Plover reservoirs within the Ichthys Field and other Permit Areas with Brewster/Plover reservoir in the Browse Basin. For comparative/regional planning purposes, a comparison of other Brewster and Plover well-blowout data modelling in the region has also been conducted. The location of all well blowout modelling data and well blowout modelling inputs parameters is presented in Figure 4-1. The well blowout spill model output data is presented in Table 4-3.
FPSO collision - condensate tank rupture	**Oil Type** Group I - Brewster condensate processed on FPSO **Release rate and volume** 2-hour release of 5700 m^3 at surface **Release location** Location 35 km west of Browse Island	With respect to the Ichthys Venturer FPSO condensate tank spill volume, the AMSA (2015) guidance recommends for an 'oil tanker non-major collision' that either 100% of largest wing tank or 50% if protected by double hull is an appropriate spill volume. All FPSO cargo tanks are arranged inboard of ballast tanks. The largest condensate cargo tank immediately inboard of a ballast tank is 11,353 m^3; 50% of this volume is 5,677 m^3. This volume was rounded up to 5,700 m^3 for the WCSS modelling purposes. There are no other FPSO's operated by INPEX, therefore the Ichthys Venturer located in the Ichthys Field is considered the WCSS for a FPSO collision scenario.

WCSS	Release parameters	Justification
Ichthys GEP rupture	**Oil Type** Group I - Brewster gas and condensate, post-processing on the CPF **Release rate and volume** 250 m water depth - 4-day release at seabed (exponentially decreasing release rate, ranging from 3,030 to 0.225 m^3/hour 70 m water depth - 2-day release at seabed. Exponentially decreasing release rate, ranging from 3,804 to 0.003 m^3/hour. Total condensate release volume of ~12,600 m^3 (250m depth) to ~9,700 m^3 (70m water depth) **Release location** Various release locations along the GEP route (refer Figure 4-2, Locations A, H, I, J and K).	INPEX operate the Ichthys Gas Export Pipeline (GEP). When production is occurring on the CPF and at the onshore Ichthys LNG Plant, gas/condensate flows from the CPF toward the onshore plant, resulting in a pressure gradient between the CPF (higher pressure end of the GEP) and the onshore plant (lower pressure end of the GEP). The GEP inventory during operation is up to 5800 MMscf. However, prior to a planned maintenance shut-downs, the GEP will be allowed to 'settle-out', where the pressure between the CPF and I-LNG beach-valve become effectively equal. The GEP inventory at maximum settle-out pressure is up to 6200 MMscf. Therefore, the spill scenario modelled for the GEP was conducted based on a situation when the GEP is at 'settle-out' pressure and has maximum gas/condensate inventory. OLGA modelling was conducted for a GEP full-bore rupture at three water depths: -250 m (Ichthys Field water depth), -150 m and -70 m (Commonwealth/NT waters boundary water depth). The outcomes of the OLGA modelling calculated total condensate release volumes of ~12,600 m^3 (-250m water depth) to ~9,700 m^3 (-70m water depth). A full-bore rupture of the GEP at the CPF end (-250 m water depth) is considered a worst-case spill, due to the greatest condensate release volume, but also due to the additional 25 bar of pressure at seabed, which results in a slower rise-time for the gas/condensate from the GEP to the ocean surface, resulting in the greatest level of entrainment of condensate in the water column during the release event. A shallower depth of the release will result in less condensate entrainment in the water column.

WCSS	Release parameters	Justification
Vessel collision (Offtake tanker or installation vessel)	**Oil Type** Group IV - Heavy fuel oil (HFO), Intermediate Fuel Oil (IFO), or Low Sulphur Heavy Fuel Oil (LSHFO) **Release rate and volume** 2-hour release of 776 m^3 at surface **Release location** Location - Ichthys Field near CPF/FPSO. Refer to Figure 4-2	There are only two vessel-based activities where Group IV oils may be utilised. There are: • condensate offtake tankers, which potentially have Group IV oils as bunker fuel onboard • medium/heavy lift vessels, used to install a Pig-Launcher-Receiver (PLR) at the GERB, (adjacent to the CPF). Therefore, this scenario is geographically limited to activities inside the Ichthys Field, near the CPF/FPSO only. As traditional HFO is considered the most persistent oil, this oil has been selected for the scenario. Offloading Tankers which could contain HFO, IFO or LSHFO will only conduct offtake operations in the Ichthys Field adjacent to the FPSO. With respect to the offloading tanker loss of containment spill volume, AMSA (2015) guidance recommends for an 'oil tanker non-major collision' that either 100% of largest wing tank or 50% if protected by double hull is an appropriate spill volume. However, INPEX does not select the tankers that arrive in the Browse Basin, and there is uncertainty around the tanker specification and general arrangements. Therefore, the WCSS is based on the general arrangements of an Aframax tanker (100% of largest wing tank) and acknowledged the distance between the Ichthys Field and the nearest bunkering port in Singapore as well as the ability for fuel to be transferred from a damaged wing tank in the event of a breach. Due to the uncertainty and variability in tanker specifications potentially arriving in the Ichthys Field, the spill volume modelled (776 m^3) is considered to adequately provide an indication of a WCSS from a collision involving an offtake tanker. Large installation vessels may operate near the CPF/FPSO in the Ichthys Field, e.g., installing additional modules on the CPF/FPSO, or installing a PLR on the GERB. DNV (2015) – Clean Design requirements for double-hull / fully protected internal tanks, allow for a maximum tank size of 1500 m^3. Combined with AMSA (2015) vessel collision guidance of 50% loss of tank protected by double hull, this defines a WCSS from an installation vessel which is compliant with DNV (2015) as 750 m^3. Therefore, the 776 m^3 HFO spill volume is considered appropriate.
Vessel collision	**Oil Type** Group II - marine gas oil (MGO) or marine diesel oil (MDO) **Release rate and volume**	There may be other construction/installation vessel which could conduct activities in the Ichthys Field which have larger tanks and use Group II oils. These large construction/installation vessels may be DNV 2015 "clean design" compliant and have up to 1500 m^3 of Group II oil/fuel in double wall tanks. These scenarios are addressed by the 776m^3 HFO WCSS, presented above. All other planned/foreseeable vessel activities outside the Ichthys Field are anticipated to use Group II fuels, with smaller vessels, which generally have unprotected wing tanks.

WCSS	Release parameters	Justification
(Seismic survey, supply/support vessel activities, geophysical and geotechnical surveys, GEP inspection, maintenance and repair).	Instantaneous release at surface 500 m^3 total release volume **Release location** Various locations, refer to Refer to Figure 4-2.	A review of the expected tank sizes associated with seismic surveys, support vessel activities, geophysical/geotechnical activities and inspection, maintenance and repair (IMR) vessels indicated the largest tank size to be approximately 284 m^3 (from a 2D seismic survey vessel). 250 m^3 spill scenarios have also been modelled, as typical largest individual wing tank size for most other typical offshore support, survey or IMR vessels. 1000 m^3 is largest internal tank of a 3D seismic vessel, however as these are typically DNV "Clean Design", the credible scenario is 500 m^3. Jack-up drill rig operating in shallow waters is also up to 500 m^3. AMSA guidance (AMSA 2015) recommends that the maximum credible volume spill for a vessel collision scenario be based on the volume of the largest single fuel tank - if not protected by a double hull. Therefore, 500 m^3 is considered the WCSS for vessels using Group II fuels operating outside of the Ichthys Field.

4 MODELLING SUMMARY OF WORST CREDIBLE SPILL SCENARIOS

This section presents the details and outputs of spill modelling which has been undertaken and utilised to inform regional spill response planning.

Section 4.1 provides a summary of all the WCSS stochastic modelling scenarios which have been utilised for regional response planning.

Section 4.2 discusses the various response strategy planning thresholds which have been selected to inform response planning/field capability assessments.

Section 4.3 presents the outputs of the WCSS stochastic modelling against the response planning thresholds. For each WCSS stochastic modelling set, the stochastic runs have been analysed to identify the individual worst-case stochastic run, as related to each individual response planning threshold. This data set is then termed the 'Basis of Design' (BOD) for each WCSS. The BOD is used to inform the Field Capability Assessments, which are presented in Section 6.

4.1 Overview of WCSS modelling

INPEX has selected a range of oil spill modelling scenarios which align with the WCSSs for each spill source. Some model scenarios have been modelled previously, as part a previously submitted EPs. Other scenarios have been selected specifically for this regional response plan. In addition, where specific response strategy planning thresholds were not included in some previously developed model outputs, for several WCSSs, the stochastic modelling data has been retrieved from archive and re-processed to acquire the relevant data required for regional response planning.

Table 4-1 provides a summary and references to the various oil spill modelling reports.

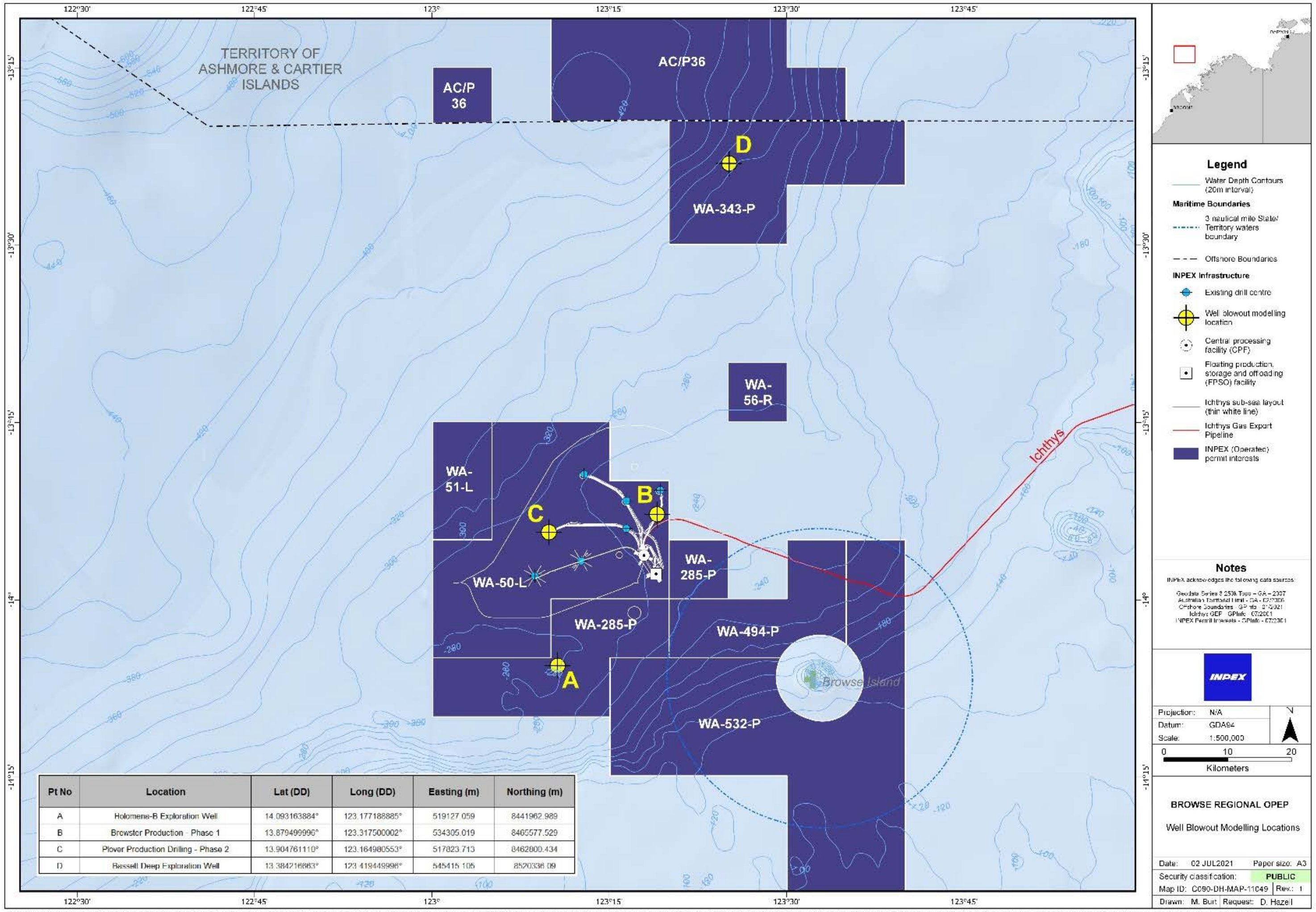
The geographic locations of the modelled well blowout scenarios are presented in Figure 4-1.

The geographic locations of the various vessel collision and GEP rupture WCSSs are presented in Figure 4-2.

Table 4-1 WCSS modelling reports

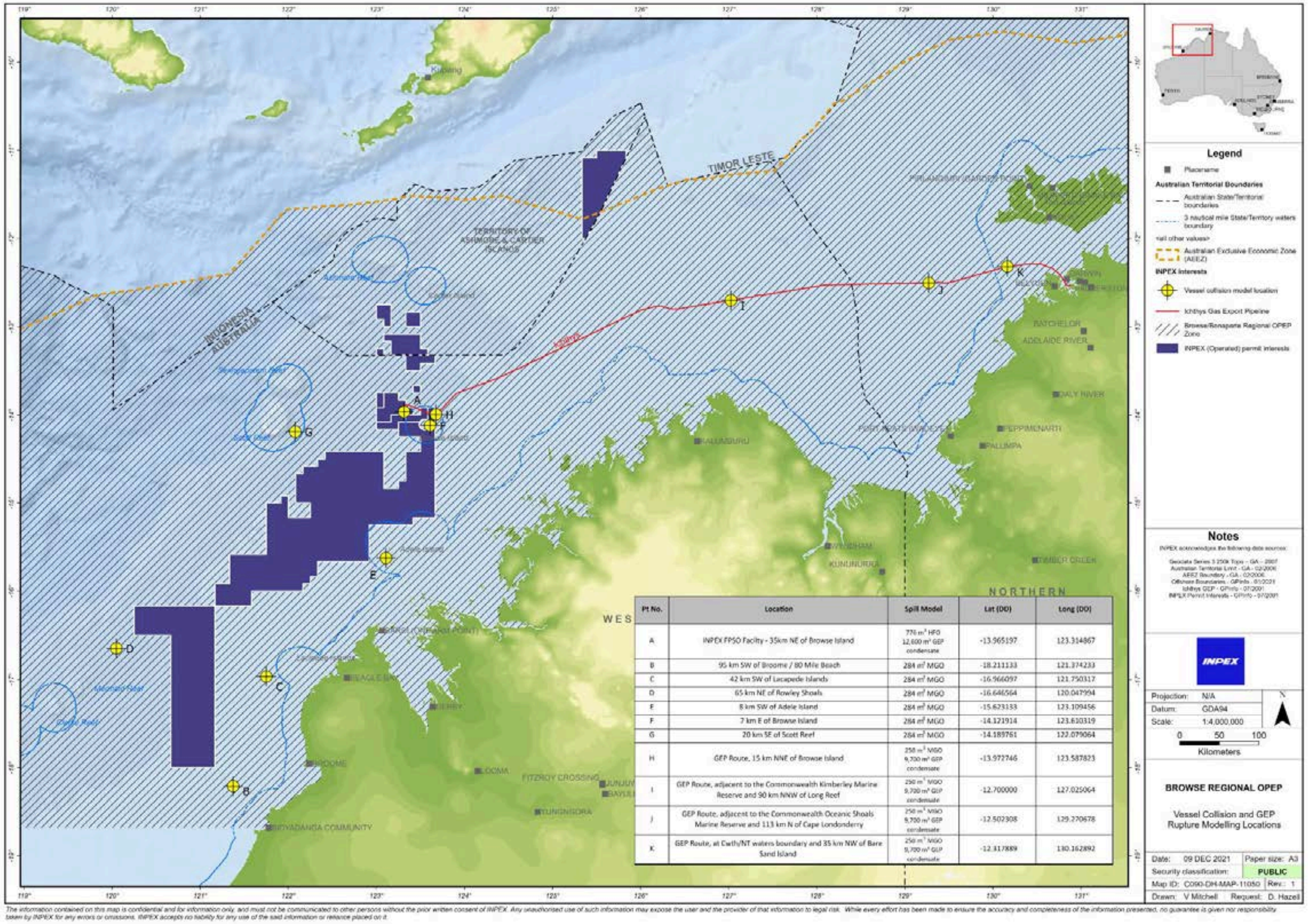
WCSS	Modelling Report References
Ichthys Phase 1 Production Drilling - Brewster condensate well blow-out	Asia-Pacific Applied Science Associates (APASA). 2013. *Brewster Development Wells WA 285: Quantitative Oil Spill Exposure Modelling.* J0203. Report prepared by Asia-Pacific Applied Science Associated. Prepared for INPEX Operations, Perth, Western Australia.
Phase 2A – Plover condensate well blow-out	RPS. 2019a. *INPEX Ichthys Phase 2 Development WA-50-L Oil Spill Risk Assessment. MAW0796J*. Report prepared by RPS for INPEX Operations Australia, Perth, Western Australia.
Bassett Deep Exploration Well – Plover condensate well blow-out	RPS. 2022a. *INPEX Bassett Deep WA-343-P Quantitative Spill Risk Assessment* MAW1225J.000 Rev 1. March 2022. Report prepared by RPS for INPEX Operations Australia, Perth, Western Australia.
Holonema-B Exploration Well – Brewster condensate well blow-out	RPS. 2021a. INPEX *Holonema Quantitative Spill Risk Assessment Report*. MAW1003J.000. Prepared by RPS Group. Prepared for INPEX, Perth, Western Australia.

WCSS	Modelling Report References
FPSO 5700 m^3 condensate tank rupture	RPS APASA. 2014a. *Ichthys Offshore Operations Gap Analysis – Quantitative Spill Risk Assessment*. J0312. Prepared by RPS ASAPA PTY LTD. Prepared for INPEX Operations Australia Pty. Subsequent reprocessing: RPS 2021b. *Spill Risk Assessment for INPEX Ichthys FPSO. Reassessment of spill scenario – release of Brewster Condensate onto the water surface*. Report MAW1003J.000. Prepared by RPS Group. Prepared for INPEX, Perth, Western Australia.
Vessel collision 776 m^3 HFO spill	RPS APASA. 2014b. *Ichthys Offshore Operations Gap Analysis – Quantitative Spill Risk Assessment. Scenario OSC 31 – Offtake Tanker Fuel Inventory – Loss of Containment at 250 m from the FPSO Stochastic Modelling Results*. J0312. Prepared by RPS ASAPA PTY LTD. Prepared for INPEX Operations Australia Pty. Subsequent reprocessing: RPS. 2021c. *Spill Risk Assessment for INPEX Ichthys FPSO - Reassessment of HFO spill scenario*. Report WAW1003J.000. Prepared by RPS Group. Prepared for INPEX, Perth, Western Australia. Report MAW1003J.000. Prepared by RPS Group. Prepared for INPEX, Perth, Western Australia.
Vessel collision 284 m^3 MGO spill	RPS. 2019b. *WA-532-P, WA-533-P and WA-50-L. Oil Spill Risk Assessment.* MAW0757J. Prepared by RPS Australia West Pty Ltd. Prepared for INPEX Operations Australia Pty Ltd. Subsequent reprocessing: RPS. 2021d. *Spill Risk Assessment for INPEX - Reassessment of 2D seismic spill scenarios*. Report MAW1003J.000. Prepared by RPS Group. Prepared for INPEX, Perth, Western Australia.
Vessel collision 250 m^3 MGO spill	RPS APASA. 2015. *INPEX – Ichthys GEP vessel spills. Scenario 2 Results Summary. Quantitative Oil Spill Risk Assessment*. J0285. Prepared by APASA. Prepared for INPEX Operations Australia Pty Ltd. Subsequent reprocessing: RPS. 2021e. *Spill Risk Assessment for INPEX - Reassessment of GEP route vessel MGO spill scenarios*. Report MAW1003J.000. Prepared by RPS Group. Prepared for INPEX, Perth, Western Australia.
Vessel collision 500 m^3 MGO spill	RPS. 2022b. INPEX Marine Gas Oil Vessel Spill Quantitative Spill Risk Assessment. Report. MAW1126J.000. Prepared by RPS Group. Prepared for INPEX, Perth, Western Australia.
Ichthys GEP full bore rupture 12,600 m^3 condensate spill	RPS. 2021f. *Spill Risk Assessment for INPEX Ichthys GEP*. Report MAW1003J.000. Prepared by RPS Group. Prepared for INPEX, Perth, Western Australia.



Pt No	Location	Lat (DD)	Long (DD)	Easting (m)	Northing (m)
A	Holomena-B Exploration Well	14.093163884°	123.177188885°	519127.059	8441962.989
B	Brewster Production - Phase 1	13.879499996°	123.317500002°	534305.019	8465577.529
C	Plover Production Drilling - Phase 2	13.904761110°	123.164980553°	517823.713	8462800.434
D	Bassell Deep Exploration Well	13.384216663°	123.419449998°	545415.105	8520336.09

Figure 4-1 Well Blowout WCCS Locations



Pt No.	Location	Spill Model	Lat (DD)	Long (DD)
A	INPEX FPSO Facility - 35km NE of Browse Island	776 m³ HFO 12,600 m³ GEP condensate	-13.965197	123.314867
B	95 km SW of Broome / 80 Mile Beach	284 m³ MGO	-18.211133	121.374233
C	42 km SW of Lacepede Islands	284 m³ MGO	-16.966097	121.750317
D	65 km NE of Rowley Shoals	284 m³ MGO	-16.646564	120.047994
E	8 km SW of Adele Island	284 m³ MGO	-15.623133	123.109456
F	7 km E of Browse Island	284 m³ MGO	-14.121914	123.610319
G	20 km SE of Scott Reef	284 m³ MGO	-14.189761	122.079064
H	GEP Route, 15 km NNE of Browse Island	250 m³ MGO 9,700 m³ GEP condensate	-13.972746	123.587823
I	GEP Route, adjacent to the Commonwealth Kimberley Marine Reserve and 90 km NNW of Long Reef	250 m³ MGO 9,700 m³ GEP condensate	-12.700000	127.025064
J	GEP Route, adjacent to the Commonwealth Oceanic Shoals Marine Reserve and 113 km N of Cape Londonderry	250 m³ MGO 9,700 m³ GEP condensate	-12.502308	129.270678
K	GEP Route, at Cwth/NT waters boundary and 35 km NW of Bare Sand Island	250 m³ MGO 9,700 m³ GEP condensate	-12.317889	130.162892

Figure 4-2 Vessel collision and GEP rupture WCSS locations

4.2 Response Strategy Planning Thresholds

Spill model outputs can be utilised to inform spill response strategy planning. Whilst IPIECA-IOGP (2013) doesn't provide any specific response strategy planning thresholds, several suitable thresholds have been identified and utilised in oil spill planning within the Australian upstream petroleum industry for a number of years.

The thresholds generally assist with WCSS response strategy planning, by either providing an indication of the minimum timeframe that should be planned for the activation of a certain response strategy, or the size/tier of field capability required for a certain response strategy.

Table 4-2 presents a literature review of various response strategy planning thresholds and discusses how each threshold can be used to inform response strategy planning.

Note, the response planning thresholds presented are not the actual response strategy activation triggers, which would be used in an actual oil spill event by the IMT. The response strategy planning thresholds are utilised during the development of the BOD, presented in Section 4.3 and this information is then used to inform the field capability assessments presented in Section 6.

Response strategy activation triggers to be utilised as decision making tools by an IMT during a real spill event are detailed in the BROPEP (X060-AH-PLN-70009).

The thresholds used to evaluate the environmental risk associated with an oil spill event are defined within the activity specify EP.

Table 4-2 Response Strategy Planning Thresholds

Response strategy planning threshold	Response strategy planning considerations	Reference / justification
Max lineal distance (km) where floating oil >1g/m^2	Used to inform response planning regarding the: • maximum range of surveillance, monitoring and visualisation (SMV) (E.g., aerial surveillance, satellite imagery etc) (Note, this floating oil threshold and entrained/dissolved thresholds can also be used to inform the potential extent of Operational and Scientific Monitoring programs, however these parameters aren't primary consideration for OSMP capability planning).	The Bonn Agreement Oil Appearance Code (BAOAC) is a series of five categories or 'codes' that describe the relationship between the appearances of oil on the sea surface to the thickness of the oil layer. Bonn-Code 1 refers to silver/grey sheens of floating oil and Bonn Code 2 includes rainbow sheen (thickness of 0.0003mm to 0.005mm, or 0.3 /m^2 to 5 g/m^2). 1 g/m^2 is therefore at the lower end of Bonn Code 2. Therefore, >1 g/m^2 has been selected as an appropriate minimum thickness to be used during oil spill modelling, to inform the geographic area which may potentially be impacted by oil, causing effects to socio-economic values, and at which water quality within a marine protected area may have been altered (NOPSEMA 2019). Therefore, during WCSS response planning, aerial/satellite surveillance capability/arrangements should be evaluated against this threshold.
Maximum instantaneous area (km^2) where floating oil >50g/m^2	Used to inform response planning regarding the: • geographic area in which to undertake surface chemical dispersant (aerial/vessel) • geographic area in which to undertake containment & recovery (C&R) (booms and skimmers) • geographic area in which to undertake in-situ burning (ISB). • note; emulsification and changes in viscosity are factors potentially limiting the effectiveness of C&R, and more significantly, changes in viscosity and/or emulsification can reduce dispersant effectiveness. Therefore consideration of these factors may be required during evaluation of modelling outcomes for response planning.	Generally, oil needs to be >100 g/m^2 (>0.1mm, which equates to Bonn Code 4/5) to feasibly corral oil with a boom and achieve any significant level, or operationally efficient level, of oil recovery with skimmers during an offshore C&R operation (O'Brien 2002; IPIECA-IOGP 2015a). In addition, as the capture/containment and corralling of oil with booms is required for ISB, this threshold is considered appropriate for that response strategy. IPIECA-IOGP (2015b) and the National Research Council (2005) state that generally oil slicks need to be >100 g/m^2 (>0.1mm, which equates to Bonn Code 4/5) to feasibly achieve a successfully dispersant operation. Whilst 100 g/m^2 may be the threshold for on water response strategy effectiveness stated in the literature, when evaluating oil spill modelling outputs, a lower response strategy planning threshold is considered appropriate.

Response strategy planning threshold	Response strategy planning considerations	Reference / justification
	• note; this threshold is not relevant for protection of sensitive resources response strategy. This response strategy typically uses booms to deflect/corral oil, the same as at sea containment and recovery. However, unlike at sea containment and recovery (which requires >100g/m^2 floating oil thickness for operational efficiency), when conducting protection of sensitive resources, nearshore protection booms can be effective at deflecting low concentrations of floating oil, over a long duration, to prevent long-term accumulation of oil in a sensitive receptor. Therefore, there is no specified response planning threshold defined for the protection of sensitive resources response strategy. • note; whilst this threshold is relevant for surface dispersant application, it's not relevant for subsea dispersant injection (SSDI). Planning for SSDI should be based on consideration of the reservoir oil properties, flowrates and the effectiveness of selected dispersants on the oil type.	The effects of winds, currents etc. cause oil to spread, and it often forms into windrows with a range of oil thicknesses across a given area. During oil spill modelling, the oil thickness within a grid-cell is averaged. Therefore, for a grid-cell reporting an average thickness of 50 g/m^2, there will be range of thicknesses, due to oil behaviour, including patches/windrows/streamers of oil, of which some will be >100 g/m^2. 50 g/m^2 is aligned with the recommendation of NOPSEMA (2019). Therefore, during WCSS response planning, on water response strategies including C&R, surface dispersant application and in-situ burning capability and arrangements should be evaluated against this threshold.
Longest length (km) or number of segments of shoreline oiled > 10 g/m^2	Used to inform response planning regarding the: • number of segments, and likely tier/size of shoreline clean-up assessment technique (SCAT) teams, including oiled wildlife response (OWR) and protection of sensitive resources assessments.	IPIECA-IOGP (2015c) classify oil on shorelines based on oil thickness. Stain is classified as <0.1mm (100g/m^2), and film as 'iridescent sheen', i.e., less than stain, with no minimum thickness. If film was considered an order of magnitude lower than stain, the thickness would be 0.01 mm (10 g/m^2). For comparative purposes, 0.01 mm thickness is equivalent to ~2 teaspoons oil/m^2. Oil is just visible at this thickness on a shoreline and there is potential for some socio-economic impacts at this thickness. Therefore, 0.01mm (10 g/m^2) is considered an appropriate threshold to understand the potential length of shoreline/number of shoreline sectors for which SCAT may be required. This is aligned with the recommendation of NOPSEMA (2019).

Response strategy planning threshold	Response strategy planning considerations	Reference / justification
		Therefore, during WCSS response planning, SCAT capability and arrangements should be evaluated against this threshold.
Minimum time to shoreline contact for oil >10g/m^2	Used to inform response planning regarding the: • timeline for mobilisation of SCAT, OWR and P&D assessment teams.	Understanding the shortest possible timeline between the spill event, and oil arriving on a shoreline at >10 g/m^2 provides a metric to consider, for the arrangements required for the mobilisation of a SCAT capability.
Longest length (km) or number of segments of shoreline oiled > 100 g/m^2	Used to inform response planning regarding number of segments, and likely tier/size of: • shoreline clean-up • OWR • protection of sensitive resources (or protect and deflect/P&D)	100 g/m^2 is often used as minimum thickness for effective shoreline clean-up (Owens and Sergy. 2000), and French-McCay (2009) conclude that 100 g/m^2 is the minimum oil thickness for effects on marine fauna and invertebrates on a shoreline. This is aligned with the recommendation of NOPSEMA 2019. Therefore, during WCSS response planning, shoreline clean-up, P&D and OWR capability and arrangements should be evaluated against this threshold.
Minimum time to shoreline contact for oil >100g/m^2	Used to inform response planning regarding: • timeline for mobilisation of shoreline clean-up, OWR, P&D and waste management capabilities.	Understanding the shortest possible timeline between the spill event, and oil arriving on a shoreline at >100 g/m^2 provides a metric to consider, for the arrangements required for the mobilisation of a shoreline clean-up/OWR capability, and associated waste management capability that will be required by these response strategies.
Worst-case volume (m^3) of oil on shoreline >100 g/m^2 at any time	Used to inform response planning regarding the: • volume of waste likely to be generated during P&D, OWR and shoreline clean-up.	100 g/m^2 often used as minimum thickness for effective shoreline clean-up (Owens and Sergy., 2000; French-McCay., 2009) conclude that 100 g/m^2 is the minimum oil thickness for effects on marine fauna and invertebrates on a shoreline, and therefore triggers potential for OWR cleaning operations and associated waste generation. Therefore, during WCSS response planning, the volume of oily waste potentially generated during shoreline clean-up, P&D and OWR and the associated waste management capability and arrangements should be evaluated against this threshold.

4.3 Basis of Design

This section presents the outputs of the WCSS stochastic modelling runs against the response planning thresholds. These spill model outputs, assessed against each individual response planning threshold has been termed the 'Basis of Design' (BOD).

Table 4-3 presents various well blow-out parameters which were used as inputs into well blowout stochastic modelling.

Table 4-4 presents the well blow-out and other Group I hydrocarbon WCSSs stochastic modelling outputs (all seasons), against the response planning thresholds.

Table 4-5 presents the vessel collision WCSSs stochastic modelling outputs (all seasons), against the response planning thresholds.

The BOD tables are used to inform the Field Capability Assessments, which are presented in Section 6.

Table 4-3 Comparison of well-blowout modelling inputs

Model	Holonema-B Exploration Well	Brewster Production Phase 1	Plover Production Drilling Phase 2	Bassett Deep Exploration Well
Release location (coordinates)	14 05' 35.39"S 123 10' 37.88"E Approximately 38 km west north west of Browse Island.	13° 52' 46.2" S 123° 19' 3.0" E Approximately 35 km north west of Browse Island.	13° 54' 17.14" S 123° 09' 53.93" E Approximately 47 km north west of Browse Island.	13° 23' 3.18" S 123° 25' 10.02" E Approximately 80 km north north west of Browse Island, and 94 km south south east of Cartier Island.
Oil type	Brewster condensate	Brewster condensate	Plover condensate	Plover condensate
Reservoir pressure (psia)	6020	6020	6683	11688
Gas flowrate (MMscf/day)	583	577	735	1006
Oil flowrate (m^3/day)	3193	3193	1082	2178
Release duration (days)	80	80	108	130
Total release volume (m^3)	255,475	255,475	116,856	283,198
Well bore size - internal diameter (inches)	8.5"	8.5"	8.5"	8.5"
INPEX well blow-out OLGA modelling report document number	X080-AD-TCN-10079	C020-AD-TCN-00023	X080-AD-TCN-10084	0000-A7-TCN-70000

Table 4-4 Comparison of stochastic modelling results against spill response planning thresholds - Group I WCSSs

Worst Credible Spill Scenario	Basis of Design – Modelling Parameter Outcomes						
	Max lineal distance (km) floating oil >1g/m^2	Maximum instantaneous area (km^2) floating oil >50g/m^2	Minimum time (days) to shoreline oil accumulation >10 g/m^2	Minimum time (days) to shoreline oil accumulation >100 g/m^2	Longest length (km) or number of segments of shoreline oiled > 10 g/m^2	Longest length (km) or number of segments of shoreline oiled > 100 g/m^2	Worst-case volume (m^3) of oil on shoreline >100 g/m^2 at any time
Well blow-out - Holonema-B Exploration Well	883 (refer Figure 4-3 and Figure 4-4)	5 (refer Figure 4-5	3 (Browse Island)	3 (Browse Island)	158 (refer Figure 4-6)	27 (refer Figure 4-7)	433 (Refer Figure 4-8)
Well blow-out – Brewster Phase 1 Production Drilling	50	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	2
Well blow-out – Plover Phase 2 Production Drilling	548	N/A[1]	4 (Browse Island)	6 (Browse Island)	N/A[1]	9	120
Well blow-out – Bassett Deep Exploration Well	287	0	5	5	137	13	31
FPSO condensate tank rupture	633	12	1 Browse Island (30 hours)	1 Browse Island (30 hours)	8	3	63
Ichthys GEP full bore rupture	102	1.3	11	No contact above threshold	1.6	0	0

[1] These parameters were not calculated/reported as part of earlier well blow-out modelling reports.

When examining the modelling results of the various well blowout simulations presented in Table 4-4, it can be seen that the Holonema-B well blowout results present an absolute worst-case scenario, with by far the highest modelled volumes of oil ashore, lengths of shoreline oiled compared with other scenarios. Holonema-B WCSS also has relatively fast time to shoreline contact for both the >10 g/m^2 and >100 g/m^2 thresholds. The reasons for the Holonema-B results being 'worst-case' regarding greatest volumes of oil ashore is because it is the highest volume oil release scenario, with the release location selected as the closest point of the Brewster reservoir to Browse Island, when considering wet-season wind conditions.

The absolute shortest time to contact was predicted from the FPSO collision WCSS resulted in shoreline contact >10 g/m^2 and >100 g/m^2 in 29 hours for Browse Island, compared to 3 days for the Holonema-B WCSS. Also, the FPSO collision also resulted in the highest instantaneous area of floating oil >50 g/m^2 at 12 km^2.

Whilst the Bassett Deep spill modelling used a higher total volume of oil released, the release rate was slower and the proposed Bassett Deep well location was far further away from sensitive receptors, which resulted in lower shoreline accumulation volumes..

There were very large differences between the Brewster Phase 1 and the Holonema-B modelling outputs. Both scenarios used the same reservoir characteristics, however resulted in vastly different model outcomes, with Brewster Phase 1 modelling presenting far smaller floating oil and shoreline accumulation volumes. These differences were as a result of the different models used for the two scenarios. The Brewster Phase 1 modelling was conducted using an older near-field modelling program with simplified assumptions. The key difference was the older modelling was undertaken under the assumption that for any well blowout, the oil would be 'atomised' at the release point, resulting in very small droplet sizes. During the far-field modelling, these small droplet sizes resulted in very high entrainment rates, and very limited floating oil, therefore limiting shoreline contact and shoreline accumulation. However the newer model used for Holonema-B produced a broader distribution of droplet sizes is generated by the nearfield modelling, which takes into account reservoir pressures and a range of other factors. This provides a more realistic representation of the range droplet sizes that would be expected. When applied to the far-field modelling, this larger range of droplet sizes results in larger volumes of surface/floating oil, which in turn results in greater floating oil concentrations over larger distances and consequently greater volumes of shoreline contact and shoreline accumulation of oil. Therefore, the outcomes of the Holonema-B modelling present a worst-case from a spill response planning perspective.

The modelling results from the GEP rupture WCSS and FPSO 5700 m^3 condensate tank rupture WCSS both predicted very short lengths of shoreline accumulation at >10 g/m^2 and >100 g/m^2 compared to the Holonema-B scenario. Also, the FPSO 5700 m^3 condensate tank rupture WCSS maximum shoreline accumulation was 60 m^3, far smaller than the predicted 433 m^3 maximum shoreline accumulation from the Holonema-B well blowout WCSS, and the was no shoreline accumulatio predicted form the GEP WCSS.

As there are some small differences on a few parameters, the consequences of these differences are analysed as part of the Strategic SIMA and field capability assessment of the well blow-out WCSS, presented in Table 6-4.

As the data in Table 4-4 indicates that Holonema-B is considered the worst of the well blow-out WCSS for this BROPEP, Table 4-3 through to Figure 4-8 are provided as worst-case spill scenario outputs from the Holonema-B modelling report (RPS 2021a).

Figure 4-3 displays the results of the stochastic run (summer/wet-season 062) which produced the greatest lineal distance for floating oil >1 g/m^2. This figure shows the total swept area of floating oil >1 g/m^2.The maximum range was 883 km and was driven by a small patch of oil exceeding the 1 g/m^2 threshold, north west of Darwin. Several other stochastic runs showed contiguous streams of oil >1g/m^2 for approximately 700 km. (Note, the term 'Zone of Consequence' is utilised by INPEX in EPs to describe areas contacted by oil >1g/m^2, but less than a defined environmental impact threshold of 10 g/m^2).

Figure 4-4 displays the results of the same stochastic run (summer/wet-season 062) as Figure 4-3, however as a series of instantaneous moments in time during the scenario, showing the floating oil >1 g/m^2. It should be noted the limited surface oil on day 79 (the second last day of the well blowout) is due to the increased wind speed during this period, resulting in very high entrainment and very limited surface/floating slicks.

Figure 4-5 displays the results of the stochastic run (summer/wet-season 002) which produced the worst-case instantaneous area (5 km^2) for floating oil >50 g/m^2. For comparative purposes, the total swept area (40 km^2) for the same stochastic run is also presented.

Figure 4-6produced the maximum length of shoreline oiled at >10 g/m^2, at the worst-case moment in time for the run, which happened to be day 100, 20 days after the well-blowout simulation had stopped introducing more oil into the marine environment. This figure shows the wide range of locations at which could be simultaneously contacted above the threshold. During this particular stochastic run, first shoreline contact >10 g/m^2 was as follows; Browse Island - day 18, Rowley Shoals and Scott Reef – day 33, Cartier Island – day 57, Kimberley coastline - day 60.

Figure 4-7 displays the results of the stochastic run (summer/wet-season 097) which produced the maximum length of shoreline oiled at >100 g/m^2, at the worst-case moment in time for the run, which happened to be day 93, 13 days after the well-blowout simulation stopped introducing more oil into the marine environment. During this particular stochastic run, first shoreline contact >100 g/m^2 was as follows; Sandy Islet - day 11, Browse Island - day 30 and Kimberley Coastline - day 60. Peak volume oil ashore across all receptors was approximately 120 m^3 in this run.

Figure 4-8 displays the results of the stochastic run (summer/wet-season 028) which produced the maximum volume of oil ashore at >10 g/m^2 and >100 g/m^2, at the worst-case moment in time for the run. This figure shows >50 m^3 at Browse Island. The peak instantaneous volume ashore at Browse Island from this run was 433 m^3. During this particular stochastic run, first shoreline contact >10 g/m^2 was as follows; Browse Island initial oil on shore on day 18 (14 m^3), Browse Island peak volume ashore on day 87 (433 m^3) and Rowley Shoals on day 88 (<1 m^3).

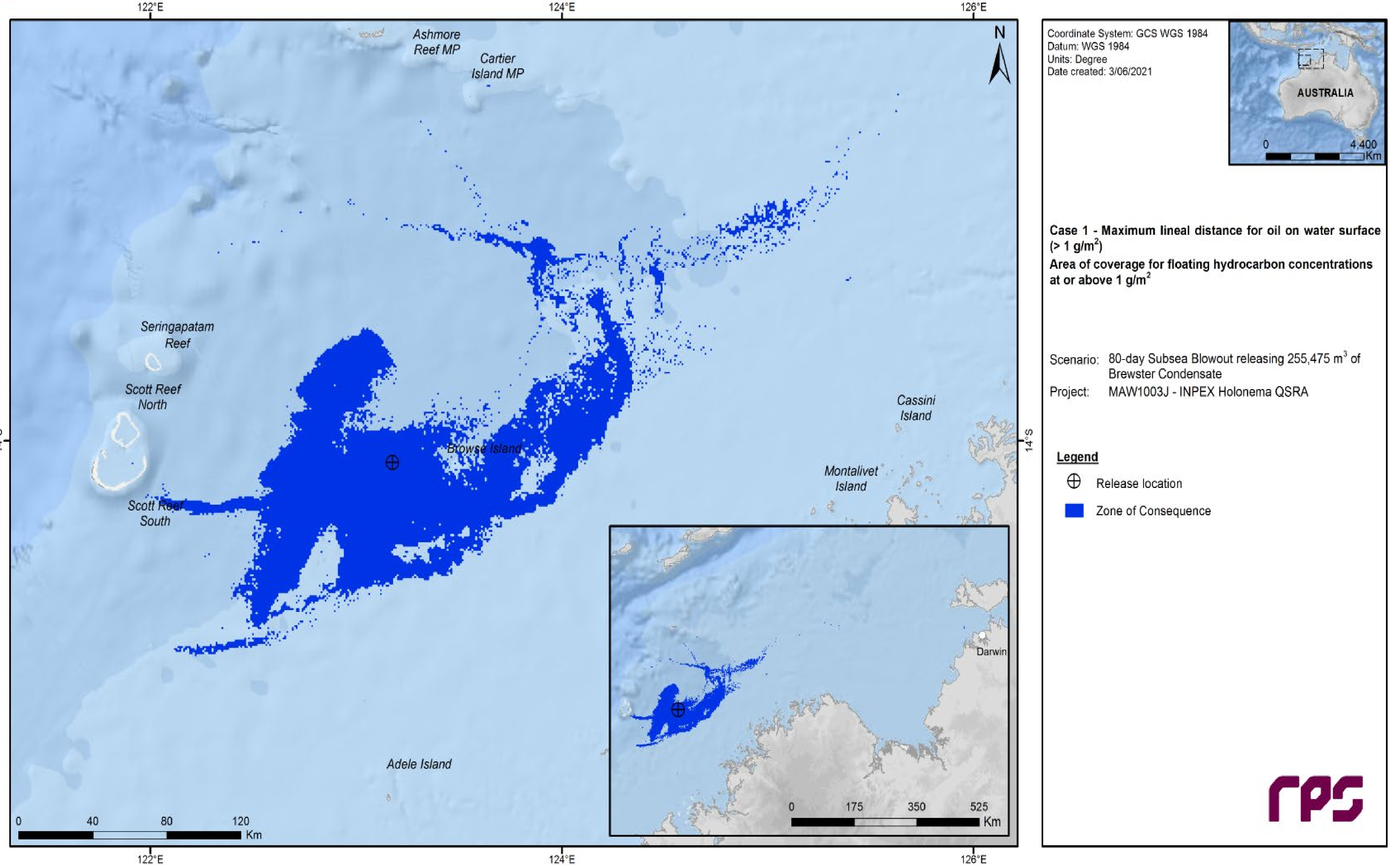


Figure 4-3 Well Blowout maximum lineal distance for floating oil >1g/m²

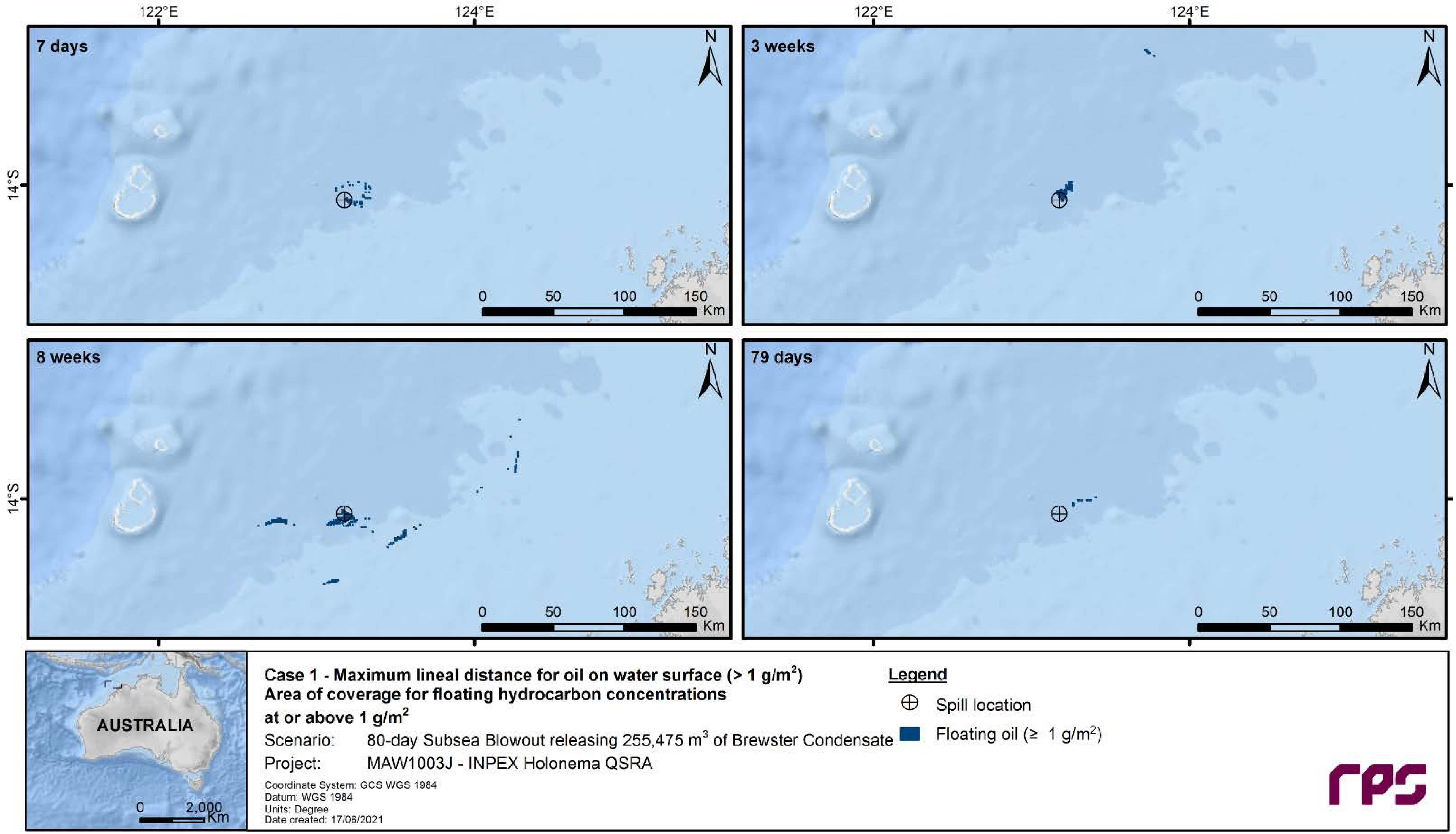


Figure 4-4 Well blow-out maximum lineal distance for floating oil >1g/m² time-series

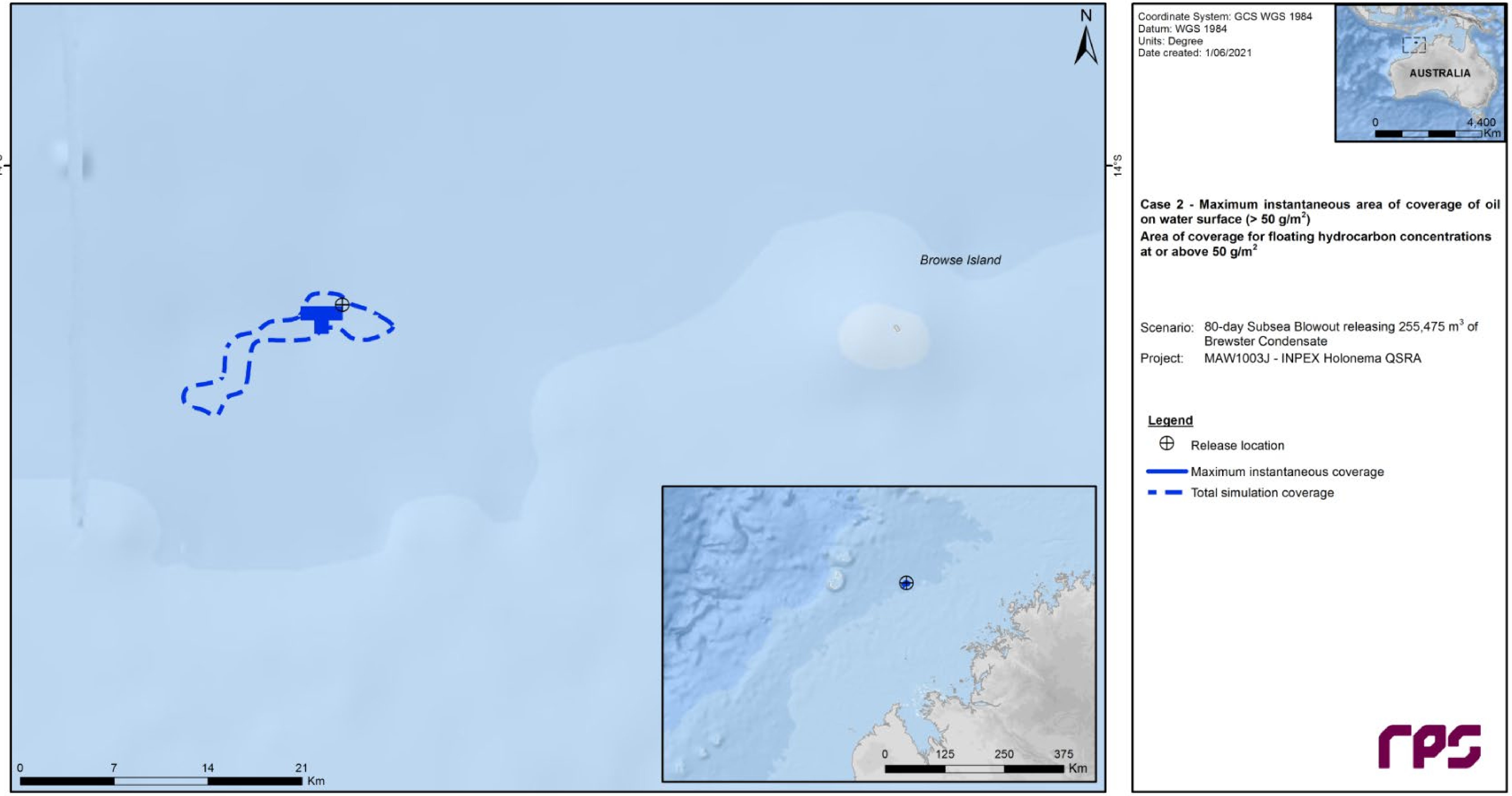


Figure 4-5 Well blow-out maximum instantaneous, and total swept area floating oil >50 g/m²

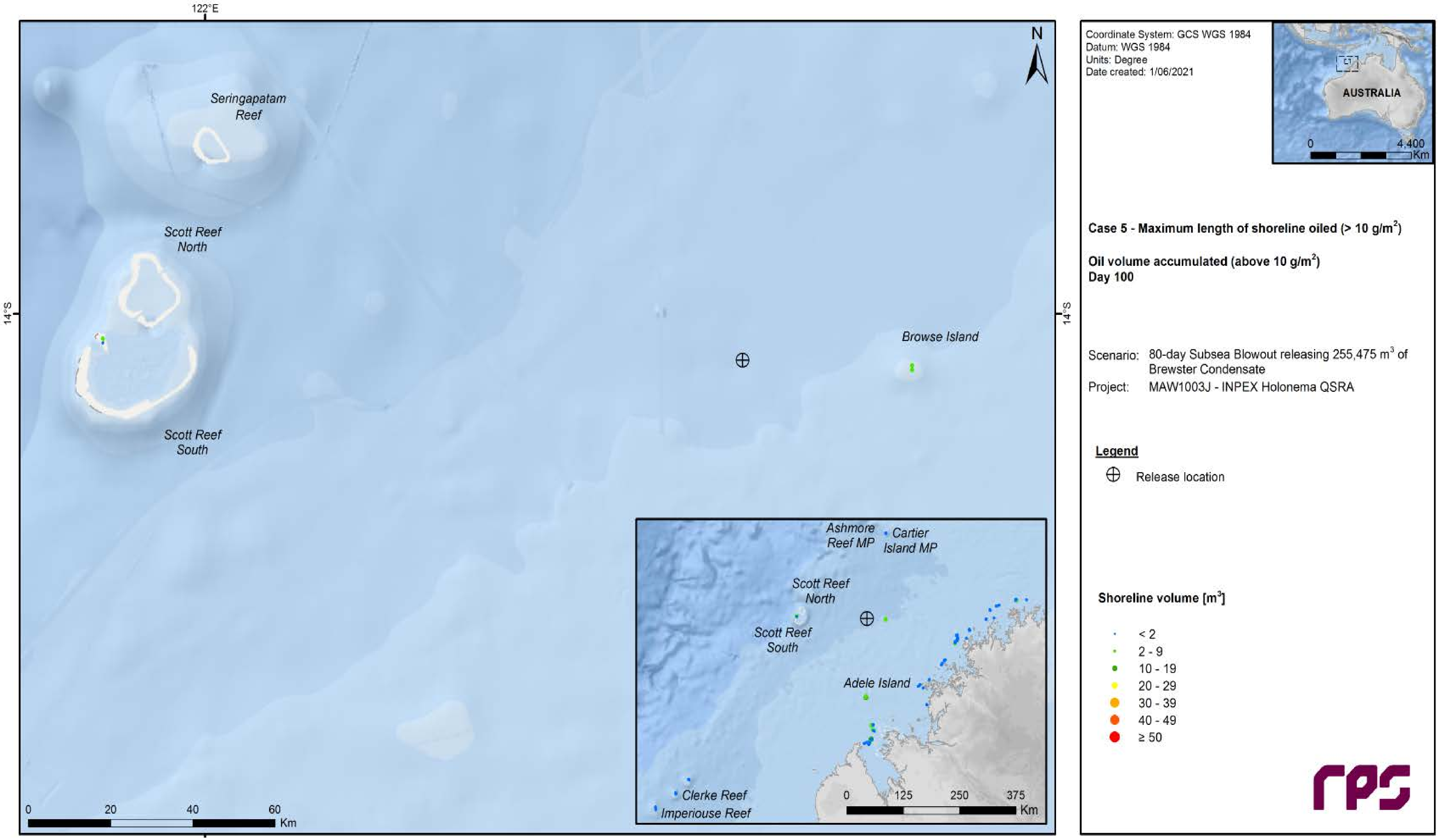


Figure 4-6 Well blow-out instantaneous maximum length (km) of shoreline oiled at >10 g/m², showing instantaneous volumes oil ashore (m³)

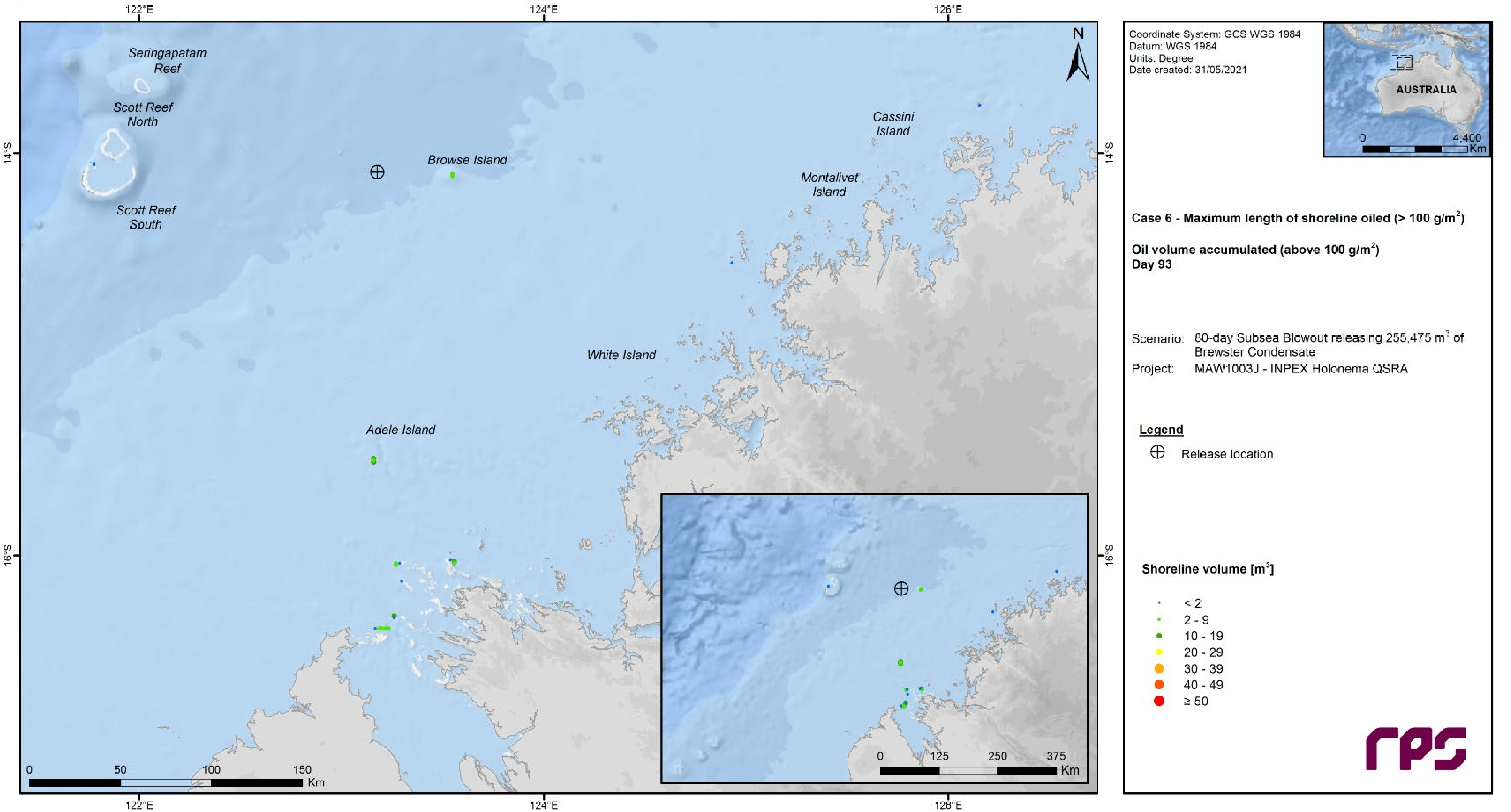


Figure 4-7 Well blow-out instantaneous maximum length (km) of shoreline oiled at >100 g/m², showing instantaneous volumes oil ashore (m³)

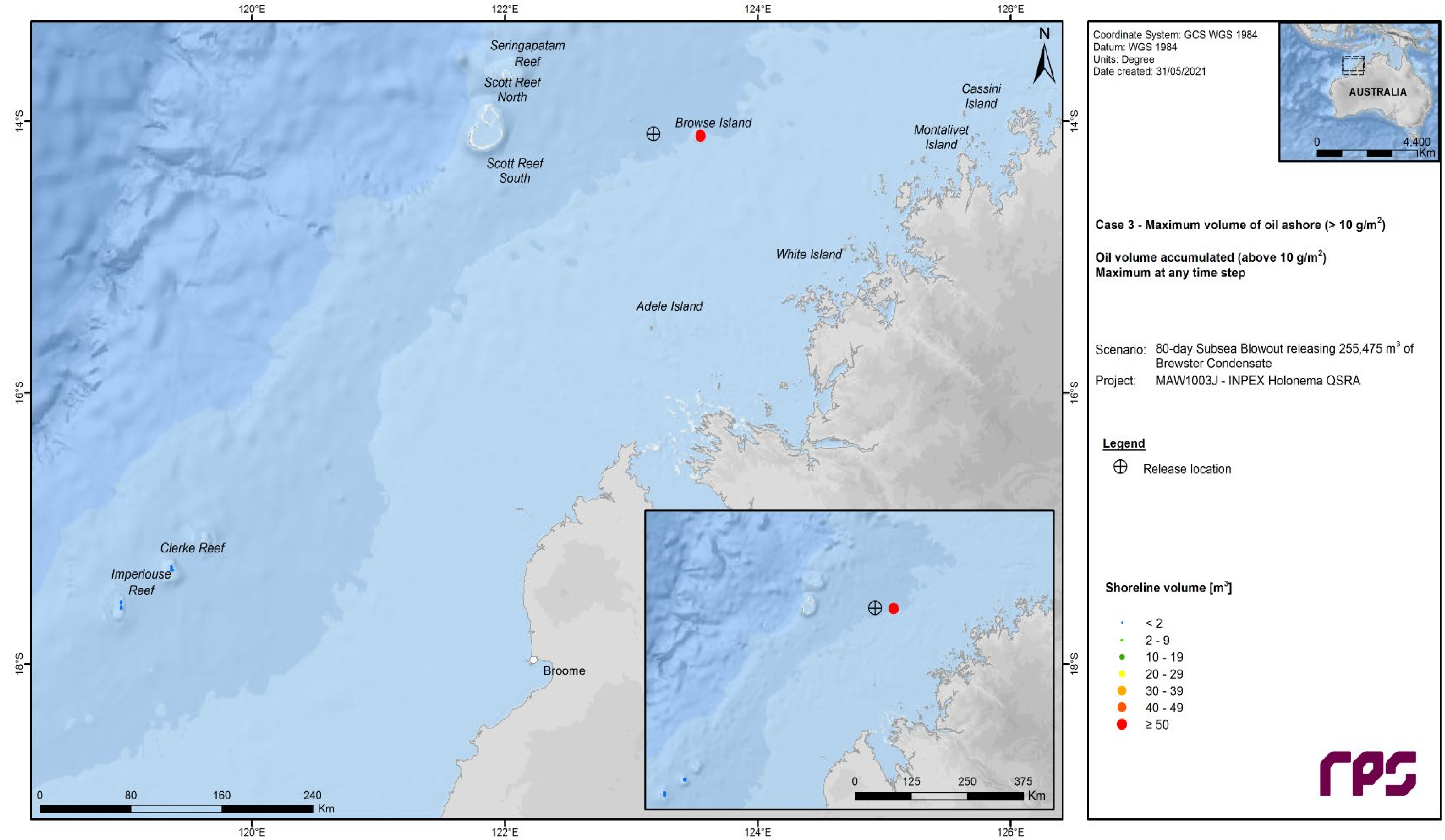


Figure 4-8: Well blow-out maximum volume oil ashore >10 g/m² and >100 g/m²

The stochastic run which produced the minimum time to shoreline contact >10 g/m^2 was run summer 014. Results from this run show:

- Browse Island contacted >10 g/m^2 on day 4.
- Kimberley coastline contacted >10 g/m^2 on day 35.

The stochastic run which produced the minimum time to shoreline contact >100 g/m^2 was run transition run 095. Results from this run show:

- Browse Island contacted >100 g/m^2 on day 4.
- no other shorelines contacted >100 g/m^2 during this run.

In summary, the analysis of these shoreline contact results from the well-blowout simulations show:

- under worst-case conditions, one shoreline could be contacted at >10 g/m^2 and >100 g/m^2 within the first week (minimum time 4 days for well blowout scenario)
- additional shoreline sectors could be contacted above thresholds within the next three to four weeks.
- significantly more shoreline sectors contacted above thresholds between days 30-60

Table 4-5 Comparison of stochastic modelling results against spill response planning thresholds – Group II and Group IV WCSSs

Worst Credible Spill Scenario	**Basis of Design – Modelling Parameter Outcomes**						
	Max lineal distance (km) floating oil >1g/m^2	Maximum instantaneous area (km^2) floating oil >50g/m^2	Minimum time (hours) to shoreline oil accumulation >10 g/m^2	Minimum time (hours) to shoreline oil accumulation >100 g/m^2	Longest length (km) or number of segments of shoreline oiled > 10 g/m^2	Longest length (km) or number of segments of shoreline oiled > 100 g/m^2	Worst-case volume (m^3) of oil on shoreline >100 g/m^2 at any time
Vessel collision 776 m^3 HFO spill at FPSO Location 35 km north east Browse Island	1157 (refer Figure 4-9 and Figure 4-10)	7.6 (refer re)	29	29	295 (refer Figure 4-12)	75 (refer Figure 4-13)	267 (Refer Figure 4-14)
Vessel collision 284 m^3 MGO spill Coordinates: 18° 12' 40.08" S 121° 22' 27.24" E 95 km south west of Broome / 80 Mile Beach	194	1.8	No contact above threshold	No contact above threshold	4	No contact above threshold	No contact above threshold
Vessel collision 284 m^3 MGO spill Coordinates: 16° 57' 57.95" S 121° 45' 1.14" E 42 km south west of Lacapede Islands	167	1.9	39	39	18	10	48 (Lacapede Islands)
Vessel collision 284 m^3 MGO spill Coordinates: 16° 38' 47.63" S 120° 2' 52.78" E	357	1.9	58	103	6	5	48 (Clerke Reef, Rowley Shoals)

Worst Credible Spill Scenario	**Basis of Design – Modelling Parameter Outcomes**						
	Max lineal distance (km) floating oil >1g/m²	Maximum instantaneous area (km²) floating oil >50g/m²	Minimum time (hours) to shoreline oil accumulation >10 g/m²	Minimum time (hours) to shoreline oil accumulation >100 g/m²	Longest length (km) or number of segments of shoreline oiled > 10 g/m²	Longest length (km) or number of segments of shoreline oiled > 100 g/m²	Worst-case volume (m³) of oil on shoreline >100 g/m² at any time
65 km north east of Rowley Shoals							
Vessel collision 284 m³ MGO spill Coordinates: 15° 37' 23.28" S 123° 6' 34.04" E 8 km south west of Adele Island	195	1.7	5	8	13	6	119 (Adele Island)
Vessel collision 284 m³ MGO spill Coordinates: 14° 7' 18.89" S 123° 36' 37.15" E 7 km east of Browse Island	392	1.9	1	5	3	3	100 (Browse Island)
Vessel collision 284 m³ MGO spill Coordinates: 14° 11' 23.14" S 122° 4' 44.63" E 20 km south east of Scott Reef	305	1.9	36	36	2	2	55 (Sandy Islet / Scott Reef)

Worst Credible Spill Scenario	**Basis of Design – Modelling Parameter Outcomes**						
	Max lineal distance (km) floating oil >1g/m^2	Maximum instantaneous area (km^2) floating oil >50g/m^2	Minimum time (hours) to shoreline oil accumulation >10 g/m^2	Minimum time (hours) to shoreline oil accumulation >100 g/m^2	Longest length (km) or number of segments of shoreline oiled > 10 g/m^2	Longest length (km) or number of segments of shoreline oiled > 100 g/m^2	Worst-case volume (m^3) of oil on shoreline >100 g/m^2 at any time
Vessel collision 250 m^3 MGO spill Coordinates: 13° 58' 21.886" S, 123° 35' 16.161" E. GEP Route, 15 km north north east of Browse Island	573	1.6	17	17	1.6	1.6	50 (Browse Island)
Vessel collision 250 m^3 MGO spill Coordinates: 13° 6' 28.641" S, 125° 22' 53.455" E GEP Route, adjacent to the Commonwealth Kimberley Marine Reserve and 90 km north north west of Long Reef	298	1.8	235 (10 days)	No contact above threshold	1.6	No contact above threshold	<1
Vessel collision 250 m^3 MGO spill Coordinates: 2° 42' 0.000" S, 127° 1' 30.239" E GEP Route, adjacent to the Commonwealth Oceanic Shoals Marine Reserve and 113 km north of Cape Londonderry	204	1.6	No contact above threshold.	No contact above threshold	No contact above threshold	No contact above threshold	<1

Worst Credible Spill Scenario	**Basis of Design – Modelling Parameter Outcomes**						
	Max lineal distance (km) floating oil >1g/m²	Maximum instantaneous area (km²) floating oil >50g/m²	Minimum time (hours) to shoreline oil accumulation >10 g/m²	Minimum time (hours) to shoreline oil accumulation >100 g/m²	Longest length (km) or number of segments of shoreline oiled > 10 g/m²	Longest length (km) or number of segments of shoreline oiled > 100 g/m²	Worst-case volume (m³) of oil on shoreline >100 g/m² at any time
Vessel collision 250 m³ MGO spill Coordinates: 12° 30' 8.311" S, 129° 16' 14.442" E GEP Route, adjacent to Flat Top Bank and 125 km west of Bare Sand Island	214	1.8	290 (12 days)	334 (14 days)	3.2	0.4	<1
Vessel collision 250 m³ MGO spill Coordinates: 12° 19' 4.400" S, 130° 9' 46.416" E GEP Route, at Cwth/NT waters boundary and 35 km north west of Bare Sand Island	185	1.6	67	67	27	12	47
Vessel collision 500 m³ MGO spill Coordinates: 12° 49' 5.71 " S, 128° 47' 17.79" E Location 180 km WSW of Bare Sand Island (NT).	88	25.7	N/A (no contact above threshold)	N/A (no contact above threshold)	N/A (no contact above threshold)	N/A (no contact above threshold)	<1

The 776 m^3 HFO spill results present an absolute worst-case scenario, with highest predicted maximum lineal distance of floating oil (>1 g/m^2 and >50 g/m^2) maximum volume of oil ashore and longest lengths of shoreline oiled at >10 g/m^2 and >100 g/m^2.

Certain MGO vessel spill scenarios did have faster time to shoreline contact, due to the proximity of the selected/modelled release location, in relation to a shoreline receptor. When MGO vessel collision scenarios were located close to a shoreline, and contact was within <10 hours, the HFO spill scenario resulted in a higher maximum volume oil ashore and higher total length of shoreline oiled at >10 g/m^2 and >100 g/m^2. Additionally, the HFO scenario provides simulations where a significant number of shoreline receptors are contacted above thresholds, whereas the MGO scenarios did not result in multiple shoreline segments/multiple shoreline receptor contacts above >100 g/m^2 from individual stochastic runs.

As the data in Table 4-5 indicates that the 776 m^3 HFO WCSS is considered the worst of the vessel collision WCSSs for this BROPEP, Figure 4-9 through to Figure 4-14 are provided as worst-case spill scenario outputs from the 776 m^3 HFO modelling report (RPS 2021c).

Figure 4-9 displays the results of the stochastic run (summer/wet season 057) which produced the greatest lineal distance for floating oil >1 g/m^2. This figure shows the total swept area of floating oil >1 g/m^2. The maximum range was 1157 km.

Figure 4-10 displays the results of the same stochastic run (summer/wet season 057) as Figure 4-9, however as a series of instantaneous moments in time during the scenario, showing the floating oil >1 g/m^2.

Figure 4-11 depicts the results of the stochastic run (transition 050) which produced the worst-case instantaneous area (7.6 km^2) for floating oil >50 g/m^2. For comparative purposes, the total swept area (75 km^2) for the same stochastic run is also presented. An analysis of all 300 runs was completed, and the range for maximum instantaneous area >50 g/m^2 was 5.75km to 7.6km.

Figure 4-12 displays the results of the stochastic run (summer/wet season 042) which produced the maximum length of shoreline oiled at >10 g/m^2, at the worst-case moment in time for the run, which happened to be day 41. This figure shows the wide range of locations at which could be simultaneously contacted above the threshold. During this particular stochastic run, first shoreline contact >10 g/m^2 was as follows: Browse Island - day 6 and then the Bonaparte Archipelago/North Kimberley Marine Park locations- days 33-40.

Figure 4-13 displays the results of the stochastic run (summer/wet season 059) which produced the maximum length of shoreline oiled at >100 g/m^2, at the worst-case moment in time for the run, which happened to be day 27. During this particular stochastic run, first shoreline contact >100 g/m^2 was as follows: Browse Island - day 9, with peak oil ashore 41 m^3 on day 12. Then the Bonaparte Archipelago/North Kimberley Marine Park shoreline locations- days 21- 24. Peak volume oil ashore across all receptors was approximately 267 m^3 on day 26 of this run.

Figure 4-14 displays the results of the stochastic run (summer/wet season 059) which also produced the maximum volume of oil ashore at >10 g/m^2 and >100 g/m^2, at the worst-case moment in time for the run. The first contact >10 g/m^2 was Browse Island on day 10. The peak instantaneous volume ashore at Browse Island from this run was 41 m^3 on day 12. Another ~225 m^3 oil arrive ashore around days 25-28 across the Bonaparte Archipelago/North Kimberley Marine Park shorelines. Peak oil ashore was 276 m^3 in this run.

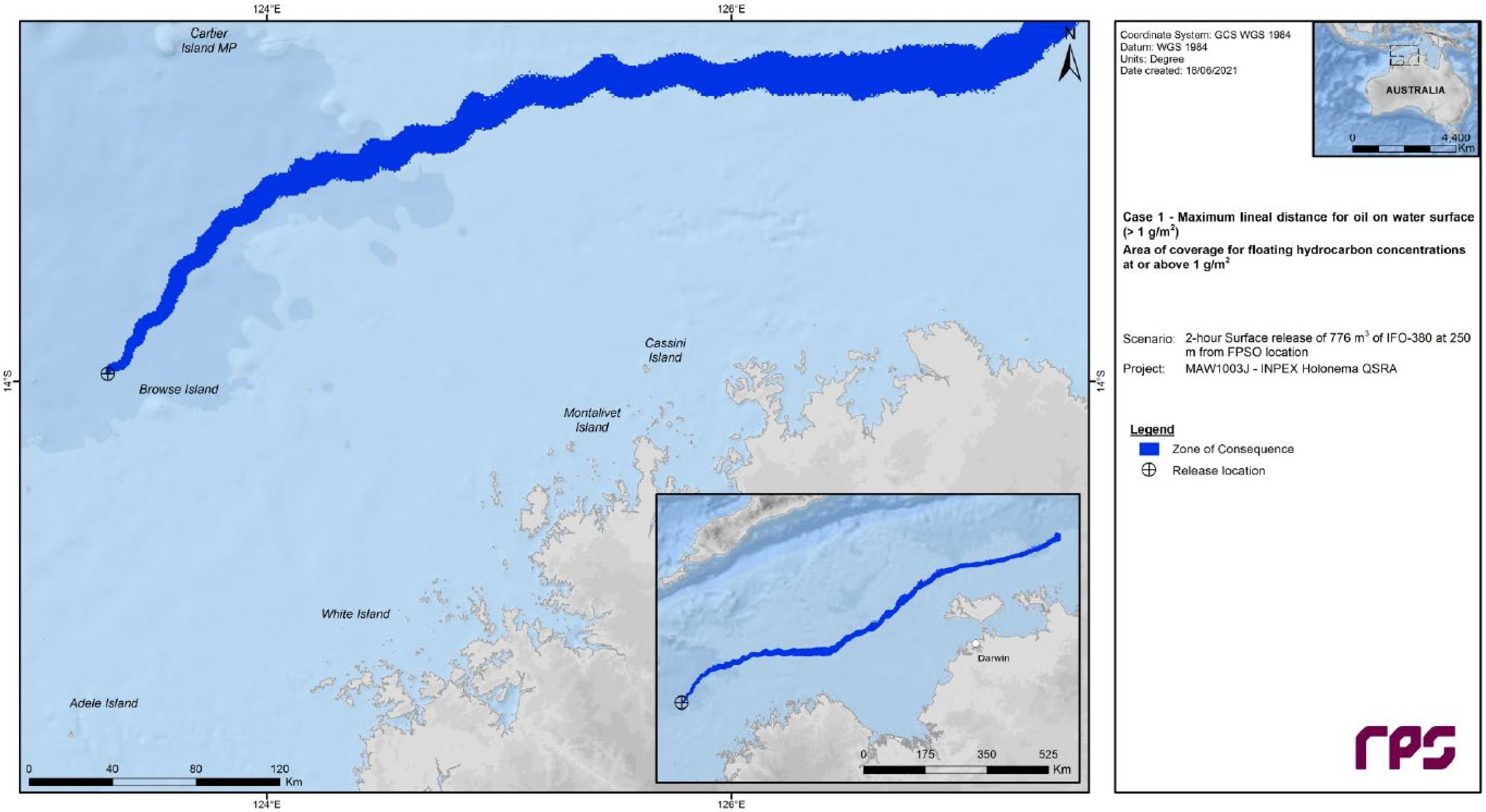


Figure 4-9: 776 m^3 HFO spill maximum lineal distance for floating oil >1g/m^2

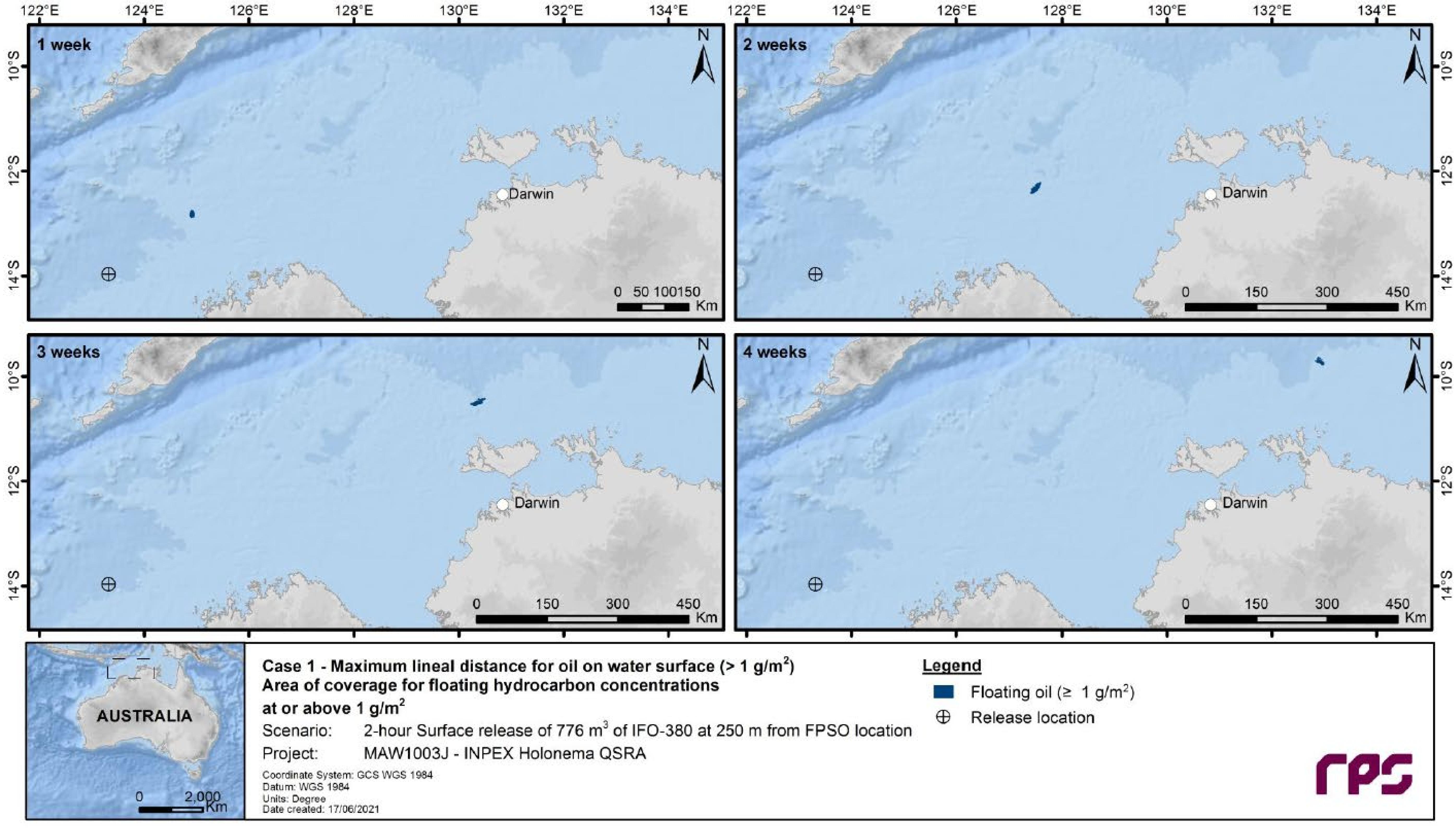


Figure 4-10: 776 m³ HFO spill maximum lineal distance for floating oil >1g/m² time-series

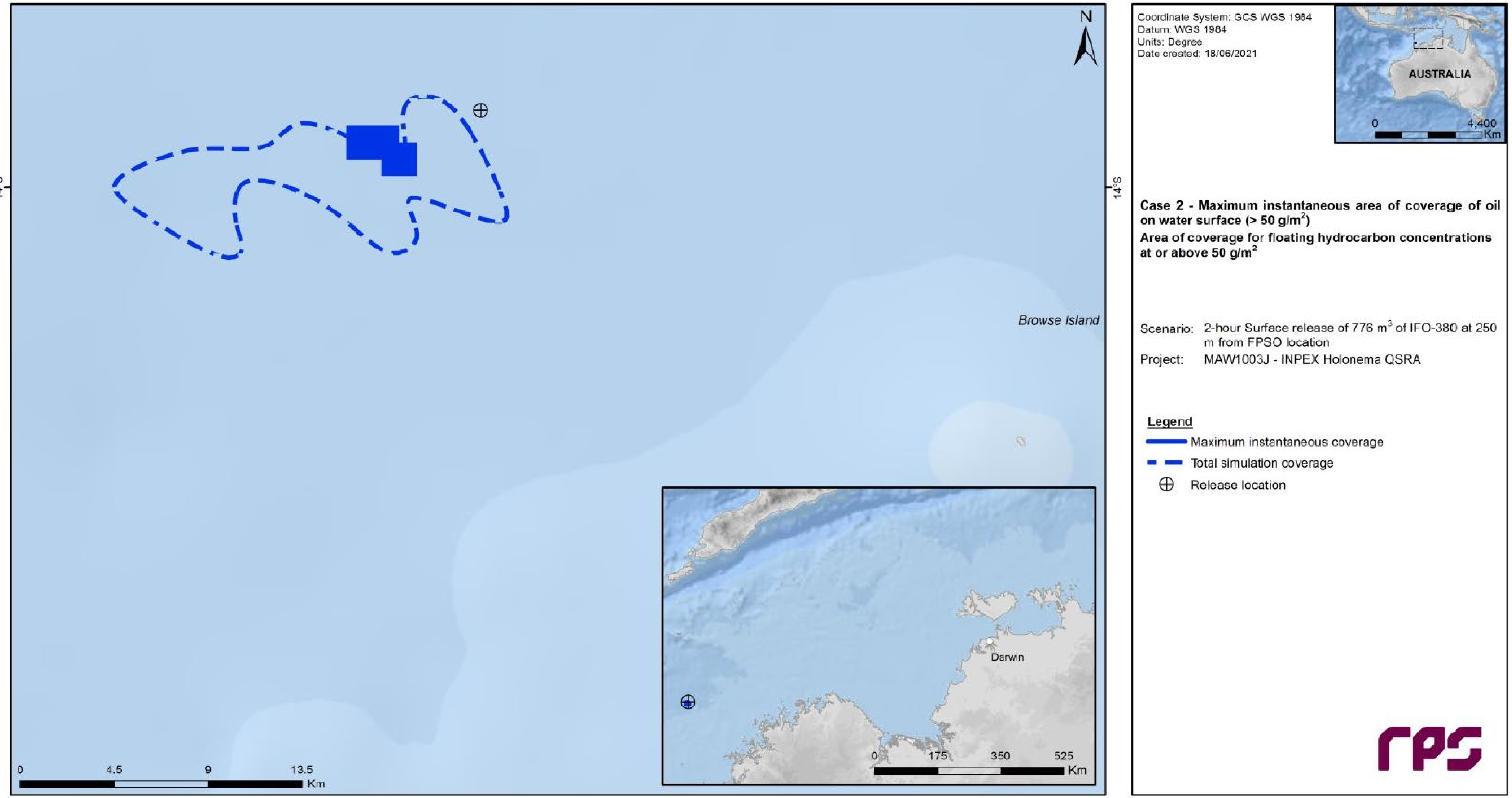


Figure 4-11: 776 m³ HFO spill maximum instantaneous, and total swept area floating oil >50 g/m²

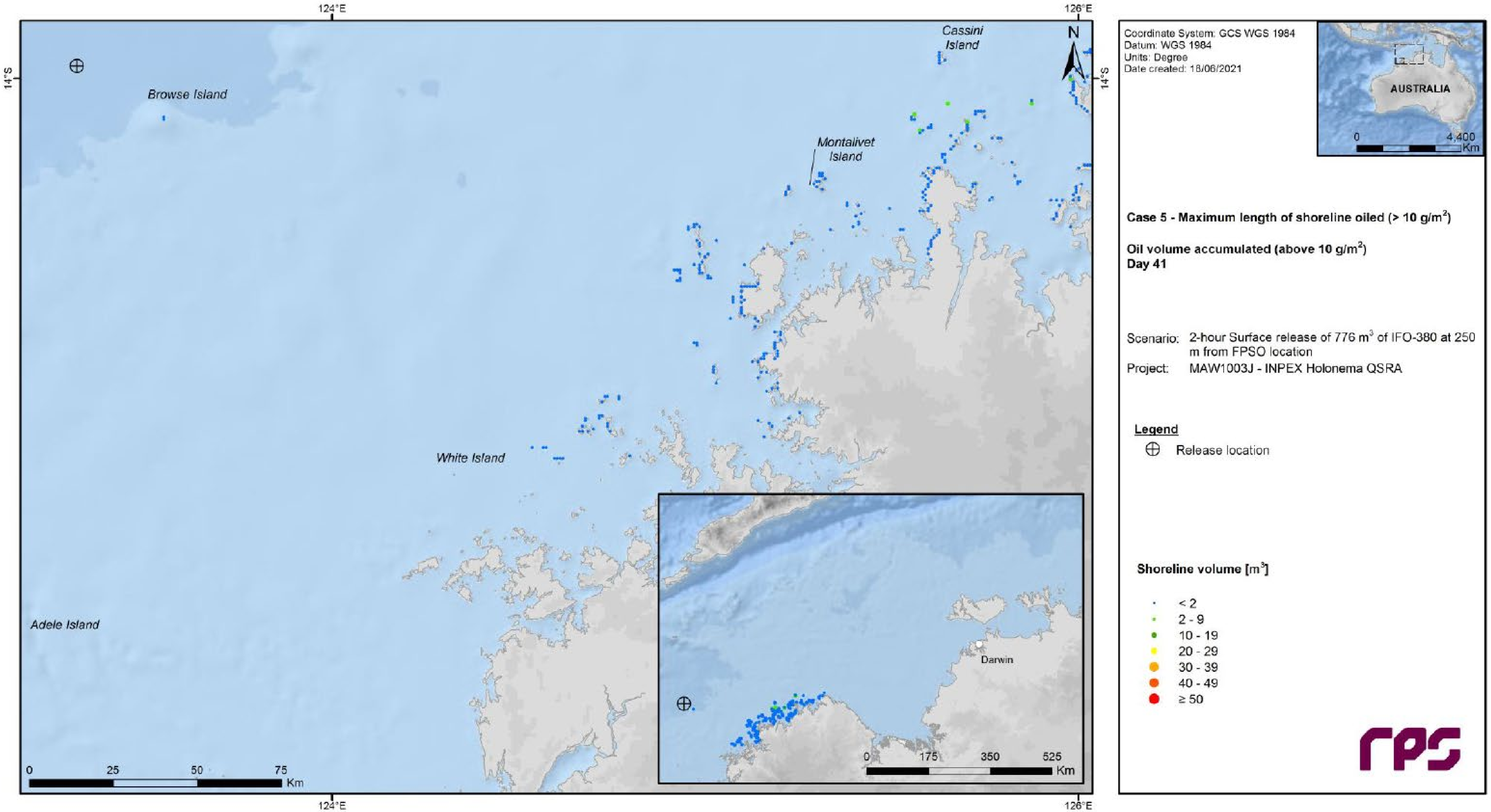


Figure 4-12: 776 m³ HFO spill instantaneous maximum length (km) of shoreline oiled at >10 g/m², showing instantaneous volumes oil ashore (m³)

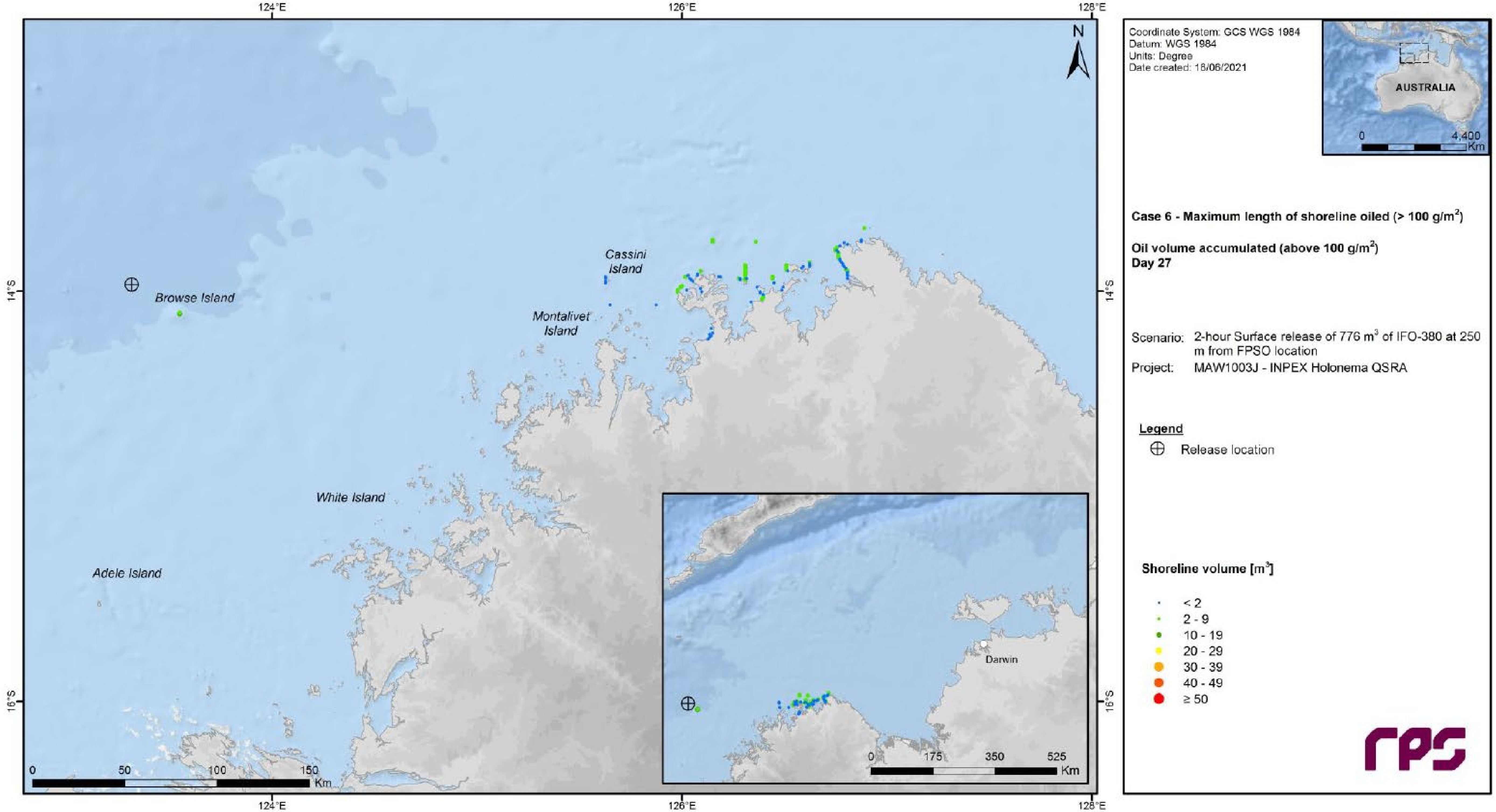


Figure 4-13: 776 m^3 HFO spill instantaneous maximum length (km) of shoreline oiled at >100 g/m^2, showing instantaneous volumes oil ashore (m^3)

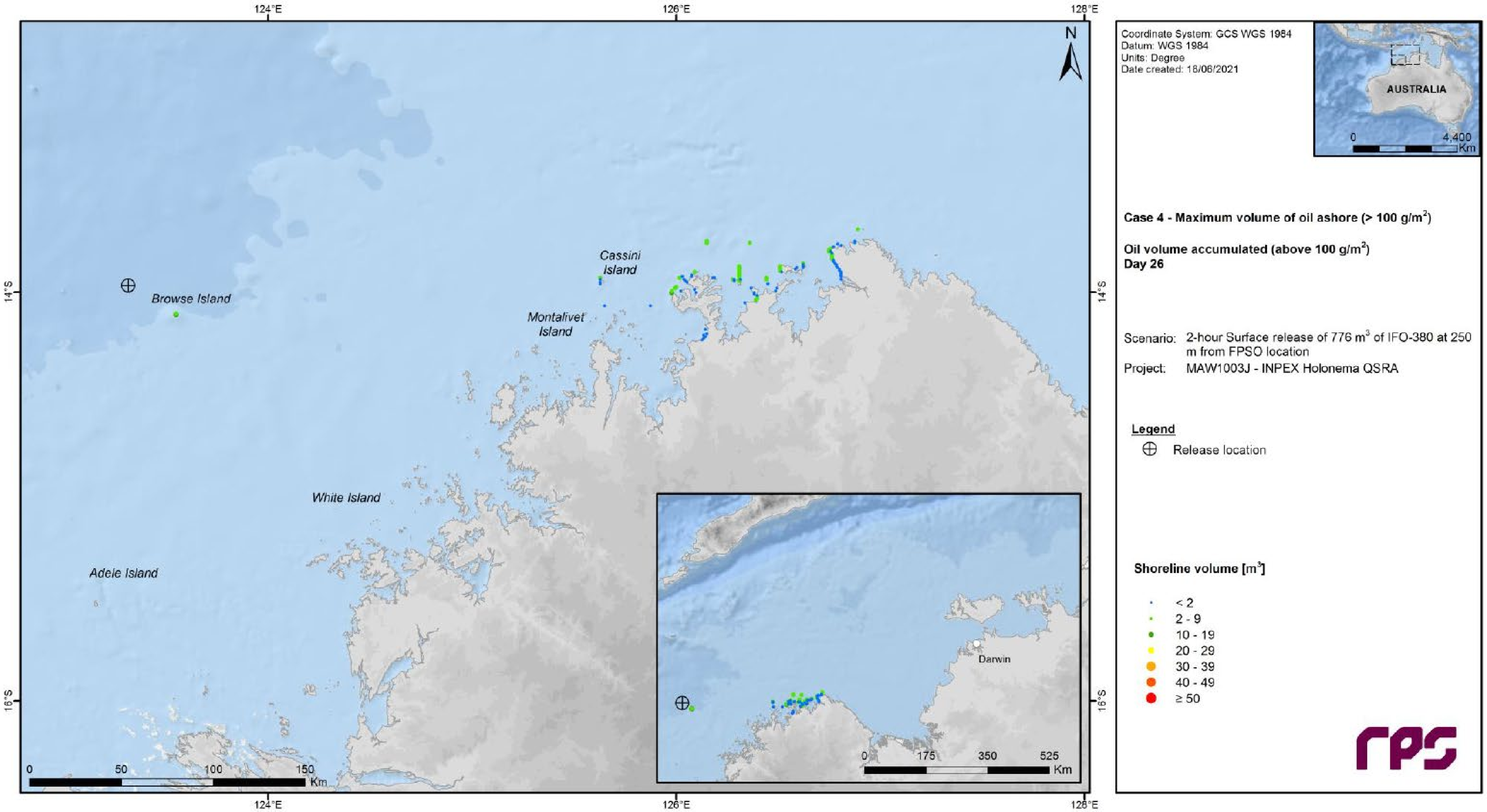


Figure 4-14: 776 m³ HFO spill maximum volume oil ashore >10 g/m² and >100 g/m²

The stochastic run which produced the minimum time to shoreline contact >10 g/m^2 was run summer 058. Results from this run show:

- Browse Island contacted >10 g/m^2 on day 1 (29 hours).
- Kimberley coastline contacted >10 g/m^2 on day 45.

The stochastic run which produced the minimum time to shoreline contact >100 g/m^2 was also summer run 058. Results from this run show:

- Browse Island contacted >100 g/m^2 on day 1 (29 hours), with 73 m^3 oil ashore by day 3.
- Other Kimberley shorelines were contacted >100 g/m^2 during this run around days 47-50.

In summary, the analysis of these shoreline contact results from the 776 m^3 simulations show:

- under worst-case conditions, one shoreline could be contacted at >10 g/m^2 and >100 g/m^2 within one day (minimum time 29 hours), with significant oil accumulation within 3 days.
- additional shoreline sectors could be contacted above thresholds within the next three to four weeks.
- significantly more shoreline sectors contacted above thresholds from days 25 onwards.

4.4 Comparison of the BOD outcomes to other petroleum activities

It should be noted that similar results would be expected for condensate well blowouts or vessel collisions within most other offshore permits (both INPEX and other petroleum titleholders) in the BROPEP region.

For example, for condensate drilling or production activities in closer proximity to Rowley Shoals, Scott Reef, or Ashmore Reef/Cartier Island, the spill scenario would likely result in shoreline contact with the near-by receptor within a few days, followed by potential shoreline contact at another offshore island or along the Kimberley or NT coastline within a few weeks during the wet season/transition season, or limited/no other shoreline contacts during the dry season.

Therefore, this BOD can be considered as a reasonable representation of the types of spill scenarios that could be expected for the majority of upstream petroleum activities associated with condensate exploration/production, in the region.

If light/medium crude wells were drilled/produced in the region, the associated WCSS's would be expected to result in increases in the floating oil concentrations and total volumes of oil ashore, however time to contact will always be dependent on the spill location and season. The process for evaluation other petroleum activities how they would be bridged to this BROPEP BOD/FCA report is presented in Section 8.2.

5 SPILL IMPACT MIGITATION ASSESSMENT

5.1 Spill Impact Mitigation Assessment

INPEX has developed a series of strategic Spill Impact Mitigation Assessments (SIMA) for each WCSS relevant to INPEX Australia's E&P activities in the Browse Basin.

The strategic SIMAs are:

- condensate spill – instantaneous surface release (X060-AH-LIS-60031)
- MGO/diesel spill – instantaneous surface release (X060-AH-LIS-60032)
- intermediate/heavy fuel oil spill – instantaneous surface release (X060-AH-LIS-60033)
- condensate/gas well or pipeline blowout – long duration subsea release (X060-AH-LIS-60034).

The SIMA process developed by IPIECA (2017a) is a pre-spill planning tool to facilitate response option evaluation/selection and support the development of the overall response plan by identifying and comparing the potential effectiveness and impacts of oil spill response strategies. The SIMA assists in the assessment of the impact mitigation potential and in making a transparent determination of response strategies that are considered most effective at minimising oil spill impacts (IPIECA 2017a). The framework includes environmental considerations as well as a range of shared values such as ecological, socio-economic and cultural aspects (IPIECA 2017a).

5.1.1 SIMA process

The SIMA process as outlined in the "Guidelines on implementing spill impact mitigation assessment (SIMA)" (IPIECA 2017a) has four stages:

1. Compile and evaluate data relevant for relevant oil spill scenarios including fate and trajectory modelling, identification of resources at risk and determination of safe and feasible response options.

2. Predict outcomes/impacts for the "No Intervention" (or "Natural Attenuation") option as well as the effectiveness (i.e. relative mitigation potential) of the response strategies for each scenario.

3. Balance trade-offs by weighing and comparing the range of benefits and drawbacks associated with each response strategy, compared to 'No Intervention', for the spill scenario.

4. Select the appropriate response strategies to form the response plan for the scenario, based on which best combination of response strategies will minimise the overall spill impacts and promote rapid recovery.

Predictive oil spill modelling (including the modelling outputs summarised in Section 4) have been used to support the strategic SIMAs through defining generic oil weathering/fate characteristics for each broad type of spill scenario.

The resource compartments presented in each SIMA reflect the values and sensitivities described in Section 4 of INPEX activity specific EPs (*Existing Environment*). The resource compartments have been defined as broad habitat types which support protected species, rather than focusing on individual protected species. This approach is recommended by IPIECA (2017a). Where a resource compartment also supports/provides habitat for protected species, such as seabird or turtle etc, additional resource compartments (identified as habitats supporting EPBC listed/protected species) have been included, to capture these 'high value resources', in accordance with IPIECA (2017a).

Within each of INPEX's four Strategic SIMAs, a relative impact score has been assigned to each resource compartment, for the 'no intervention' option. A supporting justification for each relative impact score for each resource compartment is also presented in the Strategic SIMAs.

For each strategic SIMA, nine oil spill response strategies were considered, including SMV, C&R, P&D, SCAT & shoreline clean-up, surface chemical dispersant, subsurface chemical dispersant, pre-contact OWR, post-contact OWR and in-situ burning.

For each response strategy, the impact mitigation potential was assessed against each resource compartment and given a score on a scale of '-3' to '+3', where a negative score reflects additional impact and a positive score reflects mitigation of impact on a particular compartment (balance trade-offs). A supporting justification for each impact modification score for each response strategy against each resource compartment is also presented in the Strategic SIMAs.

Each impact mitigation score was evaluated with no timing or resource limitations or weather constraints on the response strategy effectiveness.

Those response strategies with an overall positive score, and therefore represent the potential for mitigation of impact from the spill, are then selected for further assessment of the relevant capability. Those response options with an overall negative score have been discounted and are not further evaluated (refer to Section 6).

It should be noted that a higher or lower positive score does not necessarily indicate an absolute better outcome will be achieved by one response strategy compared to another, as the scores are influenced by the number of compartments an individual response strategy can affect (e.g. there are limited number of compartments which can be affected by oiled wildlife response yet this is a critical response strategy). Also, the Strategic SIMA process presented has not used averaging of individual impact mitigation scores for similar groups of habitats; an option discussed in IPEICA (2017a). Averaging impact mitigation scores across similar resource compartments (e.g. average score for the five intertidal habitats) should be considered, if developing additional Strategic SIMAs (e.g. for a ROPEP in a new region), it appears that the total impact mitigation score may becoming disproportionately biased towards or against a specific outcome. In effect, whilst the Strategic SIMA process is a semi-quantitative process to record and justify why a response strategy should or should not be considered for use under a specific spill scenario, a high level review of the outcome should still be conducted, to ensure an appropriate response strategy has not been incorrectly discounted.

A summary of the Strategic SIMA outcomes against each WCSS is presented in Table 5-1.

A more detailed summary of the Strategic SIMA outcomes is provided in Table 5-2. Table 5-2 also presents some high-level discussion of logistics and weather constraints which may affect the practicality of implementing certain response strategies.

It should be noted that it is unlikely that a single response strategy will be completely effective in a large spill scenario, hence it is expected that multiple response strategies may be utilised in the event of a WCSS.

Table 5-1 Strategic SIMA outcomes for each WCSS

WCSS	Response strategy								
	Surveillance, monitoring and visualisation	At-Sea containment and recovery (C&R)	Chemical dispersant (surface)	Chemical dispersant (subsurface)	Protection of sensitive resources (P&D)	SCAT & shoreline clean-up	Pre-contact OWR	Post-contact OWR	In-situ burning
Brewster condensate well blow-out	Y	N	N	Y	N	Y	Y	Y	N
FPSO 5700 m³ condensate tank rupture	Y	N	N	N	N	Y	Y	Y	N
Ichthys GEP rupture 12,600m³ condensate spill	Y	N	N	N	N	Y	Y	Y	N
Vessel collision 776 m³ HFO spill	Y	Y	Y	N	Y	Y	Y	Y	N
Vessel collision 284 m³ MGO spill	Y	N	N	N	Y	Y	Y	Y	N

Table 5-2 Strategic SIMA outcomes summary

Response Strategy	Likelihood of success
Surveillance, monitoring and visualisation (SMV)	The Strategic SIMA evaluations found that SMV should always be implemented in the event of any level 2/3 spill. As such, a combination of some or all of the following should always be implemented. • oil spill trajectory modelling • aerial and/or vessel surveillance • oil spill tracker buoys • satellite surveillance. The field capability assessments to implement this response strategy are presented in Table 6-4 and Table 6-5.
At-sea containment and recovery (C&R)	The SIMA evaluations (which did not consider weather and logistical constraints) found that contain and recover was appropriate for Group IV - IFO/HFO spills only, and not relevant for condensate of MGO/diesel spills. Generally, oil needs to be >100 g/m^2 (O'Brien 2002) to feasibly corral oil with a boom and achieve any significant level of oil recovery (reasonable level of efficiency) with the skimmers. The initial, gravity-dominated release and spreading of diesel is generally complete within minutes to hours after a release (O'Brien 2002), and as demonstrated via the various MGO and condensate modelling scenarios presented in Section 4. In the context of the region, which has high sea surface and air temperatures in all seasons, the spreading of any condensate and diesel spills would be very rapid, and therefore make this response strategy highly unlikely to be applicable. In addition, in the early stages of a condensate and diesel spill, in locations where concentrations are expected to be >100 g/m^2, vessel access to the immediate spill area is likely to be restricted due to the presence of VOCs in excess of safe exposure thresholds, and potential for a flammable atmosphere. Therefore, contain and recovery for a condensate or diesel spill is not considered an appropriate strategy for implementation. For an IFO/HFO spill, where the slick is more persistent, less volatile, and likely to be present on the sea surface at appropriate concentrations (>100 g/m^2) for an extended period of time (refer Table 4-5), a contain and recovery operation may be possible. The deployment of booms and skimmers to recover Group IV oil spills is generally a suitable response strategy in a sheltered environment with non-emulsified heavy oils. Therefore, this strategy's effectiveness may sometimes be limited by the prevailing sea state conditions of the North West Marine Region (NWMR).

Response Strategy	Likelihood of success
	The strategy is relatively labour intensive when the effort is considered against overall effectiveness in reducing the volume of floating oil (i.e., it only covers a small area of spill with 1 or 2 vessels deploying booms, plus numerous personnel). Other limitations including reduced effectiveness at >0.7 to 1 knot current speeds (IPIECA-IOGP 2015a) (these current speeds are often experienced in the region); ineffectiveness in adverse sea states (>20 knots / 1.8m wave height) routinely experienced during dry season and monsoonal conditions in the NWMR, skimmer reduced effectiveness in open ocean and with emulsified oils, and logistical issues associated with recovered waste at sea (ITOPF 2011a). As such, containment and recovery will remain a challenging response strategy against Group IFO/HFO oil spills in the NWMR. Weather conditions permitting, if SMV data indicates a positive outcome could be safely achieved it may be possible undertake a containment and recovery operation.
Surface chemical dispersant (vessel/aerial)	The SIMA evaluation for found that chemical dispersant (surface application) was potentially an appropriate strategy for an IFO/HFO/LSHFO surface release only. It is not appropriate for surface condensate slicks or MGO/diesel spills. Dispersant can be effective at reducing the surface expression of Group IV hydrocarbons, under specific circumstances. The reduction in the surface expression of Group IV spills would reduce the risk of contact with surface marine fauna and shoreline/intertidal sensitivities. Depending on sea-state, atmospheric conditions, weathering and emulsification of Group IV spills the 'window of opportunity' for effective dispersant application is generally limited – from a few hours, to a few days (ITOPF 2013). Dispersant is less likely to be effective against HFO, however more likely effective against IFO and LSHFO. In addition, due to the warm temperatures of northern Australian waters, the likely window for successful dispersant application may be extended, compared to colder climates. If a spill is ongoing, (i.e., leaking from a vessel over several days), the window of opportunity for dispersant application will likely be significantly extended, due to the ongoing release of fresh oil.
Subsea chemical dispersant (subsea injection)	The Strategic SIMA evaluations for found that subsea dispersant injection (SSDI) was potentially an appropriate strategy a condensate well blowout, but no other WCSS. Atmospheric modelling (RPS 2019c) of several worst-case well-blowout scenarios indicates that VOC concentrations would routinely be expected to exceed the 500 ppm VOC 15-minute short-term exposure threshold, resulting in the shut-down of any vessel activities near the well blowout location. This VOC risk would therefore potentially stop 'source control' activities, such as debris clearance or capping stack installation, potentially prolonging the duration of a well blowout and associated surface and entrained oil exposures. If SSDI were used during a well blow-out, for the time that SSDI was applied, modelling (RPS 2019c) indicates the rates of entrainment would increase and rates of evaporation would decrease. With SSDI application, during light wind conditions, ~70% of the condensate would entrain in the shallow water column (top 3m), with evaporation (and associated atmospheric VOC exposure) reducing to ~30%. Under increased wind conditions (>6 knots), evaporation becomes close to zero (RPS 2019c). Therefore, SSDI will cause a reduction in atmospheric VOC concentration, enabling a safe debris clearance/capping stack installation. Any impacts associated with the use of SSDI to achieve a successful well-kill using a capping stack are offset by the significant reduction in the overall duration of the blow-out (and net reduction in entrained hydrocarbons) compared to a relief well-kill scenario.

Response Strategy	Likelihood of success
	The increase in entrainment from SSDI is similar to normal levels of entrainment expected to occur under higher wind conditions, and the effects of increased entrainment due to SSDI are partially offset due to a reduction in oil droplet size, resulting in a significant increase in biodegradation rates (up to 50%).
Protection of sensitive resources (P&D)	The SIMA evaluations found that protection of sensitive resources (or protection and deflection/P&D) was appropriate for Group IV/HFO spills and potentially appropriate for Group II/diesel spills, however most likely to be not appropriate/technically feasible for Group I spills. The outcome of the spill modelling (refer Table 4-5) indicated that significant volumes of oil could accumulate on an offshore island/shoreline if a vessel collision occurred in close proximity. Booms could potentially be used to protect and deflect spills away from sensitive habitats, and whilst oil needs to be >100 g/m^2 (O'Brien 2002) to achieve a reasonable level of recovery efficiency during a C&R operation, booms can be effective at deflecting oil away from a sensitive receptor, or into a natural collection point, at lower concentrations, preventing long-term oil accumulation on sensitive receptors. Given the size of the offshore island shorelines (e.g., Browse Island intertidal zone is 3 km in diameter, Scott Reef, Adele Island, Ashmore Reef, Lacapede Islands etc. are much larger), substantial numbers of booms would need to be deployed to protect entire shorelines. Anchoring of booms would most likely result in additional damage to the subsurface environment (coral reef) surrounding most offshore islands. Booms could potentially be held in place by vessels, however due to widths of shorelines requiring protection, this would most likely require an unfeasibly large number of vessels and levels of equipment (e.g., 10 large offshore vessels, plus several kms of offshore boom, moving configuration every 6 hours). Anchored booms themselves would also move around on the coral intertidal reef during periods of lower tides, potentially resulting in significant physical damage to the benthos of the reef platform. If a slick were potentially reaching a more sheltered location such as the Kimberley or NT coastlines, shoreline booming may be a more appropriate strategy, on sheltered sandy beaches (not mangrove systems or rocky headlands), however the extreme tidal ranges (+7m) and presence of estuarine crocodiles in all Kimberley/NT sheltered coastal waters present very significant challenges. Therefore, if a tangible, positive outcome could be demonstrated and with the right weather conditions a resource protection operation may be possible. In the event of a spill, the IMT, in consultation with AMOSC and WA/NT Control Agency, would consider resource protection response options, based on the outcome of real-time evaluation of available SMV data. It should also be noted that for shorelines, the WA/NT Control Agencies, would make the ultimate decision on the response strategies to be implemented, with support provided by INPEX. For Ashmore Reef and Cartier Island, INPEX will be the Control Agency for shoreline response.

Response Strategy	Likelihood of success
SCAT & Shoreline Clean-up	The SIMA evaluations found that SCAT & shoreline clean-up was potentially appropriate for all WCSSs. The outcome of the spill modelling indicated that for a well blowout, >400 m^3 of weathered condensate (Table 4-4), or >100 m^3 of weathered diesel could accumulate on an offshore island. For an HFO spill, a maximum volume of >200 m^3 weathered HFO could accumulate at Browse Island, Tiwi Islands or Buccaneer Archipelago for the worst-case replicate (Table 4-5). Several other locations were also predicted to accumulate volumes of oil onshore >100 m^3 in different HFO modelled simulations. Shoreline clean-up has been consistently found to not enhance ecological recovery of oiled coastlines (Sell et al. 1995) but it may protect other resources in the area, such as birds, marine mammals or subtidal habitats including coral reefs or fish farms (CSIRO 2016). Choosing a particular clean-up technique is dependent on factors such as shoreline type, exposure, sensitivity, amount of oil, persistence of oil, toxicity of oil and rate of natural oil removal (IPIECA-IOGP 2015a). The clean-up of Group I or II spills on a shoreline is likely to be difficult, generating high volumes of waste in comparison to the volume of oil recovered. Most offshore island shorelines would be expected to ‘self-clean’ any accumulated Group I or II oils, due to the lack of adhesiveness of these oil types, the coarse substrate, the high wave energy and high tidal regime, and generally high temperatures and UV exposures. Group IV oils however are more persistent, and shoreline clean-up is more likely to be required. Sensitive shorelines with lower energy, such as mudflats and mangroves on the WA/NT coastline and any coral reefs would likely be damaged by the physical activities associated with shoreline clean-up, and therefore these locations should be left to self-clean. In the event of a spill, the IMT, in consultation with AMOSC and WA/NT Control Agencies, would consider SCAT & shoreline clean-up as a response strategy based on the outcome of real-time SMV data evaluation. It should also be noted that for shorelines, the WA/NT Control Agencies, would make the ultimate decision on the response strategies to be implemented, with support provided by INPEX. For Ashmore Reef and Cartier Island, INPEX will be the Control Agency for shoreline response.
Pre-contact OWR (hazing and translocation)	The SIMA evaluations found that wildlife hazing was potentially appropriate for all WCSS. The outcome of the spill modelling indicated that for all WCSS, weathered condensate, MGO or IFO/HFO could accumulate on offshore islands and/or mainland shorelines (refer Table 4-4 and Table 4-5 for various shoreline oiling volumes), all of which would present a risk of wildlife oiling.

Response Strategy	Likelihood of success
	Wildlife hazing is most suitable when used near sensitive shoreline habitats against persistent oily slicks, such as HFO spills. It is generally not appropriate in an open water environment. In the case of a condensate or diesel spill, where surface oil slicks are thin and not considered particularly adhesive, the likelihood and severity of impacts on wildlife are less, in contrast to IFO/HFO. Additionally, hazing isn't considered an effective measure against volatile spills which rapidly evaporate, such as condensate. IPIECA-IOGP (2014) advise that the difficulty of capturing wildlife safely and maintaining their health during relocation should not be underestimated, and that working with live or dead animals has health and safety issues including potential injuries (e.g., bites or scratches) or zoonotic diseases. The release of zoonotic diseases from a captured population back into a wild population could result in more significant impacts to overall population viability. Risks to wildlife are high during pre-emptive capture and the risks of oiling need to be weighed against the risk of injury, death, etc., from capture and relocation. The translocation of turtles from beaches and islands would likely require the capture of large numbers of hatchlings at night, followed by translocation to a location far from the slick (to prevent surface oil impacts on released hatchlings). Attempting to capture large numbers of healthy seabirds would be very challenging and there is no practicable method to capture healthy seabirds at sea (DPaW 2014). Any seabirds captured and then released would likely fly back to the shoreline from which they originally were captured. Long term veterinary care (e.g., feeding, etc.) would be required for any successfully captured birds, until spill weathering or remediation had occurred, and it was safe to release the animals. Overall, there is a potential for harm of animals captured to occur; however, as a spill response strategy it may result in a positive impact. In the event of a Group I, II or IV spill, the INPEX IMT, in consultation with relevant WA/NT Control Agencies would consider pre-contact wildlife response as a response strategy based on the outcome of real-time SMV data received, and whether indications were that a significant number of individuals of a protected species would be likely to benefit from the response strategy. It should also be noted that for shorelines and wildlife response, the relevant WA/NT Control Agency would make the ultimate decision on the response strategies to be implemented, with support provided by INPEX. For Ashmore and Cartier, INPEX will be the Control Agency for shoreline response.
Post-contact OWR	The SIMA evaluations found that post-contact wildlife response was potentially appropriate for all WCSS. The outcome of the spill modelling indicated that for all WCSS, weathered condensate, MGO or IFO/HFO could accumulate on offshore islands and/or mainland shorelines (refer Table 4-4 and Table 4-5 for various shoreline oiling volumes), all of which would present a risk of wildlife oiling.

Response Strategy	Likelihood of success
	Capture, relocation, assessment, cleaning, rehabilitation of oiled wildlife does have the ability to increase the survival of individuals. The scale of oil impacts on wildlife is dependent on factors such as timing, location, oceanographic and weather patterns, and the movements of species that forage, feed, nest and inhabit that area (IPIECA-IOGP 2014). Given the predicted weathering of any Group I, II or IV spill, most wildlife exposure is expected to be to weathered hydrocarbons, with lower associated levels of toxicity (Stout et al. 2016). Group I and II hydrocarbons are relatively non-adhesive compared to HFO, and generally not considered an oil product that would 'coat' the feathers of birds, requiring a full wildlife cleaning response on a shoreline. They are also not likely to generate a thick surface barrier on a shoreline which would coat adult nesting turtles or turtle hatchlings as they transit to the ocean. However, this may be the case for a Group IV spill. Any seabirds captured, cleaned and released may fly back to the shoreline from which they originally were captured and may be repeatedly affected. Therefore, long term veterinary care (rehabilitation, feeding, etc.) would be required for any successfully captured birds, until spill weathering or remediation had occurred, and it was safe to release the seabirds. Once oiled, it is generally agreed that for most bird species, there is a very low survival rate, with many studies reporting the probability of dying near to 100%. The only reported high success rates of seabird cleaning are typically associated with cleaning pelicans and penguins which are not present within the Browse Basin. IPIECA-IOGP (2014) advise working with live or dead animals has health and safety issues including potential injuries (e.g., bites or scratches) or zoonotic diseases. The release of zoonotic diseases from a captured population back into a wild population could result in more significant impacts to overall population viability. ITOPF (2011b) note that there are many cases where oiled turtles have been cleaned successfully and returned to the water. In the event of a Group I, II or IV spill, the IMT would consider, in consultation with WA/NT Control Agency, post-contact wildlife response as a response strategy based on the outcome of the real-time SMV data received, and whether indications were that a significant number of individuals of a protected species would be likely to benefit from the response strategy. It should also be noted that for shorelines and wildlife response, the WA/NT Control Agency would make the ultimate decision on the response strategies to be implemented, with support provided by INPEX. For Ashmore and Cartier, INPEX will be the Control Agency for shoreline response.
Controlled in-situ burning (ISB)	The SIMA evaluations found that ISB was not an appropriate response strategy for any of the WCSS evaluated in this report.

6 FIELD CAPABILITY ASSESSMENT

This section presents the completed field capability assessments.

It also includes other supporting information related to following:

- selection of WCSSs for detailed field capability assessment
- cone of response model
- oil spill budgets
- summary of environmental values and sensitivities of the BROPEP region
- summary of tiered preparedness models

6.1 Selection of WCSS for Field Capability Assessment

In accordance with the processes described in IPIECA-IOGP (2013) Part 2, two scenarios have been selected for detailed Field Capability Assessment, due to their BOD and Strategic SIMA outcome.

Justification for the selection of the two WCSS is provided in Table 6-1.

Table 6-1 Selection of WCSS for Field Capability Assessment

WCSS	Selected (Yes/No)	Justification
Brewster condensate full bore well blow-out	Yes	Brewster well blow-out WCSS presents the largest volume of condensate release of the three condensate release scenarios, by three orders of magnitude. It is the only scenario where subsurface dispersant injection is considered an appropriate response strategy. The duration and release volume result in multiple shorelines being contacted >100 g/m^2, potentially requiring multiple SCAT, shoreline clean-up and OWR activities in remote locations.
FPSO 5700 m^3 condensate tank rupture	No	The FPSO collision WCSS total release volume is several orders of magnitude lower than the well-blowout WCSS. Table 4-5 demonstrate that risk of impacts to shoreline values and sensitivities from the FPSO collision WCSS is far lower than the potential level of impact from the well blow-out WCSS. Therefore, the field capability assessment conducted for a well blow-out WCSS will determine a capability requirement which is in excess of the FPSO collision WCSS.
Ichthys GEP full bore rupture 12,000 m^3 condensate spill	No	The GEP rupture WCSS total release volume is several orders of magnitude lower than the well-blowout WCSS. Table 4-5 demonstrate that risk of impacts to values and sensitivities from the GEP rupture WCSS is far lower than the potential level of impact from the well blowout WCSS. Therefore, the field capability assessment conducted for a well blow-out WCSS will determine a capability requirement which is in excess of the GEP rupture WCSS.
Vessel collision 776 m^3 HFO spill	Yes	The HFO WCSS presents the largest volume of a fuel oil release of the HFO and MGO vessel collision scenarios. It is the only scenario where surface chemical dispersant is considered an appropriate response strategy, and also has the greatest likelihood of requiring containment and recovery activities. This scenario also has the longest lineal distance >1 g/m^2 floating oil, longest length shoreline oiled at >10 g/m^2 and >100 g/m^2 of any WCSS, and the second highest volume of oil on shoreline >100 g/m^2. When considering the emulsification factor associated with a HFO spill, this WCSS would likely exceed the well blowout total volume of oil ashore. Combined with the persistency of Group IV oils, this would subsequently result in the largest shoreline clean-up, OWR and shoreline waste management program.

WCSS	Selected (Yes/No)	Justification
Vessel collision 284 m^3 MGO spill	No	The vessel collision MGO WCSS total release volume is approximately one third of the volume compared to the vessel collision HFO WCSS. Both the HFO WCSS and MGO WCSS present potential for impacts at remote offshore islands as well as Kimberley/NT coastal islands and shorelines. However, the BOD results (Table 4-5) demonstrate that the scale/magnitude of impacts both on the open ocean and on shorelines is generally significantly less for an MGO WCSS compared to the HFO WCSS. An evaluation of the stochastic modelling results demonstrated that a MGO WCSS typically only impacts an individual shoreline sector, where-as the modelling showed that a HFO WCSS has potential to impact a larger volume/length/greater number of shoreline sectors. MGO WCSS typically only impact a single shoreline location. From an oiled wildlife perspective, a location such as the Lacapede Islands (turtle nesting) or Adele Island (seabird nesting) are likely to have larger numbers of wildlife present, compared to Browse Island (being the closest shoreline location from the HFO spill risk). However due to the volumes calculated ashore, emulsification (increasing total volume of HFO oil ashore), significantly increased persistency of HFO, and widespread area of potential shoreline contact from the HFO WCSS, it is considered that the HFO WCSS has the potential to result in a greater oiled wildlife impacts, compared to any modelled MGO scenario. Maximum volumes of oil ashore presented in Table 4-5 are 'neat oil', not accounting for emulsification. Group IV oils emulsification typically result in larger total oil volumes arriving ashore, and in combination with bulking factors, also result in larger oily waste volumes being generated during shoreline clean-up. Group IV oils are also more persistent on shoreline (higher pour-point and less susceptible to UV degradation) and are likely more recoverable. Therefore, a larger shoreline clean-up team would typically be required compared to an equivalent volume of 'neat' MGO oil arriving ashore. Also, Group IV persistency likely results in higher number/consequence of OWR response, for the same volume of oil ashore. The Strategic SIMA outcome identifies the potential for the activation of the same response strategies as for the MGO WCSS and the HFO WCSS scenario, with two exceptions. The HFO WCSS scenario also includes the use of at-sea containment and recovery, and surface chemical dispersant, which are not appropriate during an MGO spill scenario. Therefore, the field capability assessment conducted for the HFO WCSS will determine a capability requirement which is in excess of the field capability required for the MGO WCSS.

6.2 Cone of response

To maximise the effectiveness of the overall response effort, the most effective and advantageous options should be deployed as close to the source as possible, (depending on safety and operational limitations). Supplementary actions should then radiate out from this location. This approach is known as the 'cone of response' model and is displayed in Figure 6-1. Optimising the response in this way can help to maximise the removal of oil from the water's surface (IPIECA-IOGP 2015a).

IPIECA-IOGP (2015b) have developed a similar cone of response model (refer to Figure 6-2); however, this only considered the at sea response strategies.

Figure 6-1 provides the layout of at-sea response strategies with Zone A for C&R located closest to the spill source, followed by Zone B for FWAD and Zone C for vessel dispersant at increasing distances from the spill source. In contract, the IPIECA-IOGP (2015b) model (Figure 6 2), shows dispersant operations closest to the spill source and C&R used adjacent to a shoreline sensitivity.

Another 'cone of response' model, which commences from the start of the spill has been developed by AMOSC, provided as Figure 6-3.

These various models have been provided, as an indication of the potential variety of configurations in which the various response strategies can be deployed, to achieve specific response objectives.

The field capability assessment process is used to assess and determine the most suitable capabilities and arrangements for the various response strategies for each WCSSs. Where relevant, the field capability assessment should take into consideration the various 'cone of response' models available, and different outcomes which can be achieved by varying how and where each response strategy is implemented.

Whilst subsea dispersant injection is within the scope of this document, other source control activities such as capping stack deployment, debris clearance and relief wells are not. Source control capabilities and arrangements are addressed in relevant activity specific EPs.

Remote shoreline operations are not typically addressed in spill response literature and the cone of response models. Remote shoreline operations are a significant consideration for the BROPEP. The BROPEP encompasses a region with incredibly low levels of infrastructure along the mainland coastline between Broome and Darwin, several thousand islands within State/Territory coastal waters, and a significant number of very remote offshore islands/reef systems. Therefore, some response activities such as SCAT, P&D, shoreline clean-up and OWR are highly likely to require the use of a floating/vessel-based logistics platform. This is similar to having a floating offshore command post/staging area, as shown in Figure 6 1. However, additional logistical support such as smaller vessels, landing barges and possibly light utility helicopters are required to facilitate response logistics.

Techniques to facilitate remote shoreline oil spill response in northern Australia have been significantly researched by INPEX and Shell, with a primary focus on Browse Island. However the principles, logistics plans, safety plans, etc. that have been developed for a response at Browse Island are broadly applicable to any remote northern Australian location. This is because the hazards are similar including:

- extreme remoteness of most locations (>1 hour flight time to any town/city, no/minimal local services available)
- lack of any infrastructure (i.e. roads, ports, airfields) at virtually every shoreline location

- large tidal ranges and challenging met ocean conditions making shoreline landing via vessel difficult at times
- estuarine crocodiles and other marine fauna hazards, especially for islands closer to the mainland
- intense heat/humidity

Detailed remote response planning documentation is available via the INPEX Browse Island Oil Spill Response Guideline (X060-AH-GLN-60015). The INPEX/Shell offshore/remote response techniques have been tested as part of several desktop exercise, including with NOPSEMA, AMSA and WA DoT during spill response planning (APPEA 2020).

Whilst INPEX's focus has been remote response at offshore islands, remote response can also be facilitated at remote shorelines with road access, by establishing remote accommodation camps/forward operating bases (FOBs).

A summary of remote response requirements is provided in Table 6-2.

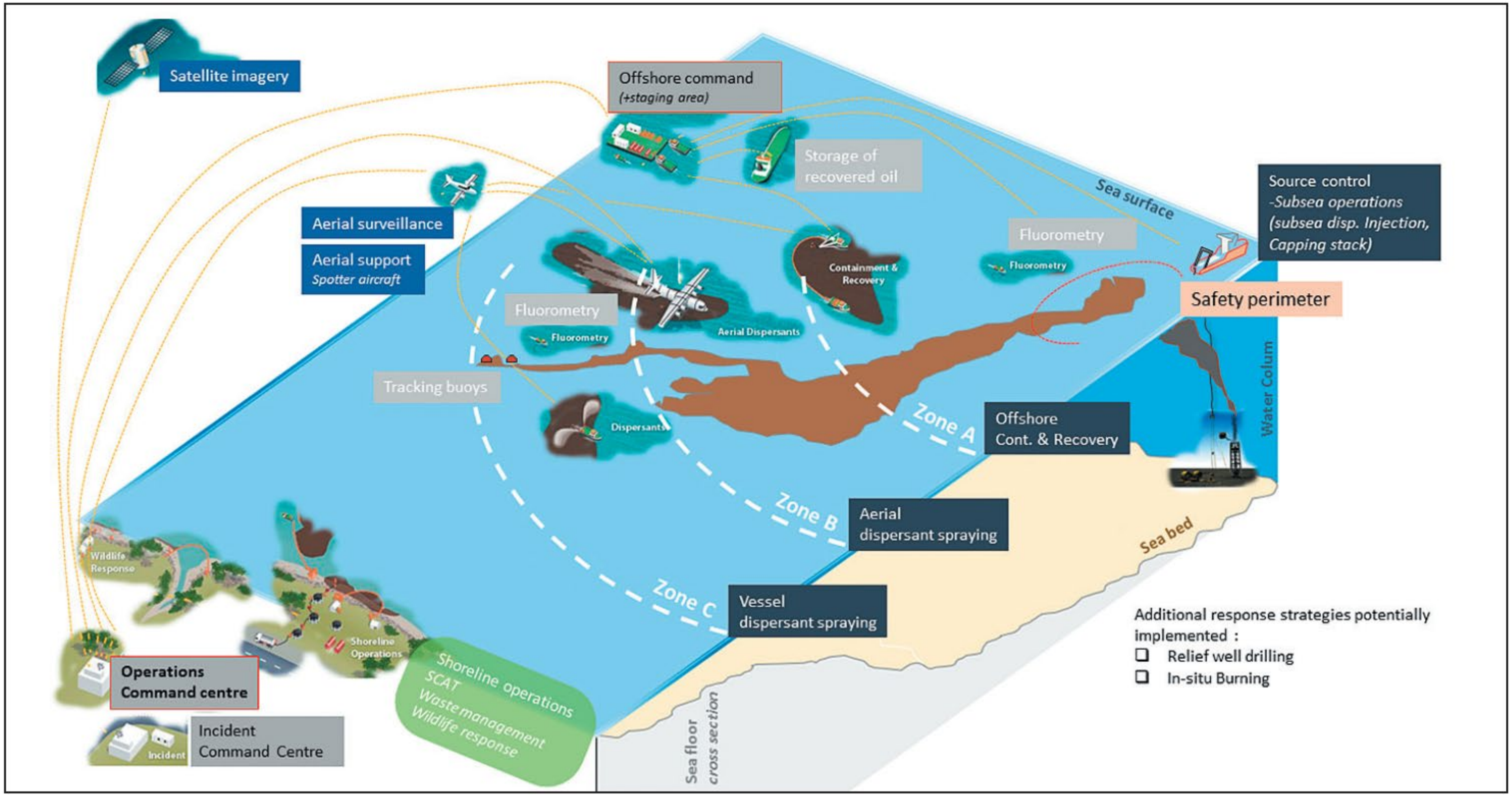


Figure 6-1 Cone of Response Model (Source EOSP, 2012).

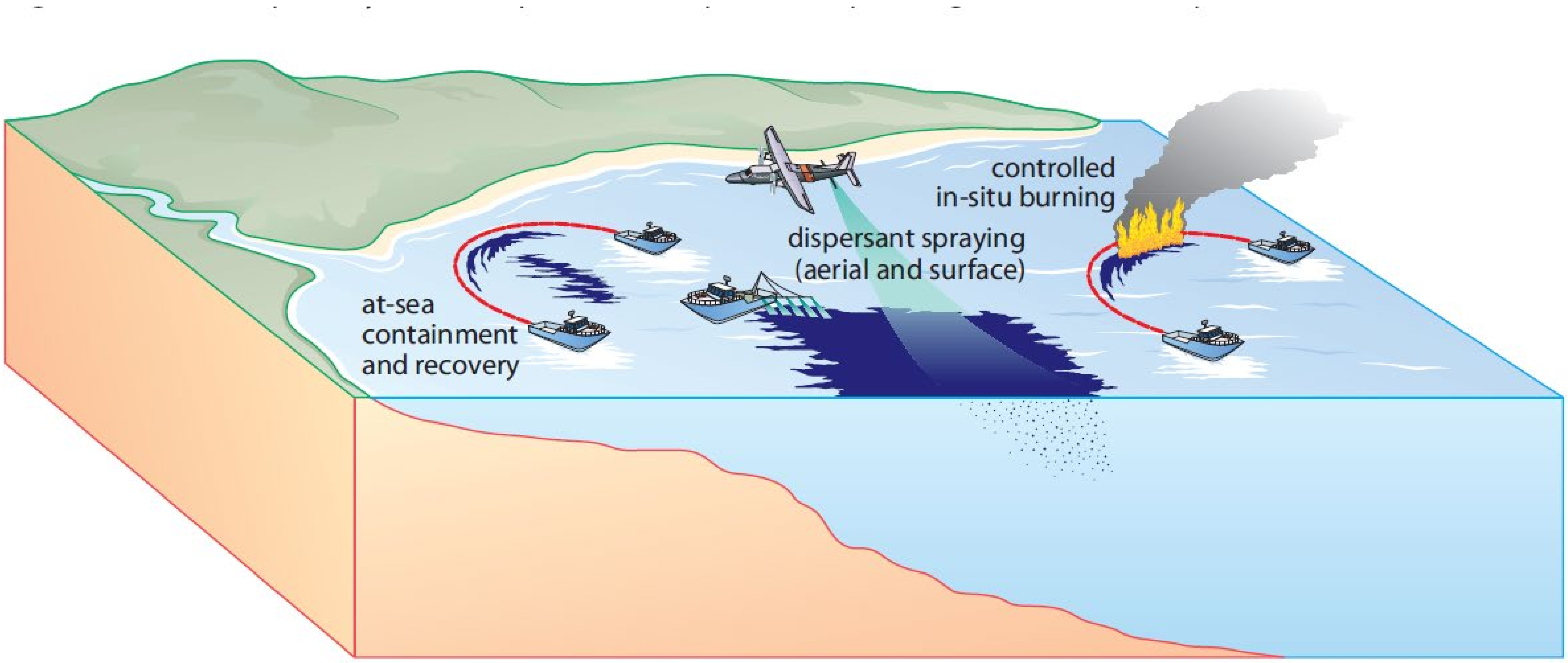


Figure 6-2 At sea response techniques for responding to a surface spill (Source: IPIECA 2015b)

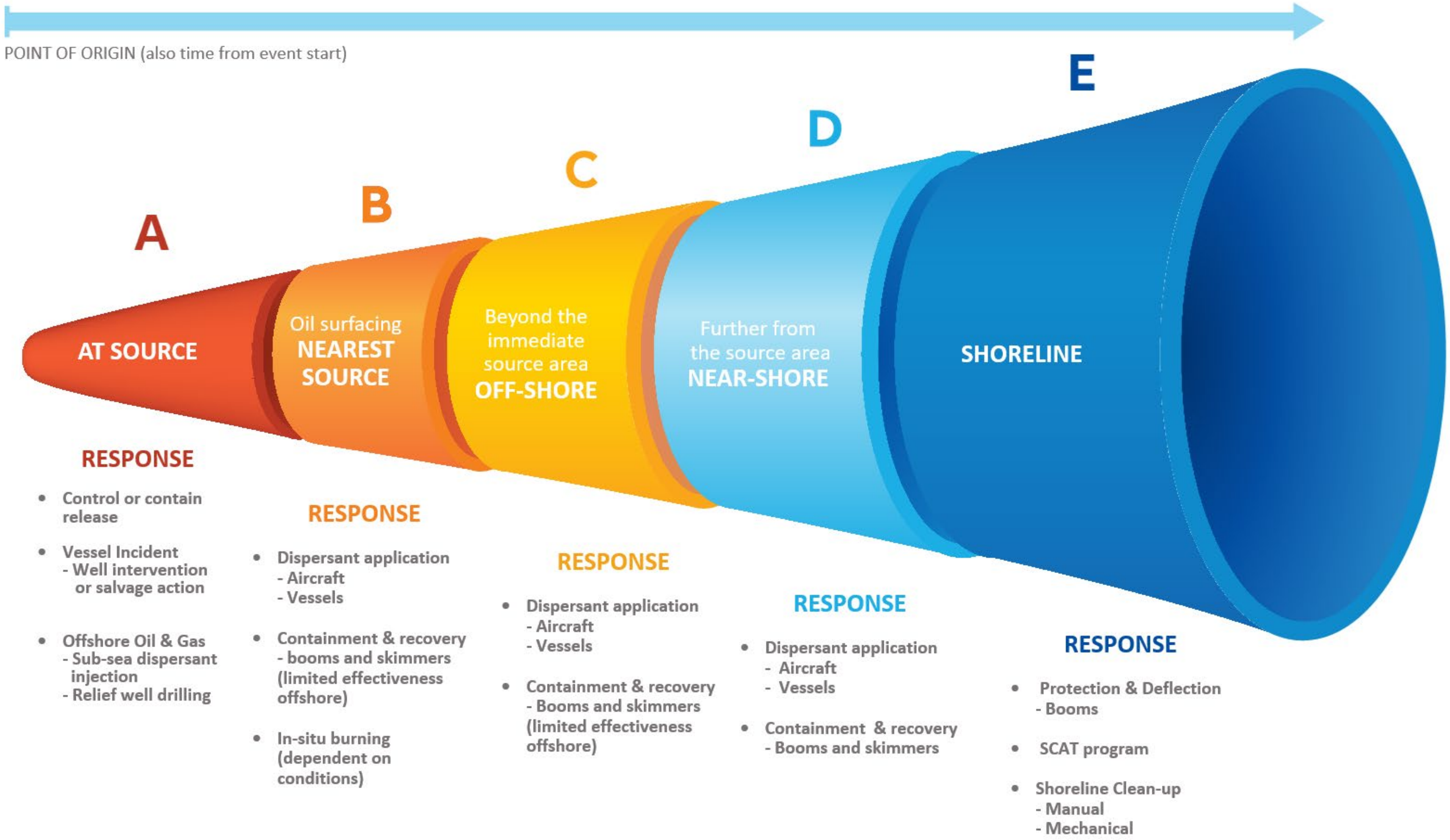


Figure 6-3 Cone of response- AMOSC model

6.3 Oil Spill Budget

An oil spill budget is a process used to assist in the evaluation of the field response capability, based on the volume/thickness of oil within a certain area, weathering and behaviour of the oil over time in the environment, and the effectiveness of the various response strategies.

Oil spill budgets are used as part of the field capability assessments, presented in Section 6.5.

The below sub-sections describe factors affecting an oil spill budget for the various response strategies.

Generation of an oil spill budget can provide an early indication of a number of response parameters including:

- potential waste volumes
- scale of response
- duration of response
- likely efficacy of specific response strategies

6.3.1 At Sea Containment and Recovery

At sea containment and recovery is the controlled collection and recovery of floating oil from the water's surface. The response typically involves the deployment of booms and oil skimmers from suitable vessels, as well as the collection, transfer and disposal of oil and oily water recovered during the response.

A traditional U-sweep or J-sweep configuration involved two vessels (or one vessel using a para-vane to hold the boom mouth open). The width of the mouth of the boom is typically one third the boom length, therefore ~120 m wide mouth if 400 m of boom was deployed.

Advanced booming techniques require up to 3 to 5 vessels per strike team with advanced booming equipment such as current-busters & speed-sweep systems. These configurations and equipment can operate at higher speeds (up to 5 knots), however have a narrower swath width, typically only 15 - 22 meters (IPIECA-IOGP 2015a). Advanced booming techniques are useful in scenarios when the slick has spread and fragmented, however targeted operations will typically require some form of air or drone support due to the difficulty of oil on water observation from vessels. Another issue is that current busters have limited oil storage capacity in the pocket, and therefore booming operations must stop, and switch to skimming when the system becomes full. Therefore, the overall encounter rate/oil recovery rate over an operational period may not vary significantly when compared to traditional techniques.

Effective containment and recovery can reduce the potential risks and impact of a marine pollution event associated with:

- marine fauna
- sensitive shoreline environments
- shoreline response
- waste generation.

However, the overall effectiveness of containment and recovery can be limited by a combination of operational constraints which may include but not limited to:

- slick: thickness and percentage cover on surface (affecting the encounter rate)

- slick: state of weathering (how recoverable the oil is with a skimmer)
- weather: suitable weather/sea state conditions and current strengths

Generally oil needs to be >100 g/m^2 (>0.1mm, which equates to Bonn Code 4/5) to feasibly corral oil with a boom and achieve any significant level, or operationally efficient level, of oil recovery with skimmers during an offshore C&R operation (O'Brien 2002 and IPIECA-IOGP 2015a)

Continuing containment and recovery operations for slicks noted to be in Code 1, Code 2, and Code 3 (silver/grey sheen, rainbow sheen and metallic sheen respectively) would require consideration of potential recovery rates versus the likely benefits to the environment, as well as operational risk and cost.

The rate at which the spilled oil can be captured within the boom is known as the encounter rate (IPIECA-IOGP 2015a), and is a product of the:

- swathe width of the boom configuration
- speed at which the boom is being towed
- thickness and continuity of the oil slick that is being encountered, which may vary considerably, due to slick spreading & fragmentation.

It is possible to estimate encounter rates and recovery volumes based on the following; oil thickness x boom opening (which is generally 1 third length) x efficiency rate (typically around 10% but could be higher depending on oil type).

Containment and recovery potential calculations provide an indication of the possible impact per strike team on oil spill budget. Calculations can be done on the following basis to indicate a maximum recoverable volume in m^3/hr:

- width of boom collecting oil on water (full span width for advanced boom systems such as a Current Buster, or 30% of boom length for conventional Ro-Boom or similar system)
- thickness of oil on water (typically within BONN Agreement Discontinuous True Colour range of between 50µm and 200µm)
- rate of travel over water, which is typically a maximum of 0.75 knots for conventional boom, or up to 4 – 5 knots for advanced booming systems (because excess speed over water will result in oil escaping beneath the boom)
- time of operation per day (daylight hours minus deployment time, skimming time (advancing boom systems) or other HSE requirements/constraints)

Two worked examples for oil spill budget for at sea containment and recovery are provided below. Note, these examples are based on the strike team encountering contiguous oil of 50µm (minimum containment potential) and 200µm (maximum containment potential), across the entire mouth of the boom, for the entire duration of an operational period.

- Current buster strike team
  - Equipment Current Buster 4 (National Plan stockpile standard)
  - Encounter width full span (22 m)
  - BONN agreement Discontinuous True Colour Range, 50µm and 2 knots speed over water (minimum)
  - BONN agreement Discontinuous True Colour Range, 200µm and 4 knots speed over water (maximum)
  - 8 hr operational period per day

  - **Minimum containment potential = 33 m^3/day**
  - **Maximum containment potential = 261 m^3/day**

- Traditional Ro-Boom strike team
  - Equipment 2 x 200 m lengths offshore Ro-Boom
  - U or J formation with encounter span 30% of total length = 120 m
  - BONN agreement Discontinuous True Colour Range, 50µm (minimum) and 200µm (maximum) oil on water
  - Speed over water 0.75 knots
  - 8 hr operational period per day
  - **Minimum containment potential = 67 m^3/day**
  - **Maximum containment potential = 267 m^3/day**

However, based on the constraints listed above, experience has shown that the efficiency of at-sea containment and recovery operations can vary widely and recovery is usually limited to between 5% and 20% of the initial spilled volume (IPIECA-IOGP 2015a).

6.3.2 Surface Dispersant

Dispersant application is designed to transfer oil from the surface of the ocean to the water column and to enhance the natural process of biodegradation. Being able to target oil closest to the source provides the best outcome in terms of efficacy of the dispersant product on the hydrocarbon. This minimises the ongoing impact of pollution in the environment and reduces the overall potential oil spill budget. Dispersants can treat more oil over time typically than other response options due to the versatility of application using both aircraft and vessels. Careful planning for dispersant operations will ensure that any requirement for dispersant application can continue as needed for the duration of a response.

For successful operations the dispersant must be effective. This can be determined in a number of ways including:

- jar test (From a sample collected at source or spill) conducted on site
- efficacy testing by a laboratory on known products and hydrocarbons
- visual analysis by trained responders of test spray from aircraft or vessel

Noting that for heavier oils dispersion can take longer (up to 30 minutes) to occur depending on the dose/concentration applied and wind/wave activity, which will drive mixing of the dispersant into the oil.

Australian stockpiles of dispersant consist generally of products considered to be effective on a broad range of oils rather than specific to a given type. The application rate may change considerably (high application rates for thicker layers of viscous oil, lower rates for thinner, lighter oils) but efficacy on a typical crude product is usually above 70%.

In addition, calculations can be derived to generate an indicative number of assets or strike teams. Example dispersant oil spill budget considerations are provided below.

Aircraft Application

Aircraft application for an offshore response provides the ability to treat large volumes of oil over a large area, in a relatively rapid timeframe. Aircraft also have the ability to transit quickly to respond and to treat slicks separated over large distances.

Aerial operations are restricted to daylight hours and typically require good visibility, minimum cloud ceiling of 1000ft, and wind speeds below 35 knots to ensure aircraft and pilot safety. Pilots are responsible for aircraft operations and safety at all times.

Defining a single aircraft and support requirements as a strike team, indicative impact on oil budget per strike team can be derived using the following parameters (based on an air-tractor / crop-duster type aircraft):

- total or daily volume of release
- calculated dispersant volume to treat at initial 1:20 dispersant to oil ratio
- dispersant efficacy on oil is 70%
- one aircraft can deliver 3 m^3 per sortie
- one aircraft can typically conduct a maximum of 4 sorties per day, reduced to 3 sorties per day, if conducing operations a significant distance offshore)

The impact of one Fixed Wing Aircraft strike team is approximately 42 m^3 of oil treated per sortie or 126 m^3 per day with 4 sorties.

Vessel Application

Vessel-based dispersant spray application provides the ability to accurately target oil on the water. However air support, or the use of drones, allows operators to locate slicks that are difficult to observe from sea level. Smaller amounts of dispersant, or diluted dispersant can be applied based on onsite assessment of efficacy, improving application efficiency.

There are a number of different systems for vessel-based application and the general considerations for efficient use include:

- mounting of spray arms as far forward as possible to avoid the bow wave moving oil out of the spray path
- nozzles that produce a flat spray of droplets (not mist or fog) that strike the water in a line perpendicular to the direction of vessel movement
- operation of vessel in prevailing wind/weather conditions to avoid overspray onto decks or personnel
- initial (rule of thumb) dispersant to oil ratio of 1:20 which can then be adjusted to actual field concentrations based on observed efficacy
- treatment should initially target the outer edges of the thicker portions of any slick rather than through the middle or on thin sheen at surrounding edges.

Defining a single vessel and support requirements as a strike team, indicative capability impact on oil spill budget can be derived using the following parameters:

- total or daily volume of release
- calculated dispersant volume to treat at initial 1:20 dispersant to oil ratio
- dispersant efficacy on oil is 70%

- calculated vessels required based on 1 m^3/hr dispersant delivery per 8 hr day per vessel (based on single AFEDO system – note - other spray systems may vary in delivery rates /capability)
- number of spray systems per vessel

The impact of one vessel-based strike team is approximately 14 m^3 of oil treated per 1 m^3 of dispersant, or 112 m^3 of oil per day, using 8 m^3 of dispersant per day.

6.3.3 Subsurface Dispersant Injection

Sub-sea dispersant injection (SSDI), conducted essentially at the source, has a significant impact on the oil spill budget and provides a number of advantages over surface dispersant application including:

- application can be continuous regardless of time of day or weather and sea state
- once set up, injection requires less manpower and assets
- efficacy on fresh oil at source is higher, and with increased dispersant mixing due to the turbulent flow in the oil/gas stream, SSDI requires less dispersant (1:100 dispersant to oil ratio typically used for SSDI) providing the ability to treat large volumes of oil with lower volumes of dispersant compared to surface dispersant application.
- sub-surface injection has been shown to significantly reduce volatile organic carbons (VOCs) at surface (e.g., Macondo/Gulf of Mexico incident), increasing safety of responders on waters adjacent to the source of the release.

An indicative capability impact on oil budget can be derived using the following parameters:

- total or daily volume of oil released
- calculated dispersant volume to treat the oil at an initial 1:100 dispersant to oil ratio (AMOSC 2016; IPIECA-IOGP 2016a), or
- maximum dispersant flowrate at point of injection

6.3.4 In Situ Burning

ISB requires wave heights typically below 1 m and wind speeds below 10 knots (IPIECA-IOGP 2016b)

To implement an effective in-situ burn response, a minimum surface hydrocarbon thickness of 2-5 mm (2000 - 5000 g/m^2) is required to be present. Booms would be required to corral the spill, in an attempt to generate additional oil thickness. Therefore, ISB could potentially be attempted in the same locations, on the same slicks as at sea containment and recovery.

The efficiency rates can then be calculated based on the same factors as used for at sea containment and recovery, noting that additional time is then required to conduct the burn itself.

6.3.5 Protection of Sensitive Resources

There is no ‘minimum thickness’ for effective P&D booming (unlike at sea containment and recovery where 100 g/m^2 typical thickness is required for reasonable oil recovery volume). Booming at lower floating oil concentrations can still result in a positive environmental outcome, by preventing accumulation over time.

Oil spill budget factors that can be

- location specific tidal ranges and current speeds will need to be taken into consideration, to determine potential nearshore/shoreline booming configurations and their potential effectiveness.
- based on potentially effective booming configurations, it is possible to calculate the required lengths of boom and associated ancillaries for specific receptors/locations.
- an estimate would then need to be made in regard to the interception rate and recovery rates for nearshore/shoreline oil.

6.3.6 Shoreline Response

Shoreline response is one of the final areas to impact the oil spill budget. Clear derivation of the impact is complex considering:

- volumetric changes to the oil over time due to weathering
- bulking factors based on marine or shoreline debris
- bulking factors introduced through cleaning methods or requirements
- waste management and hazardous waste minimisation

A ‘rule of thumb’ estimate (IPIECA-IOGP 2015c) of the impact of shoreline clean-up efforts on oil spill budget is that one person can remove 1–2 m^3 per day.

6.3.7 Oiled Wildlife Response

Some elements of potential oiled wildlife capability can be evaluated, based on a range of parameters, including:

- location, density and abundance (and seasonality) of wildlife population(s) potentially at risk from a WCSS
- oil types (including weathering properties) and how the fresh vs weathered oil(s) may affect the various wildlife species
- credible response options/tactics for the various species/populations (E.g., comparison of hazing vs pre-emptive capture and translocation vs collection/rescue, intake, first aid/stabilisation, initial clean and rapid release, or full cleaning, long-term rehabilitation and release).
- the species protection/priority status, and evaluation of the impact of the loss of individual animals on the overall species/population viability; which informs the justification for full cleaning and rehabilitation, vs other treatment/welfare options.

OWR planning should ensure that capabilities are available for the likely/credible OWR options/tactics, based on the evaluation of the key species at risk.

During oiled wildlife cleaning, it is expected that between 600 – 1000 L of fresh water may be required to wash and rinse one wildlife casualty. Additional water is required for rehabilitation pools, general cleaning etc. Therefore, the supply of fresh water, and oily water storage is a key consideration.

An overall space requirement of approximately 2,400 m^3, a water flow capacity reaching 60,000L/day and an electrical load of 200 Amps (for heating, air conditioning etc) are a conservative estimate for a centre dealing with 100 to 500 wildlife casualties at a cleaning/rehabilitation facility at one time (DBCA 2014).

6.4 Environmental Overview of the BROPEP Region

A detailed description of the existing environment, including full EPBC Protected Matters Search outputs and literature review of the values and sensitivities potentially impacted by oil spills are contained within each activity specific EP, related to this BROPEP.

In addition, environmental values and sensitivities maps are provided in Appendix C of the BROPEP (X060-AH-PLN-70009).

However, to provide context for spill response planning purposes, a very high-level summary of the environmental values and sensitivities of the region is provided below.

- Deep offshore waters
  - Typically nutrient poor, supporting pelagic fish, sharks, cetaceans etc, and marine avifauna
  - Some demersal fisheries
  - Some offshore oil and gas developments
- Offshore submerged banks and shoals
  - typically coral/coralline algae dominated substrates, supporting diverse shallow water reef ecosystems, including aggregation/feeding areas for marine megafauna
- Offshore emergent reefs/islands
  - typically coral/coralline algae dominated substrates, supporting diverse shallow water reef ecosystems, including aggregation/feeding areas for marine megafauna
  - coarse sandy beaches, some with limited vegetation
  - most offshore islands typically supporting protected marine fauna (turtle/bird) roosting/breeding/nesting.
- Kimberley/NT coastline – outer islands
  - highly tidal, typically moderate wave energy rocky shorelines or coarse sandy beaches, with highly diverse fringing coral reef ecosystems
  - some beaches supporting protected marine fauna (turtle/bird) roosting/breeding/nesting, and occasional presence of estuarine crocodiles.
- Kimberley/NT coastline – inshore islands/mainland coast
  - highly tidal, typically moderate to low energy shorelines, dominated by extensive mangrove habitats, with some rocky outcrops and medium to fine-grain sediment beaches.
  - mangrove and beach habitats support diverse ecosystems, including significant populations of estuarine crocodiles.

6.5 Tiered Preparedness

Tiered preparedness is described by the IPIECA-IOGP (2016c) Tiered Preparedness Guideline as:

- Tier 1 capabilities describe the locally held resources used to mitigate spills that are typically operational in nature occurring on or near an operator's own facility.
- Tier 2 capabilities are typically extra resources from regional or national providers, used to increase response capacity or to introduce more specialist technical expertise.

- Tier 3 capabilities are globally available resources that further supplement Tiers 1 and 2. The resources held at the three tiers work to complement and enhance the overall capability by enabling seamless escalation according to the requirements of the incident.

An important concept is the cumulative nature of a tiered response. The elements of a Tier 1 response are supplemented by higher tier capability and not superseded or replaced by it.

The National Plan (AMSA 2020a) identifies three levels of incidents as follows:

- Level 1: Incidents are generally able to be resolved through the application of local or initial resources only (E.g., first-strike capacity)
- Level 2: Incidents are more complex in size, duration, resource management and risk and may require deployment of jurisdiction resources beyond the initial response
- Level 3: Incidents are generally characterised by a degree of complexity that requires the Incident Controller to delegate all incident management functions to focus on strategic leadership and response coordination and may be supported by national and international resources.

Combining these two descriptions, for the purposes of regional response planning, within an Australian context,

- Tier one resources are typically being held 'locally'
- Tier two are those held regionally (E.g., West Coast vs East Coast resources) or a portion of the nationally capability
- Tier three being full deployment of the national resources, and global capability where required.

Table 6-2 presents an example analysis of the equipment/assets which could be deployed for each field response activity under each tier of response in an Australian context.

This table was initially prepared by the Australian Marine Oil Spill Centre (AMOSC) in 2020, as part of an Australian Petroleum Production and Exploration Association (APPEA) IMT training and capability assessment project and is therefore presented below as an indicative/conceptual model only (i.e. this a conceptual model, not endorsed under the NatPlan or any State/Territory Control Agency oil spill contingency plan (OSCP)).

This conceptual model has been developed/presented below, for the purposes of assisting in the consideration of field capability units/strike teams, when conducting the field capability assessment process.

Table 6-3 presents the BROPEP specific definitions of tiered capability.

Table 6-2 Example Tiered Preparedness Capability Overview

Response Strategy	Response strategy objective	Capability Description	Tier One Example Criteria	Tier Two Example Criteria	Tier Three Example Criteria
Surveillance, monitoring and visualisation (SMV)	To collect spill event/response data from a wide variety of sources, to enable informed and timely IMT decision making during a response.	Oil Spill Trajectory Modelling (OSTM) • OSTM will provide predictions of the trajectory and fate of the oil spill • OSTM can be used to predict effectiveness of dispersant • OSTM outputs can be further interrogated to inform health and safety decisions (such as atmospheric risks etc). The capability requirements for OSTM are provided below. • Validated OSTM computer model/program • Trained personnel, on call, to rapidly activate the OSTM.	1 x OSTM run ordered and received.	2 or more OSTMs ordered and received over a few days to 1 week.	Multiple daily OSTMs ordered and received over long duration response.
		Aerial surveillance aircraft and trained spotters • aerial surveillance will assist with validating the OSTM predictions, through visual confirmation of the location and type of slick. • personnel trained in aerial observation The capability requirements for Aerial Surveillance are provided below. • Suitable aircraft (fixed or rotary wing) • Trained air observer personnel	1 x vessel maintaining surveillance (spill is small enough that vessel surveillance is sufficient to replace planned aerial surveillance)	Opportunistic – primary visual surveillance provided by aerial surveillance.	Opportunistic – primary visual surveillance provided by aerial surveillance.
		Vessel surveillance • vessel surveillance will assist with validating the OSTM predictions, through visual confirmation of the location and type of slick. The capability requirements for Aerial Surveillance are provided below. • Suitable vessel • Trained spill observer personnel	1 x vessel maintaining surveillance (spill is small enough that vessel surveillance is sufficient to replace planned aerial surveillance)	Opportunistic – primary visual surveillance provided by aerial surveillance.	Opportunistic – primary visual surveillance provided by aerial surveillance.
		Electronic surface tracker buoys (ESTBs) • ESTBs will assist with validating the OSTM predictions • ESTBs will assist with aerial surveillance flight planning The capability requirements for ESTBs are provided below. • ESTBs • satellite tracking/data reporting platform • suitable deployment platforms (vessels, aircraft etc).	1-3 x Satellite Tracker Buoys deployed near release location during initial release (first 3-6 hours) only.	Additional ESTBs deployed near leading edge of slick or separately identified slicks that develop over time (Sets of 3 buoys depending on slick leading-edge size) at end of daylight operations. 3 - 6 ESTBs deployed.	Routine deployment of clusters of ESTBs deployed near leading edge of slick at end of daylight operations, over multiple days during a long-duration spill event. >6 ESTBs deployed. The need for ongoing deployment of additional ESTBs, or re-deployment of those used previously, would be subject to review based on overall benefit over time.

Response Strategy	Response strategy objective	Capability Description	Tier One Example Criteria	Tier Two Example Criteria	Tier Three Example Criteria
		Satellite imagery • satellite imagery will assist with validating the OSTM predictions The capability requirements for satellite imagery are: • satellites with suitable spectrum for spill observations • satellite data reporting platform • personnel trained in the interpretation of satellite imagery.	N/A	Single satellite imagery acquisition.	Multiple satellite imagery acquisitions over long duration response, with dedicated imagery interpretation capability also activated.
		Operational Monitoring Programs (part of the OSMP) • provides water quality data and other data to support IMT response decision making The capability requirements for OSMP are: • trained scientific personnel for sampling, data interpretation and reporting • scientific field sampling equipment • logistics platforms (typically small to medium vessels) • laboratories for analysis of samples	Not required if hydrocarbon type known and a sample can be obtained. If spill type is unknown, one or two water quality samples, from in-field vessels if available.	Partial OSMP activation (e.g., water quality sampling only).	Full suite of Operational Monitoring activation (exact program details will be scenario specific, depending on activation triggers).
At sea containment and recovery	To reduce the volume of oil on the sea surface, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines.	The capability requirements for C&R based on key elements of IPIECA-IOGP (2015a) are: • Offshore Contain and Recovery (C&R) basic strike team • 200-400m offshore boom and skimmer • single large vessel with a rolled stern for boom deployment, and with boom-vane (single vessel operation), or an additional small support vessel for two vessel operation for U-sweep or J-sweep operation • offshore waste storage/transport resources for transport of recovered oil to shore Offshore C&R – Advanced Strike Team • 600m - 1000m offshore boom and skimmer • advanced booming equipment such as current-buster or speed-sweep • U-sweep or J-sweep configuration, or funnel booming arrangements • 3-5 vessel configuration • aerial surveillance (aircraft or drones) to provide information to vessel to enhance encounter rate C&R trained personnel • basic and Advanced booming requires experienced/trained C&R personnel, such as AMOSC core-group operations team, who can lead/supervise a contain and recover team	1-2 x C&R strike teams (single or two vessel configurations), using locally based C&R equipment and resources.	3 – 5 x C&R strike teams (single or two vessel configurations) 1 – 2 x advanced booming configuration Additional C&R equipment and resources sourced from AMOSC/AMSA stockpiles located in the same region.	6 or more basic C&R strike teams (single or two vessel configurations) 3 or more advanced C&R strike teams Additional C&R equipment and resources sourced from AMOSC/AMSA stockpiles from around Australia. International C&R equipment mobilised through National Plan and Global Response Network (through AMOSC/AMSA) (e.g., Oil Spill Response Limited (OSRL) equipment).

Response Strategy	Response strategy objective	Capability Description	Tier One Example Criteria	Tier Two Example Criteria	Tier Three Example Criteria
		• vessel deck crews can receive on the job training from appropriately trained C&R team leads • Typically a minimum of 5 deck personnel required for a single basic strike-team. Additional teams required for advanced booming configurations.			
Surface dispersant - vessels	To reduce the volume of oil on the sea surface, by dispersing it into the water column, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines.	The capability requirements for vessel dispersant are provided below, based on key elements of IPIECA-IOGP (2015b). Offshore vessel dispersant strike team • Typical minimum vessel specs for offshore vessel dispersant would include: – single vessel (minimum 15-20m length – depending on operating environment and expected sea conditions) – deck space for IBCs or single 10 m^3 ISO-tank – dispersant spray systems, such as fixed booms or AFEDO units Dispersant application trained personnel • personnel trained in vessel -based dispersant application • minimum 2 x trained operator + 2 deck crew	Single vessel dispersant spraying strike team using locally based dispersant equipment & local dispersant stockpile.	2 – 4 vessel dispersant spraying strike teams on station. Some dispersant equipment/stocks shifted to site from AMOSC/AMSA stockpiles located in the same region.	5 or more vessel dispersant spraying strike teams on station. Large scale dispersant equipment/stocks shifted to site from AMOSC/AMSA stockpiles around Australia. Equipment/dispersant stocks sourced and imported from overseas 3rd party suppliers. Possible activation of Global Dispersant Stockpile – Singapore, Americas, Middle East & Europe. Just in time dispersant manufacture considered /actioned (Nalco/Chemetell/Dasic/Total Fluids)
Surface Dispersant - Fixed wing aerial dispersant (FWAD)	To reduce the volume of oil on the sea surface, by dispersing it into the water column, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines.	The capability requirements for aerial dispersant using air-tractors (AT) are based on the AMOSC Fixed Wing Aerial Dispersant Operations Plan (FWADOps Plan) (AMOSC 2020) which contains the overarching national fixed wing arrangements, as well as AMOSC regional Aerial Operations plans specific to each state/region. A FWAD air-tractor offshore strike team would consist of: • Air tractor(s) – single pilot • Air Attack Supervisor Platform (helicopter preferred over fixed wing aircraft), trained Air Attack Supervisor, and Aircraft Loading Officer. • Search and Rescue platform (vessel or aircraft) The FWAD airbase support requirements outlined in the FWADOps Plan consists of all the elements required to effectively manage airbase operations in support of Aerial Dispersant Application including: • Suitable runway/airstrip with: – operations/coordination room – office facilities – internet, fax, telephone – catering facilities / Amenities – toilets, kitchen, eating room – access arrangements – 24/7 – security arrangements – equipment, operations room, airfield	1 x Air Tractor (AT) aircraft on station; 1-3 sortie from FWAD. Delivery of up to 10 m^3/day.	2 – 6 AT aircraft on station; multiple sorties (4 – 24 sorties/day). Delivery of up to 77 m^3/day.	>6 AT aircraft, >24 sorties/day. Potential for activation of Global Response Network internationally available aircraft – 727, 737 & L-382 aircraft (OSRL and other providers). Delivery of >77 m^3/day. Equipment/dispersant stocks sourced and imported from overseas 3rd party suppliers. Potential for activation of Global Dispersant Stockpile – Singapore, Americas, Middle East & Europe. Potential for activation of agreed 'just in time' dispersant manufacture considered / actioned (Nalco/Chemetell/Dasic/Total Fluids)

Response Strategy	Response strategy objective	Capability Description	Tier One Example Criteria	Tier Two Example Criteria	Tier Three Example Criteria
		– availability of bulk water – vehicle access – truck, 4wd, car, bus – storage for equipment • Additional details confirmed through the Airport Operations Manager or Aerodrome Reporting Officer including: – refuelling facilities and arrangements – bulk, drums, truck – identification of fuel requirements of aircraft – JET A1/AVGAS – identification of availability and transfer arrangements for refuelling emergency service arrangements – fire, ambulance, rescue, hospital – transport arrangements for airbase personnel – distance from town Dispersant stockpiles would be mobilised to meet aircraft at the appropriate location. Timeframes are: • 3rd party trucking provided within 4hrs of activation • estimated vehicle loadout = 90 mins per vehicle			
Offshore subsea dispersants	To reduce the volume of oil floating up to the sea surface, by dispersing it at the seabed, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines.	The capability requirements for subsea chemical dispersant injection are provided below. In conjunction with AMOSC the Australian offshore oil and gas industry has established the Sub-Sea First Response Toolkit (SFRT) which as capable of clearing the wellhead as well as allowing sub-sea dispersant injection. The equipment is housed and maintained in Fremantle by Oceaneering and requires the following to assist in mobilisation and deployment: • large support vessel with work-class remote operated vehicle (ROV) • small support vessel for operational monitoring – water quality, including towed fluorometer, including trained water quality scientists. Included in the SFRT or available once deployment has been arranged are: • dispersant injection wands and associated dispersant injection equipment including pumping manifolds and downlines • access to the AMOSC Fremantle based 500 m^3 SSDI dispersant stockpile	nil	AMOSC SSDI equipment including 500 m^3 dispersant stockpile and injection equipment mobilised (as part of the AMOSC Subsea First Response Toolkit). Equipment/dispersant stocks sourced and imported from overseas 3rd party suppliers. Potential for activation of Global Dispersant Stockpile – Singapore, Americas, Middle East & Europe. Potential for activation of agreed 'just in time' dispersant manufacture considered/actioned (Nalco/Chemetell/Dasic/Total Fluids)	

Response Strategy	Response strategy objective	Capability Description	Tier One Example Criteria	Tier Two Example Criteria	Tier Three Example Criteria
Controlled in-situ burning	To reduce the volume of oil on the sea surface, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the sea surface and on potentially impacted shorelines.	The capability requirements for in-situ burning, based on key elements of IPIECA (2016b) are: • appropriate support vessels for deployment and management of fire rated containment boom • smaller vessels to facilitate ignition, recovery of burn residue, standby fire safety, and transport of personnel and equipment • fire-retardant booms (from international stockpiles) • incendiary devices • trained personnel from Global Response Network (e.g., MSRC, OSRL)	nil	nil	Overseas provision of fire boom and trained responders from overseas providers. (OSRL, MSRC and others.)
Protection of sensitive resources (P&D)	To prevent/reduce the volume of oil on entering a sensitive habitat, resulting in a reduction in the likelihood and/or consequence of impacts associated with floating oil on the values and sensitivities of the habitat.	The capability requirements for a single protection of sensitive resources/protect & deflect (P&D) strike team include: • 100m – 200m shore-seal boom (4 to 8 x 25m, +50kg lengths) • 200m – 400m nearshore boom and associated ancillaries (shoreline and nearshore anchor kits, sandbags etc) (8 to 16 x 25m, +50kg lengths) • 1 - 2 x small, typically shallow draft support vessel • 1 – 4 x Light vehicle(s)/Utility Task Vehicle (side by side UTV) • 1 x skimmers / oil recovery devices suited for nearshore/shoreline environment • 4 – 8 x nearshore anchor kits • (optional) 1000 – 4000 sandbags • onshore solid and liquid waste management resources • trained responders (2 minimum) • general labour personnel (8 minimum) Once P&D boom is deployed and in place it will require monitoring and potential adjustment over changes in tide and weather/wind/sea state. This can be achieved with a reduced number of personnel, the remainder of which can be redeployed to alternative activities.	1 – 4 shoreline-based sensitivities protected (shoreline/nearshore booming) 1 – 2 P&D strike teams (establish booming and monitor)	5 – 16 shoreline-based sensitivities protected 3 – 8 P&D strike teams (establish booming and monitor) Regional equipment stockpiles mobilised. 1-2 x remote P&D operations. Isolated island or remote operations required – access only via vessel (>2 hours travel from port or marine FOB). Responders required to camp / stay overnight on a support vessel.	>16 sensitivities protected >8 shoreline protection strike teams National stockpiles of equipment mobilised. >2 remote P&D operations. Isolated island or remote operations required – access only via vessel (>2 hours travel from port or marine FOB). Responders required to camp / stay overnight on a support vessel.
				*Note: 'Remoteness' and 'isolation' are triggers for an escalation in tier. This is based on (1) the time frames for operators to execute this tactic and (2) to reflect the complexity of these operations with resources drawn from outside the immediate region.	
Shoreline and inland assessment (SCAT – including oiled wildlife reconnaissance).	To systematically collect data about the location, nature and degree of shoreline oiling, (including at risk/impacted wildlife), to inform shoreline treatment and oiled wildlife response planning.	The capability requirements for an individual SCAT team are provided below, based on key elements of IPIECA (2015c). A single SCAT team will typically consist of: • 1 or 2 x trained SCAT specialist • 1 x trained oiled wildlife expert/advisor • 1 x indigenous heritage advisor/ranger and/or 1 x local government ranger • 4x4 vehicle or utility task vehicle (side by side UTV) • SCAT data recording platform/tools	1 SCAT team <10 kilometres shoreline to survey	2 – 10 SCAT teams >10 – 100km shoreline to survey, OR, Complex shorelines (Environmental Sensitivity Index (ESI) 1 or 2, ESI 6 – 10) AMOSC Core-Group (CG), Government Control Agency staff NRT members from other jurisdictions	>10 SCAT teams >100km of shoreline to survey OR, Complex shorelines (ESI 1 or 2, ESI 6 – 10), and/or, Full deployment of industry / AMOSC and NRT resources

Response Strategy	Response strategy objective	Capability Description	Tier One Example Criteria	Tier Two Example Criteria	Tier Three Example Criteria
		• potential for 1 x drone and drone-operator for locations with restricted access Trained SCAT and wildlife personnel are available from industry/AMOSC as well as individual states via National Response Team (NRT) arrangements. Indigenous SMEs and local knowledge specialists are available through the states.		Expanded multi-agency response including multiple state gov agencies. 1-2 x remote SCAT operations. Isolated island or remote operations required – access only via vessel (>2 hours travel from port or Marine FOB). Responders required to camp / stay overnight on a support vessel.	Potential for mobilisation of Global Response Network personnel to SCAT teams from OSRL and other third parties. >2 remote SCAT operations. Isolated island or remote operations required – access only via vessel (>2 hours travel from port or Marine FOB). Responders required to camp / stay overnight on a support vessel.
Shoreline clean-up	To reduce the volume of oil on shoreline, to reduce the likelihood/consequence of impacts on the values and sensitivities of the shoreline and promote/increase the speed of the natural recovery of the shoreline to its pre-oiled state.	The capability requirements for the Shoreline Clean-up element of the Shoreline Response Program below are based on key elements of IPIECA Shoreline Response Programme Guidance (IPIECA-IOGP 2020) and are for one individual shoreline response clean-up team. • 1 x Trained Responder (As shoreline clean-up Team Lead) • 7 - 10 x labour hire personnel (on the job training) • manual clean-up tools (rakes, shovels, hand trowels, etc) • oily waste storage containers (Heavy duty plastic bags) • potentially 1 x small machinery (e.g., rubber tracked bobcat) or tray back all-terrain vehicle to transport recovered oily waste to centralised temporary hazardous waste storage • ablutions and welfare facilities for personnel • decontamination resources (additional personnel and equipment)	Day 0 – day three Immediate deployment and mobilisation with the aim of having team/s on the ground within 24 to 48 hrs. 1-2 x shoreline clean-up teams 10 – 20 m^3 oily waste recovered per day Resources from local area.	Day three – day seven 3 – 30 shoreline clean up teams 30 – 300 m^3 oily waste recovered per day Potential inclusion of advanced clean-up techniques including high volume / low pressure flushing, surf washing, mechanical equipment. Resources and equipment from within the region from industry, AMOSC/CG, labour contracting entities and other mutual aid, NRT.	Day seven onwards >30 shoreline clean up teams >300 m^3 oily waste recovered per day Potential inclusion of advanced clean-up techniques including high volume / low pressure flushing, surf washing, mechanical equipment. Potential for resources from non-spill sector (Defence, volunteer groups) with just-in-time training and provisioning National Plan resources and equipment from industry, AMOSC/CG, labour contracting entities and other mutual aid and NRT. Potential for mobilisation of Global Response Network equipment and resources.
				1-2 x shoreline clean-up teams operating at a single remote/isolated shoreline. Isolated island or remote operations required – access only via vessel (>2 hours travel from port or Marine FOB) or air. Responders required to camp / stay overnight on a support vessel.	>2 x shoreline clean-up teams operating at multiple remote/isolated shorelines. Isolated island or remote operations required – access only via vessel (>2 hours travel from port or Marine FOB) or air. Responders required to camp / stay overnight on a support vessel.

Response Strategy	**Response strategy objective**	**Capability Description**	**Tier One Example Criteria**	**Tier Two Example Criteria**	**Tier Three Example Criteria**
		Escalation of SRP will require utilisation of FOB for the purpose of coordination and support.	Level 1 • single marquee • 1 x FOB team leader or Sector Command • 1 x medic (also providing admin support).	Level 2 • larger FOB base set-up • FOB Manager • 1-2 x shoreline division commanders • 1-2 admin assistants • 4 – 8 Sector Commanders • 1 x health & safety rep • 1 x medic • 1 x logistics/catering coordinator • 1 x waste management coordinator	Level 3 • very large FOB set-up • FOB Manager • 3+ x shoreline division commander • 3+ x deputy commanders • 3+ x admin assistants • 8+ x sector commanders • 3+ HSE reps • 2+ medics • 2+ logistics/catering • 1-2 waste management coordinators • 1-2 Information Technology (IT)/communications specialists
Inland Response	N/A	N/A	N/A	N/A	N/A
Oiled wildlife response (OWR)	To minimize the impacts of an oil spill on wildlife by both prevention of oiling where possible and mitigating the effects on individuals when oiling has taken place (IPIECA-IOGP 2014).	The capability requirements for an individual OWR collection & transport team are provided below, based on key elements of IPIECA-IOGP (2017b) and WA DBCA (2014). • 2-4 x trained OWR personnel • 1 x OWR collection kit (for capture and transport of oiled wildlife) • 1 x vehicle The capability requirements for an individual wildlife cleaning/rehabilitation team are provided below, based on key elements of IPIECA-IOGP (2017b) and WA DBCA (2014). • Wildlife treatment/rehabilitation team would typically consist of: • 1 x OWR container • 5 x trained OWR personnel • 10 x labour hire personnel • 2 x trades persons (electrician, plumber etc., to set-up of OWR container) • liquid and bio-hazard oily waste storage The capability requirement for wildlife hazing typically includes: • vessel air-horns, vessel water cannons etc. • acoustic deterrents/bird scaring devices, deployed onshore or from a vessel • visual deterrents • physical barriers/structures.	As per State Plan - level one and two state response Localised resources (Operator + government + AMOSC)	State plan levels three and four Localised +State + National Mutual aid 1-2 x OWR collection/transport team operating at a single remote/isolated shoreline. Isolated island or remote operations required – access only via vessel (>2 hours travel from port or Marine FOB) or air. Responders required to camp / stay overnight on a support vessel.	Level five and six (and multiples of) + international + complexity of animal oiling >2 x OWR collection/transport teams operating at multiple remote/isolated shorelines. Isolated island or remote operations required – access only via vessel (>2 hours travel from port or Marine FOB) or air. Responders required to camp / stay overnight on a support vessel.

Response Strategy	Response strategy objective	Capability Description	Tier One Example Criteria	Tier Two Example Criteria	Tier Three Example Criteria
Tertiary/onshore waste management	To limit the environmental impacts including secondary contamination associated with the transport and disposal of the collected oily waste products (liquids, solids, biohazard, etc.).	The capability requirements for tertiary waste collection are provided below, based on the key elements of IPIECA-IOGP (2016d) Oil Spill Waste Management and Minimisation. • waste management planning (aims, objectives, processes and procedures) • waste collection and storage • waste transportation including licensed hazardous waste transport trucks (vacuum trucks, solid contaminated waste transport trucks etc) • pre-treatment, treatment, and final disposal, (e.g., licenced onshore tertiary waste treatment facilities (landfill, soil remediation, incineration facilities etc)	<20 m^3/day of solid/liquid/biohazard oily waste, transported to licenced tertiary waste treatment/disposal facility.	20 – 300 m^3/day of solid/liquid/biohazard oily waste, transported to licenced tertiary waste treatment/disposal facility.	>300 m^3/day of solid/liquid/biohazard oily waste, transported to licenced tertiary waste treatment/disposal facility.
Remote response platform (Note: remote response platforms are not a true response strategy, however, are required to support shoreline response strategies in remote locations.)	To provide a logistics platform which can safety transport personnel and equipment to a remote shoreline, and safety recovery oily waste and oiled wildlife from the remote shoreline.	The capability requirement for a remote logistics platform are provided below. This capability requirement is based on the INPEX Browse Island Oil Spill Incident Management Guide (X060-AH-GLN-60015), which extensively examined and risk assessed oil spill response activities in remote northern Australian context and was developed in consultation with the WA Control Agency. In addition, the plan utilised the remote oiled wildlife guidance provided in the WA DBCA OWR Plan (WA DBCA 2014). Remote response platforms may be used to support many response strategies, including P&D, SCAT, Shoreline Clean-up & OWR. An offshore/floating remote response platform to support would likely require: • accommodation support vessel (ASV) • sleeping, catering etc for spill response command team, spill response field personnel and vessel crew • offshore FOB, communications, planning platform • remote first aid/emergency response capability • small vessels/tenders Transport crew and equipment between ASV and shorelines, and recover small volumes of oily waste, oiled wildlife Potential for landing barge and light machinery (e.g., tracked bobcat) for transport of heavier equipment and recovery of larger volumes of recovered oily waste from the shoreline Potential for light utility helicopter (landing on ASV helicopter pad) for very logistically challenging locations, including transport of personnel, equipment, and slinging of heavy equipment/waste, as required. Spill response equipment and appropriately trained personnel, as per the relevant response strategy If a floating remote response platform was to be established to support oiled wildlife cleaning at sea, the platform would require (WA DBCA and AMOSC 2015):	N/A	1-2 x floating remote response platforms at a single location or; 1 x land-based remote response platform. <20 platform support staff (vessel crews/camp staff) <10 spill response command/admin/support staff <40 field response personnel at single location. Note – smaller vessels and team sizes required for remote SCAT operations.	Multiple remote response platforms (floating or land-based) at multiple remote locations. >20 platform support staff (vessel crews/camp staff) >10 spill response command/admin/support staff >40 field response personnel at single location.

Response Strategy	Response strategy objective	Capability Description	Tier One Example Criteria	Tier Two Example Criteria	Tier Three Example Criteria
		• 200 m^2 deck space (including space to mount 20ft oiled wildlife cleaning sea-container) • 120,000L water • oily water storage and/or treatment system • fridges/freezers (biological waste/necropsy sample storage) A shore-based remote response platform would likely require: • land-based mobile camp • sleeping, catering etc for spill response command team, spill response field personnel and camp crew • onshore FOB, communications, planning platform • remote first aid/emergency response capability • suitable transport (4x4 vehicles, etc) • potential for light utility helicopter (landing on ASV helicopter pad) for very logistically challenging locations, including transport of personnel, equipment, and slinging of heavy equipment/waste, as required. • spill response equipment and appropriately trained personnel, as per the relevant response strategy Remote response personnel would typically include: • ~5-10 spill response command personnel (on-scene commander, admin/logistics support, HSE rep, medic). • ~20-40 spill response field personnel (potentially undertaking a range of response strategies including SCAT, OWR and shoreline clean-up) • ~10-20 platform support staff (vessel master/camp boss, catering/stewards, vessel/vehicle drivers, helicopter pilots). Note – smaller vessels and team sizes would be expected for remote SCAT operations.			

IPEICA-IOGP (2016c), encourages contingency planning to be undertaken in a manner which not only examines the tiers of capabilities through single distinct levels (e.g., as represented in Table 6-2), but also to evaluate and illustrate where the resources could/should be sourced from to fulfil risk mitigation aims. The identification of individual/discrete capabilities that may be required for oil spill response enables a much more specific and tailored representation of response capability matched to each operation/risk.

Thus the response capability required is unique to all operations and locations, with each situation being shaped by both setting and operational factors which not only affect the risk profile but also influence how resources will be provided. Each response strategy/capability can be considered independently, and the planning process can consider at least the following four determining factors:

- inherent operational-specific risks (e.g., the oil type, inventory and related release scenarios)
- location-specific risk (e.g., the proximity of oil-sensitive environmental receptors)
- relative proximity and access to supporting resources and their logistical requirements, and
- applicable legislative requirements or stipulated regulatory conditions.

Each of these factors may influence the provision of response resources/capabilities across the range of response strategies, which can then be presented in the form of a unique pictogram (or tiered preparedness wheel) for any operation.

Once completed, the model/tiered preparedness wheel provides a simple visual representation of the response capabilities that are available and how they can be combined to provide the capacity required to mitigate the risk identified for each operation or location. A non-specific example of this model is provided below.

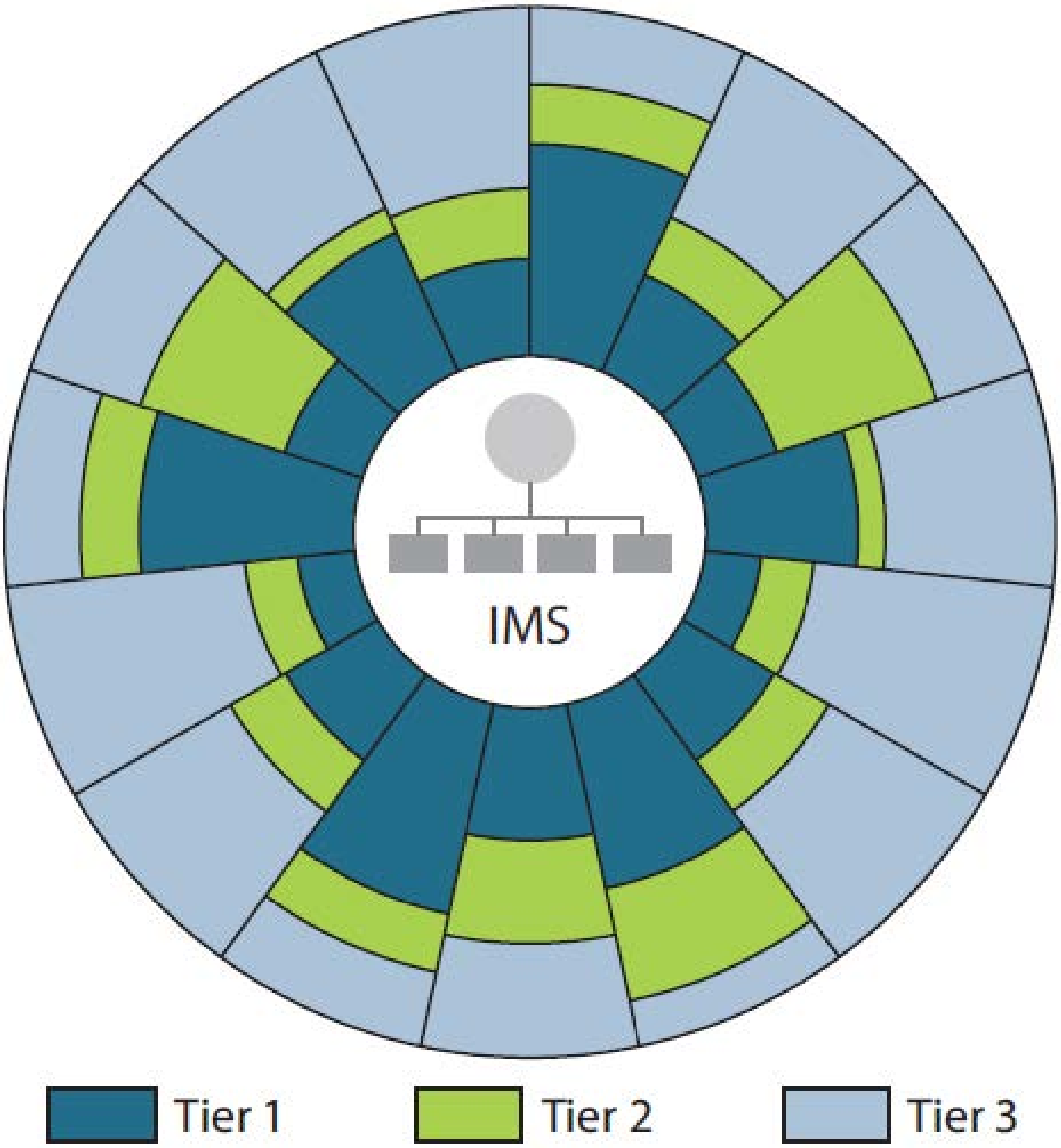


Figure 6-4: Example tiered preparedness wheel (IPIECA-IOGP 2016c)

The IPIECA-IOGP (2016c) tiered preparedness evaluation process described above is considered appropriate, not only for individual petroleum titleholder operations, but also for regional response planning. Within a region/hydrocarbon exploration/production basin, there are inherent similarities in the four determining factors described by IPEICA-IOGP (2016c). For example, consistency in oil types and release scenarios, similar location specific risks and environmental sensitivities, similar logistical challenges and all are operating within the Australian NatPlan and OPGGS (E) regulatory environment.

Using the tiered preparedness wheel concept, a BROPEP specific tiered capability overview is provided in Table 6-3. This table defines the tier, (1, 2 or 3), the target operational timeframe within which the capability should be able to be mobilised, to achieve the response strategy objective, and the geographic location in which the capability should be located, to enable the mobilisation of the response capability within the target timeframe.

Table 6-3: BROPEP Tiered Capability Overview

Tier	General Description	Target operational timeframe	BROPEP capabilities and locations
Tier 1	Basin/area specific resources, typically able to be activated quickly, mobilised (en-route to site) and/or on location and operationally within 24 - 48 hours.	<48 hours	Ichthys/Prelude offshore facilities and vessels • ESTBs • dispersant stockpiles and spray equipment • logistics assets (vessels/aircraft) Broome • AMOSC Tier 1 stockpile • logistics assets (vessels/aircraft) Darwin • AMSA Tier 2 equipment stockpile • logistics assets (vessels/aircraft)
Tier 2	Regional/coast specific resources, requires air or land movements to FOB, deployed and infield operationally within 48-72 hours (operationally active during days three to four).	48 – 72 hours	AMOSC & AMSA NW Shelf, Exmouth and Fremantle based equipment stockpiles. NW Shelf/Fremantle logistics assets (vessels/aircraft). AMOSC Core-Group within WA/NT. WA/NT Control Agency personnel
Tier 3	National or international resources, operational in the field from day four onwards.	>72 hours	Australian east-cost and international based equipment stockpiles, logistics assets and personnel.

6.6 Field Capability Assessment

The field capability assessment process, which is aligned with the principles of IPIECA-IOGP (2013 and 2016c) and also meets the requirements of the OPGGS (E) Regulations 2009 is summarised as follows:

1. Define the response strategy
2. Present the Strategic SIMA outcome. If YES, continue with evaluation. If NO, no further evaluation required for the response strategy.
3. Evaluate the relevant BOD outcome for the response strategy (E.g., the oil thickness over geographical area and minimum time to contact etc), above relevant response strategy planning thresholds
4. Evaluate relevant oil spill budget considerations for the response strategy
5. Identify the maximum possible field capability in terms of equipment, personnel and logistics assets (vessels, aircraft etc) to treat the WCSS oil spill budget requirement, within the geographical and time constraints derived from the BOD.
6. Evaluate operational considerations, to determine the selected field capability. Operational considerations include factors such as overlap of objectives with other response strategies (E.g., on water response strategies), safety, weather and logistical constraints, cone of response options, environmental values/sensitives at risk, risk of secondary impact etc.
7. Present "As low as reasonably practicable" (ALARP) justification of the selected field capability
8. Present the Selected Field Capability Statement, including specified field capability/arrangements and minimum implementation timeframes.
9. Define the overall capability as Tier 1, 2 or 3, depending on the location of the required resources/capability and mobilisation requirement/arrangements.

To assist in the definition of the tier for a response strategy, within the Selected Field Capability Statement column, the capability can be split into components of Tier 1, 2 or 3, as required.

Table 6-4 and Table 6-5 provide the field capability assessments for two WCSS selected for detailed analysis. Where a more thorough assessment of steps 3 to 8 is required (i.e. space constraints within the tables), a detailed assessment is provided in relevant Appendices, cross-referenced in the tables.

The data from the field capability assessments has then been used to develop the tiered preparedness wheels for the two selected WCSSs. These are presented as Figure 6-5 and Figure 6-6.

For completeness, occasionally other WCSS/BOD outliers are discussed within the field capability assessment tables, for contextual purposes. This ensures all possible variations of a WCSS event are discussed and the required capability and arrangements are addressed.

In addition, stakeholder consultation was conducted with the relevant State/Territory Control Agencies, in regard to the development of the maximum field capability statements for response strategies to be implemented within State/Territory waters/shorelines. Specifically, SCAT, shoreline clean-up, OWR and protection of sensitive resource strategies were evaluated against the BOD scenarios. The BOD (including all figures/tables) were presented to the WA Control Agency (WA Department of Transport (DOT)) and Wildlife Response Agency (WA Department of Biodiversity, Conservation and Attractions (DBCA)), 1 month in advance of the workshop. At the workshop, the proposed maximum capabilities were discussed and agreed, and are presented in Table 6-4 and Table 6-5.

Figure 6-5 presents an indicative Tiered Preparedness Wheel for a condensate well blowout in the BROPEP region. This is a qualitative representation of the field response capability described in

Table 6-4.

Note, this wheel is based on the IPIECA-IOGP (2016c) tiered preparedness wheel, which includes elements which are outside of the scope of this document. Specifically; inland response, stakeholder engagement and communication, economic assessment and compensation have been left blank on this wheel.

Source control is shown in the figure (as SSDI is in scope of this document), however the overall source control capability and arrangements are addressed in the INPEX Australia Environment Plans Source Control Capability and Arrangements Report [D021-AH-REP-70000].

Figure 6-6 presents an indicative Tiered Preparedness Wheel for a vessel collision resulting in a Group IV hydrocarbon spill in the BROPEP region. This is a qualitative representation of the field response capability described in Table 6-5.

6.6.1 Well Blowout Brewster Condensate Spill

Table 6-4 Field capability assessment- Brewster condensate blow-out

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement (minimum implementation time)	Tier (1/2/3)
SMV - Aerial surveillance	Yes	Maximum lineal distance (km) floating oil >1g/m^2: 833km (Holonema-B model output) Localised slick during first 24-48 hours.	N/A	Day 1 - Single air observation platform with trained aerial observer. (very limited slick extent) Day 2 onwards – Two or more air observation platforms, with trained aerial observers.	The objective of aerial surveillance is to provide ongoing situational awareness of the slick location, size, appearance and behaviour, to enable informed and timely IMT decision making during a response. Aerial surveillance can only be undertaken during daylight hours and is guided using the OSTM modelling results and tracker buoy locations. **Aircraft** As part of ongoing operations in the region, INPEX maintains a minimum of four crew change helicopters available in Broome at all times. A crew change helicopter could be cancelled from current tasking and diverted to the spill location immediately if safe to do so, provided it was not required for higher priority safety/evacuation related tasks. The crew change helicopters have the INPEX oil spill observation aid available, ready for use during a spill event. Fixed wing aircraft on call-off contracts for rapid mobilisation are only available during the cyclone-season. During the dry-season, fixed wing aircraft are utilised by the tourism industry, and therefore these fixed wing aircraft service providers will not guarantee mobilisation within specified timeframes during the dry season, however, will provide services on a best-endeavours basis. The cost to maintain dedicated fixed wing aircraft at Broome, Truscott or Darwin would be approx. $100,000 per month, per aircraft. The cost to maintain a single, or multiple dedicated fixed wing aircraft is not considered reasonable, as INPEX's current arrangements enable aerial surveillance of any permit/license area within 5 hours (daylight only). **Trained Aerial Observers** The accuracy of aerial surveillance data reported to the IMT via INPEX helicopters could be improved though the use of trained aerial observers. There would be additional training costs associated with training helicopter and fixed wing pilots as formal aerial oil spill observers. The INPEX oil spill observation aid is considered a suitable substitute to formal training and is appropriate for use during the first 24-48 hours of the spill, when the spill is likely to be located in a small geographical area. The quality of data that would be received by the IMT, from personnel such as a helicopter co-pilot using the INPEX oil spill observation aid, and data from other operational and monitoring evaluation techniques, should still provide adequate information for the INPEX IMT to conduct its role, especially during the first 24-48 hours of a spill, where the slick is expected to remain close to the release location.	The quality of information provided to the IMT by maintaining dedicated fixed-wing aerial surveillance aircraft or trained aerial observers on stand-by is not expected to be improved to a level that would result in substantial environmental benefits or increased situational awareness for the IMT, compared to the use of INPEX helicopters and crews during the initial days of a spill. Other techniques, such as OSTM will be implemented in parallel with aerial and/or initial/onsite vessel observations. This combination of data is considered sufficient to inform the IMTs situational awareness during the early stages of a spill response. The maximum field capability statement can be achieved within 72 hours, using the proposed arrangements.	INPEX will maintain 4 crew-change helicopters on contract to support petroleum activities in the region. INPEX will ensure hard copies of the INPEX Oil Spill Observation Guide is available at the helicopter base in Broome. INPEX will maintain a framework agreement/call-off contract with a fixed-wing aircraft provider in the region. INPEX will maintain arrangements which provide access to AMOSC and OSRL trained aerial observer personnel. Aerial surveillance will be mobilised using the following capabilities, within the specified timeframes Tier 1; (During initial 24 hours – within 5 hours of INPEX IMT activation, crew-change helicopter mobilisation to commence surveillance activities at the spill location, with second pilots using the INPEX Oil Spill Observation Guide (daylight operations only)) Tier 2 (24 – 72 hours – 1 x fixed wing aircraft. Multiple overflights per day. second pilot/observer using the INPEX Oil Spill Observation Guide; or AMOSC Core-Group trained aerial observers from 48 hours onwards.) Tier 3 (48 hours onwards – AMOSC CG trained aerial observers available in Broome/Darwin)	3

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					It should be noted that the crew change helicopter pilots are familiar with observing the natural colours and shades of the ocean in the BROPEP region, and therefore less likely to incorrectly identify natural phenomenon such as cloud shadow or algal bloom for oil slicks. Trained aerial observers, for use during a protracted spill response are available via AMOSC. These personnel can be mobilised to Broome, Darwin, Truscott, etc., within 48 hours. Additional trained aerial observers are available via OSRL for a large/long duration response. As the BROPEP covers activities in Commonwealth waters, and typically nearest emergent receptors are several/tens of kilometres from the petroleum activities (>20 km where drilling and heavy fuel oil risks are present), immediate aerial surveillance is not critical to the IMT's first strike or Day 1 Incident Action Plan (IAP) development requirements. During the early hours of a spill, vessel/facility surveillance is also available.		Tier 3 (72 hours onwards – 2+ x fixed wing aircraft. Multiple overflights per day, using trained aerial observers.)	
SMV - Vessel surveillance	Yes	Maximum lineal distance (km) floating oil >1g/m^2: 833km (Holonema-B model output) Localised slick during first 24-48 hours.	N/A	Full-time vessel on stand-by to conduct vessel surveillance of any possible slick.	The objective of vessel/platform-based surveillance is to provide ongoing situational awareness of the slick location, size, appearance and behaviour, to enable informed and timely IMT decision making during a response. INPEX's CPF, FPSO and Mobile Offshore Drilling Units (MODU) are all supported by vessels including offtake support vessel (OSV), platform supply vessels (PSV) and Anchor handing tugs (AHTs). Seismic, geophysical/geotechnical surveys and construction/installation activities are all vessel-based activities. Hence, with the exception of operating a pipeline, most activities almost always have some vessels present. If a spill occurs at or from a facility, the facility personnel are also able to undertake spill observation/reporting. Close-range vessel surveillance during the initial stages of a loss of well containment or GEP rupture is not considered safe due to the potential for a significant explosion risk (flammable atmosphere) and a limited initial surface slick from a subsurface condensate spill. Therefore, the IMT will be unlikely to direct any vessel to undertake a surveillance activity near the source of any subsea release of condensate. It should be noted that in the event of a vessel/FPSO collision, the damaged vessel ERT may not be able to conduct dedicated vessel surveillance activities, however, will be able to provide initial pollution report and ongoing situation report information, for the slicks within their visible range. Other vessels may be prioritised to complete tasks that are not directly related to the oil spill response, such as transfer of injured personnel to nearby facilities or to shore, supporting the damaged vessels involved in the collision, or search and rescue operations. These could also possibly provide some information to the IMT on slick location, appearance and behaviour.	The quality of information provided to the IMT by maintaining dedicated or stand-by vessel surveillance capability is not expected to be improved to a level that would result in substantial environmental benefits or increased situational awareness for the IMT, compared to the use of INPEX's contracted vessels and helicopters during the first day or two of a spill. Aerial surveillance and OSTM will provide the greatest level of situational awareness to the IMT.	INPEX will maintain routine vessel operations, as required to support its petroleum activities. All INPEX contracted vessel Emergency Response Team (ERT) personnel will undertake an OPEP induction, which includes spill observation volume estimate and slick appearance reporting requirements, and an overview of the INPEX Oil Spill Observation Guide and INPEX Surface Spill Volume Calculator tool. INPEX Offshore Health, Safety and Environment (HSE) personnel on INPEX operated facilities (CPF and FPSO) will undertake the INPEX Oil Spill Monitoring E-Learning course, which includes spill observation volume estimate and slick appearance reporting requirements, and overview of the INPEX Oil Spill Observation Guide and INPEX Surface Spill Volume Calculator tool.	1

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					A typical PSV/AHT bridge is 10 m to 20 m above sea level. A small support vessel bridge may only be 3 m to 5 m above sea level. Due to this low visual elevation (compared to aerial surveillance platforms) and typical vessel speed (~14-18 knots), the observational data a vessel of any size can provide is significantly limited, compared to the observation data able to be obtained by aerial observers. Additional vessels could be on dedicated stand-by for vessel surveillance at significant cost, however a greater level and quality of information will be obtained, at a cheaper cost, with a quicker mobilisation time, by mobilising aerial observation platforms instead of vessel platforms.	The cost to mobilise an additional vessel for surveillance purposes is not considered ALARP, given similar or cheaper cost will provide an aerial surveillance platform. It is therefore considered ALARP to provide oil spill observation tools and training to facility and vessel crews already under contract.	In the event the INPEX IMT determines that surveillance is required, the IMT may task a vessel under existing contract to conduct opportunistic vessel-based surveillance activities – or will contract an aerial surveillance capability.	
SMV - Oil Spill Trajectory Modelling	Yes	Maximum lineal distance (km) floating oil >1g/m^2: 833km (Holonema-B model output) Localised slick during first 24-48 hours.	N/A	Single OSTM provider on call at all times, able to rapidly complete and provide modelling simulations to the IMT. Capability to complete ongoing model validation and model revisions over a long duration event.	The objective of OSTM is to provide forecasts of the trajectory and fate from oil plumes resulting from surface or subsurface releases, to enable informed and timely IMT decision making during a response. OSTM requires access to information/situational awareness data provided by the Emergency Response Team on site. The IMT should reasonably be able to activate and transmit relevant situational awareness data to the OSTM contractor within 2 hours of the formation of the IMT. The purpose of OSTM is to provide spill trajectory forecasts, to enable the IMT to assess risks, select additional response strategies and develop IAPs, which would be implemented in the days after the initial response. Therefore, attempting to reduce the activation timeframe of OSTM would not provide any benefit in relation to 'first strike' activities, and not affect other response strategy selection or capability mobilisation. Therefore, there is no benefit in reducing the activation timeframes. OSTM is an iterative process using real-time observations to refine modelling predictions. No alternatives have been identified that could improve the quality/outputs of this oil spill response control. For the WCSS, only a single OSTM provider is anticipated to be required; however multiple runs over weeks to months may be required for the well blow-out scenario. VOC modelling and dispersant effectiveness modelling (for SSDI only) would also be required, to support the source control and surface response activities.	Sufficient provision has been made for availability of a suitable OSTM contractor. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain a contract with a suitably experienced OSTM contractor, available on-call 24/7, for activation by the INPEX IMT. (OSTM contractor available on 24/7 call-out arrangement). (OSTM contractor activated within 2 hours of IMT formation).	3

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SMV – Electronic satellite tracker buoys (ESTBs)	Yes	Maximum lineal distance (km) floating oil >1g/m^2: 833km (Holonema-B model output) Localised slick during first 24-48 hours.	N/A	3 x tracker buoys able to be deployed during initial 24 hours of spill. Additional supply of tracker buoys in batches of 3 available for deployment on subsequent days.	The objective of the deployment of ESTBs is to assist with situational awareness of the IMT during periods when aerial surveillance isn't available (e.g., night-time), and for the longer-term validation of the OSTM. These processes enable informed and timely IMT decision making during a response. In an ideal situation, three ESTBs should be deployed as a cluster, at the leading edge of the slick. Clusters should be deployed preferrable at the end of daylight hours on Day 1, and subsequent days, as required. INPEX maintain a total of ten ESTBs, which are positioned at different locations, depending on the activities underway. To support production activities, one ESTB will always be located on the CPF, FPSO and OSV. To support drilling activities, one ESTB will be located on each of the three drilling support vessels (AHTs/PSVs). This configuration of ESTBs should ensure that clusters of buoys can be deployed for spills from production/drilling locations. The remaining four ESTBs will be located either at Broome and Darwin logistics bases, or onboard other vessels such as seismic survey, geophysics survey, IMR or installation vessels, during those relevant campaigns. One ESTB on a seismic/geophysical/geotechnical survey vessel is considered appropriate, given they only utilise marine diesel fuel, in lower volumes. At certain times, one or two ESTBs will be out of circulation, for maintenance/biannual servicing. More ESTBs are available via mutual aid, including Shell/Prelude, AMOSC and OSRL, if required.	Sufficient provision has been made for deployment of multiple ESTBs during day one of a spill from production and drilling activities, or a single ESTB from vessel activities outside of WA-50-L. Additional ESTBs are available via mutual aid arrangements. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain a total of ten ESTBs, to support activities within the region covered by the BROPEP. • One ESTB on the CPF, FPSO and OSV, at all times. • One ESTB will be maintained each of 3 drilling support vessels, whenever there is an operational MODU/drilling campaign. • During vessel-based petroleum activities outside of WA-50-L, minimum one ESTB onboard the main activity vessel. • The remaining ESTBs will be located on other vessels, or onshore logistics bases, or will be rotated through biannual servicing – as required. INPEX will maintain mutual aid arrangements with Shell, AMOSC and OSRL which provide access to additional ESTBs. Tier 1 (ESTBs maintained at INPEX offshore activity locations – deployed by a vessel supporting the CPF, FPSO, MODU or other vessel-based activity) Tier 2/3 (Deployment of mutual aid ESTBs)	3
SMV – Satellite imagery	Yes	Maximum lineal distance (km) floating oil >1g/m^2: 833km (Holonema-B model output) Localised slick during first 24-48 hours.	N/A	Minimum of one suitable satellite imagery provider/image analyst activated, with imagery available in the IMT within a few hours of the spill occurring.	Information gained from satellite imagery would be used in combination with other controls such as visual surveillance and OSTM, to enable informed and timely IMT decision making during a response. Access to satellite imagery is limited due to the continuous movement and orbit of satellites around the globe. Typically, imagery can only be obtained a few days after the initial request is made to the satellite imagery from service providers. The delays are not considered a risk, as they do not reduce the IMT's situational awareness. During the first few days of a spill, the slick will remain in a small geographic area, and other techniques including vessel and aerial surveillance should provide sufficiently accurate information, to inform IMT decision making.	The actual timing of receipt of imagery is dependent on satellite orbits/paths. Maintaining arrangements for access to at least one satellite imagery provider is the best that can be achieved.	INPEX will maintain mutual aid arrangements with AMOSC and OSRL to ensure suitable oil spill observation satellite imagery is available to be accessed by the IMT. Tier 3 (Satellite imagery requested within 6 hours of IMT formation for a Level 3 spill)	3

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					If the spill was 'Level 2', with a slick which will be easily monitored via air surveillance, and no significant or complex shoreline contacts are expected, satellite imagery may not be required. However, satellite imagery would be required for any Level 3 event, where monitoring of a significantly large or dispersed slick is required, or complex/multiple shoreline contacts in remote areas are anticipated, and therefore satellite imagery would help support OSTM validation, impact predictions.	Satellite imagery is a tool which assists with overall validation of spill modelling and aerial surveillance, however the IMT will still maintain a high level of situational awareness, if satellite imagery isn't immediately available. Therefore, the selected capability is considered ALARP.		
Surveillance, Monitoring and Visualisation – Operational Monitoring	Yes	Maximum lineal distance (km) floating oil >1g/m^2: 833 km (Holonema-B model output) Localised slick during first 24-48 hours.	N/A	Surface and subsurface water quality sampling, including fluorometry.	The objective of the surface and subsurface water quality operational monitoring program is to provide ongoing situational awareness of the slick location, size, appearance, behaviour, and its potential impacts/risks, to enable informed and timely IMT decision making during a response. The capability requirements for OSMP are provided below. • trained scientific personnel for sampling, data interpretation and reporting • scientific field sampling equipment • logistics platforms (typically small to medium vessels) • laboratories for analysis of water quality samples.	INPEX will maintain a contract with a suitable OSMP contractor, to mobilise undertake a full OSMP program. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain a contract in place with an OSMP service provider which includes: • Project Management Plans (E.g., HSE, Medivac, Communications, Security etc) • OSMP method statements • OSMP readiness/capability reporting process Refer to BROPEP (X060-AH-PLN-70009 Appendix A – OSMP), for the specific OSMP activation and termination criteria and mobilisation timeframes.	3
At Sea Containment and Recovery	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Surface Dispersant – Vessel	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Surface Dispersant - Aerial	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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Offshore Subsea Dispersant	Yes	3200 m^3 condensate released per day at seabed.	Typical SSDI requires approximately 100:1 oil to gas ratio. Therefore, approximately 32 m^3 dispersant required per day.	For a condensate well blow-out, SSDI would not typically be applied to entrain the oil, as condensate has a naturally high entrainment rate. SSDI can significantly reduce VOC risks, to enable safe direct intervention activities (debris clearance, capping stack etc.). Therefore, SSDI would not be required to be mobilised until day 10 onwards (following well site surveys to confirm direct intervention activities are needed). To treat the ongoing flow and reduce surface VOC risks from a condensate well-blowout, SSDI equipment including a support vessel with work-class ROV, and SSDI injection equipment and a dispersant supply chain is required.	Offshore subsea dispersant (or subsea dispersant injection/SSDI) involves the use of an ROV, to inject dispersant directly into the hydrocarbon stream flowing from the damaged well. The outcome of SSDI is a significant increase of entrainment of oil in the water column. By increasing the proportion of hydrocarbons becoming entrained, there will be a reduction in hydrocarbons arriving on the ocean surface, and an associated reduction in hydrocarbons evaporating into the atmosphere. As discussed in Table 5-2 the primary consideration for use of SSDI for Brewster/Plover wells is to reduce the VOCs in the atmosphere during direct well intervention activities; not to reduce surface expression of condensate. Modelling results (RPS 2019c) indicates that under a worst-case Brewster blowout scenario, VOC concentrations from oil/condensate evaporating into the atmosphere are likely to exceed safe exposure thresholds within 1 km of the release location. The workforce onboard vessels conducting source control activities (e.g., BOP intervention, debris clearance and capping stack installation) could therefore be exposed to VOCs, and if gas monitoring indicated exposure had exceeded the VOC thresholds, the vessel would be required to cease the activity move out of the area. In effect, VOC exposure may impact the feasibility of debris clearance, capping stack installation and ultimately limit available source control options to drilling a relief well. There is no requirement for additional/duplicate SSDI spreads. A single SSDI spread will be able to successfully inject dispersant into the well stream at the optimal ratio of approximately 100:1, which has been demonstrated to reduce VOC concentrations below safe levels (RPS 2019c). Injecting additional dispersant into the well-stream will not result in any greater/beneficial reduction in VOC concentrations in the atmosphere. Based on a worst-case oil release rate 3200 m^3/day), at 100:1 treatment ratio, the dispersant requirement is 32 m^3/day. For a worst case (complex) activity, 30 days of SSDI could be required. Therefore, a worst-case total of ~1000 m^3 dispersant could be required. SSDI would generally not be required to commence mobilisation onto a vessel in Broome until approximately day 10 of a response (aligning with BOP intervention/debris clearance mobilisation activities). The SSDI spread maintained by AMOSC as part of the subsea first response toolkit (SFRT). The SFRT is located in Fremantle, WA and includes 500 m^3 of Slick-Gone-NS dispersant and can be mobilised to Broome within 10 days. Therefore, 50% of the total worst case dispersant requirement for a worst credible SSDI response can be mobilised outside of critical path timeframes. Additional Australian and global dispersant stockpiles can be mobilised, should it be estimated that the AMOSC 500 m^3 will be used up. Additional dispersant would not be required until a minimum of ~day 25 of the response, and therefore any additional dispersant stocks could be easily mobilised by vessel or aircraft to Broome within the required timeframe.	Sufficient provision has been made for availability of a SSDI spread and dispersant stockpile and large vessels with work-class ROVs. This level of capability is considered suitable to achieve the maximum field capability statement	INPEX will maintain contracts with AMOSC, to ensure access to the SFRT, including the 500 m^3 dispersant stockpile and dispersant injection tools. INPEX will maintain its OSRL membership, to ensure access to the global dispersant stockpile.	3

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					INPEX maintains access to the global dispersant stockpile through INPEX Corporations membership with OSRL. Therefore, INPEX has access to sufficient dispersant for a worst case (30 day) SSDI activity.			
Controlled in-situ burning	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SCAT (including OWR reconnaissance)	Yes	Maximum of 158 km of shoreline oiled >10 g/m^2 Shorelines oiled spread over wide range of offshore islands and islands of the Bonaparte and Buccaneer Archipelagos. Minimum 1 - 3 days for first shoreline contact >10 g/m^2 (for FPSO spill scenario). Minimum time to contact 3 days for well blowout scenario. Typically, up to 3-4 weeks before second shoreline sector is contacted. Significant increase in shoreline contacts between days 30-60.	N/A	As agreed through stakeholder consultation with WA Control Agency. First remote SCAT team to mobilise from port (e.g., Broome/Darwin) within 2 days. Two additional remote SCAT teams required within 7 days. Peak capability of 6 remote SCAT teams; 3 roving SCAT teams and 3 SCAT teams embedded within remote shoreline response units. This capability will ensure roving/highly mobilise SCAT teams, to rapidly evaluate a wide range of shorelines, with additional SCAT capability to work directly with shoreline response teams at identified protection priority locations.	The objective of SCAT is to systematically collect data about the location, nature and degree of shoreline oiling and at risk/impacted wildlife, to inform shoreline treatment and oiled wildlife response planning. **Control Agency Overview** Shoreline response activities including SCAT are typically under the control of the relevant State/Territory Control Agency. Control Agencies may choose to conduct the SCAT activity, including provision of SCAT specialists, wildlife specialists, local government rangers and/or Aboriginal heritage advisors/rangers. The Control Agency may also request of INPEX some specialist support personnel including SCAT and OWR experts and logistical support for remote and/or larger SCAT operations. The only two shoreline locations within the region which do not have a State/Territory Control Agency are Ashmore Reef and Cartier Island, both of which are Commonwealth Lands. In the event of a spill from a petroleum activity reaching these locations, INPEX would be the Control Agency. Under this scenario, the SCAT team would only consist of SCAT specialists and wildlife response specialists provided by industry mutual aid, and possibly a Parks Australia ranger or other government appointed person with local knowledge. There are no relevant Aboriginal Heritage Advisors required at Ashmore Reef / Cartier Island. Note: Cartier Island and the surrounding marine area within a 10 km radius was a gazetted Defence Practice Area up to 20 July 2011. Although no longer used, there is a substantial risk that Unexploded Ordnances remain in the area. Landing or anchoring anywhere within the Cartier Island Commonwealth Marine Reserve is strictly prohibited. Therefore, SCAT of these islands should be conducted via drone for Cartier Island. Due to the sensitivity of these shoreline receptors and safety issues outlined above, the merits of SCAT and shoreline clean-up at Cartier Island will need to be discussed in consultation with Director of National Parks. **SCAT Personnel** In accordance with WA DoT consultation, each remote SCAT team should consist of 2 x SCAT personnel, 1 x OWR personnel, and 1 x local government or parks advisor /aboriginal heritage advisor (person with local knowledge of the area). The relevant State/Territory Control Agency, or Commonwealth Government, will provide personnel such as Park rangers, and Aboriginal Heritage Advisors.	Sufficient provision has been made to support the deployment of multiple remote SCAT teams. Whilst SCAT teams will typically be appointed and under the control of the relevant State/Territory Control Agency, additional SCAT personnel can be made available via mutual aid arrangements, within the required timeframes. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain mutual aid arrangements with AMOSC and OSRL which provide access to SCAT specialist (including drone operator and drone capability), and oiled wildlife response specialist personnel. Tier 2 (1 x remote SCAT team, (2 x SCAT and 1 x OWR personnel) and SCAT equipment including drone, available to mobilise from Broome/Darwin within 48 hours) (Additional 2 x remote SCAT teams, (4 x SCAT and 2 x OWR personnel) available to mobilise from Broome/Darwin within 7 days) Tier 3 – Peak capability (Additional 3 x remote SCAT teams (3 additional teams embedded within remote shoreline response units (6 x SCAT and 3 x OWR) available to mobilise from Broome/Darwin – one team each at day 6, 14 and 30) Total capability (total of 24 x SCAT & 12 x OWR personnel - 12 x SCAT & 6 OWR each team working 14-day rotations) Refer Remote Logistics rows regarding vessels and light utility helicopter capability and arrangements.	3

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					INPEX is able to source relevant SCAT and wildlife specialists via its mutual aid arrangements with AMOSC. AMOSC staff and core-group SCAT trained personnel, and OWR personnel are available to mobilise to a vessel alongside in Broome/Darwin within 48 hours. Additional SCAT trained personnel are available via OSRL for a large/long duration response. **SCAT Equipment** SCAT equipment typically consists of a paper-based or electronic (e.g., tablet/phone application) SCAT recording platform. The Control Agency may specify their preferred SCAT recording tool. Alternatively, AMOSC have suitable SCAT recording tools/templates. Therefore, there is no requirement for INPEX to maintain any specific SCAT recording tools/templates. **SCAT Logistics** Small vessels would be used for 'roving' SCAT teams. Other SCAT teams would be embedded within larger remote shoreline response units, operating from both large and small vessels. Refer to the row 'Remote Response – Vessels' for details regarding small vessel capability and arrangements. AMOSC maintain a drone and drone operators (also trained in SCAT), which can be used to assist with SCAT operations in remote or difficult to access locations.			
Protection of sensitive resources (PSR)	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Shoreline clean-up	Yes	Maximum of 433 m^3 total volume oil ashore from worst stochastic run	Assume no emulsion factor associated with condensate spills. Assume 10x bulking factor, for oily waste on shoreline. Worst-case of 433 m^3 neat oil ashore at Browse Island = 4300 m^3 oily waste to be recovered.	As agreed through stakeholder consultation with WA Control Agency. First remote shoreline response unit (including SCAT, shoreline response and OWR) to mobilise from port (e.g., Broome/Darwin) within 6 days.	The objective of shoreline clean-up is to reduce the volume of oil on shoreline, to reduce the likelihood/consequence of impacts on the values and sensitivities of the shoreline and promote/increase the speed of the natural recovery of the shoreline to its pre-oiled state. **Control Agency Overview** Shoreline response activities including shoreline clean-up are typically under the control of the relevant State/Territory Control Agency. Control Agencies may choose to deploy their own shoreline clean-up leads and teams, or the Control Agency may also request of INPEX some specialist support personnel including shoreline clean-up team leads, additional labour hire, shoreline clean-up equipment and logistical support for remote and/or larger clean-up operations.	Whilst shoreline clean-up teams will typically be under the control of the relevant State/Territory Control Agency, additional shoreline clean-up specialist personnel, labour hire and standard and specialist shoreline clean-up equipment can be made available via mutual aid arrangements, within the required timeframes.	INPEX will maintain mutual aid arrangements via AMOSC and OSRL which provide access to shoreline clean-up team lead personnel. INPEX will maintain labour hire contracts, for access to general labour hire personnel. INPEX will maintain mutual aid access via AMOSC to shoreline clean-up equipment including the AMOSC stockpiles, for mobilisation to a support vessel alongside in Broome/Darwin Port.	3

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		Maximum of 158 km of shoreline oiled >100 g/m^2 including 4 x offshore islands, and islands in the Buccaneer and Bonaparte Archipelago (refer Figure 4-7). Oil volumes ranging from <2 m^3 to <50 m^3. Minimum 1 - 2 days for first shoreline contact >100 g/m^2 (for FPSO spill scenario). Minimum time to contact 3 days for well blowout scenario. Typically, up to 3-4 weeks before second shoreline sector is contacted. Significant increase in shoreline contacts between days 30-60.	Assume each shoreline clean-up person can recover 1 m^3 oily waste per day = 4300 person days for worst-case (by volume) shoreline clean-up operation. Worst-case shoreline response (by length) could be across several remote locations – however not at all locations simultaneously.	A second remote shoreline response unit required within 14 days. A third remote shoreline response unit required within 30 days. Peak capability 3 remote shoreline response units. This capability will ensure rapid mobilisation of the first remote shoreline response unit to the first potentially contacted shoreline receptor. Additional shoreline contacts are not expected for a few weeks, therefore the mobilisation of second and third remote shoreline response units is aligned with worst-credible multiple shoreline contact scenarios and timings.	The only two shoreline locations within the region which do not have a State/Territory Control Agency are Ashmore Reef and Cartier Island, both of which are Commonwealth Lands. In the event of a spill from a petroleum activity reaching these locations, INPEX would be the Control Agency. Under this scenario, the SCAT team would only consist of SCAT specialists and wildlife response specialists provided by industry mutual aid, and possibly a Parks Australia ranger or other government appointed person with local knowledge. There are no relevant Aboriginal Heritage Advisors required at Ashmore Reef/Cartier Island. Refer note in SCAT row regarding Cartier Island unexploded ordinance risk. Remote shoreline response will not be triggered until sufficient SMV and or SCAT information is provided to the relevant Control Agency, to make a determination that remote shoreline clean-up is both safe and appropriate to undertake, especially in consideration of the oil type – weathered condensate. It is expected that the minimum time for mobilisation (departure from a port) for any remote shoreline clean-up operation would be 6 days. 6 days is based on extensive consultation with the WA Control Agency in 2021. In addition, WA DoT conducted detailed evaluation, including multi-day exercise on remote response at Browse Island in 2019. Tasks undertaken during this 6-day preparation period include risk assessments and HSE planning, identification and mobilisation of a large number of specialist personnel and equipment (including significant number of government agency personnel), identification and mobilisation of a number of large and small vessels, and possibly light utility helicopter. Whilst extensive preparatory works for this type of activity have already been undertaken (e.g., detailed planning for remote response undertaken as part of the INPEX Browse Island Oil Spill Incident Management Guide (X060-AH-GLN-60015)), the actual event specific planning and HSE/risk assessments for a remote shoreline response must be undertaken thoroughly, given the significant risks associated with this type of an activity. **Shoreline Clean-Up Personnel** There is an appropriate limit to the number of personnel that should be put ashore during shoreline response in a remote and typically environmentally sensitive locations, to avoid additional impacts, e.g., trampling of turtle nests and disturbance to bird feeding, roosting and nesting behaviours. In general, to reduce wildlife disturbance on small, offshore remote locations, a longer duration response with a smaller number of personnel may be desired. The numbers of responders able to access a shoreline are also somewhat limited by accommodation/logistics support. For offshore islands with the ability for helicopters to safely land, it has been calculated that up to 24 personnel could work onshore on a single day, based on one utility helicopter conducting the daily transits between the shore and a single floating accommodation platform. Higher numbers could be transferred daily, using small boats, or a combination of boats plus helicopter, for shoreline access.	This level of capability is considered suitable to achieve the maximum field capability statement.	Tier 2 (Mobilise single remote shoreline response unit including SCAT, shoreline clean-up team and OWR team and associated equipment and logistics support from Broome/Darwin wharf within 6 days) Tier 3 (Mobilise second remote shoreline response unit within 14 days, and third unit within 30 days) Refer Remote Logistics rows regarding vessels and light utility helicopter capability and arrangements.	

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					The exact numbers of personnel and skills of those personnel selected to respond on a shoreline will be made by the relevant Control Agency, based on the degree of oiling, seasonality and sensitivity of receptors are risk at the time. However, as a basis for planning, as defined by the WA Control Agency, an ideal single remote shoreline response unit would include a total of 43 response personnel, plus vessel/support crew. Details as follows: • Sector Command Team (10 personnel – 2 x leader/deputy, 3 x admin, 2 x HSE, 2 x paramedic, 1 x multi-media/communications). • SCAT team (4 personnel – 2 x SCAT, 1 x OWR, 1 x local ranger) • shoreline clean-up team (21 personnel - 4 leadership, 17 labour hire) • OWR wildlife collection/rescue and preventative actions team (5 personnel) • OWR intake (TRIAGE, first aid or other response) (3 personnel including 1 vet) • vessel crew, tender drivers, helicopter operations staff etc. Based on a shoreline clean-up team of 21 personnel per remote shoreline response unit, and assuming 1 m^3 oily waste recovered per person per day, a single unit would be required to operate for ~200 days to complete the clean-up, or 3 remote shoreline response units operational for ~70 days, to recover 4300 m^3 of oily waste. It is expected the relevant State/Territory Control Agency will provide some government appointed personnel to oversee/lead the remote shoreline response operation. WA Control Agency expect to provide approximately 20 of the response personnel. INPEX would be required to provide the additional field response personnel. However, should the Control Agency request/require additional remote shoreline response personnel, or INPEX is the Control Agency (e.g., Ashmore/Cartier) INPEX plus mutual aid capability and labour hire, will provide the full shoreline response personnel capability. Initial contingents of AMOSC staff and core-group personnel with shoreline clean-up expertise are available to mobilise to Broome or Darwin within 48 hours, however initial full team assembly is not expected until day 6. Additional shoreline clean-up trained personnel are available via OSRL for a large/long duration response. INPEX is able to source additional labour hire personnel via contracted labour hire providers. Therefore, INPEX consider that sufficient arrangements are in place to mobilise shoreline clean-up teams within required timeframes. Additional trained shoreline clean-up personnel could be positioned on stand-by in Broome or Darwin. However, as full remote shoreline response unit mobilisation is planned for day 6, this is not considered to be ALARP.			

					Shoreline Clean-Up Equipment Shoreline types of the regional (as classified by IPIECA-IOGP 2015c) include: • rocky shorelines of the Bonaparte and Buccaneer Archipelago including outer islands of King Sound (shoreline types 1A, 1B, 1C, 2A and 2B) • fine sands, silts, clays, muds of the sheltered and highly tidal mangrove/salt marsh and salt flat systems of the Kimberley and NT mainland shorelines (shoreline types 8A-E, 9 A-C, and 10A, 10C & 10D). • coarse sandy/gravel beaches, typical of the offshore islands and outer islands of the Kimberley coastline (shoreline types 3B, 4, 5, 6A, 6B and 7). In regard shoreline clean-up of the cliffs/rocky coves of the Buccaneer and Bonaparte Archipelagos, IPIECA-IOGP (2015c) advises that in many cases the base of cliff faces can be accessed only with great difficulty and can present an extremely hazardous working environment. Typically, cliffs and inaccessible rocky coves are highly exposed and are best left to clean naturally unless there are overriding reasons to do otherwise. Unless the oil has been thrown up to extreme heights by exceptional weather conditions and is therefore unlikely to be reached by the sea under normally prevailing conditions, residual staining would be expected to diminish markedly over two or three seasonal cycles. Given the extreme tidal regime of the Kimberley coastline, and recommendations from IPIECA-IOGP (2015c), planning for cleaning of remote rocky cliffs/shorelines of the Kimberley is not considered appropriate. In regard to mangroves/salt marshes, IPEICA-IOGP (2015c) states that based on experience, in general light refined products are more damaging than crude oils and crude oils are more damaging than heavy fuel oils. Also, there is potential for significant damage to mangrove and salt-marsh plants/root systems from attempting most clean-up techniques. Therefore, given the BOD/modelling identified very little condensate loading at WA/NT mainland locations (where significant mangrove and saltmarsh system exist), planning for shoreline clean-up of these areas is not required for this WCSS. Typical response strategies for sandy beaches will be small remote response teams, conducting manual clean-up (e.g., rakes, shovels and lined bulka-bags), with limited likelihood for use of any mechanical/machinery assisted cleaning, except for small, tracked vehicles which may be used for collection and transport of small volumes collected oily waste to collection points/landing barges. The high tidal regime will result in enhanced natural surf washing/flushing, a recognised technique within IPIECA-IOGP (2015c). If significant volumes of buried oil (which could be re-mobilised) were identified, advanced cleaning techniques may be required. IPIECA-IOGP (2015c) states that the options for removal of buried oil include lifting the clean overburden and moving it aside to expose the band of buried oil, which is then removed and transported off the beach for disposal. Another option is to transport the band of buried oil to the water's edge for surf washing. If relatively close to the surface, the oil might be mobilised through harrowing or ploughing, or by using flushing lances to release the oil and flush it to the water's edge where it can be recovered with skimmers or sorbents. These techniques would need to be			

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					assessed/recommended by the Control Agency, as part of a long-term shoreline treatment program. This type of shoreline clean-up/treatment equipment is available from the AMOSC Level 3 stockpiles. WA/NT Control Agency may choose to mobilise their own shoreline clean-up equipment. WA Control Agency spill response trailers are located in Karratha, Fremantle and Albany. The AMOSC Broome stockpile and AMSA Darwin stockpiles also includes additional shoreline clean-up equipment. Additional AMOSC shoreline clean-up equipment stockpiles are located at Exmouth, Fremantle and Geelong. **Shoreline Clean-Up Logistics** It is expected the relevant Control Agency would require INPEX to provide the logistical support/platforms for any remote shoreline clean-up operations. The response platforms for remote shoreline clean-up activities typically include small and large support vessels, and potentially light utility helicopters. Refer to the row 'Remote Response' for details regarding capability and arrangements.			
OWR Hazing/deterrence Pre-emptive capture and relocation Collection/rescue & intake Cleaning & rehabilitation	Yes	1-2 days (FPSO) or 3 days (well blowout) for time to contact at shoreline >100 g/m^2 at turtle breeding Biologically Important Area (BIA) shoreline. Worst case volume 433 m^3 oil ashore in areas of >100 g/m^2 at turtle breeding BIA shoreline.	Key receptors potentially affected are EBCP listed species, with marine turtles and avifauna identified as the species most susceptible to oiling. Review of the WCSSs with WA DoT and DBCA did not trigger a requirement to plan for large scale OWR washing and rehabilitation.	As agreed through stakeholder consultation with WA Control Agency and OWR Agency: First remote shoreline response unit (including SCAT, shoreline response and OWR) to mobilise from port (e.g., Broome/Darwin) within 6 days. A second remote shoreline response unit required within 14 days. A third remote shoreline response unit required within 30 days. Peak capability 3 remote shoreline response units.	The objective of oiled wildlife response is to minimise the impacts of an oil spill on wildlife by both prevention of oiling where possible and mitigating the effects on individuals when oiling has taken place (IPIECA-IOGP 2014). **Control Agency Overview** Shoreline response activities including OWR are typically under the control of the relevant State/Territory Control Agency. Control Agencies may choose to deploy their own OWR team leads and support personnel, or the Control Agency may request INPEX provide some specialist support personnel including OWR team leads, additional OWR trained personnel and labour hire, OWR equipment and logistical support for remote and/or larger OWR operations. The only two shoreline locations within the region which do not have a State/Territory Control Agency are Ashmore Reef and Cartier Island, both of which are Commonwealth Lands. In the event of a spill from a petroleum activity reaching these locations, INPEX would be the Control Agency. Under this scenario, the SCAT team would only consist of SCAT specialists and wildlife response specialists provided by industry mutual aid, and possibly a Parks Australia ranger or other government appointed person with local knowledge. There are no relevant Aboriginal Heritage Advisors required at Ashmore Reef/Cartier Island. Refer note in SCAT row regarding Cartier Island unexploded ordinance risk.	Whilst OWR teams will typically be under the control of the relevant State/Territory Control Agency, additional OWR specialist personnel, labour hire and OWR equipment can be made available via mutual aid arrangements, within the required timeframes. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain mutual aid arrangements with AMOSC and OSRL which provide access to OWR team personnel. INPEX will maintain labour hire contracts, for access to general labour hire personnel. INPEX will maintain mutual aid access to OWR equipment including OWR kits and containers, for mobilisation to a support vessel alongside in Broome/Darwin Port. Tier 2 (Mobilise single remote shoreline response unit including SCAT, shoreline clean-up team and OWR team and associated equipment and logistics support from Broome/Darwin wharf within 6 days) Tier 3 (Mobilise second remote shoreline response unit within 14 days, and third unit within 30 days) Refer Remote Logistics rows regarding vessels and light utility helicopter capability and arrangements.	3

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		Multiple marine avifauna and turtle BIA shorelines (several offshore islands, plus several islands of Buccaneer & Bonaparte Archipelago) contacted at >100 g/m^2. Typically, up to 3-4 weeks before second shoreline sector is contacted. Significant increase in shoreline contacts between days 30-60.		This capability will ensure rapid mobilisation of the first remote shoreline response unit to the first potentially contacted shoreline receptor. Additional shoreline contacts are not expected for a few weeks, therefore the mobilisation of second and third remote shoreline response units is aligned with worst-credible multiple shoreline contact scenarios and timings.	Remote oiled wildlife response will not be triggered until sufficient SMV and/or SCAT (including OWR) information is provided to the relevant Control Agency, to make a determination that remote OWR is both safe and appropriate to undertake. It is expected that the minimum time for mobilisation (departure from a port) for any remote shoreline clean-up and OWR operation would be 6 days. **OWR personnel** There is an appropriate limit to the number of personnel that should be put ashore during shoreline response in a remote and typically environmentally sensitive locations, to avoid additional impacts, (e.g., trampling of turtle nests and disturbance to bird feeding/roosting/nesting behaviours). In general, to reduce wildlife disturbance on small, offshore remote locations, a longer duration response with a smaller number of personnel may be desired. The numbers of responders able to access a shoreline are also somewhat limited by accommodation/logistics support. For offshore islands with the ability for helicopters to safely land, it has been calculated that up to 24 personnel could work onshore on a single day, based on one utility helicopter conducting the daily transits between the shore and floating accommodation location. Higher numbers could be transferred daily, using small boats for shoreline access. The exact numbers of personnel and skills of those personnel selected to response on a shoreline will be made by the relevant Control Agency., based on the degree of oiling, seasonality, density and sensitivity of receptors are risk at the time. However, as a basis for planning, as defined by the WA Control Agency, an ideal single remote shoreline response unit would include a total of 44 response personnel, plus vessel/support crew. Details as follows: • sector command team (10 personnel – 2 x leader/deputy, 3 x admin, 2 x HSE, 2 x paramedic, 1 x multi-media/communications). • SCAT team (4 personnel – 2 x SCAT, 1 x OWR, 1 x local ranger) • shoreline clean-up team (21 personnel - 4 leadership, 17 labour hire) • OWR wildlife collection/rescue and preventative actions team (5 personnel) • OWR intake (TRIAGE, first aid or other response) (3 personnel inc. 1 vet) • vessel crew, tender drivers, helicopter operations staff etc. It is expected the relevant State/Territory Control Agency will provide some government appointed personnel to oversee/lead the remote shoreline response operation, including key OWR personnel such as vets and other OWR team leads. Personnel from government agencies with local knowledge of the species potentially impacted are most likely to be living/working in Darwin, Kununurra and Broome, and therefore the mobilisation of these personnel should not limit the overall OWR mobilisation timeframes.			

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					WA Control Agency expect to provide approximately 5 of the OWR personnel. INPEX would be required to provide the additional OWR personnel. However, should the Control Agency request/require additional remote shoreline response personnel, or INPEX is the Control Agency (e.g., Ashmore/Cartier) INPEX plus mutual aid capability and labour hire, will provide the full OWR personnel capability. INPEX maintains OWR personnel capability and arrangements via the AMOSC OWR Team, and associated AMOSC OWR mutual aid capabilities. These include: **AMOSC OWR team** • trained wildlife personnel available through the Oiled Wildlife Rehabilitators Network (approximately 100 personnel) • Philip Island Nature Park (approximately 100 personnel). • INPEX could provide additional personnel via INPEX Master Service Agreement with Environmental Service Providers, or other labour hire companies. Initial contingents of AMOSC staff and OWR team and mutual personnel with OWR training are available to mobilise to Broome/Darwin within 48 hours, however initial full team assembly is not expected until day 6. Additional OWR trained personnel are available via OSRL for a large/long duration response. Therefore, INPEX consider that sufficient arrangements are in place to mobilise OWR personnel within required timeframes. Additional trained OWR trained personnel could be positioned on stand-by in Broome or Darwin. However, as full remote shoreline response unit mobilisation is planned for day 6, this is not considered to be ALARP. **OWR Equipment- Wildlife hazing** Hazing/deterrence are terms used for activities that are undertaken to prevent wildlife from entering contaminated sites, and/or to make wildlife move away from areas that are likely to be affected by the spill (IPIECA-IOGP 2014). Techniques include: • human disturbance (the simple presence of people in the wildlife habitat) • vehicular disturbance (e.g., terrestrial vehicles, boats and aircraft) • visual disturbance (e.g., lights, reflectors, flags, effigies, etc.) • auditory disturbance (e.g., noise generators) • physical structures (e.g., fences) to prevent wildlife accessing contaminated sites. Animals often quickly become habituated to the deterrent stimulus, at which point efficacy will decrease markedly and the deterrent should be changed accordingly.			

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					Hazing/deterrence is better undertaken by trained and experienced personnel as there are many factors to be considered, both before and during hazing. These include the geographical area (e.g., is there a suitable, un-oiled environment for the animals to relocate to) and species variation. Effective hazing requires the creativity of experts with a knowledge of species behaviour and their natural history so that the most appropriate methods can be applied. A significant consideration is the need to avoid methods that make animals move towards the oil instead of away from it (IPIECA-IOGP 2014). In the case of a condensate and diesel spills, where surface oil slicks are thin and not considered particularly adhesive, the likelihood and severity of impacts on wildlife are less, in contrast to IFO/HFO. Additionally, hazing isn't considered an effective measure against volatile spills which rapidly evaporate, such as condensate. Therefore, given the open ocean environment likely to be impacted by a floating slick from a well blow-out, at sea wildlife hazing would not be likely to result in a significant environmental benefit. Wildlife hazing/deterrence would be more suitable when used near or on sensitive shoreline habitats, and generally against more persistent oil slicks. Wildlife hazing equipment such as bird scarers could be purchased and maintained offshore, on dedicated vessels for rapid deployment to a shoreline. However, floating slicks from the WCSSs in this BROPEP are likely to take days to reach sensitive shorelines, during which time, vessels can be mobilised with OWR experts and wildlife hazing equipment from a port. Therefore, maintaining wildlife hazing equipment onshore is considered appropriate. AMOSC maintain a range of wildlife hazing equipment as part of their stockpiles. **Wildlife collection pre-contact capture and translocation** Both alive and deceased oiled wildlife will need to be collected during an oil spill response operation. Alive oiled wildlife is collected for translocation, and/or subsequent assessment, treatment, rehabilitation or other wildlife welfare options. AMOSC OWR kits have been developed and are located around Australia including in Broome, Exmouth, Fremantle and Geelong. INPEX could purchase additional OWR kits however sufficient capability is considered already available. In addition, the types of equipment are readily available to be purchased from typical retail outlets/hardware stores. Physical structures, such as drift-fences (e.g., wooden stakes and rolls of shade-cloth), could be set-up on remote beaches to capture emergent turtle hatchlings before they enter an oiled intertidal zone, and relocate/release the hatchlings to an area well away from the slick (informed by modelling to determine the best locations for release). This type of equipment (and other visual disturbance type equipment) is readily available from gardening or hardware stores within the region. Therefore, is not considered necessary to maintain stockpiles of these types of equipment. **Oiled wildlife cleaning / rehabilitation equipment**			

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					Oiled wildlife containers (20 ft sea containers, specifically built for oiled wildlife cleaning) are located around Australia including Darwin, Karratha and Fremantle. Oiled wildlife containers are accessible via AMOSC. Given the current availability of containers, it is not considered ALARP for INPEX to purchase/maintain additional containers. The oiled wildlife containers could be mounted onto the deck of a large support vessel, to facilitate the intake/TRIAGE and possibly cleaning of small numbers of oiled wildlife. However, following cleaning, wildlife would be required to be transported to a dedicated/purpose build oiled wildlife rehabilitation centre. If a full rehabilitation centre was required for a large number of animals, it would need to be established at an onshore location. The physical area required for wildlife intake, first-aid, necropsy, cleaning, rehabilitation etc. is far larger than can be accommodated utilising vessels offshore. The challenge associated with remote operations is the time to transport oiled wildlife from the collection location to a rehabilitation centre. In the context of the BROPEP region, this could be >24 hours for transport alone. The welfare of animals, and overall objectives of the oiled wildlife response operation will need to be taken into consideration, before establishing a full rehabilitation centre. Stakeholder consultation with WA DBCA has confirmed that based on the WCSS modelling and wildlife species most likely to be impacted by shoreline oil in the BROPEP region, a full oiled wildlife remote cleaning operation and/or transport and mainland rehabilitation program would be unlikely to be required. The relevant State/Territory Control Agency would make the decision based on OWR information available at the time. Therefore, mobilisation of oiled wildlife containers is not anticipated to be required as part of floating remote shoreline response units. However, if oiled wildlife containers were required, they are available for use via AMOSC mutual aid arrangements. **Oiled wildlife waste management** Oiled wildlife cleaning will generate liquid oily waste. Approximately 0.5 m^3 of liquid waste is estimated per medium size bird. Therefore, if 100 medium size birds were cleaned, up to 50 m^3 of liquid oily waste would be generated. At an offshore location, liquid waste can be stored in the inboard tanks, or on deck mounted liquid waste storage tanks. At an onshore location, liquid waste storage would need to be established. Ultimately, all oily waste would be required to be disposed of at a licensed onshore oily waste disposal facility. Refer Waste Management row for further information. It should be noted, a review of the WCSSs with WA DoT and DBCA did not trigger a requirement to plan for large scale OWR washing and rehabilitation, and therefore detailed planning for the management of significant volumes of liquid oily waste is not required.			

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					OWR Logistics It is expected the relevant Control Agency. would require INPEX to provide the logistical support/platforms for any remote OWR operations. The response platforms for remote OWR activities typically include smaller and larger support vessels and possibly light utility helicopters. Please refer to the rows 'Remote Response' for details of remote response capabilities and arrangements.			
Controlled in-situ burning	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Waste management	Yes	Maximum volume (433 m^3) oil ashore	No emulsion factor for condensate spills. Bulking factor 10:1 for shoreline clean-up = 4300 m^3 oily waste (including PPE, etc.). No significant liquid waste is expected to be generated from a condensate spill response.	Suitable logistics supply vessel to transport solid/liquid oily waste from remote locations to port. Licensed land-based transport and oily waste disposal capability for 4300 m^3 solid waste. No significant liquid waste is expected to be generated from a condensate spill response.	INPEX maintains contracts with licensed waste contractors, to treat and/or dispose of oil contaminated wastes as part of routine operations. INPEX's existing waste contracts allows for immediate mobilisation of any required waste receptacles (drums, Intermediate Bulk Containers (IBCs), covered skip-bins, tote-tanks etc.) to offshore facilities, when requested by INPEX. There are no limitations/no additional capability required, for obtaining waste storage and transport receptacles, as these are used as part of routine offshore operations. Based on the estimated worst-case volume of oil accumulated on shorelines (430 m^3), no emulsification factor and a bulking factor for waste created of 10:1, approximately 4300 m^3 of waste could be generated. Shoreline clean-up waste would likely be captured in lined bulka-bags and 1 m^3 IBCs or transportable half-height containers. Therefore approximately 4300 m^3 capacity would be required, over the full duration (weeks/months) of any shoreline clean-up. AMOSC maintains specialised oil spill waste management equipment, including lancer barges, fast-tanks etc. equipment, predominantly stored in the Fremantle and Geelong stockpiles, with small amounts in Broome and Exmouth stockpiles. The licenced waste contractors have capacity to treat/dispose of the calculated volume of solid oily contaminated waste, at existing waste management facilities in the NT and WA. Whilst no significant liquid oily wastes are expected to be generated from a condensate spill response, onshore liquid oily waste disposal capabilities are available in NT and WA. These capabilities are routinely utilised as part of INPEX's offshore production and maintenance activities.	Sufficient provision has been made for availability of a suitable licensed waste management contractor. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain contracts with licensed waste contractors for the disposal of solid and liquid oil contaminated wastes. INPEX will maintain mutual aid agreements for access to AMOSC specialist solid and liquid waste storage/transport equipment.	2

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Remote response - support vessels	N/A	The BOD has identified that multiple remote response operations may be required at multiple remote shorelines. Refer SCAT, shoreline clean-up and OWR rows for further details.	N/A	The maximum field capability statement presented in this row is based on the combined selected field capability statements from both WCSSs presented in Table 6-4 and 6-5. OSV and PSVs capable of dispersant spray supporting Ichthys Field activities. One large support vessel and one small support vessel to support 1 x C&R strike teams in Ichthys Field within 48 hours. Additional C&R strike-team (one large and one small support vessel) departing Darwin or NW shelf within 48 hours. A single small vessel to support remote SCAT within 2 days. Two additional small vessels for SCAT within 7 days.	INPEX maintains access to a range of vessels through long-term hire contracts (e.g., OSVs/PSV/AHTs etc. currently operating in the BROPEP region) and access to a wide variety of other vessels through various call-off contracts/framework agreements. These contracts/arrangements include larger vessels such as PSVs, AHTs, construction vessels etc. and also medium to small support vessels (<30m length). Larger vessels could be used for activities such as containment and recover, vessel dispersant, wildlife hazing and as accommodation support vessels to support remote shoreline response activities. Small support vessels are widely available and can be used for supporting shallow water/nearshore response activities (E.g., SCAT, P&D and wildlife hazing, etc.), and appropriately designed smaller vessels including landing barges can be used for transporting equipment and personnel to shore and backloading oiled waste and wildlife as part of remote shoreline response operations. Each vessel can be loaded with different spill response equipment as relevant to the response activity and location. Support vessels are available in Broome and Darwin, and elsewhere around WA/Australia as required. Smaller vessels, in an emergency, could be along-side a smaller wharf to load marine crew, spill response personnel, fuel and supplies within a maximum of 24 hours, and then commence transit to the spill location. To support offshore production and drilling activities in the BROPEP region, there is a regular flow of large support vessels between offshore facilities and Broome and Darwin ports. Therefore, a large support vessel could be alongside Broome/Darwin port, loaded with spill response equipment and back underway steaming towards a spill location, generally within ~24 hours. However, there are some limitations. Large vessels can't always be guaranteed to be in close proximity to Broome or Darwin, and on rare occasions, it may take 18-24 hours for a large vessel to steam from an offshore location to port, to commence mobilisation of spill response equipment, and then steam back to a spill location. Therefore, total duration to mobilise equipment (E.g., C&R offshore booms and skimmers) from port to a spill location could be up to 48 hours. Other limitations include limited berth spaces available on wharfs in Broome and Darwin for these larger vessels. Therefore, immediate access to wharf space cannot be guaranteed. In addition, the Darwin marine supply base only has two very short windows per day to transit the access channel due to tidal restrictions, placing further restrictions on mobilisation from Darwin. Surge capability is available, with additional large support vessels also typically available on the NW Shelf (E.g., Exmouth/Dampier). Vessels from the NW Shelf would require approximately 48 hours to transit to Broome and then commence mobilisation activities.	The cost of maintaining a large support vessel, and fleet of smaller ancillary vessels, on stand-by is not considered ALARP, given the very large additional cost, and very low likelihood of a spill reaching a shoreline at >100 g/m^2 within the first few days of a spill event. Suitable arrangements will be maintained to ensure small and large vessels and other logistical support is available to support an initial C&R and vessel dispersant activity, and multiple remote SCAT, shoreline clean-up and OWR teams, within the specified mobilisation timeframes. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain call-off arrangements/framework agreements with a range of small and large vessel providers, to ensure several small and large vessels can be mobilised, as required. (OSVs/PSVs fitted with dispersant spray capability supporting Ichthys Field production activities) (Large and small vessels, able to support C&R operations; one C&R strike-team within Ichthys Field/Browse Basin within 48 hours) (Small vessel mobilised within 48 hours to support remote SCAT. Two additional small vessels within 7 days). (Single large vessel, and support tenders for remote shoreline response unit able to complete vessel mobilisation and depart from Broome/Darwin wharf within 6 days. Second unit in 14 days. Third unit in 30 days.)	3

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement (minimum implementation time)	Tier (1/2/3)
				Single remote floating platform to support SCAT/shoreline clean-up/OWR (large vessel plus supporting tenders etc.) required to mobilise within 6 days. Second remote shoreline response unit (large vessel and small support vessels) within 14 days. Third within 30 days.	The mobilisation from port of a remote shoreline response unit is not expected to be required until day 6, due to the more complex HSE planning, large and complex team size and additional equipment all required for the mobilisation. Therefore, sufficient time is available to identify and mobilise additional large support vessels. It should be noted that the relocation of equipment stockpiles from their storage facilities in Broome and Darwin to the wharf will not result in any additional time, as the positioning of this equipment on the wharf would occur whilst the support vessel is in transit/alongside in Broome or Darwin, and in conjunction with other activities (E.g., bunkering). The only identified method to further improve the speed of a vessel-based response would be to have additional vessels on stand-by pre-loaded with spill response equipment and personnel. It is not possible (space and weight limitations) to store and maintain all potentially required types of equipment offshore at all times. In addition, there may be an operational requirement to have specific equipment from the stockpiles mobilised to different locations on different types of vessels, depending on the nature of the spill, receptors at risk and weather conditions at the time. The cost to maintain a large vessel on stand-by in Broome or Darwin is approximately $20,000 per vessel per day. Any vessel would still need to wait for wharf space to become available, to load the relevant response equipment and personnel, then depart for the spill location. This cost is not considered ALARP, given the low likelihood of the spill event, and low likelihood (especially in the dry season) of a significant shoreline contact occurring in a short period of time. It should be noted that strong winds and elevated sea-states will limit the effectiveness of most vessel-based response activities and reduce shoreline accessibility. There is no additional vessel-based capability that can overcome this limitation. Light utility helicopter capability can assist to overcome this issue, discussed below. It should be noted that if poor weather conditions were found to be limiting vessel-based responses and access to islands/shorelines, these same weather conditions would also very likely be significantly increasing the entrainment rates of any floating condensate, reducing volumes of oil ashore and increasing natural weathering of any oil on shorelines.			
Remote Response - land based remote accommodation camp	N/A	The BOD has identified that multiple remote response operations may be required.	N/A	3 remote response platforms required, however all floating/offshore. Therefore, no land-based remote accommodation camps required.	The vast majority of the area covered by the BROPEP has no road access at all, which prevents the ability to establish a remote response land-based camp/FOB. The only area within the region with potential for suitable land-based road access is the Dampier Peninsula, between Broome and Cape Leveque/One-Arm Point. However, the BOD results for the WCSS's did not identify any shoreline contact >100 g/m^2 on the Dampier Peninsula. Therefore, there is no requirement for the establishment of capability/arrangements to support a large shoreline clean-up or OWR, supported by a remote response land-based camp/FOB on the Dampier Peninsula.	A remote response land-based camp/FOB is not considered as an appropriate/ALARP element of the BROPEP.	N/A	N/A

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement (minimum implementation time)	Tier (1/2/3)
		Refer SCAT, shoreline clean-up and OWR rows for further details						
Remote response - light utility helicopters	N/A	The BOD has identified that remote response operations may be required. Refer shoreline clean-up and OWR rows for further details	N/A	Shoreline clean-up and OWR will likely need to be supported by floating remote response platforms required. A light utility helicopter may also be required for situations where shoreline access was significantly challenging and there is an urgent need to rapidly conduct the shoreline clean-up/OWR activity. Only a single receptor would be contacted in the first week – therefore only a single light utility helicopter would be required initially. Should a light utility helicopter be required for the initial shoreline clean-up/OWR activity, that activity would not mobilise from port until a minimum of day 6.	The objective for use of a light utility helicopter during remote shoreline response is to provide a mechanism for transporting personnel, equipment and oily waste/wildlife, between the remote shoreline and remote support base (accommodation support vessel or remote shoreline FOB). Shoreline responses including shoreline clean-up and OWR would typically only be mobilised pending results of an initial SCAT survey, followed by a level of detailed remote response logistical, operational and HSE and Emergency Response planning. Early SCAT assessment results may quickly indicate that some level of shoreline clean-up and OWR may be required, however it is expected that a minimum of 7 days of planning and equipment/personnel mobilisation would be required, prior to a remote response vessel mobilisation from port. Therefore, a light utility helicopter would not be required in any less than 7 days. Using a BK-117, H-135 or H-145 light utility helicopter, the helicopter's maximum capacity is two pilots transporting six passengers. The use of additional utility helicopters would enable more responders to access the affected location. However, this will require additional helicopter landing pads/locations to accommodate the helicopter overnight. To mobilise and maintain a second light utility helicopter offshore, a very large support vessel equipped with a helicopter pad would be required. The costs associated with this large support vessel and second helicopter would be in excess of $100,000 per day. Under a worst credible scenario, only a single remote shoreline operation requiring the use of a light utility helicopter is anticipated. The minimum requirements for a helicopter to support oil spill response activities at remote shoreline locations are: • capacity to carry at least 6 personnel and their equipment, • ability to be fitted with cargo hooks for the ability to sling loads (i.e. equipment/waste) between the shoreline and nearby support vessels. • long range fuel tanks due to the distance offshore • twin engines • life raft, satellite tracking and other safety systems. Under the International Civil Aviation Organization (ICAO) Annex 6 Civil Aviation Safety Regulation (CASR) 133, transport category helicopters with a seating capacity of >19 must be operated under Performance Class 1 or Category A.	Due to high cost ($1.5M-$2M AUD/year), it is not considered ALARP to maintain a light utility helicopter on stand-by at all times in Broome/Darwin for spill response. A light utility helicopter is not required for 6 days, and only required under certain circumstances, should vessel-based logistics to land personnel ashore be unfeasible due to weather/metocean constraints. Therefore, maintaining framework agreements with helicopter companies to provide a light utility helicopter within 7 days, on a best endeavours basis is considered ALARP in relation to the maximum field capability statement.	INPEX will maintain framework agreements with a helicopter provide for access to light utility helicopters within 7 days, on a best-endeavours basis.	3

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement (minimum implementation time)	Tier (1 / 2 / 3)
				Therefore, a single light utility helicopter available by day 7, to join the vessel on its mobilisation to/at the remote shoreline response location is considered as the maximum field capability requirement.	Therefore, crew transfer helicopters, including the search and rescue (SAR) helicopter, are not available for shoreline oil spill response support activities. In addition, whilst the Sikorsky S-92 helicopters used for INPEX crew changes meet some of the criteria (E.g., personnel capacity, twin engines and long-range fuel tanks required to access remote areas), they do not have the capability to sling equipment as they cannot be configured with cargo hooks. In addition, because of the size of the S-92, the downwash generated is in excess of 125 km/h and landing on unprepared sites can cause “brown-out” conditions which can restrict visibility due to the recirculation effect of the rotor downwash. Therefore, these helicopters are not deemed suitable for remote shoreline operations. Smaller helicopters can be operated under Performance Class 2 or 3 (Category B) and under ICAO Annex 6 CASR 133 and the Civil Aviation Safety Authority (CASA) regulations may be able to land at remote shoreline locations with extreme caution. Under the International Association of Oil and Gas Producers - Aircraft Management Guidelines Document 390, INPEX risk assessments, the INPEX Refueling Handbook and CASA Civil Aviation Advisory Publication 234-1 (2) Paragraph 5.4.2 recommends all aircraft operating under charter should have sufficient fuel to fly to an alternate aerodrome which is not a remote island. For example, for a response at Ashmore or Cartier Islands, the closest usable airport would be Mungalalu-Truscott Airbase. The remoteness of other potential shoreline response locations along the WA coastline presents similar challenges. Based on the distance of Cartier Island to Mungalalu-Truscott and the requirement for smaller helicopter types that can land at remote islands, the most suitable twin-engine helicopter types identified were the MBB Kawasaki BK-117 and the Airbus H-135 or H-145 (if fitted with a long-range fuel tank). A large support vessel with a helicopter deck could however be considered an alternative landing location to the remote island, assisting in redundancy landing locations for remote helicopter activities. Small helicopters such as BELL 206, AS350B and EC120 are capable of landing on remote islands with difficult access. However, they have single engines and were ruled out as they do not meet INPEX’s aviation standards for safety, fuel range or have the ability to transport enough people/equipment to implement an effective response. Light utility helicopters, such as the BK- 117 and Airbus H-135 or H-145, are generally working under contract with many configured in an air ambulance role or surf rescue role. The market for surplus available aircraft around Australia is therefore limited and the response time cannot be guaranteed. INPEX has in place ‘best-endeavours’ agreements with the crew-change helicopter company, to also provide a light utility helicopter, within 7 days, under a ‘best-endeavours’ arrangement.			

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement (minimum implementation time)	Tier (1 / 2 / 3)
					The only way to guarantee the availability of a light utility helicopter would be to position one, on standby in Broome or Darwin on a permanent basis. The high cost (calculated as AUD $1.5–2.0 million per year) of maintaining this capability, including the hire of the aircraft, pilots on standby, reoccurring training and maintenance of the aircraft, is considered to be grossly disproportionate to the environmental benefit gained. This is because the remote shoreline response operations are not expected to mobilise until day 6, and the light utility helicopter is only needed if shoreline landing via vessel is not practicable or safe. It should be noted that if heavy sea conditions were restricting vessel access, this same wave action would be increasing the natural break-up and weathering of oil at sea and on shorelines.			
Remote Response Crew Change Helicopters	N/A	N/A	N/A	Single crew change helicopter available to support ongoing crew rotations from remote response operations.	The objective for use of a crew change helicopter during remote shoreline response is to provide an alternative mechanism for transporting personnel between a remote vessel-based response platform and a mainland airbase. Under most remote response operations, it is envisaged that the remote response vessel fleet will be able to facilitate crew changes in and out of ports. However certain circumstances (E.g., larger scale, long duration remote responses) may warrant the additional support of crew change helicopters, to conduct personnel movements between the remote response location and mainland airbases. In addition, a crew-change helicopter could be utilised as an air-attack aircraft (observing FWAD air-tractor operations), (refer Table 6-5 FWAD row for further information). INPEX maintain contract with a helicopter provider, to provide a fleet of crew-change helicopters for routine operations. This fleet of helicopters would be utilised to facilitate crew-change for oil spill response activities at remote locations. If additional crew-change helicopters are required above the standard fleet already maintained in Broome, additional aircraft can be arranged through the helicopter provider.	The INPEX crew-change helicopter fleet which supports production activities in WA-50-L will be suitable for managing crew-change of spill responders at remote locations. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain a fleet of crew change helicopters to support production activities in WA-50-L. These helicopters can be used to support remote oil spill response crew change, or FWAD activities if required. (INPEX crew-change helicopters always available – daylight hours)	3

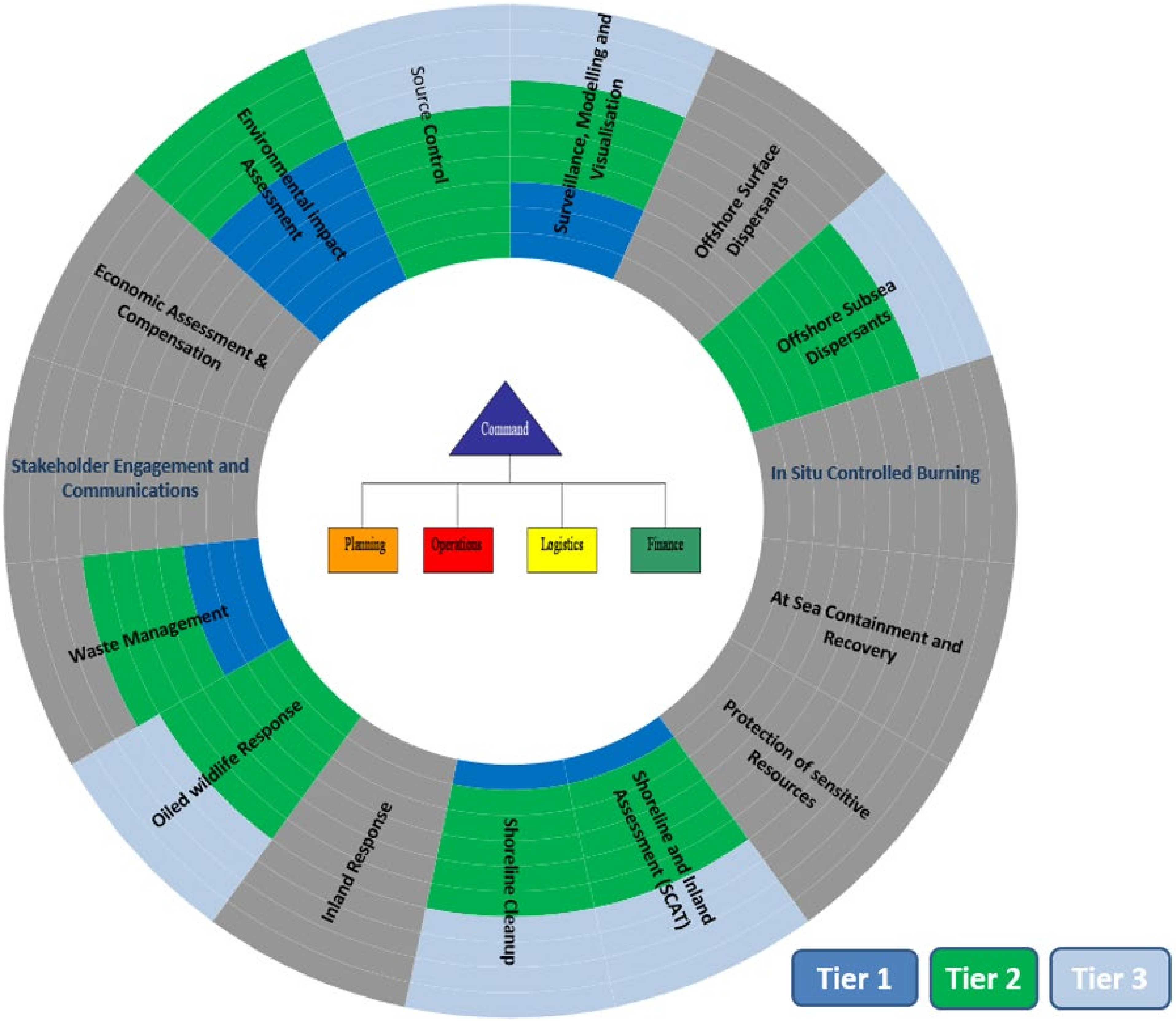

Figure 6-5 Tiered Preparedness Wheel – Condensate Well Blow-out

6.6.2 Vessel collision Group IV spill

Table 6-5 Field Capability Assessment – Vessel Collision 776 m³ HFO Spill

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement	Tier (1/2/3)
SMV - Aerial surveillance	Yes	Maximum lineal distance (km) floating oil >1g/m²: 1150km Localised slick during first 24-48 hours.	Refer Table 6-4– row “SMV - Aerial surveillance”					
SMV - Vessel surveillance	Yes	Maximum lineal distance (km) floating oil >1g/m²: 1150km Localised slick during first 24-48 hours.	Refer Table 6-4– row “SMV – Vessel surveillance”					
SMV - Oil Spill Trajectory Modelling	Yes	Maximum lineal distance (km) floating oil >1g/m²: 1150km Localised slick during first 24-48 hours.	Refer Table 6-4– row “SMV – Oil spill trajectory modelling”					
SMV – Satellite tracker buoys	Yes	Maximum lineal distance (km) floating oil >1g/m²: 1150km Localised slick during first 24-48 hours.	Refer Table 6-4– row “SMV - SMV – Satellite tracker buoys”					
SMV – Satellite imagery	Yes	Maximum lineal distance (km) floating oil >1g/m2:	Refer Table 6-4– row “SMV - SMV – Satellite imagery”					
At Sea Containment and Recovery	Yes	Refer to Appendix A					INPEX will maintain contracts/framework agreements with large vessel providers.	2

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement	Tier (1 / 2 / 3)
							INPEX will maintain mutual aid arrangements with AMOSC, which provides access to C&R equipment for two strike-teams as part of the AMOSC Broome/Exmouth stockpiles. In addition, AMOSC can provide advancing booming systems from the Fremantle, and Geelong stockpiles. INPEX will maintain access to AMOSC Core-Group personnel trained in offshore C&R. (Single C&R strike team available in Ichthys Field within 48 hours)	
Surface Dispersant – Vessel	Yes	Refer to Appendix B					INPEX will maintain a vessel dispersant capability respond to Group IV spills in the Ichthys Field, including the following: • FPSO Venturer – 16 m^3 dispersant and AFEDO system and dispersant spray trained personnel • Ichthys 3 x OSV/PSVs – equipped with dispersant spray systems and trained personnel INPEX will maintain a mutual aid arrangements with Shell and AMOSC, which provide access to: • Prelude FLNG's support vessels – including vessel dispersant spray systems, dispersant stockpiles and trained personnel • AMOSC Broome & Exmouth stockpiles – including vessel dispersant spray systems and dispersant stockpiles, and Core-Group trained personnel.	2
Surface Dispersant - Aerial	Yes	Refer to Appendix C					INPEX will maintain mutual aid arrangements with AMOSC, which provide access to the AMOSC contracted FWAD capability. (Two AT-802 air tractors and supporting FWAD capability including dispersant stocks and FWAD airbase personnel available at nominated airfield within 24 hours)	2

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement	Tier (1/2/3)
Offshore Subsea Dispersant	No	NA						
Controlled in-situ burning	No	NA						
SCAT	Yes	Maximum of 295 km of shoreline oiled >10 g/m^2 Shorelines oiled spread over wide range of offshore islands and islands of the Bonaparte and Buccaneer Archipelagos. Minimum 1 day for first shoreline contact >10 g/m^2. Typically, up to 3-4 weeks before second shoreline sector is contacted. Significant increase in shoreline contacts between days 30-60.	NA	Refer to Table 6-4 row "SCAT"				
Protection of sensitive resources (PSR)	Yes	N/A	N/A	Protection booming maintained offshore, or on remote shorelines ready for rapid deployment.	As discussed in Table 5-2, there are a significant number of challenges associated with nearshore/shoreline protection booming at both offshore locations, and along the WA/NT mainland coastlines/archipelagos, including very large tidal ranges/currents, estuarine crocodiles at all mainland locations etc. The overall length of the intertidal zone, in areas with tidal ranges of 5m – 12m is so vast that attempting to utilise shore-seal/shore-guardian boom over such a large area would not be feasible. In addition, the extreme currents of the region would likely result in very limited effectiveness of booms.	It is not considered ALARP to maintain any shoreline/protection booming equipment offshore or at any specific sensitive receptor location, due to the very low likelihood of activation of this strategy. It is considered ALARP to maintain some shoreline/protection booming equipment as part of the Broome stockpile.	Maintain mutual aid arrangements to provide access to AMOSC shoreline protection booming systems within the AMOSC stockpiles including Broome. Maintain mutual aid arrangements to provide access to AMOSC and OSRL personnel trained in shoreline protection.	1

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement	Tier (1/2/3)
					Decision to deploy shoreline/protection booming would need to be based on an assessment of a specific spill scenario, weather conditions and accessibility/practicalities of the operation at a specific location of interest. Therefore, maintaining shoreline protection equipment at a centralised stockpile, which can be rapidly mobilised to a vessel to deploy to a remote location is the most practical option. Should shoreline/protection booming be deemed appropriate, it is likely (and was verified by WA DoT/WA Control Agency during stakeholder consultation) that nearshore booming would be conducted as part of a broader remote shoreline response operation, at a very specific shoreline location. Therefore planning/mobilisation and logistics would be conducted as part of the broader remote shoreline response operation. AMOSC maintain shoreline/protection booming equipment at the Broome and Exmouth stockpile, as well as a large stockpile in Geelong. AMOSC maintain personnel trained in shoreline/protection booming. Additional shoreline/protection booming trained personnel are available via OSRL for a large/long duration response.			
Shoreline clean-up	Yes	Maximum of 276 m^3 total volume oil ashore from worst stochastic run. Maximum of 75 km of shoreline oiled >100 g/m^2 including 4 x offshore islands, and islands in the Buccaneer and Bonaparte Archipelago (refer Figure 4-3). Oil volumes ranging from <2 m^3 to <50 m^3.	Assume 2 x emulsification factor for IFO/HFO spill. Assume 10x bulking factor, for oily waste on shoreline. Worst-case of 276 m^3 neat oil ashore = 5520 m^3 oily waste to be recovered. Assume each shoreline clean-up person can recover 1 m^3 oily waste per day = 5520 person days for worst-case (by volume) shoreline clean-up operation.	.**Refer to** Table 6-4 – row "Shoreline clean-up" Note, the only difference between the Group I and Group IV shoreline clean-up oil spill budget is a slight increase in worst-case volume oil ashore, from 4300 m^3 oily waste for the condensate scenario, to 5520 m^3 oily waste from the IFO/HFO scenario. The proposed number of remote shoreline response units would remain at a peak of 3, for both the Condensate and IFO/HFO scenario. However, the remote shoreline response units would be required to operate for an extra 20 days, to recover the additional volume of oily waste from the IFO/HFO scenario.				

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement	Tier (1 / 2 / 3)
		Minimum 1 days for first shoreline contact. Typically, up to 3-4 weeks before second shoreline sector is contacted. Significant increase in shoreline contacts between days 30-60.	Worst-case shoreline response (by length) could be across several remote locations – however not at all locations simultaneously.					
Oiled wildlife response – wildlife collection	Yes	1 day for time to contact at shoreline >100 g/m² at turtle breeding BIA shoreline. Worst case volume 276 m³ oil ashore in areas of >100 g/m² at turtle breeding BIA shoreline. Multiple marine avifauna and turtle BIA shorelines (several offshore islands, plus several islands of Buccaneer & Bonaparte Archipelago) contacted at >100 g/m². Typically, up to 3-4 weeks before second shoreline sector is contacted. Significant increase in shoreline contacts between days 30-60.	Key receptors potentially affected are EBCP listed species, with most at risk species being turtles and birds. Review of the WCSSs with WA DoT and DBCA did not trigger a requirement to plan for large scale OWR washing and rehabilitation.	**Refer to** Table 6-4– row "Oiled Wildlife Response"				

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement	Tier (1/2/3)
Waste management	Yes	Maximum volume (276 m^3) oil ashore	2 x emulsion factor for IFO/HFO spills. Bulking factor 10:1 for shoreline clean-up = 5520 m^3 oily waste including Personal Protective Equipment (PPE) etc. Assuming a highly efficient C&R operation was conducted, assume 10% oil recovered, assume ~30 m3 liquid oily waste. Assume a conservative additional 20 m^3 liquid oily waste from sensitive receptor protection activities.	Suitable logistics supply vessel to transport solid/liquid oily waste from remote locations to port. Licensed land-based transport and oily waste disposal capability for 5220 m^3 solid waste, and 100 m^3 liquid oily waste	INPEX maintains contracts with licenced waste contractors, to treat and/or dispose of oil contaminated wastes as part of routine operations. INPEX's existing waste contracts allows for immediate mobilisation of any required waste receptacles (drums, IBCs, covered skip-bins, tote-tanks etc.) to offshore facilities, when requested by INPEX. There are no limitations/no additional capability required, for obtaining waste storage and transport receptacles, as these are used as part of routine offshore operations. Based on the estimated worst-case volume of oil accumulated on shorelines (276 m^3) and the assumed emulsion and bulking factors for wastes, 5520 m^3 of solid oily waste could be generated. Shoreline clean-up waste would likely be captured in bulka-bags and 1 m^3 IBCs or transportable half-height containers. Therefore approximately 5520 m^3 capacity would be required, over the full duration (weeks/months) of any shoreline clean-up. AMOSC maintains specialised oil spill waste management equipment, including lancer barges, fast-tanks etc. equipment, predominantly stored in the Fremantle and Geelong stockpiles, with small amounts in Broome and Exmouth stockpiles. The licenced waste contractors have capacity to treat/dispose of the calculated volume of solid oily contaminated waste and liquid waste, at existing waste management facilities in the NT and WA. These facilities are routinely utilised for oily waste disposal as part of INPEX's offshore production/maintenance activities.	Sufficient provision has been made for availability of a suitable licensed waste management contractor. This level of capability is considered suitable to achieve the maximum field capability statement.	INPEX will maintain contracts with licensed waste contractors for the disposal of solid and liquid oil contaminated wastes. INPEX will maintain mutual aid agreements for access to AMOSC specialist solid and liquid waste storage/transport equipment.	2
Remote response - support vessels	**Refer to** Table 6-4 – row "Remote response - support vessels"							

Response strategy	Strategic SIMA outcome	BOD Outcome	Oil Spill Budget Outcome	Maximum Field Capability Statement	Operational Considerations and ALARP assessment of the Field Capability	ALARP Justification of Selected Field Capability Statement	Selected Field Capability Statement	Tier (1 / 2 / 3)
Remote response - land based remote accommodation camp	**Refer to** Table 6-4– row "Remote response - land based remote accommodation" camp							
Remote response - light utility helicopters	**Refer to** Table 6-4– row "Remote response - light utility helicopters"							
Remote response – crew change helicopters	**Refer to** Table 6-4– row "Remote response – crew change helicopters"							

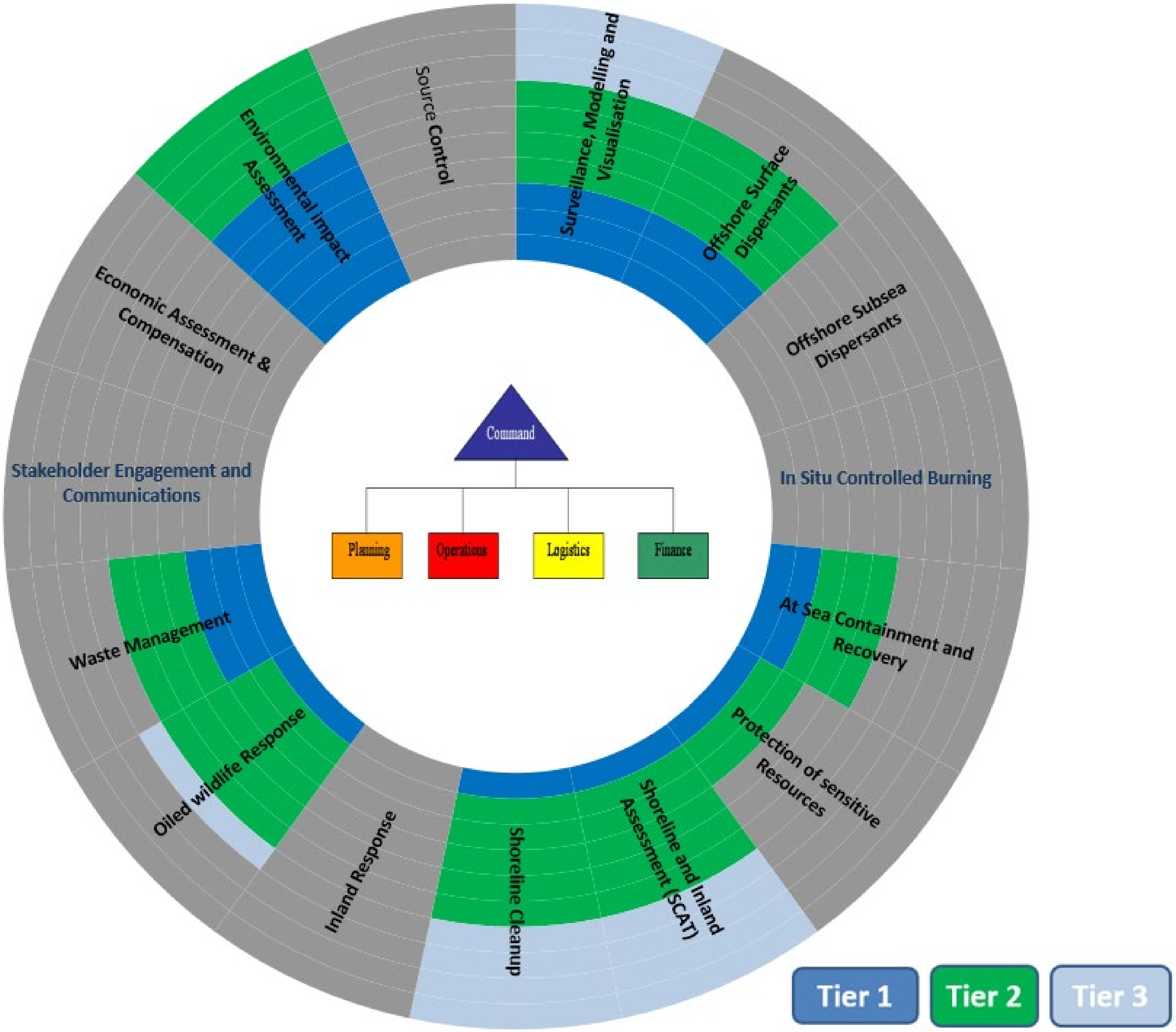

Figure 6-6 Tiered preparedness wheel- Vessel collision HFO / Group IV spill

7 FIELD CAPABILITY, ARRANGEMENTS AND ENVIRONMENTAL RISK ASSESSMENT OF RESPONSE

This section provides:

- a suite of EPOs and EPSs related to maintaining and testing preparedness of the capabilities and arrangements for the oil spill response strategies
- an evaluation of the potential environmental impacts and risk associated with the implementation of the oil spill response strategies.

The EPOs and EPSs related to the IMT capability/arrangements are contained in the BROPEP IMT Capability Assessment Report (X060-AH-REP-70015).

The EPOs and EPSs related to the implementation of the capability/arrangements during spill response are contained in the BROPEP (X060-AH-PLN-70009).

7.1 Oil Spill Response Field Capability Preparedness

Table 7-1 provides the EPOs, EPSs and measurement criteria related to maintaining oil spill response strategy/capability preparedness.

Table 7-1 Environmental performance outcome, standards and measurement criteria for oil spill response field capability preparedness

Environmental performance outcome	Performance standards	Measurement criteria
INPEX will be prepared and ready to respond to oil spill events.	INPEX will maintain capabilities and arrangements to activate the oil spill response strategies, within the timeframes specified in Table 6-4 and Table 6-5.	Records confirm capabilities and arrangements to activate the oil spill response strategies, within the timeframes specified in Table 6-4 and Table 6-5 are maintained.
	Biennially servicing of INPEX oil spill tracker buoys will include a test which confirms the ability of the buoy to transmit its GPS location.	Oil spill satellite tracker buoy biannual service reports will include records of tests confirming the buoy transmits GPS location.
	INPEX will maintain vessel sharing agreements with Shell/Prelude, which facilitates best endeavours sharing of vessels including access to dispersant capability and oil spill tracker buoys between Ichthys and Prelude offshore production assets.	Documented INPEX/Shell agreements/arrangements
	INPEX will validate the oil spill response capability and arrangements, as specified in Table 6-4 and Table 6-5, through a desktop capability/arrangements validation exercise once per calendar year. Mutual aid personnel and equipment capabilities will be validated through review of AMOSC/OSRL service level statements and AMOSC/OSRL assurance activities. The logistics capability will be evaluated by contacting the relevant logistics service providers to: • validate each logistics providers emergency contact details against those on record in the INPEX Australia Emergency Contact Directory • validate the contractor's availability/capability of logistical assets, to arrive in Broome/Darwin within timeframe specified in Table 6-4 and Table 6-5.	INPEX Australia BROPEP Capability Annual Validation Exercise Report. Exercise reports demonstrate objectives have been tested, improvement opportunities identified, and links provided to relevant action tracking registers.

Environmental performance outcome	Performance standards	Measurement criteria
	• logistics assets/service providers to be tested include: – light utility helicopter – crew change helicopter – fixed wing aircraft – small support vessels – large support vessels. The results of this desktop validation exercise will be summarised in the INPEX Australia BROPEP Annual Performance Report.	
	INPEX will validate the availability and capability of the OSMP contractor through six monthly OSMP contractor capability reports. Reports will include availability of personnel and equipment required to implement the OSMP.	OSMP contractor six monthly capability reports.
	INPEX will maintain contracts with three support vessels, operating at the Ichthys Field location, equipped with dispersant spray equipment.	Records demonstrate three INPEX/Ichthys support vessels are equipped with dispersant spray systems.
	INPEX will maintain 16 m^3 of dispersant and a mobile dispersant spray system on the FPSO in the Ichthys Field (WA-50-L).	Records demonstrate 16 m^3 of dispersant and a mobile dispersant spray system is located in WA-50-L.
	Hard copies of the INPEX Oil Spill and Dispersant Visual Observation Guide for Vessels and Aircraft will be available: • on the PSVs and OSV, and where that dispersant / dispersant spray equipment is located in WA-50-L • at the INPEX aviation contractor base in Broome.	Records confirm the INPEX Oil Spill and Dispersant Visual Observation Guide for Vessels and Aircraft will be available:

Environmental performance outcome	Performance standards	Measurement criteria
		• on the PSV and OSV, and where that dispersant / dispersant spray equipment is located in WA-50-L • at the INPEX aviation contractor base in Broome.
	PSV/OSV vessels dispersant spray booms will be maintained in accordance with vessel preventative maintenance system. PSV/OSV vessel crews will maintain dispersant spray competency, through one dispersant equipment deployment drill per swing, per calendar year (total of two deployment drills per vessel per year). Each drill will ensure crews: • maintain familiarity with operation of vessel spray booms including review of the vessels own dispersant spray SOP and JHA • maintain familiarity with INPEX dispersant spray processes and use of INPEX dispersant reporting tools, through review of: – INPEX oil spill observation and dispersant spray guide. – INPEX PSV/OSV Oil Spill and Dispersant training presentation.	Records demonstrate: • preventative maintenance of spray booms has been conducted • dispersant deployment exercises have been conducted annually by vessel crews.
	FPSO service technicians and HSE crew will be trained in dispersant application via an on-line E-learning module. This module will be required to be completed every 2 years. This E-learning module will cover the following topics: • INPEX Oil Spill Observation and Dispersant Guide. • INPEX AFEDO dispersant spray unit Standard Operating Procedure and Job Hazard Analysis.	Records demonstrate: • FPSO crews trained via online E-learning module every 2 years • preventative maintenance of AFEDO unit conducted • dispersant deployment exercises conducted annually.

Environmental performance outcome	Performance standards	Measurement criteria
	~~The INPEX FPSO AFEDO system will be maintained in accordance with the FPSO's preventative maintenance system.~~ Once per calendar year, FPSO service technicians (who are trained in dispersant application) will ~~move the AFEDO unit onto an available support vessel and~~ conduct a physical deployment/testing of the AFEDO spray unit. The objectives of the dispersant spray test drill will include: • Practical review of Operating Procedure and Job Hazard Analysis • Practice communications for a dispersant spray drill between field team and Central Control Room • Central Control Room team practice use of the BROPEP dispersant controls/dispersant application decision matrix.	

7.2 Risk Assessment of Response Strategy Implementation

As identified in the Strategic SIMA, not all response strategies are appropriate for every WCSS. Different hydrocarbon types, spill locations and spill volumes require different combinations of strategies, to implement an effective response.

Based on the field capability evaluations presented in Table 6 4 and Table 6 5, INPEX has identified appropriate response strategy capabilities and arrangements to reduce the impacts and risks of hydrocarbon spills from INPEX's petroleum activities to ALARP.

However, the deployment of response strategies has the potential to introduce further impacts and risks to the environment. This section evaluates the potential environmental impacts and risks associated with implementing response strategies and evaluates the controls to manage those risks.

An impact and risk evaluation for the implementation of the response strategies is presented in Table 7-2.

The impact and risk evaluation table presented below utilises the same risk evaluation process as described in Section 6 of INPEX EPs.

The EPOs and EPSs presented in Table 7-2 have been duplicated within Section 4 of the BROPEP (X060-Ah-PLN-70009), as the IMT must be aware of and implement the below EPOs/EPSs during a spill response.

Table 7-2 Impact and risk evaluation- Response strategy implementation

Identify hazards and threats – All response strategies
Vessel and aviation activities.
Routine sewage effluent, grey water and food waste discharges from vessels used in oil spill response, when located close to shorelines (such as turtle and marine avifauna breeding rookeries), could result in changes to water quality resulting in the exposure of EPBC-listed species to untreated/non-macerated discharges.
Accidental release of waste overboard as a result of inappropriate management may result in impacts to marine fauna through entanglement or ingestion of waste material, with the potential to result in injury. Inappropriate waste management also has the potential to expose marine flora and fauna to changes in water quality and may result in reduced ecosystem productivity or diversity.
The physical presence of vessels used in oil spill response has the potential to result in vessel-to-vessel collisions.
The physical presence and use of vessels during spill response has the potential to result in collision (vessel strike) with marine fauna which may result in death or injury to individuals. Increased vessel traffic may result in increased turtle/vessel interactions and disruption to inter-nesting behaviours.
The physical presence and use of vessels during spill response near to shorelines used for wildlife roosting and breeding has the potential to result in light emissions affecting wildlife behaviour.
The movement/anchoring of nearshore/shoreline protection booms in intertidal waters of remote shorelines/offshore islands has the potential to physically damage intertidal/shallow subtidal reefs.
The introduction of inappropriately managed ballast water could result in the introduction of marine pests into shallow benthic habitats including Australian and State/Territory Marine Parks.
The movement of equipment and personnel from vessels and helicopters onto remote locations/offshore islands has the potential to introduce terrestrial exotic pests, including rats.
The operation of aircraft including helicopters and fixed wing aircraft may result in noise impacts and/or other disturbance to cetaceans.
Shoreline response activities
The movement of equipment and personnel and lighting onto turtle nesting beaches has the potential to disturb turtle nests and turtle-nesting activities.
Incorrect management of hydrocarbon-contaminated wastes generated during sensitive receptor protection booming and shoreline clean-up has the potential to create additional contamination of the shoreline.
OWR activities
Poorly implemented wildlife hazing can result in unintended secondary impacts and disturbance to natural wildlife activities.
Capture, cleaning and rehabilitation of oiled wildlife has the potential to create additional stress to animals and introduce diseases back into wild populations.
Surface and subsea dispersant activities
Dispersant use can result in reduced water quality and toxicity to intertidal and subtidal marine flora and fauna from dispersant and increased concentrations of entrained/dispersed hydrocarbons in the water column.

Containment and recovery activities Operational efficiencies may be achieved during containment and recovery activities, by discharging oil/oily water to maximise the concentration of oil in vessel/deck storage tanks. As such, some discharges of oil/oily water back to the marine environment may be required during containment and recovery activities.	
Potential consequence: Vessel and aviation activities	**Severity**
The values and sensitivities with the potential to be impacted are transient, EPBC-listed species (marine fauna including foraging BIAs). Due to the types of small vessels which may support an oil spill response, all vessels may not be fitted with sewage disinfection systems, sewage macerators or food macerators. Therefore, EPBC-listed species, such as marine turtles and marine avifauna may be exposed to untreated sewage, grey water and food scraps, particularly when response vessels are conducting activities near breeding rookeries, such as Browse Island, Lacapede Islands and Scott Reef. The duration of any exposure is likely to be limited to between a few days and a number of weeks, depending on the duration of the oil spill response activity. Due to the local currents and deep offshore waters surrounding these offshore islands, and higher currents around nearshore waters of WA/NT coastlines, any temporary changes to water quality that may occur are expected to be short term and localised and are therefore considered to be Insignificant (F). Various conservation management plans identify inappropriate waste management as a key threatening process to the recovery of EPBC-listed species. Inappropriate storage and handling of solid and liquid wastes generated through routine operations during an oil spill response could result in impacts to individuals of transient, EPBC-listed species, resulting in isolated and localised impacts only. Therefore, the consequence is considered to be Insignificant (F). The physical presence of vessels during the implementation of response strategies has the potential to increase the risk of a vessel-to-vessel collision. The hazards, consequences, likelihood and risks of a vessel collision are discussed in all EPs, and therefore this is not replicated within this BROPEP. The standard controls specified within EPs to prevent vessel collisions are replicated within this table. While there is potential for a small number of individual marine fauna to be impacted by vessels associated with the activity, any potential vessel strike to marine fauna is likely to be limited to isolated incidents. As reported by the DEE (2017), although the outcome can be fatal for individual turtles, vessel strike (as a standalone threat) has not been shown to cause stock level declines. In the event of the death of an individual whale, whale-shark or turtle, it would not be expected to cause a significant effect at the population level. These impacts must also be traded off against the purpose of the vessel, being to minimise/mitigate spill risks to EPBC habitats. Therefore, the consequence is considered to be Minor (E). The use of deck lighting on vessels at night during the implementation of response strategies has the potential to increase the risk of disturbance to marine megafauna (if vessels are operating adjacent to turtle nesting beaches at night). Under most circumstances, night-time vessel based oil spill response activities adjacent to shorelines is not expected to be required. Therefore, significant on water or deck lighting is not expected to be in use on vessels supporting remote shoreline spill response. The impact of vessel light emissions on adjacent sensitive shorelines could result in some behavioural disturbance, such as impact on turtle hatchling orientation. Any impact is likely to be minor, only affecting a small proportion of the population, and temporary in nature (i.e. only for the duration of the spill response). Therefore, the consequence is considered to be minor (E).	Moderate (D)

The physical presence and movement of shoreline booms/anchors in intertidal environments could potentially cause damage to coral reefs/intertidal ecosystems, resulting in localised, short to medium term impacts to these habitats (Minor E). Vessel-based contain and recover response activities would generate a significant quantity of hydrocarbon-contaminated solid and liquid waste. Contaminated solids would include PPE, oil coated booms, skimmers etc. and the oily contaminated liquids collected during the response activity. Inappropriate management of the oily contaminated waste could result in localised contamination of the marine environment resulting in harm to individuals of protected species (Minor E). The *Threat abatement plan to reduce the impacts of exotic rodents on biodiversity on Australian offshore islands of less than 100,000 hectares* (DEWHA 2009) identifies that exotic rodents (such as rats) have been a major cause of extinction and decline of island biodiversity. Introduction of rodents to any of the offshore islands in the EMBA could result in a medium-term impact on a population of protected species (Moderate D). Similarly, the consequence of inappropriate ballast water management could result in the introduction of marine pests into marine parks, resulting in medium-term impacts on a protected ecosystem (Moderate D). An individual close pass of an aircraft over an individual or group of cetaceans during oil spill response activities would likely result in a minor disturbance, such as very short term behavioural changes, for the affected cetaceans (Insignificant F).	
Potential consequence: Shoreline response activities	**Severity**
Physical presence and movement of personnel across turtle-nesting beaches could potentially cause damage to buried turtle eggs, reducing turtle-nesting success. Artificial light is known to disorientate marine turtles, particularly hatchlings and female adults returning to the sea from nesting areas on the shore (Pendoley 2005). Incorrect management of personnel and equipment on turtle-nesting beaches could result in a minor impact on a small proportion of a turtle-nesting population (Minor E). Sensitive receptor protection (intertidal booms and skimming) and shoreline clean-up responses may generate a significant quantity of hydrocarbon-contaminated solid and liquid waste. Contaminated solids would include PPE, spill clean-up equipment (shovels, rakes, etc.) and the oil-contaminated sediments collected from shorelines (IPIECA 2015) and oil coated booms, skimmers etc. and the oily contaminated liquids and sediments collected during the nearshore booming/skimming activities. Inappropriate management of oil-contaminated waste could result in localised secondary contamination of the nearshore marine environment shoreline sediments and harm to individuals of protected species (Minor E).	Minor (E)
Potential consequence: Oiled wildlife response activities	**Severity**
The values and sensitivities with the potential to be impacted are transient, EPBC-listed species (turtles and marine avifauna). A wildlife hazing tactic can increase the survival of wildlife potentially affected by a spill (particularly seabirds, marine mammals and reptiles in transit) by encouraging wildlife to move away from the location of the spill. However, there may be potential for increased stress to wildlife individuals subjected to hazing activities, or the potential to cause wildlife to move into the area affected by the spill from poorly implemented hazing activities (IPIECA-IOGP 2017b). In addition, inappropriate hazing activities could also temporarily interfere with other natural roosting/breeding processes of a local population. Therefore, the consequence of inappropriately implemented wildlife hazing activities is considered Minor (E).	Moderate (D)

Pre-contact and post-contact OWR (capture and translocation, or capture, intake, first-aid cleaning, and rehabilitation of wildlife) can increase the survival rates of wildlife which may be, or has become, oiled at sea or onshore. However depending on the species, there is significant potential for increased stress and other issues to some animals during capture, cleaning, relocation and/or rehabilitation (IPIECA-IOGP 2017b). The welfare considerations for each individual animal, whilst also balancing the conservation significance of the wider population/species must be considered, when determining the appropriate wildlife response tactics to implement. The consequence of inappropriate selection of wildlife response tactics could result in additional harm or poor welfare outcomes to individual animals and could also result in the introduction of zoonotic diseases back into, and spreading throughout wild populations, resulting in longer term impacts to populations not impacted by the spill. Therefore, the consequence of inappropriate selection of OWR tactics is considered (Moderate D).	
Potential consequence: Surface dispersant and subsea dispersant activities	**Severity**
The values and sensitivities with the potential to be impacted are: • transient, EPBC-listed species (marine fauna) • benthic communities (submerged reefs and shoals, and seagrasses) • BIAs associated with turtle and marine avifauna nesting. Applying a dispersant can reduce the amount of hydrocarbon present on the surface of the water column; therefore, reducing the exposure of surface sensitive receptors (such as seabirds and turtles), shorelines and intertidal biota. In addition, reducing the surface expression of the hydrocarbon creates a safer working environment for response personnel and can have benefits to air-breathing fauna. Dispersants have an inherent level of toxicity. Additionally, chemically dispersed hydrocarbons may, in certain instances, have a higher level of toxicity to benthic communities than the hydrocarbons themselves. Dispersant use results in increased hydrocarbon entrainment in the water column, increasing the bioavailability of the hydrocarbon potentially impacting subtidal values and sensitivities, particularly in shallow-water environments. Monitoring undertaken after surface dispersant application during the Montara spill showed increases in entrained hydrocarbons concentrating in the top 25 m of the water column (AMSA 2010). The distance at which receptors could be impacted by dispersed hydrocarbons has been assessed using the 100- parts per billion (ppb) threshold for entrained/dissolved hydrocarbons. INPEX commissioned a series of dispersant effectiveness modelling simulations for a 1000 m^3 IFO release from a GEP installation vessel, at various locations along the Ichthys GEP route prior to GEP construction. The modelling used a number of 'worst-case volume of oil ashore' and 'worst-case time/concentration at a receptor' stochastic modelling runs. The dispersant modelling report (RPS APASA 2014b) remodelled the identified worst-case stochastic model runs, with various dispersant treatments (vessel, aerial, or both), and compared 'with dispersant versus without dispersant' outcomes for surface oil concentrations, shoreline contact, and 'entrained/dissolved' concentrations at various receptors. Five of the modelling scenarios resulted in 70 m^3 to 120 m^3 of oil being successfully dispersed, within <2.5 km of a sensitive receptor. Timings ranged from instantaneous contact to a few hours to contact. The increase in entrained/dissolved oil concentrations (due to dispersant application) received at this receptor ranged from 454 ppb to 1607 ppb. These received concentrations are similar too, or up to ten times higher, than the 100-ppb impact threshold.	Minor (E)

In another modelled scenario, 48 m^3 of oil was successfully dispersed, at 12 km from Browse Island. Prevailing wind and current directed this dispersed oil plume directly at Browse Island. The received dispersed oil concentration at Browse Island was 247 ppb, which is still double the concentration of the 100-ppb threshold. In another scenario, 50 m^3 of oil was successfully dispersed, 15 km from Browse Island. The modelled wind and currents resulted in the dispersed oil plume reaching Browse Island in 20 hours. The received concentration was 8.4 ppb, one order of magnitude below the 100-ppb threshold. These results demonstrate that increasing the distance and/or time for the dispersed oil to reach a receptor results in a significant decrease in received entrained/dissolved oil concentrations at the receptor. Based on the conclusions of RPS APASA (2014b), the INPEX dispersant application decision matrix (Refer INPEX BROPEP Section 4.5.4), incorporates a highly conservative no dispersant application buffer of 20 km around any wholly submerged feature. Dispersant application closer than 20 km to intertidal reefs or islands can occur, in consultation with relevant state/territory Controlling Agencies, or Director of National Parks if within an Australian Marine Park, provided the Operational SIMA demonstrates an environmental benefit is anticipated. The closest submerged shoals to the Ichthys Field are Echuca and Heywood shoals, 79 km and 96 km away, respectively. They have average depths of 26 m and 33 m, respectively, and Browse Island has submerged and intertidal habitat (concentrated in a shallow, subtidal zone <20 m depth). Dispersant sprayed on the sea surface close to these sensitive receptors may result in additional impacts to submerged/intertidal habitats. The degree of impact associated with the toxicity of the dispersant and dispersed hydrocarbon is, however, dependent on the operational use and the performance standards engaged for the application. The 20 km no dispersant application buffer around wholly submerged receptors should prevent impacts to these receptors. Impacts from dispersant application closer to submerged/intertidal receptors, such as Browse Island, are expected to be short-term and localised with the potential for minor or temporary impacts (Minor E). These impacts (at intertidal locations, such as Browse Island) would only occur when the Operational SIMA demonstrated a positive outcome for dispersant use. The decision to conduct dispersant application (including consideration of the associated consequences) within 3 nautical miles (nm) of a State/Territory shoreline would only occur under direction/instruction from the relevant WA/NT Control Agency, or Director of National Parks if within an Australian Marine Park. Subsea Dispersant Injection (SSDI) on condensate wells has traditionally not been considered environmentally acceptable, as under light wind conditions (<5 knots), a high proportion of condensate will evaporate into the atmosphere, removing the hydrocarbons from the marine environment. With increasing wind conditions, more hydrocarbons become entrained. By conducting SSDI, an even higher proportion of the condensate would become entrained in the water column, resulting in a potential increase in impacts associated with entrained hydrocarbons. SSDI modelling (RPS 2019c) confirmed (using multiple Ichthys Field worst-case blow-out scenarios) that under light wind conditions, up to 80% of the released condensate would evaporate into the atmosphere, and likely exceed VOC safe exposure thresholds in close proximity (<1 km) of the release location. Under the light wind conditions, approximately 20% of the condensate would become entrained in the top ~3 m of the water column, with a very small proportion undergoing biodegradation (<10%).	

SSDI modelling (RPS 2019c) also confirmed that when comparing the same scenarios (without SSDI vs with SSDI), under the same light wind conditions, the effect of SSDI would be an increase in condensate entrainment up to ~70%, in the top ~3 m of the water column, with evaporation reduced to ~30%. RPS (2019e) weathering simulations also confirmed that with elevated wind speeds (>10 knots), the natural rate of entrainment of condensate is roughly equivalent to that which occurs when SSDI is in use. In addition, the SSDI modelling (RPS 2019c) also confirmed that after approximately 1 week of SSDI use, due to the much smaller oil droplet sizes, the rate of biodegradation has increased to ~50% of the rate of entrainment (compared to a biodegradation rate of <10% without SSDI). SSDI modelling results (RPS 2019c) concluded that SSDI would significantly reduce the risk of VOCs exceeding safe exposure thresholds. Therefore, the use of SSDI to eliminate the VOC risk to source control vessels/workers may increase the likelihood of a successful well kill using a capping stack, instead of a relief well, potentially reducing source control activities and overall spill duration by several months. A credible worst-case scenario could involve the use of SSDI for up to one-month duration, to complete a complex debris removal and capping stack installation activity. If the scenario was less complex, SSDI may only be required for a few days. Therefore, SSDI could result in an increase in entrainment of condensate from ~20% to ~70%, in the top ~3 m of the water column, for the days on which SSDI was used. However, the time saved to control the well through the use of SSDI and a successful capping stack installation would result in an overall net reduction in the volume of condensate entrained in the water column over the response period. In summary, the overall effect of SSDI is considered to be a temporary increase in entrained hydrocarbons in the top of the water column, for the duration which SSDI is used. The increase in entrainment from SSDI is similar to normal levels of entrainment expected to occur under higher wind conditions. The effects of increased entrainment due to SSDI are partially offset due to a reduction in oil droplet size, resulting in a very significant increase in biodegradation rates. Any impacts associated with the use of SSDI to achieve a successful well-kill using a capping stack are offset by the significant reduction in the overall duration of the blow-out (and net reduction in entrained hydrocarbons) compared to a relief well-kill scenario. Due to the mitigating factors described in the paragraph above, the potential impacts and risks associated with SSDI on submerged and intertidal receptors is considered Insignificant (F).	
Containment and recovery activities	**Severity**
AMSA (2020b) *Maritime discharges of oil and oily water during emergency and response situations* provides guidance on the legal mechanism to obtain approval for discharge of oil/oily water during containment and recovery activities. Therefore, provided the relevant AMSA (or State/Territory government) approval has been granted, the discharge of oil/oily contaminated water from vessels during containment and recovery activities would be conducted, to achieve higher rates of efficiency in the overall oil recover operation. Therefore, the consequence is considered Insignificant (F).	Insignificant (F)
Identify existing design safeguards/controls	
Vessels fitted with lights, signals, an automatic identification system (AIS) transponders and navigation equipment as required by the *Navigation Act 2012*.	

Due to the nature of call-off vessels that may be used during an oil spill response, not all vessels can be confirmed to be equipped with onboard sewage treatment plants compliant with MARPOL 73/78 (depending on the sewage treatment plant installation date) or an approved sewage comminuting and disinfecting system. However, all vessels will comply with the requirements of MARPOL 73/78, Annex IV for sewage discharges and Annex V for food scrap discharges during oil spill response activities. Implementation of EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05 and 8.07). Vessel speed restrictions and separation distances maintained for whale sharks, consistent with the Whale Shark Wildlife Management Program no. 57 (DPaW 2013).			
Propose additional safeguards/control measures (ALARP evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	No response strategies implemented.	No	Not responding to a spill which could result in harm to wildlife populations and leaving the spill without understanding its fate and trajectory is not considered to be ALARP. The spill could harm wildlife populations, contact shorelines above impact thresholds, or pose an operational risk to response personnel; therefore, INPEX will deliver monitoring and evaluation and other appropriate secondary response strategies to reduce impacts to ALARP.
	Eliminate use of vessels (collision risk and associated discharges) during a spill response.	No	Vessels are critical assets for monitoring and implementing oil spill response activities.
	Eliminate use of vessel lighting (to eliminate light emission impacts on shoreline receptors) during a remote shoreline response.	No	Vessels used during spill response must maintain adequate lighting for safety of navigation, and lighting as required for safety of personnel undertaking activities on a deck at night.
Substitution	None identified.	N/A	N/A
Engineering	None identified.	N/A	N/A
Procedures and administration	Visual inspections to prevent introduction of terrestrial exotic pests to offshore islands.	Yes	Visual inspections of vessels, helicopters, equipment and personnel mobilising to remote shorelines as part of any shoreline response activity will significantly reduce the risk of any introductions of terrestrial exotic pests. While the DEWHA threat abatement plan (DEWHA 2009) is focused on vessel-based vectors for introductions, this control is consistent with the intent of the actions described within that plan.

	Shoreline response activity HSE plan prepared and implemented which incorporates consideration of impacts to turtle nesting and anchoring of shoreline protection booms.	Yes	To ensure risks to turtle nesting activities are minimised a site-specific HSE plan for any shoreline response activity will be developed to address any risks to turtle nesting associated with personnel and equipment movement on offshore islands / mainland turtle-nesting beaches. The plan will address specific issues including: • personnel and equipment movement on turtle-nesting beaches • light-spill (if night-time activities are required) These sections of the relevant HSE plan will be prepared in consultation with AMOSC, Department of Agriculture, Water and the Environment (DAWE) (for response on Cwlth shorelines), and WA/NT Control Agencies and wildlife agencies for responses on WA/NT shorelines.
	Vessel specific lighting plan, prepared and implemented, which incorporates consideration of impacts to turtle nesting, from vessel light emissions.	Yes	To ensure risks to turtle nesting activities are minimised a vessel-specific lighting plan will be prepared, for vessels supporting remote shoreline response operations, adjacent to identified turtle nesting beaches, during turtle nesting season. The plan will address specific issues including: • minimum lighting required for navigation • permitted/restricted activities on deck at night, and the minimum lighting requirements for the safe conduct of those permitted activities. The vessel specific lighting plans will be developed by the Vessel's bridge crew, in consultation with AMOSC, Department of Agriculture, Water and the Environment (DAWE) (for response on Cwlth shorelines), and WA/NT Control Agencies and wildlife agencies for responses on WA/NT shorelines.
	Shoreline response activity HSE plan prepared and implemented which incorporates consideration of impacts to anchoring of shoreline protection booms on intertidal habitats.	Yes	To ensure risks to intertidal habitats are minimised a site-specific HSE plan for any sensitive receptor protection activity will be developed to address any risks of anchoring/equipment damage to intertidal habitats including intertidal coral reefs. These sections of the relevant HSE plan will be prepared in consultation with AMOSC, DAWE (for response on Cwlth shorelines), and WA/NT Control Agencies for responses on WA/NT shorelines.
	No discharge of ballast water within Commonwealth and State/Territory Marine Parks	Yes	Whilst all vessels are required under Australian law to manage ballast water according to the Australian Ballast Water Management Requirements, an additional control, to further reduce risks from ballast water will be the prohibition of discharge of ballast water within Commonwealth and State/Territory Marine Parks.

	OWR shall be undertaken in accordance with the relevant State/Territory OWR Plan and/or Manual, under direction from the relevant State/Territory Control Agency. Wildlife response including the selection of tactics, TRIAGE and welfare considerations will be managed in consultation with the relevant State/Territory wildlife agency, or DAWE for response on Cwlth shorelines, to ensure the OWR tactics are implemented in accordance with the relevant OWR Plan and/or Manual. All necessary permits from relevant government agencies will be obtained prior to commencing wildlife response activities. Conditions of all permits will be complied with at all times during the response.	Yes	State/Territory OWR Plans and Manuals have been developed by relevant OWR experts. These documents define processes to ensure all OWR activities are undertaken in an appropriate manner, taking into consideration the welfare of individual wildlife, as well as the risks to overall populations/species. It is appropriate that any OWR is undertaken in accordance with the relevant State/Territory OWR documentation, and in accordance with relevant permits, and in close consultation with the relevant OWR agencies, to ensure the best outcome for the wildlife potentially at risk from the spill.
	A waste management plan will be prepared and implemented for any offshore, nearshore or shoreline response operations, in consultation with AMOSC and relevant Control Agencies.	Yes	A waste management plan to manage all hydrocarbon-contaminated solid/liquid waste is necessary to prevent secondary contamination of shorelines and nearshore marine environment.
	Vessel and/or aerial dispersant application on Group IV hydrocarbons will only occur in accordance with the IMT dispersant application decision.	Yes	INPEX has developed the IMT dispersant application decision matrix which outlines specific conditions that must be satisfied before dispersant applications can take place, in order to reduce impacts and risks to ALARP. In order to verify that applications are acceptable to key stakeholders, in accordance with the WA DoT Dispersant Use Guidelines, WA/NT Controlling Agency will be notified before any dispersant application in Commonwealth waters for spills which may enter WA/NT waters. This requirement is captured within the IMT dispersant application decision matrix.
	Dispersants with high efficacy for dispersal of Group IV hydrocarbons will be used for surface dispersant application.	Yes	Selection of appropriate dispersants for the potential/credible spill products will ensure the highest chance of their successful dispersal. Poor selection of dispersant products could result in less efficient dispersant operations.

	Dispersants with high efficacy for dispersal of condensates, and demonstrated oil to dispersant injection ratios will be used for SSDI.	Yes	The initial SSDI stockpile is the AMOSC SFRT 500 m^3 of Slick-gone NS. Slick-gone NS was tested along-side two other dispersants (Corexit 9500 and Finasoil OSR 52), in a study (Brandvik *et al*. 2014). The study evaluated dispersant effectiveness (shift in droplet size distribution) under typical SSDI conditions, including direct injection of the dispersant into fresh/warm oil, under very turbulent conditions. Three dispersants were tested against four oil types (paraffinic crude, waxy crude, asphaltenic crude and a light oil/condensate), with specific gravities ranging from 0.941 kg/l (heavy crudes), to 0.797 kg/l (condensate). The results of simulated SSDI dispersant injection on the condensate concluded that Slick-gone NS achieved the largest reduction in droplet sizes, with a significant shift observed with a 100:1 oil to dispersant injection ratio. Therefore, the use of the AMOSC SFRT Slick-gone NS dispersant stockpile is considered appropriate for use on Ichthys Field condensates. 100:1 is also considered an appropriate initial injection rate.
	INPEX will monitor VOC levels during a well control incident to inform the need to activate SSDI and adjust dispersant injection flowrates, as required to reduce VOCs on the ocean surface to safe levels, to facilitate debris clearance and capping stack deployment.	Yes	SSDI is only planned for use when VOCs are above safety thresholds, which would prevent the safe vessel operations to conduct debris clearance and capping stack deployment. Therefore, monitoring of VOC thresholds is critical to monitor the success of the SSDI activity. If required, increases in dispersant injection ratio may be needed, if VOC reduction below acceptable VOC exposure thresholds (e.g. 15minute/500 ppm, 8 hr/300 ppm) are not achieved. Any increased condensate entrainment due to SSDI is partially offset due to a reduction in oil droplet size, resulting in a very significant increase in biodegradation rates. Any impacts associated with the use of SSDI to achieve a successful well-kill using a capping stack are offset by the significant reduction in the overall duration of the blow-out (and net reduction in entrained hydrocarbons) compared to a relief well-kill scenario.
	Dispersant injection rates will be informed by water quality monitoring outcomes.	No	As discussed above, the purpose of SSDI use on condensate wells is to reduce VOC risks in the atmosphere, to facilitate safe debris clearance and capping stack deployment. Therefore, dispersant ratios/injection rates will be monitored and adjusted based on atmospheric VOC measurements, not based on water quality monitoring.
	Dispersant impacts to the marine environment will be verified via water quality monitoring.	Yes	Should SSDI be required to be activated, the impact of SSDI on water quality and the broader environment will be monitored, in accordance with the INPEX OSMP/water quality monitoring program.

<table>
<tr><td></td><td>Conduct discharges of oil/oily contaminated water (decanting) during containment and recovery activities, to improve the efficiency of oil recovery during the spill response.</td><td>Yes</td><td>In accordance with AMSA (2020b) Maritime discharges of oil and oily water during emergency and response situations, the normally tight MARPOL restrictions on oil/oily water discharge quality can be relaxed if it is necessary during a spill response to discharge oil/oily water to minimise the overall damage from pollution, and is approved by the relevant government.
In accordance with AMSA (2020b), the relevant government administrators include the following AMSA positions: the AMSA Local Manager; the Manager Marine Environmental Pollution Response; the General Manager, Marine Environment; and the General Manager, Ship Safety Division.
Some States/Territories may have processes for approval within their relevant jurisdiction, however if the State/Territory is silent on the issue, or in conflict with the MARPOL Regulation intent (to permit the discharge during spill response), then the Commonwealth legislation applies, as the means to implement the international/MARPOL obligation.
Note, the approvals are specified vessels for a particular spill response, and not as a general discharge approval.
There is no specific AMSA form for this application, however the applicant (IMT) should provide a full explanation to assist the person assessing the approval, and as a minimum, should provide the following information:
• who and why - the vessel, the incident and the applicant
• what - the planned response operations that require the oily water discharge
• how - the state and capability of the ship as a response platform
• result - the expected discharge volumes or rates.</td></tr>
<tr><td colspan="4">Identify the likelihood</td></tr>
<tr><td>Likelihood</td><td colspan="3">The likelihood of Level 2 or Level 3 spills from INPEX's petroleum activities are evaluated in each activity specific EP. The use of response strategies may increase the likelihood of an additional impact occurring if the response strategies are implemented inappropriately. However, based on the controls described, the likelihood of response activities resulting in the consequences described is considered Unlikely (4).</td></tr>
<tr><td>Residual risk</td><td colspan="3">Based on a worst-case consequence of Moderate (D) and likelihood of Unlikely (4) the residual risk is Moderate (7).</td></tr>
<tr><td colspan="4">Residual risk summary</td></tr>
<tr><td>Consequence</td><td>Likelihood</td><td colspan="2">Residual Risk</td></tr>
</table>

Moderate (D)	Unlikely (4)	Moderate (7)
Assess residual risk acceptability		

Legislative requirements

The activities and proposed management measures are compliant with industry standards and relevant Australian legislation/guidance, E.g., the NatPlan (AMSA 2020a); AMSA (2020b) regarding oil discharges during spill response activities, the Western Australian State Hazard Plan – Maritime Environmental Emergencies (WA DoT 2021), specifically concerning implementation of oil pollution emergency plans; EPBC Regulations regarding vessel and aircraft operations near cetaceans, and MARPOL 73/78 for vessel discharges and garbage management.

Stakeholder consultation

Stakeholders have been engaged and issues/feedback have been incorporated into the BROPEP regarding potential impacts and risks associated with implementation of response strategies. Stakeholder engagement is an ongoing process.

Conservation management plans / threat abatement plans

Several conservation management plans identify marine debris as a key threatening process to recovery. Also, the relevant action from the *Threat abatement plan for the impacts of marine debris on vertebrate marine life* (DEWHA 2009) is to “contribute to the long-term prevention of the incidence of harmful marine debris”. The prevention of garbage entering the marine environment and the appropriate management of sewage and food wastes reduces the risk of impacts to the marine environment and demonstrates alignment with the various conservation management plans and threat abatement plans.

The *Threat abatement plan to reduce the impacts of exotic rodents on biodiversity on Australian offshore islands of less than 100,000 hectares* (DEWHA 2009), describes the threat of invasion or reinvasion of rodents on bird populations. The relevant action from DEWHA (2009) is to prevent invasion or reinvasion via prevention / risk reduction for rodents gaining access to key vessels at key ports. INPEX’s controls align with the intent of preventing invasion/establishment of pests.

The recovery plan for marine turtles in Australia (DEE 2017) and the *National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds* (DEE 2020) identifies that light pollution and vehicle damage (and therefore possibly excessive foot traffic) are possible threats to turtle nesting, which could result from shoreline response activities during an oil spill response. Controls which align with the intent of the Recovery Plan and National Light Pollution Guidelines have been adopted.

ALARP summary

As the level of environmental risk is assessed as Moderate, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the controls demonstrate compliance with legislative requirements
- the controls meet stakeholder expectations
- management of the activity is aligned with the relevant conservation management plans / threat abatement plans
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as “moderate”, the consequence does not exceed “C – significant” and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
Risks of impacts to the environment from vessel discharges during oil spill response activities will be reduced and maintained to ALARP and acceptable levels.	All vessels involved in oil spill response activities will conduct sewage disposal activities in accordance with MARPOL 73/78, Annex IV.	Emergency event response records.
	All vessels involved in oil spill response activities will conduct food scrap disposal activities in accordance with MARPOL 73/78, Annex V.	Emergency event response records.
	Any vessel conducting containment and recovery activities in Commonwealth water will obtain a vessel specific approval from AMSA prior to conducting any decanting/discharge of oil/oily water mixtures.	Emergency event response records.
No disturbance/injury/ mortality of cetaceans, whale sharks or turtles resulting from interactions with vessels and aircraft undertaking spill response activities.	Interactions between support vessels and cetaceans will be consistent with EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.05) Interacting with cetaceans (modified to include turtles): • Spill response vessels will not travel faster than 6 knots within 300 m of a cetacean or turtle (caution zone) and minimise noise. • Spill response vessels will not approach closer than 50 m to a dolphin or turtle and/or 100 m for a whale (with the exception of bow riding). If a cetacean shows signs of being disturbed, support vessels will immediately withdraw from the caution zone at a constant speed of less than 6 knots.	Emergency event response records.
	Interactions between spill response vessels and whale sharks will be consistent with the Whale Shark Wildlife Management Program no. 57 (DPaW 2013); specifically, spill response vessels will not travel faster than 8 knots within 250 m of a whale shark (exclusive contact zone) and not approach closer than 30 m of a whale shark.	Emergency event response records.

	Interactions between spill response aircraft and cetaceans will be consistent with EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.07) - aircraft/cetacean separation requirements (500m altitude and radius for helicopters, 300m altitude and radius for fixed wing aircraft).	Emergency event response records.
No inappropriate disposal of waste to the marine environment from vessels during spill response.	All vessels involved in oil spill response activities will conduct garbage management in accordance with MARPOL 73/78, Annex V.	Emergency event response records.
No introduction of terrestrial exotic pests to island ecosystems or introduction and establishment of introduced marine species of concern to State/Territory or Commonwealth marine parks during response activities.	Premobilisation visual inspections of vessels and equipment before mobilisation to an island location and recorded on quarantine inspection checklists. Inspection date/time/outcome to be recorded on quarantine inspection checklists	Emergency event response records.
	Premobilisation visual inspections of helicopters and equipment before mobilisation to an island location. Inspection date/time/outcome to be recorded on aircraft technical log.	Emergency event response records.
	No de-ballasting within State, Territory or Commonwealth marine parks during oil spill response activities.	Emergency event response records.

No incidents of loss of hydrocarbons to the marine environment as a result of a vessel collision during oil spill response.	Vessels will be fitted with lights, signals, AIS transponders and navigation equipment as required by the Navigation Act 2012.	Emergency event response records.
No secondary ocean or shoreline contamination due to inappropriate waste management during the implementation of spill response strategies.	Waste management plan(s) will be developed in consultation with AMOSC, and as necessary, the relevant State/Territory Control Agency. Waste management plans will include consideration of: • methods to eliminate, reduce and re-use materials to reduce the overall volume of waste generated • waste storage, transport and disposal arrangements • decontamination stations and other relevant processes to prevent secondary contamination.	Emergency event response records.

Risks of impacts to transient, EPBC-listed species, (marine turtles) and intertidal habitats from a shoreline response are reduced and maintained to ALARP and acceptable levels.	In the event of a shoreline response, an HSE plan will be prepared, in consultation with AMOSC and WA/NT wildlife agencies (via relevant WA/NT Control Agency) or DAWE (for Commonwealth lands) which addresses potential impacts to turtle nesting including: • personnel and equipment movement on turtle-nesting beaches • light-spill (if night-time activities are required).	Emergency event response records.
	In the event of a shoreline response, a vessel-specific lighting plan will be prepared, for vessels supporting remote shoreline response operations, adjacent to identified turtle nesting beaches, during turtle nesting season. The plan will address specific issues including: • minimum lighting required for navigation • permitted/restricted activities on deck at night, and the minimum lighting requirements for the safe conduct of those permitted activities. The vessel specific lighting plans will be developed by the Vessel's bridge crew, in consultation with AMOSC, Department of Agriculture, Water and the Environment (DAWE) (for response on Cwlth shorelines), and WA/NT Control Agencies and wildlife agencies for responses on WA/NT shorelines.	Emergency event response records.

Risks of impacts to intertidal habitats from nearshore/shoreline booming operations reduced and maintained to ALARP and acceptable levels.	In the event of a sensitive receptor protection response, an HSE plan will be prepared, in consultation with AMOSC relevant WA/NT Control Agency or DAWE (for Commonwealth lands) which addresses potential impacts to intertidal reefs and defines controls for nearshore/shoreline booming anchor layouts and other controls to limit impacts to intertidal ecosystems.	Emergency event response records.
Risks of impacts to transient, EPBC-listed species, (marine turtles, marine mammals and marine avifauna) from wildlife response activities are reduced and maintained to ALARP and acceptable levels.	OWR shall be undertaken in accordance with the relevant State/Territory OWR Plan and/or Manual, under direction from the relevant State/Territory Control Agency, or in consultation with the DAWE (Commonwealth waters and shoreline OWR). All necessary regulatory permits will be obtained prior to commencing wildlife response activities, and conditions will be implemented.	Emergency event response records.
Risks of impacts to marine water quality and shallow benthic communities from surface dispersant application are reduced and maintained to ALARP and acceptable levels.	Vessel and/or aerial dispersant applications will be undertaken in accordance with the IMT dispersant application decision matrix.	Emergency event response records.
	Only dispersants with high efficacy for dispersal of Group IV hydrocarbons which are listed on the AMSA oil spill control agent (OSCA) register will be used in the event of dispersant application.	Emergency event response records.
	SSDI (AMOSC SFRT Slick-Gone NS dispersant stockpile) will only be activated when:	Records of:

Impacts to the shallow water column through use of SSDI will be reduced to ALARP through the implementation of the Environmental Performance Standard.	• Air quality monitoring and/or modelling determines there is a credible risk of atmospheric VOC concentrations exceeding safe exposure thresholds for source control activities; and • There is a requirement to conduct source control activities in the zone where atmospheric VOCs may present a hazard to the safety of workers, and • Air quality monitoring and/or modelling of gas levels and lower explosive limits determines if source control activities including SSDI could be safety conducted.	• Air quality monitoring and/or modelling demonstrating a credible risk of atmospheric VOC concentrations exceeding safe exposure thresholds for source control activities • SSDI injection occurring concurrently with source control activities
	SSDI injection concentration will initially be set at 100:1 (based on best estimate of well flow-rate at the time of the blow-out). Effectiveness of SSDI will be monitored through ongoing measurement of VOC concentrations on the surface, by source control vessels. If VOC exposure thresholds are exceeded, SSDI ratio will be incrementally increased, until VOC concentrations are below safe exposure thresholds.	Records of: • SSDI injection ratio • atmospheric VOC concentration monitoring during source control activities
	In the event of SSDI activation, water quality monitoring will be activated in accordance with the Operational and Scientific Monitoring Program, to verify impacts from SSDI activities upon the marine environment.	Records of OSMP activation and water quality monitoring results.

8 IMPLEMENTATION

An implementation strategy is described within all INPEX EPs. The implementation strategy addresses the following;

- overview of the INPEX Business Management System, including HSE management systems/processes
- leadership and commitment including Environment Policy
- capability and competency including the organisational team and responsibilities associated with the implementation of the EP
- documentation, information and data management related to the EP
- risk management process used within the EP
- operate and maintain; specific processes/systems required for EP implementation
- management of change, including the specific change management process for the EP
- stakeholder engagement, including processes for ongoing engagement and consultation with stakeholders potentially affected by the EP
- contractors and suppliers, including selection and management processes
- security and emergency management
- incident investigation and lessons learned, which also includes monthly and annual performance reporting.
- monitor, review and audit; defining the processes to ensure ongoing compliance and continual improvement of the EP
- management review, including senior management review of the EP

Within the implementation strategy of each EP, only some elements are relevant to the BROPEP suite of documents. The following are considered necessary to include as stand-alone processes within this document;

- the review process for the BROPEP suite of documents
- the management of change process to be applied for the BROPEP suite of documents
- the annual performance reporting requirements against the BROPEP suite of documents
- the management review process for the BROPEP suite of documents

The details of these are provided in the following sections.

8.1 Review of the BROPEP

The BROPEP suite of documents are listed in Table 1-1.

The BROPEP suite of documents will be reviewed following any events requiring their activation, in order to identify any lessons learned, or other relevant triggers for review.

Environmental performance outcomes, standards and measurement criteria relating to updating the BROPEP suite of documents are presented in Table 8-1.

Table 8-1: Environmental performance outcome, standards and measurement criteria for updating the BROPEP

Environmental performance outcome	Performance standards	Measurement criteria
INPEX will be prepared and ready to respond to oil spill events.	The BROPEP suite of documents will be reviewed and updated if necessary, following any INPEX IMT exercise or incident in which the BROPEP was used/activated.	Records demonstrate a review and update (if necessary) of the BROPEP.
	The BROPEP suite of documents will be reviewed and updated if necessary, if new oil spill related information is identified through the quarterly risk review process, which could affect the BROPEP.	Records demonstrate quarterly risk reviews consider oil spill risk elements.
	The BROPEP suite of documents will be reviewed and updated if necessary, based on findings from the annual management review and annual performance report.	Records demonstrate a review and update (if necessary) of the BROPEP.

8.2 Management of Change

Changes to INPEX documents are managed in accordance with a business-wide standard, and related procedures and guidelines. Where a change to management of an activity is proposed, it will be logged. Internal notification will be communicated via a management of change (MoC) request. The request will identify the proposed change(s) along with the underlying reasons and highlight potential areas of risk or impact. In accordance with the INPEX business rules, it is mandatory to undertake an environmental risk assessment in every case for changes that could affect the environment, including oil spill risks and response arrangements.

The MoC request will be managed by an environmental adviser who will then determine the necessary approval/endorsement pathway, in consultation with the environmental approvals coordinator. Minor changes (such as updating a document or process) that do not invoke a revision trigger are made in document reviews from time to time.

In accordance with Regulation 17 of the OPGGS (E) Regulations 2009, a revision of an EP will be submitted to NOPSEMA where:

- a change is considered to represent a new activity
- a change is considered to represent a significant modification to, or a new stage of, an existing activity
- a change will create a significant new environmental impact or risk that is not provided for in the current BROPEP suite of documents
- a change will result in a series of new (or increased) environmental impacts or risks that, together, will result in a significant new environmental impact or risk, or a significant increase in an existing environmental impact or risk.

The MoC request process will be periodically checked against NOPSEMA guidance to ensure ongoing compliance and will be undertaken as part of the management review process described in Section 1548.4.

As the BROPEP suite of documents are an integrated element of all NOPSEMA accepted EPs, the MoC process is also applicable to these documents. Due to the nature of the BROPEP process, specific BROPEP MoC evaluation processes have been developed.

Figure 8-1 shows the process to assess and document potential changes associated with the BROPEP BOD and Field Capability, as defined in this document.

Figure 8-2 shows the process to assess and document potential changes associated with the INPEX IMT capability and arrangements, as presented in the BROPEP IMT Capability Assessment Report (X060-AH-REP-70015).

Where an MoC is required for changes to BROPEP documentation, the INPEX EP MoC template will be used to formally record/document the change.

When a new or revised EP is required to be re-submitted to NOPSEMA, and the new or revised EP also requires/results in changes to any of the BROPEP suite of documents, the updated BROPEP documents will be submitted, with the new/revised EP, to NOPSEMA.

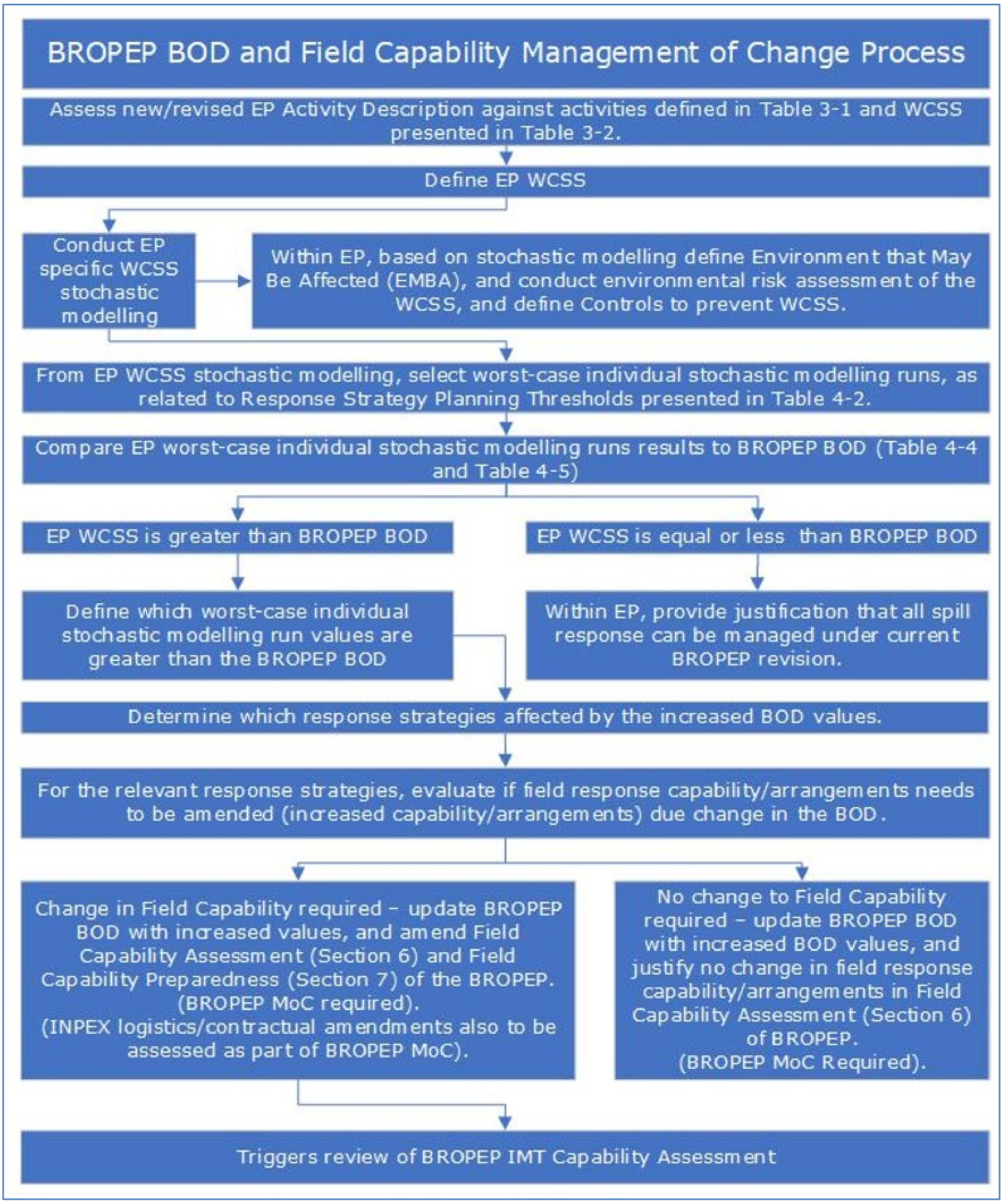

Figure 8-1: BROPEP BOD and Field Capability Management of Change Process

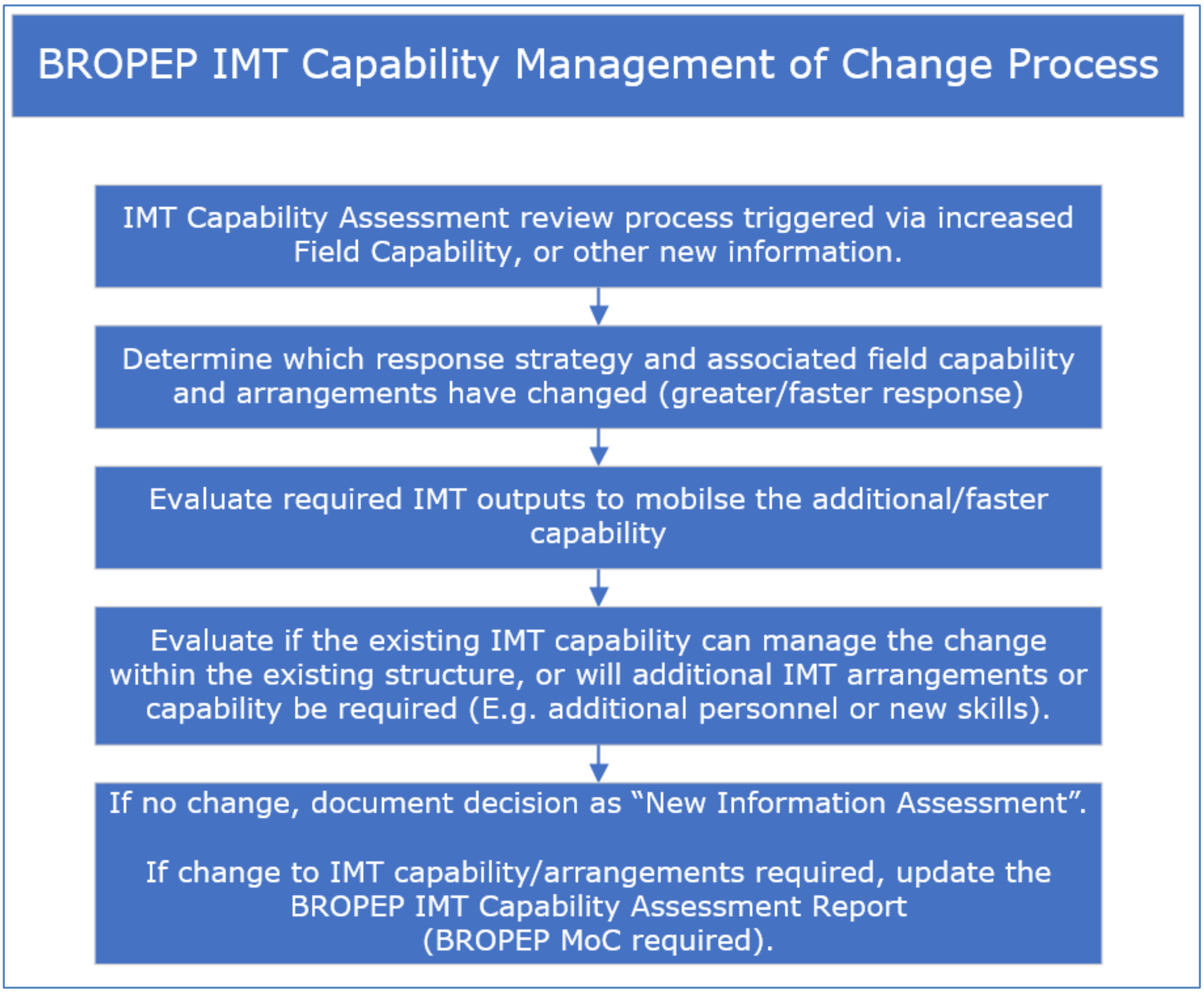

Figure 8-2: BROPEP IMT Capability Management of Change Process

8.3 Annual Performance Reporting

In accordance with Regulation 14(2) of the OPGGS (E) Regulations 2009, INPEX will undertake a review of its compliance with the environmental performance outcomes and standards set out in the BROPEP suite of documents and will provide a written report of its findings to NOPSEMA on an annual basis. The BROPEP annual reporting period will be from the 01 January to 31 December of each calendar year. The submission date for the BROPEP environmental performance report will be 01 April each calendar year.

Any findings from the Annual Performance Report will be included on an INPEX action tracking register.

8.4 Management Review

Management reviews of the BROPEP suite of documents shall assess whether:

- control measures detailed in this BROPEP are effective in maintaining spill preparedness and response capability to an ALARP and acceptable level
- implementation of the MoC process has been applied consistently and appropriately, ensuring oil spill preparedness and response capability and arrangements remain ALARP and at acceptable levels, commensurate with INPEX's activities and spill risks

- any changes in legislation, NOPSEMA guidance or other matters relating to oil spill preparedness and response have been taken into consideration in relation to the BROPEP suite of documents
- the Operational and Scientific Monitoring Program (within the BROPEP) remains fit for purpose

Where the documented findings of the BROPEP management reviews have implications for the BROPEP documents, the BROPEP will be updated in accordance with Table 8-1.

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APPENDIX A: FIELD CAPABILITY ASSESSMENT – AT SEA CONTAINMENT AND RECOVERY

Appendix A provides a detailed field capability assessment for at sea containment and recovery (C&R), in response to a 776 m^3 IFO/HFO WCSS at the Ichthys Field location.

A.1 SIMA outcomes

Strategic SIMA for IFO/HFO determined C&R and surface dispersant application would both have positive effect for majority of values and sensitivities in Commonwealth waters. The nearest shoreline receptors are Browse Island (33 km from FPSO), and Scott Reef (100 km from FPSO).

A.2 Cone of response

Cone of response associated with on-water response strategies for IFO/HFO spill would typically involve a combination of the following:

- surveillance, monitoring and visualisation (SMV)
- at-sea containment and recovery (C&R)
- fixed wing aerial dispersant (FWAD)
- vessel dispersant

The exact arrangement/combination of response strategies would be selected based on the spill scenario, state of weathering of the oil, weather forecast and best available combination of vessels/aircraft and equipment.

A.3 Basis of Design - WCSS Modelling Overview

Based on the stochastic modelling, the probability of shoreline oil accumulation >100 g/m^2, and the maximum accumulated volume (m^3) oil ashore, averaged over all replicate simulations, at Browse Island (closest shoreline receptor to the HFO spill risk location) is as follows:

- wet season (December – February) – 21% probability of contact – average of 11 m^3 ashore.
- dry season (March – August) – 5% probability of contact – average of 3 m^3 ashore.
- transition season – (September – November) – 19% probability of contact – average of 9 m^3 ashore.

The maximum instantaneous area of floating oil >50 g/m^2 was 7.6 km^2, indicating there should be no limitation on the number/size of vessel fleet to conduct C&R operations.

re displays the results of the stochastic run (transition 050) which produced the worst-case instantaneous area (7.6 km^2) for floating oil >50 g/m^2. An analysis of the first 72 hours across all 300 runs was completed, and the range for maximum instantaneous area >50 g/m^2 was 5.75 km^2 to 7.6 km^2.

For the purpose of comparing short duration releases to longer duration release scenarios, four additional 776 m^3 HFO spill deterministic runs were also conducted, as many vessel/tanker spills do not occur instantaneously and often remaining ongoing for several days. The following process was used for these additional deterministic modelling runs:

- Two sets/samples of wind data (covering 10 days) were selected. These represented relatively windy conditions (to maximise the calculated trajectory in the downwind direction) but within range of spill responses (C&R and surface dispersant application); typically wind data in the range of 15-20 knots. The samples of wind data also used the corresponding current data, to keep surface current response realistic.
- The selected wind/current data sets were used as model inputs for a 2-hour release scenario and a 4-day release scenario.
- For the four-day scenario, a variable discharge rate was used over 4 days. The loss rates were represented as exponentially reducing but with the following daily distribution, representing a decreasing release rate over time (i.e. typical long duration tanker spill scenario):
  - Day 1 – 325 m^3
  - Day 2 – 225 m^3
  - Day 3 – 150 m^3
  - Day 4 – 76 m^3
- Each simulation spanned 7 days beyond spill cessation (10 days beyond spill commencement).
- This process was repeated for the two wind/current data sets, generating four deterministic model runs.

Once the model runs were completed, the modelling data was analysed and the area swept by oil concentrations > 50 g/m^2 over the full duration was mapped and the area of slicks > 50 g/m^2 was calculated at 6 hourly intervals.

The output of the model scenarios is provided in Table 9-1, and presented as Figure 9-1 to Figure 9-4.

Table 9-1: 776 m^3 HFO Scenario – Analysis of 50g/m^2 threshold for 4 deterministic runs

Scenario	Replicate	Area coverage of floating oil at >50 g/m^2		
		Total area (km^2)	Maximum instantaneous area (km^2)	Time step at maximum instantaneous area
4-day release of 776 m^3 of HFO	1	8	0.3	12
	2	22	0.5	17
2-hour release of 776 m^3 of HFO	1	256	5.7	59
	2	183	5.4	39

The short duration releases (refer Figure 9-3 and Figure 9-4) result in the movement of a single, compact and concentrated patch of oil. Figure 9-1 and Figure 9-2 present the 'instantaneous' spill as a series of small patches of floating oil >50g/m^2. In reality, between the patches of floating oil >50 g/m^2 (visible on these figures), other areas slightly <50 g/m^2 would occur. Further, it would result in a long continuous streamer of oil, with some areas greater and some areas less than 50 g/m^2. A similarly long streamer of oil from the release location would continue to be present over the duration of the 4-day release, slowly reducing in thickness/concentration as the release rate decreases. Streamer concentration would increase from a 2- or 3-day spill.

Figure 9-1 shows the total swept area/total simulation coverage of floating oil >50 g/m^2 for the entire 10-day duration of the simulation, as well as the maximum instantaneous area floating oil >50 g/m^2, which occurred at hour 12 of this simulation.

Figure 9-2 shows the total swept area/total simulation coverage of floating oil >50 g/m^2 for the entire 10-day duration of the simulation, as well as the maximum instantaneous area floating oil >50 g/m^2, which occurred at hour 17 of this simulation.

Figure 9-3 shows the total swept area/total simulation coverage of floating oil >50 g/m^2 for the entire 10-day duration of the simulation, as well as the maximum instantaneous area floating oil >50 g/m^2, which occurred at hour 59 of this simulation.

Figure 9-4 shows the total swept area/total simulation coverage of floating oil >50 g/m^2 for the entire 10-day duration of the simulation, as well as the maximum instantaneous area floating oil >50 g/m^2, which occurred at hour 39 of this simulation.

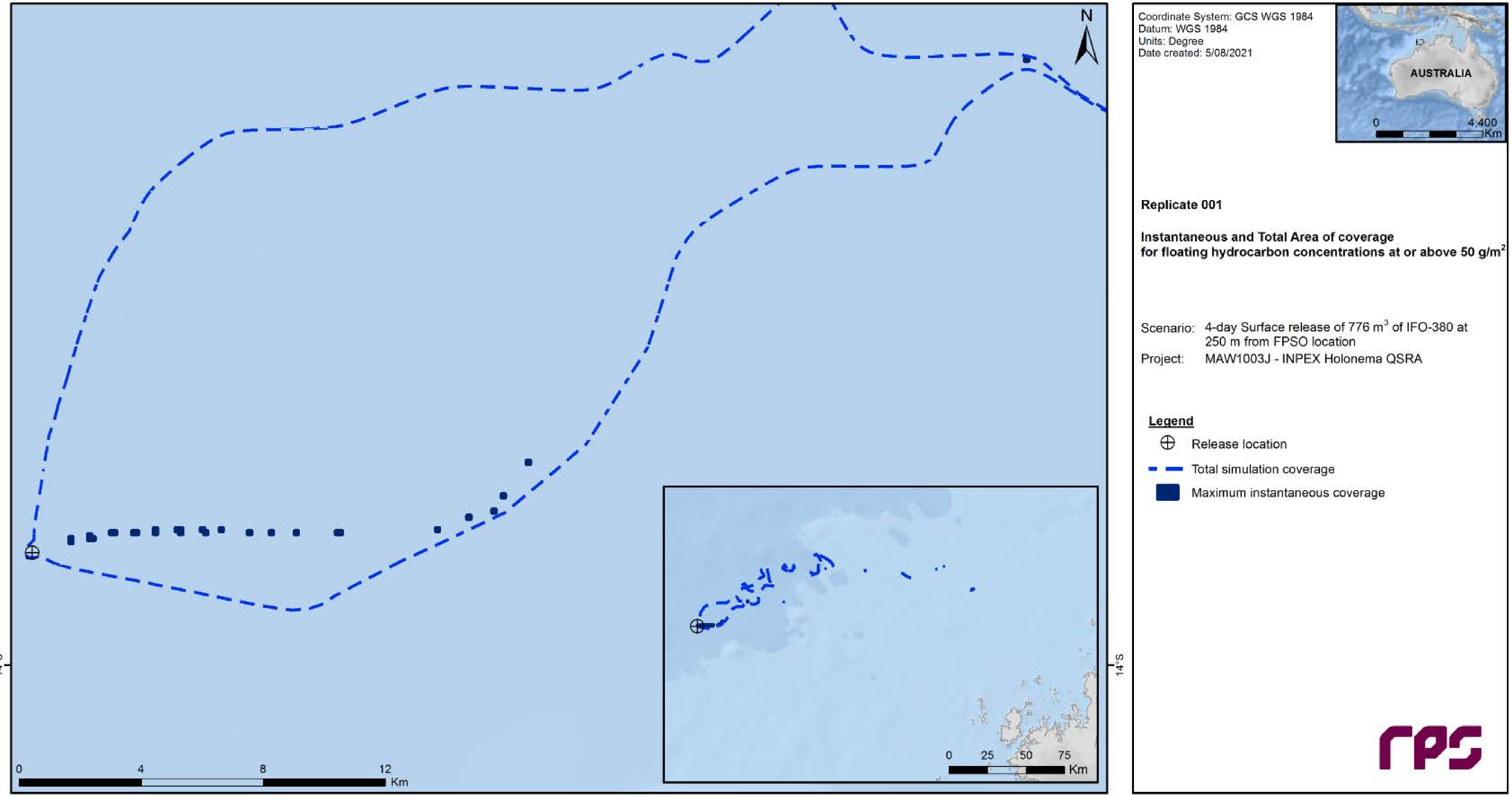

Figure 9-1: Deterministic replicate #1 – 4-day release – maximum instantaneous, and total swept area floating oil >50 g/m²

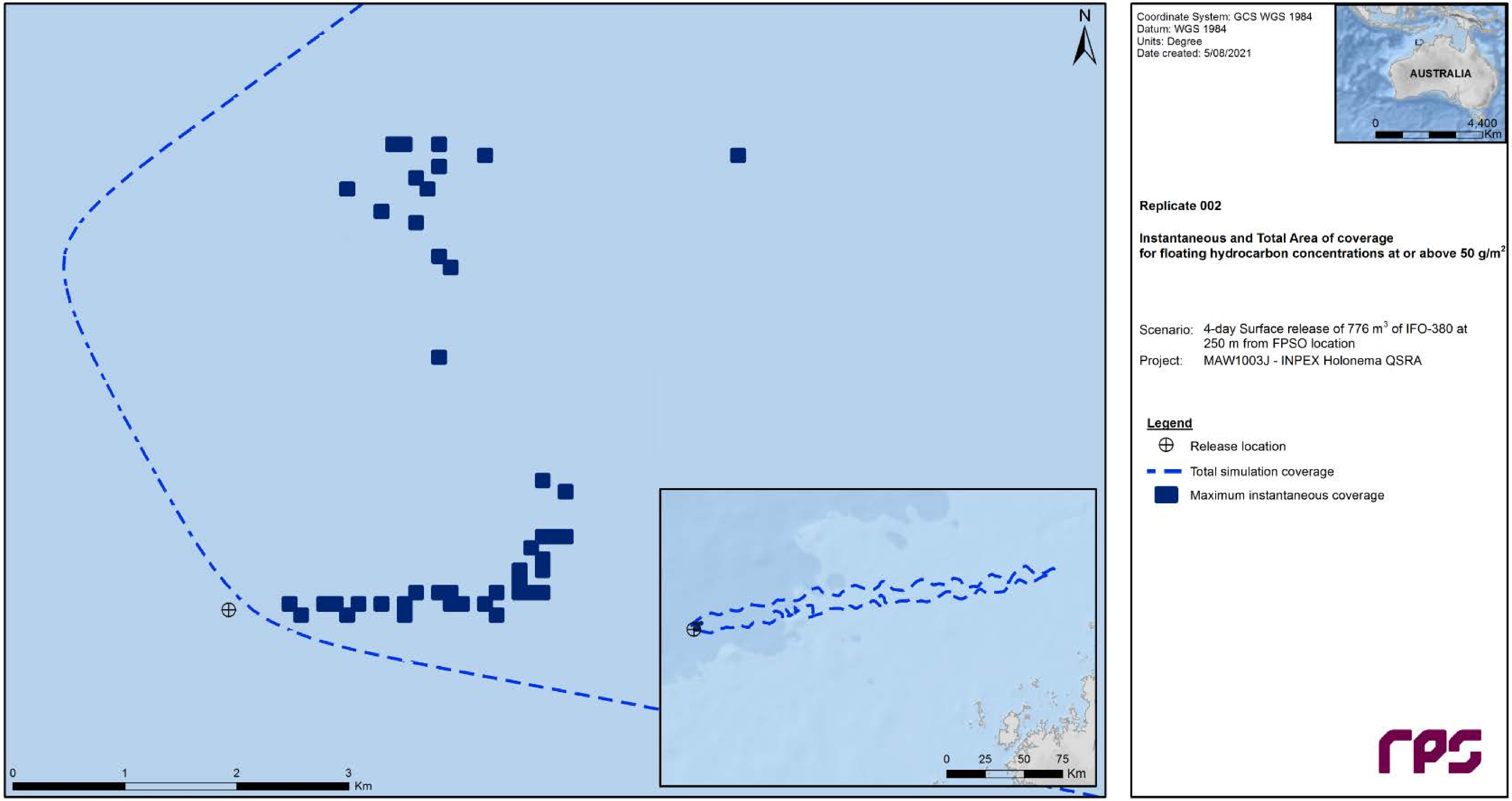

Figure 9-2: Deterministic replicate #2 – 4-day release – maximum instantaneous, and total swept area floating oil >50 g/m²

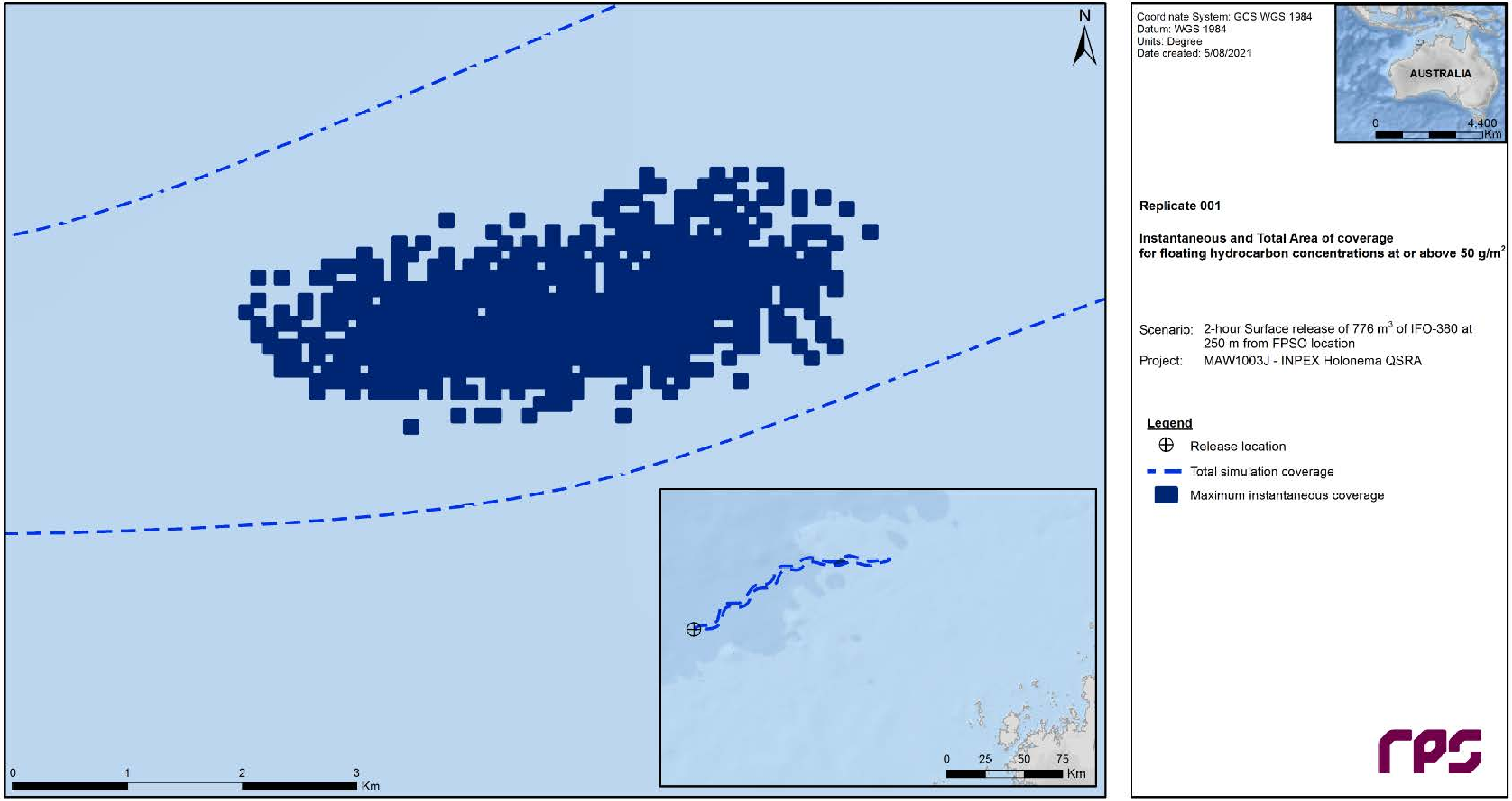

Figure 9-3: Deterministic replicate #1 – 2-hour release – maximum instantaneous, and total swept area floating oil >50 g/m^2

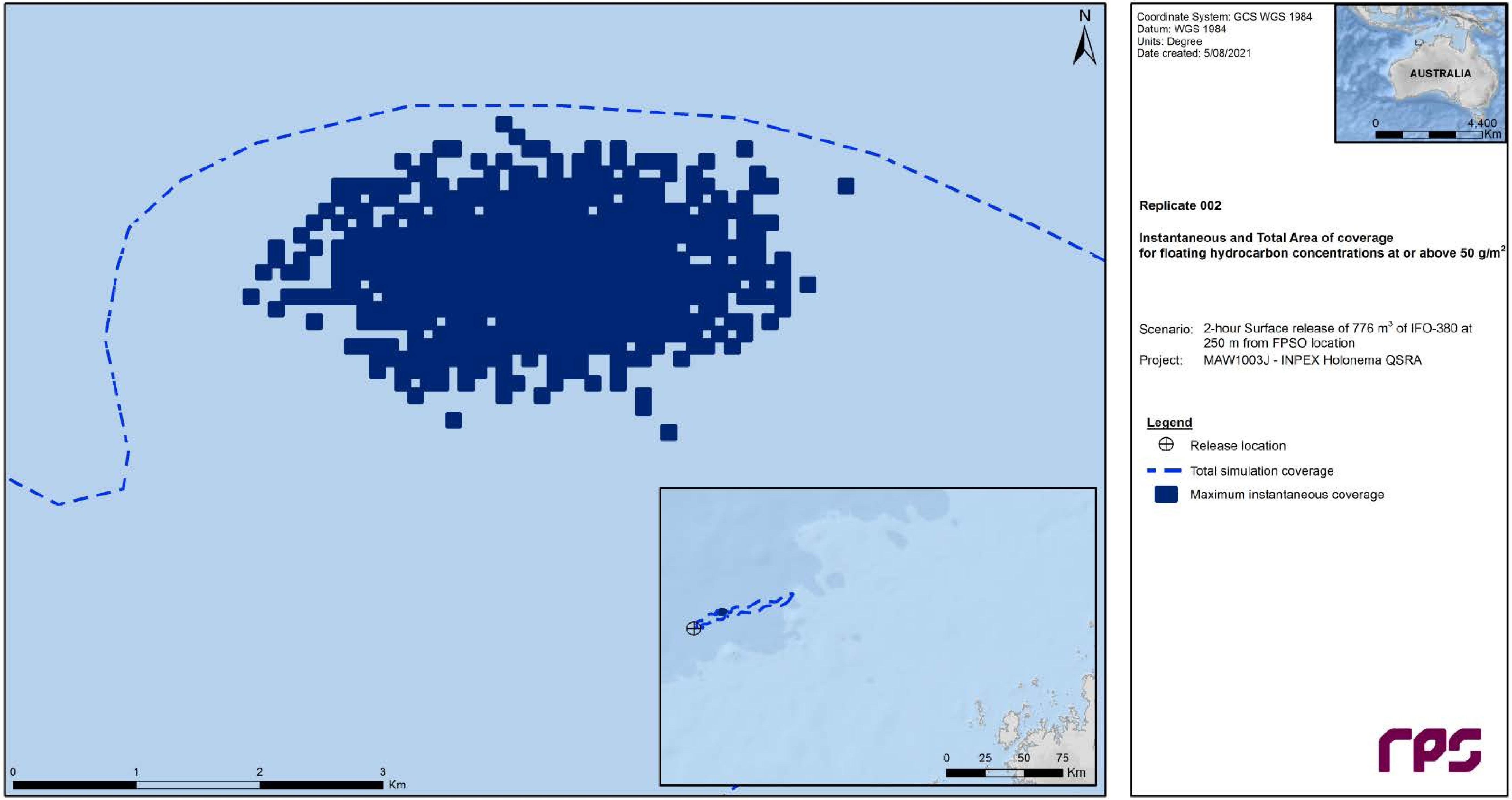

Figure 9-4: Deterministic replicate #2 – 2-hour release – maximum instantaneous, and total swept area floating oil >50 g/m^2

A.4 Oil Spill Budget and Maximum Field Capability Statement

As summarised in Table 6-2, offshore C&R typically involved vessels, offshore booms, skimmers and offshore liquid oily waste storage. Preferred vessels for offshore containment and recovery are AHTs with a large open deck and rolled/open stern, for safe deployment of offshore boom.

Sea-state of Beaufort 1-4 is optimal (IPICA-IOGP 2015a), with the operation targeting Bonn Code 4/5 oil (>100 g/m^2).

Fixed boom C&R systems (E.g., magnetic brackets and short length of boom attached to a leaking vessel) would not be a practicable option in Commonwealth waters. It would be extremely challenging to anchor/hold the boom in a suitable configuration due to the water depth (without a large number of vessels holding a single boom in position) and combined with strong currents in NW Australia, a boom fixed to a leaking vessel would not be expected to capture any significant volume of recoverable oil, as oil is likely to flush under the boom due to current speeds.

A minimum single offshore C&R operation would require a large AHT, or other similar large vessels with a rolled stern, able to deploy offshore boom from the back deck. The capability would also require deployment of suitable skimmers and some form of liquid oily waste storage capacity (E.g., inboard or deck tanks). For a single vessel operation, a boom-vane system would be required to maintain the booms configuration. If no boom-vane system was available, a second vessel (possibly slightly smaller) to tow the leading edge of the boom would also be required.

Alternatively, an advanced booming system (E.g., speed-sweep or current buster system), typically requiring 3-5 vessels could be used, which would be better for recovery of more fragmented spills, as the system can operate at higher speeds.

Regardless of the technique (traditional versus advanced) the encounter rates will vary significantly, depending on the oil behaviour. For example far higher encounter rate will occur if the oil is in very thick patches compared to if the oil has become spread-out into windrows. Chasing patches/windrows is very time consuming, due to slow vessel speeds (typically 1 knot over water for traditional, or 4 knots with advanced booming techniques).

Theoretical calculations of encounter rates for contiguous oil have been provided in Section 6.3.1. However, there is potential for significant variability in encounter and recover rates, due to variations in oil types, variation in the weathering of different products in the environment over time, changing wind and current speed and direction, all contributing to the oil spill budget calculation results being of limited accuracy.

Therefore, attempting to calculate or quantitatively define a maximum field capability statement is extremely challenging for this response strategy.

In order to achieve any significant volume of oil recovery, a theoretical maximum field capability for offshore C&R could be viewed as a Tier 2 capability (refer Table 6-2), such as three to five traditional C&R strike teams, or 1-2 advanced booming strike teams (~10 vessels plus equipment), maintained offshore at all times, either dedicated to response, or as part of other operational activities. Costs associated with maintaining a single vessel offshore, on stand-by is approximately $20,000/day.

A.5 Operational Considerations and ALARP assessment of the Field Capability

A.5.1 Containment and Recovery – capability maintained offshore

The following sections discuss consideration of offshore vessels, and offshore storage, maintenance, training and deployment of a C&R booming system on an AHT.

AHT Routine Operations

Typically, INPEX maintains one MODU on contract, either for production or exploration drilling activities in the BROPEP region (there may be brief periods between drilling campaigns when a MODU isn't present, between drilling campaigns).

Typically, two AHTs and a third PSV (usually with closed stern) provide vessel support to a MODU.

At all times, one AHT or PSV must remain in attendance of the MODU (i.e. close to the MODU's 500 m safety zone), as a safety vessel.

Typically, under MODU safety cases, the safety vessel is not permitted to depart from the MODU for any reason, until an alternative safety vessel can replace the vessel being released.

The other two vessels are typically either in transit, or in port, conducting resupply activities. Typically a voyage for an AHT, from Browse Basin to Broome, vessel cargo activities in port and return is approximately 72 hours based on vessel economical steaming rates (18 knots). Therefore, typically there is only one vessel at a MODU, and that vessel is unable to be immediately released.

Storage, maintenance and crew training for C&R equipment offshore

Ro-Boom and most other types of offshore boom are typically 200 m per reel. Generally, with large vessels such as AHT's, 400m (2x reels) would be appropriate for an offshore C&R set-up. In addition, there would be the other ancillaries such as power packs and control stands, skimmer, hoses and waste storage. Due to being on the back deck of a vessel (exposed to weather) and the requirement to move/load equipment, all equipment should be containerised. The complete C&R equipment package as described above would most likely require three 10-foot offshore related containers (AMOSC pers comms 2021[2]).

During routine operations, AHTs typically will have decks full of cargo, as part of route cargo transfer operations. Therefore, storage of the C&R containers mid-ships towards the stern, in a deployment ready position isn't practicable. The C&R containers would be required to be stored most likely far forward, against the gunwales, away from normal cargo operations areas.

Further, during anchor handling operations at the start of end of drilling a well, for safety/operability reasons, AHT decks are required to be clear of other cargo. Therefore, prior to conducting routine anchor handling operations, the C&R equipment containers would need to be moved onto a MODU or other vessel for temporary storage, and then off again.

During cyclone avoidance activities, AHTs should have clear decks. Therefore, for periods of cyclone avoidance, C&R equipment containers would most likely need to have sea-fastenings removed and the boom stored on a MODU or relocated back to Broome.

[2] Personal communication, Mr Nathan Young, Australian Marine Oil Spill Centre. Geelong, pers.comm. 07 April 2021.

The permanent equipment storage on ATHs would result in a reduction deck-space available to utilise for cargo operations, resulting in additional voyages per year and additional fuel burn etc., resulting in additional costs due to reduced efficiency. There are also additional costs (reduced productivity), associated with regular shifting of containers between the AHT and MODU (E.g., for anchor handling/cyclone avoidance).

Maintenance (involving further additional costs) would typically involve the following (AMOSC pers comms 2021):

- 6 monthly service: contents check, minor service items, and function testing
- 12 monthly service: fluids and filters checked/changed, lubrication, corrosion inhibition, fuel replenishment/replacement and function testing (includes boom reels, power packs and ancillaries)

For successful and safe rapid boom deployment of C&R systems offshore, without the expert onsite assistance from AMOSC Core-Group, a team of trained crew members would be required. Typically, a minimum of 5 trained deck crew per shift would be required, therefore 10 trained crew onboard at all times (2 x shifts per day). Assuming 2.5 swings per vessel (25 crew), and 5 additional crew to cover the long-term crew change-over, approximately 30 personnel would be required to be trained per vessel. It would not be practical to conduct a full day of boom and skimmer deployment training (including various booming configurations, skimmer operations etc) with crews during actual operational periods, as the AHT activity schedules are very reactive/responsive to the needs to the MODU. Therefore, crew training would typically be on an 'off-swing' period.

Based on 'off-swing' 2 days training, including accommodation, flights etc., costs would equate to ~$5,000 per selected crew member, or $150,000 training per vessel. With a two-year refresher training requirement, the cost is $75,000 per vessel per annum. Assuming both AHT vessels crews were required to be trained, to maximise availability of an AHT with trained crew being on available, 2 x AHT annual crew training cost is ~$150,000.

Whilst a C&R system could be potentially stored onboard a MODU, there would be costs associated with long-term storage (deck-space utilisation), however these costs would likely be less than with an AHT. Regardless, the maintenance and AHT crew training costs incurred would remain unchanged.

In summary, there would be significant costs associated with the storage, maintenance, crew training and reduced AHT productivity, for maintaining C&R equipment on AHTs offshore.

Mobilisation / activation of C&R system stored offshore

For safe boom deployment from an AHT, the C&R equipment containers would need to be positioned on the vessel centreline, near the stern. Therefore, either due to day-to-day cargo activities or anchor handling activities, the C&R containers will be required to be relocated.

Relocating the C&R containers would typically be conducted using the MODU crane. This would also involve moving other containers/cargo around the deck and require sea-fastening of the C&R containers and all other cargo before C&R equipment deployment could occur. This activity would typically take approx. 3-5 hours.

Once the C&R equipment is positioned, it would typically take ~2 hours for 400 m of offshore boom to be deployed.

Even if the C&R containers were stored onboard a MODU, the MODU crane would still be required to move cargo around onboard an AHT to make space for the C&R equipment containers, so there is no significant timesaving during C&R equipment mobilisation/deployment, by storing the C&R equipment on a MODU, compared with storage onboard an AHT.

Typical time for C&R equipment deployment if stored offshore would be 5-7 hours, based on the following:

- 3-5 hours for MODU crane to
    - clear cargo from AHT deck and create suitable space
    - move C&R containers (either onboard AHT or on MODU) onto centre/aft deck of AHT
    - AHT crew to sea-fasten the C&R containers into position and prepare for equipment deployment
- 2 hours for trained AHT crew to deploy 400 m offshore boom once equipment is in position and secured on the rear deck of the AHT.

A.5.2 Containment and Recovery – capability maintained onshore

C&R equipment could be stored at onshore locations, such as Broome.

There is a routine flow of vessels between Broome and the Ichthys/Prelude facilities and other offshore petroleum operations.

In event of a spill, offshore C&R equipment can be deployed from the Broome AMOSC stockpile, via Broome Port, onto a PSV or AHT.

If deployed onto an AHT, the equipment can be sea-fastened directly to the deck, and the AHT can then sail directly to site, and commence boom deployment.

If deployed onto a PSV, the equipment would need to be containerised (as additional offshore lifting is required) and the PSV would require the use of an offshore facility crane to transfer the boom system onto an AHT, adding a small amount of additional time.

Typically, the time duration for identification and mobilisation of the vessel to Broome Port, and mobilisation of equipment onto the vessel at Broome port, and then steaming to Ichthys Field is expected to take between 24-48 hours. If a vessel was already near/in Broome port, the equipment load-out and steaming back to Ichthys Field would take ~24 hours. If a vessel needed to be mobilised from Ichthys Field to Broome, and then return to Ichthys Field, it would take ~48 hours. 48 hours is the worst-case situation, as generally there is a vessel closer to, or in Broome Port.

Timing for the mobilisation of offshore C&R equipment from AMOSC Broome stockpile to Broome Port won't on critical path, as the stockpile is located adjacent/close proximity to the Port.

During the vessel mobilisation period, AMOSC staff/core-group personnel could be in transit to Broome and mobilise directly with the C&R vessel (pending flight times) or alternatively transfer via INPEX contracted crew-change helicopter from Broome to Ichthys Field, and then transfer via crane from a Facility onto vessel deck and commence supervision of C&R operations.

AMOSC store and maintain their C&R equipment at their various stockpile locations at no additional cost. Also, AMOSC staff and AMOSC Core-Group are already trained to conduct C&R supervision. Therefore, there is no additional cost associated with C&R equipment storage, maintenance or personnel training for the onshore C&R option.

AMSA, also maintain advancing booming systems regionally in Darwin, Karratha, and Fremantle, with additional units in other National Plan stockpiles. This equipment is accessible under National Plan arrangements, should it be required.

A.6 Containment and Recovery - ALARP Justification of Selected Field Capability

The objective of C&R is to collect oil at sea, to prevent/limit the volume of oil arriving on shoreline. Stochastic modelling results indicate that for an IFO/HFO spill at the Ichthys Field, for 50% of the year (dry season), there is a ~5% chance of oil arriving on the nearest shoreline (Browse Island) and ~20% for the other half of the year. Therefore, when evaluating the effort/cost of C&R response preparedness, the response objective, and likelihood of significant shoreline contact must be considered, compared to the costs of the various response options, as part of the ALARP evaluation.

Cost of maintaining a single large vessel with rolled sterns, C&R equipment and trained crew, on stand-by in Ichthys Field, purely for spill response activities is approximately $20,000 per day ($7.3M per annum), plus ~$150,000 per annum crew training costs. These costs are not considered ALARP, even if shared with a near-by operator, such as Shell/Prelude. Therefore, the 'maximum field capability statement' of multiple dedicated spill response vessels with C&R equipment offshore, ready to respond, is not considered ALARP, due to the very large costs, compared with typically expected oil recovery rates for C&R systems.

When considering vessels already available as part of routine drilling and production activities, PSVs, OSVs and other commonly used offshore vessels such as inspection/maintenance and repair vessels do not have rolled sterns. This limits the available primary C&R vessels to AHTs.

MODUs are typically supported by 2 x AHTs with rolled sterns, plus a third standard PSV (non-rolled stern). However, AHTs are not always at the MODU location during drilling activities. When not conducting anchor handling activities, AHTs are conducting re-supply runs between the MODU and port (typically Broome).

A single vessel (either an AHT or PSV) must remain on station adjacent/near-by the MODU as a safety vessel at all times during drilling activities. The other two vessels are typically conducting re-supply runs. Therefore, if an AHT is undertaking safety vessel duties at the MODU, there is no guarantee of its immediate release. It could be perhaps 12/24 hours before the next vessel in the MODU fleet arrives on location at the MODU, to take over safety vessel duties and release an AHT for C&R activities. Therefore, even though AHTs may be available, they can't be relied upon to be activated as an immediate C&R strike team.

Even if an AHT was available to be released immediately, (and the crew were fully trained, at the training cost specified above), and C&R equipment was stored onboard the vessel, it would be a minimum 5-7 hours before boom could be deployed.

The alternative option, for onshore storage of C&R equipment in Broome, could have a single C&R strike team operational in Ichthys Field typically within 24 to 48 hours (maximum 48 hours, but more likely closer to 24 hours, as one vessel is typically close to, or in Broome Port at most points in time). The additional Exmouth AMOSC stockpile equipment and NW shelf vessels could be utilised to mobilise a second C&R strike team.

Therefore, the onshore storage option typically only results in a 12–16-hour delay (provided vessel was already in Broome Port, which is the case the majority of the time) compared to the offshore storage option.

If the weather forecast indicates C&R is likely to be a viable option (i.e. signification period of wind <20 knots over several days, to facilitate a reasonable amount of oil recovery), the slick is unlikely to move a significant distance from the location where it was spilled and is most likely going to oscillate on local currents/tidal flows, rather than drift on a rapid trajectory directly towards a sensitive receptor such as Browse Island or Scott Reef.

As presented in Figure 6-1 and Figure 6-2, C&R can be deployed both at the source of the spill, as well as being deployed to target slicks approaching a specific shoreline sensitivity. Therefore a C&R capability mobilised from onshore should be able to arrive on site and conduct C&R activities, targeting slicks before they arrive at a sensitive location, rather than attempting to target slicks immediately at the source.

As shown in Figure 9-1 to Figure 9-4, both short and long duration release scenarios are likely to result in some recoverable oil on surface after several days, especially in the longer duration release scenario (which is arguably also the more likely scenario). If the spill was an ongoing release, C&R could also be used directly near the spill source, upon arrival.

Therefore, given the logistical limitations and additional costs, the offshore storage of C&R equipment is not considered ALARP. Onshore storage of C&R equipment is considered ALARP, as under most circumstances, this option should still be able to achieve the response objective of reducing the oil volume arriving at a shoreline, with far lower costs and logistical constraints compared to the offshore storage option.

It should be noted that the encounter rate of surface dispersant use is by far the largest of any response technique (IPIECA-IOGP 2015b), and therefore a vessel-based dispersant first strike capability is considered optimal, compared to C&R, in deep, offshore waters away from sensitive shorelines.

A.7 Containment and Recover - Selected Field Capability Statement

It is considered ALARP to maintain the following as the selected capability for at sea C&R.

- INPEX will maintain contracts/framework agreements with large vessel providers.
- INPEX will maintain mutual aid arrangements with AMOSC, which provides access to C&R equipment for two strike-teams as part of the AMOSC Broome/Exmouth stockpiles. In addition, AMOSC can provide advancing booming systems from the Fremantle, and Geelong stockpiles.
- INPEX will maintain access to AMOSC Core-Group personnel trained in offshore C&R.

Refer Appendix D for additional information regarding on-water response strategy implementation planning (including the combined use of at-sea containment and recovery, vessel dispersant and aerial dispersant) for Group IV spills, including short and long duration spills.

APPENDIX B: FIELD CAPABILITY ASSESSMENT – VESSEL DISPESRANT

Appendix B provides a detailed field capability assessment for vessel-based dispersant operations, in response to a 776 m^3 IFO/HFO WCSS at the Ichthys Field location.

B.1 SIMA outcomes

Strategic SIMA for IFO/HFO determined C&R and surface dispersant application would both have positive effect for majority of values and sensitivities in Commonwealth waters. Nearest shoreline sensitivity is Browse Island (33 km from FPSO), and Scott Reef (100 km from FPSO).

Dispersant can be effective at reducing the surface expression of Group IV hydrocarbons, under specific circumstances. The reduction in the surface expression of Group IV spills would reduce the risk of contact with surface marine fauna and shoreline/intertidal sensitivities. Depending on sea-state, atmospheric conditions, weathering and emulsification of Group IV spills the 'window of opportunity' for effective dispersant application is generally limited – from a few hours, to a few days (ITOPF 2013).

Dispersant is less likely to be effective against HFO, however more likely effective against IFO and LSHFO. In addition, due to the warm temperatures of northern Australian waters, the likely window for successful dispersant application may be extended, compared to colder climates. If a spill is ongoing, i.e. leaking from a vessel over several days, the window of opportunity for dispersant application will likely be significantly extended, due to the ongoing release of fresh oil.

B.2 Cone of response

Refer Appendix A.2 – Cone of response

B.3 Basis of Design - WCSS Modelling Overview

Refer Appendix A.3 – Basis of Design – WCSS Modelling Overview

B.4 Oil Spill Budget and Maximum Field Capability Statement

Preferred vessels for vessel dispersant in Commonwealth waters would:

- be a minimum 20 m length – depending on operating environment and expected sea conditions
- have deck space for IBCs or single 10 m^3 ISO-tank
- be capable of utilising dispersant spray systems, such as fixed spray booms or AFEDO units

For an instantaneous spill in the BROPEP region (tropical water temperatures), IFO/HFO typically increases in viscosity to become not amendable to dispersant within 6-24 hours (faster for HFO, slower for IFO, and more rapidly with increasing wind speeds).

To fully treat the HFO WCSS, the vessel dispersant oil spill budget calculations are as follows:

- 776 m^3 spill is treated at 20:1 oil to dispersant ratio = 40 m^3 dispersant required
- Single vessel using an AFEDO system, using the standard AFEDO dispersant flowrate of 40 L/min = flowrate of 2.4 m^3 per hour

- Assume 60% operational spraying time per hour = 1.5 m^3 dispersant per hour
- Assume a single vessel can conduct spray operations for 8 hours per operational daylight period = a maximum of 12 m^3 dispersant sprayed per daylight operational period.

Based on the above calculation, ~3-4 vessels, on stand-by with 40 m^3 dispersant in Ichthys Field would be required to fully treat the 776 m^3 IFO/HFO WCSS in the first 24 hours (first 12-hour daylight window).

B.5 Operational Considerations and ALARP assessment of the Field Capability

The following sections discuss consideration of offshore storage, maintenance, training and deployment of a vessel-based dispersant system offshore.

B.5.1 Vessel Dispersant – capability maintained offshore

INPEX's Ichthys production activities require support from a fleet of support vessels, including an OSV, PSVs, AHTs and IMR vessels.

Whilst not all OSVs, PSVs or IMR vessels will be maintained in the Ichthys Field at any time (the only location with the Group IV spill risk at the time of preparation of this BROPEP), certain vessels have a higher likelihood of being present. Typically, the OSV will be present majority of the time, including all condensate tanker operations. The OSV is only in Broome for crew-change approximately once per month. The AHTs, PSVs are often transiting between the facilities and port, and very occasionally in port for longer durations for maintenance. IMR vessels are only occasionally mobilised, for short duration inspection and maintenance campaigns.

Therefore, maintaining vessel dispersant spray capability on OSV and PSVs provides the highest likelihood that one or more dispersant spray systems can be mobilised, if required, at short notice.

In addition, by maintaining a mobile dispersant system (E.g., an AFEDO system), a dispersant stockpile and trained personnel onboard a facility, any available vessel, including the AHTs, can easily be converted and used for vessel-based dispersant spray activities.

Training of offshore personnel in dispersant spray systems is relatively easy compared to training for offshore containment and recovery. The equipment is simpler, lighter with far fewer safety hazards, and deployment drills can be conducted without significant disruption to routine activities.

B.5.2 Vessel Dispersant – capability maintained onshore

Vessel dispersant equipment could be stored at onshore locations, such as Broome.

There is a routine flow of AHTs, PSVs, OSVs and other vessels between offshore facilities and Broome. There are also other smaller vessels which are also suitable for vessel-based dispersant application which typically berth in Roebuck Bay (Broome Port). In event of spill, vessel dispersant spray systems and dispersant stocks could be deployed from a Broome supply base, via Broome Port, onto any suitable vessel (movement of equipment will not be a critical path activity). Once the equipment is onboard, the vessel can then sail directly to site, and commence dispersant spray activities. Total duration for equipment transport, loadout and commencement of sailing to site is typically <24 hours for small vessels, would also generally be <24 hours for larger vessels (provided vessel was already near Broome Port).

During the equipment transit, AMOSC staff/core-group personnel could be in transit to Broome and mobilise directly with a vessel (pending flight times) or alternatively transfer via INPEX contracted crew-change helicopter to the offshore facility, and then transfer via crane from Facility onto vessel deck and commence supervision of vessel dispersant operations.

The AMOSC Broome and Exmouth equipment stockpile already contains vessel-based dispersant equipment and dispersant stockpiles

The cost of equipment storage/maintenance onshore is slightly reduced compared to offshore. AMOSC Core-Group personnel already maintain training for vessel dispersant supervision. Therefore, there would be no additional cost associated with vessel dispersant equipment storage, maintenance or training, for the onshore option compared to the offshore option.

B.6 Vessel Dispersant - ALARP Justification of Selected Field Capability

The cost of maintaining additional vessels equipped with dispersant spray systems, dispersant stockpiles and trained crew, on stand-by in Ichthys Field, purely for spill response activities is not considered ALARP, even if shared with a near-by operator, such as Shell/Prelude, given existing Ichthys/Prelude vessels can be/are already equipped with vessel-based dispersant capabilities.

IFO/HFO/LSHFO slicks will increase in viscosity over time. Therefore, early dispersant application is required to maximise the likelihood of success of this response strategy.

The encounter rate of dispersant use is by far the largest of any response technique and is therefore preferentially selected as the most suitable first-strike response strategy compared to C&R (IPIECA-IOGP 2015b).

To ensure the fastest possible vessel dispersant response, spray systems, dispersant stockpiles and trained personnel should be maintained on vessels which have the highest likelihood of being near the Ichthys production assets. Whilst there can be no guarantee that a PSV or OSV will be present in Ichthys Field at all times, an AFEDO system on the FPSO provides redundancy, for use on any other available support vessel.

Due to the long duration for mobilisation of vessel dispersant systems from Broome to the Ichthys Field, onshore storage is not considered an appropriate primary option. However, not all spills are instantaneous, and the majority of spills from vessels actually release over multiple days. Therefore, maintenance of an onshore capability, to provide additional/surge vessel dispersant capacity is considered appropriate.

Therefore, given the availability of suitable offshore vessels and associated storage capacity, it is considered ALARP and acceptable to maintain a vessel dispersant capability in the Ichthys Field.

Additional redundancy/mutual aid capability (Tier 2 capability) including Prelude vessel dispersant capability and Broome/onshore stored capability can also be readily activated, if required.

B.7 Selected Field Capability Statement

It is considered ALARP to maintain the following as the selected capability for vessel dispersant.

INPEX will maintain a vessel dispersant capability to respond to Group IV spills in the Ichthys Field, including the following:

- FPSO Venturer – 16 m^3 dispersant and AFEDO system and dispersant spray trained personnel
- Ichthys 3 x OSV/PSVs – equipped with dispersant spray systems and trained personnel

INPEX will maintain mutual aid arrangements with Shell and AMOSC, which provide access to:

- Prelude FLNG facilities support vessels – including vessel dispersant spray systems, dispersant stockpiles and trained personnel
- AMOSC Broome & Exmouth stockpiles – including vessel dispersant spray systems and dispersant stockpiles and Core-Group trained personnel.

Refer Appendix D for additional information regarding on-water response strategy implementation planning (including the combined use of at-sea containment and recovery, vessel dispersant and aerial dispersant) for Group IV spills, including short and long duration spills.

APPENDIX C: FIELD CAPABILITY ASSESSMENT – AERIAL DISPERSANT

Appendix C provides a detailed field capability assessment for fixed wing aerial dispersant (FWAD) operations, in response to a 776 m^3 IFO/HFO WCSS at the Ichthys Field location.

C.1 SIMA outcomes

The Strategic SIMA for IFO/HFO determined C&R and surface dispersant application would both have positive effect for majority of values and sensitivities in Commonwealth waters. The nearest shoreline receptors are Browse Island (33 km from FPSO) and Scott Reef (100 km from FPSO).

C.2 Cone of response

Refer Appendix A.2 – Cone of response

C.3 Basis of Design - WCSS Modelling Overview

Refer Appendix A.3 – Basis of Design – WCSS Modelling Overview

C.4 Oil Spill Budget and Maximum Field Capability Statement

For an instantaneous spill in the BROPEP region (tropical water temperatures), Group IV (IFO/HFO/LSHFO) spills will typically increase in viscosity to become not amendable to dispersant within 6-24 hours; faster for HFO, slower for IFO and LSHFO, but more rapidly for any fuel type with increasing wind speeds. However, for a long duration release, fresh oil, still amenable to dispersant use would be available for several days. The longer duration release is also likely to result in longer thin 'streamers' of fresh oil which could be targeted by FWAD operations (refer Figure 9-1 and Figure 9-2).

To fully treat the HFO WCSS, the aerial dispersant oil spill budget calculations are as follows:

- 776 m^3 spill is treated at 20:1 oil to dispersant ratio = 40 m^3 dispersant required
- A single air-tractor can deliver 3 m^3 of dispersant in a single sortie and conduct a maximum of 4 sorties per day (potentially less for significant offshore distances).
- Therefore, each air-tractor can deliver between 9 to 12 m^3 dispersant per daylight period.

Based on the above calculations, 3-4 FWAD air-tractors, ready to mobilise from Truscott at no-notice would be required to fully treat the 776 m^3 IFO/HFO WCSS in the first 24 hours (first 12-hour daylight period).

C.5 Operational Considerations and ALARP assessment of the Field Capability

C.5.1 FWAD –Capability

The current FWAD arrangement in place which covers the entire Australian coastline is jointly managed by AMSA & AMOSC.

AMOSC's FWADC contract provides for 'wheels up' of 6 aircraft around Australia within 4 hours of activation.

There are a significant number of additional air tractors around Australia which do not form part of the FWADC contract (40 – 50 aircraft) that can be made available within relatively short timeframes (noting timeframes vary based on time of year and current operations, E.g., fire-fighting and crop-dusting operations).

When triggered, the FWADC contract provides the following: Air Tractor AT802, pilot, Aerotech First Response Liaison Officer, an Air Attack Supervisor, an Aircraft Loading Officer, and transportation for all personnel to the nominated location.

The Air Attack Supervisor is typically identified as a key critical path role. AMOSC maintain an Air Attack Supervisor as part of the Aerotech First Response FWADC contract. Other personnel are available via AMSA and the National Response Team (traditionally from bushfire services).

An Air Attack Supervisor platform (helicopter or fixed wing) will need to be supplied by INPEX, in the event INPEX is the Control Agency for the spill. Aerotech First Response also have the capability to source this capability, if required. INPEX would typically utilise a crew-change helicopter as the Air Attack Supervisor platform.

Dispersant stocks would be transported from the nearest AMOSC or other mutual aid stockpile.

Given that FWAD would only be an appropriate response strategy in the event of an ongoing spill, it's reasonable to assume an ongoing spill would occur over a few days, with some vessel dispersant applied during day 1.

As shown in Figure 9-1 and Figure 9-2, during a long duration release scenario, it is likely that a long streamer of oil thick enough for aerial dispersant application would be present near the release location.

Therefore, based on the use of two aircraft (Bachelor, NT and Exmouth, WA based air-tractors) applying up to 24 m^3/day, and working in conjunction with vessel-based dispersant capability (applying up to 12 m^3/day/vessel), the surface (vessel and FWAD) capability would be able to deliver the required 40 m^3 of dispersant within the second daylight period.

C.6 Aerial Dispersant - ALARP justification of Selected Field Capability

The cost of maintaining additional air tractors, outside of the existing FWAD arrangements would not result in any significant environmental benefit, given

- all the other logistics, Air Attack Supervisor and other key personnel etc., could not be maintained at Lombadina or Mungalalu-Truscott airbases, as part of the capability, and therefore the capability would still only be operational by day 2
- a vessel-based dispersant capability exists which can deliver a significant volume of dispersant on day 1.

Therefore, the current AMOSC/FWAD capability and arrangements are considered ALARP.

C.7 Aerial Dispersant - Selected Capability

It is considered ALARP to maintain the following as the selected capability for aerial dispersant.

- INPEX will maintain mutual aid arrangements with AMOSC, which provide access to the AMOSC contracted FWAD capability.

Refer Appendix D for additional information regarding on-water response strategy implementation planning (including the combined use of at-sea containment and recovery, vessel dispersant and aerial dispersant) for Group IV spills, including short and long duration spills.

APPENDIX D: ON WATER RESPONSE STRATEGY IMPLEMENTATION PLAN FOR GROUP IV (IFO/HFO) SPILLS

This appendix provides a general discussion regarding the phasing and implementation of on-water response strategies for Group IV spill scenarios, including short and long duration releases.

As shown in Appendix A.3, the short duration release scenario is likely to result in a slick which remains relatively compact with a large single patch, or area of ocean surface exposed to floating oil >50 g/m^2. The longer duration (4 day) release scenario demonstrated that there is likely to be a longer, narrow streamer of oil >50 g/m^2 which would be expected due to the slower release rate, but longer release duration.

The longer duration release scenario will also result in more fresh oil which is still amendable to dispersant use for several days whilst the spill is congoing, compared to the short duration release scenario, where an increase in viscosity of the slick (rendering dispersant inoperable) will likely occur within the first 24 hours.

The field capabilities to be implemented for each on-water response strategy described below are based on the Selected Field Capability Statements provided in Appendices A, B and C.

D.1 Group IV spill from vessel – short-duration release

This scenario assumes that the Group IV spill from the vessel has stopped after a few hours. Due to weathering, the oil will most likely not be amendable to dispersant operations after the first day. The below activity descriptions assume that weather conditions are conducive for at-sea response operations.

Day 1

- SMV mobilised to confirm spill and gain/maintain ongoing situational awareness
- Vessel-based dispersant is activated – test spray confirms efficacy and dispersant spray operations commenced
- Additional dispersant stocks are mobilised from Broome (or other stockpiles) to support potential for ongoing vessel-based dispersant operations
- Additional vessels, (contracted or vessels of opportunity) sourced for potential for ongoing vessel-based dispersant operations
- FWAD capability not activated – ruled out based on time to deploy versus the window of opportunity for effective dispersant application
- Identification of vessels for C&R, and commencement of mobilisation of vessels, equipment and personnel to Broome Port and when possible, commence steaming to site.

Note - window of opportunity for dispersant application from a short duration spill may result in ongoing dispersant operations being stood down on day 1.

Day 2

- SMV operations utilised to maintain ongoing situational awareness
- Where possible, vessel-based dispersant activities continue until they are no-longer effective due to increased oil viscosity.
- C&R vessels steaming to site/commence C&R activities on location

Day 3 onwards

- SMV operations utilised to maintain ongoing situational awareness
- C&R vessels continues C&R activities on location.

D.2 Group IV spill from vessel – long-duration release

This scenario assumes fresh Group IV oil is continuing to release from the vessel over a duration of several days, providing ongoing source of oil amendable to dispersant operations, and prolonged effectiveness of C&R operations.

Below activity descriptions assume that weather conditions are conducive for at-sea response operations.

Day 1

- SMV mobilised to confirm spill and gain/maintain ongoing situational awareness
- Vessel-based dispersant is activated – test spray confirms efficacy and dispersant spray operations commenced
- Additional dispersant stocks are mobilised from Broome (or other stockpile) to support the potential for ongoing vessel-based dispersant operations
- Additional vessels, (contracted or vessels of opportunity) sourced for potential for ongoing vessel-based dispersant operations
- FWAD capability is mobilised to the nominated airfield (E.g., Lombadina/Mungalalu-Truscott airfield)
- Additional dispersant is mobilised to the nominated airbase to support potential for ongoing FWAD operations
- Identification of vessels for C&R, and commence mobilisation of vessels, equipment and personnel to Broome Port and when possible, commence steaming to site.

Day 2

- SMV operations utilised to maintain ongoing situational awareness
- Vessel-based dispersant operations continue. Resupply runs ongoing.
- FWAD surveillance flights and FWAD spray runs commence
- C&R vessels steaming to site/commence C&R activities on location

Day 3 onwards

- SMV operations utilised to maintain ongoing situational awareness
- Vessel-based dispersant operations continue. Resupply runs ongoing
- FWAD spray runs ongoing. FWAD dispersant resupply ongoing
- C&R vessels continues C&R activities on location.

INPEX AUSTRALIA – BROWSE REGIONAL OIL POLLUTION EMERGENCY PLAN – INCIDENT MANAGEMENT TEAM CAPABILITY ASSESSMENT

Report

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RECORD OF AMENDMENT

Revision	Section	Amendment

DOCUMENT DISTRIBUTION

	Name
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NOTICE

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Acronym, abbreviation or term	Meaning
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority (Cwlth)
APPEA	Australian Petroleum Production and Exploration Association
BROPEP	INPEX Australia Browse Regional Oil Pollution Emergency Plan (X060-AH-PLN-70009)
BROPEP BOD/FCA	INPEX Australia BROPEP Basis of Design (BOD) and Field Capability Assessment Report (X060-AH-REP-70016)
BROPEP IMTCA	INPEX Australia - Browse Regional Oil Pollution Emergency Plan – Incident Management Team Capability Assessment (X060-AH-REP-70015)
CMT	Crisis Management Team
COP	common operating picture
CPF	central processing facility
C&R	containment and recovery
EA/JV	External Affairs/Joint Venture
EPO	environmental performance outcome
EPS	environmental performance standard
ERP	emergency response plan
ERT	emergency response team
FOB	forward operational base
FPSO	floating production storage and offloading facility
FWAD	fixed wing aerial dispersant
HFO	heavy fuel oil
HSE	health, safety and environment
IAP	incident action plan

Acronym, abbreviation or term	Meaning
IMT	incident management team
LO	Liaison Officer
m^2	square metre
MODU	mobile offshore drilling unit
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority (Cwlth)
NT	Northern Territory
NT DIPL	Department of Infrastructure, Planning and Logistics (NT)
OIM	offshore installation manger
OM	operational monitoring program
OPICC	offshore petroleum incident coordination committee
OSMP	operational and scientific monitoring program
OSRL	Oil Spill Response Limited
OSRO	oil spill response organisation
OSTM	oil spill trajectory modelling
OWR	oiled wildlife response
PPRR	prevention, preparedness, response, recovery
P&D	protection and deflection
SAR	search and rescue
SCAT	shoreline clean-up assessment technique
SIMA	spill impact mitigation assessment
SMV	surveillance, monitoring and visualisation
SOPEP	shipboard oil pollution emergency plan
SSDI	subsea dispersant injection

Acronym, abbreviation or term	Meaning
VOC	volatile organic compound
WA	Western Australia
WA DoT	Department of Transport (WA)
WCSS	Worst Credible Spill Scenario

1 PURPOSE

The purpose of this document is to:

- Present a summary of the outcomes of the INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment Report (X060-AH-REP-70016), including the oil spill field capability requirements for a series of Worst Credible Spill Scenarios (WCSSs).
- Describe a generic Incident Management Team (IMT) capability assessment process.
- Present a generic IMT capability assessment for the Browse Basin WCSSs, including consideration of cross-jurisdictional response scenarios.
- Provide an overview of the INPEX IMT capability and linkages to the INPEX Crisis Management Team (CMT) and linkages to field based Emergency Response Teams (ERTs), and with mutual aid capabilities including external oil spill response organisations (OSROs).
- Provide an assessment of how the INPEX IMT capability including CMT and OSRO support can meet the capability requirements presented in the generic IMT capability assessment.
- Provide environmental performance outcomes (EPOs) and environmental performance standards (EPSs) related to the INPEX IMT capability and arrangements for oil spill response.

Note, the implementation strategy for the INPEX Australia – Browse Regional Oil Pollution Emergency Plan suite of documents, is described in the INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment Report (X060-AH-REP-70016).

The inter-relationship of this document to other Browse Regional Oil Pollution Emergency Plan documentation is presented in Table 1-1 and shown in Figure 1-1.

Table 1-1: BROPEP documentation overview

Document title	Document number	Purpose
INPEX Environment Plans		All INPEX EPs contain a detailed activity description and activity-specific oil spill scenarios. Specifically, INPEX EPs include the following: • a description of the activity-specific spill scenarios (including the potential release rates, volumes, locations, hydrocarbon types, etc.) • activity-specific oil spill modelling (used to inform environmental risk assessments) • an assessment of oil spills risks/impacts on environmental values and sensitivities • evaluations of controls to prevent oil pollution from the specific-activity. The WCSS from all INPEX EPs are included in the INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment.
Strategic Spill Impact Mitigation Assessments (SIMAs): • Condensate spill – instantaneous surface release • Marine gas oil/diesel spill – instantaneous surface release • Intermediate fuel oil/heavy fuel oil (HFO) spill – instantaneous surface release • Condensate/gas well or pipeline blowout – long duration subsea release	X060-AH-LIS-60031 X060-AH-LIS-60032 X060-AH-LIS-60033 X060-AH-LIS-60034	The four INPEX Strategic SIMA documents are pre-spill planning tools. These are used to facilitate response option selection by identifying and comparing the potential effectiveness and impacts of the various oil spill response strategies on a range of environmental values and sensitivities. The Strategic SIMAs utilise a semi-quantitative process to evaluate the impact mitigation potential of each response strategy. This method provides a transparent decision making process for determining which response strategies are most likely to be effective at minimising oil spill impacts. The SIMA process includes environmental considerations as well as a range of shared values such as ecological, socio-economic and cultural aspects.
INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment (BROPEP BOD/FCA)	X060-AH-REP-70016	The BROPEP BOD/FCA presents an overview of all of INPEX Australia's offshore petroleum exploration and production activities and associated oil spill risks. It includes an evaluation of modelling outcomes from a series of selected WCSSs and presents an oil spill response field capability analysis.

Document title	Document number	Purpose
		The BROPEP BOD/FCA includes the EPOs and EPSs relevant to the preparedness and environmental risk assessment of field response capability and arrangements and the broader BROPEP implementation strategy (i.e. reviews, management of change process, etc.).
INPEX Australia - Browse Regional Oil Pollution Emergency Plan – Incident Management Team Capability Assessment (BROPEP IMTCA) (this document)	X060-AH-REP-70015	The BROPEP IMTCA utilises the field capability assessments as inputs to evaluate the size and structure of the INPEX IMT necessary to mobilise and maintain the field capability. The BROPEP IMTCA outlines the EPOs and EPSs relevant to INPEX IMT capability and arrangements.
INPEX Australia - Browse Regional Oil Pollution Emergency Plan (BROPEP)	X060-AH-PLN-70009	The BROPEP is the tool which will be utilised by the INPEX IMT during any impending/actual oil spill event. This document assists/guides the IMT through the process of notifications, gaining/maintaining situational awareness, response strategy evaluation and incident action plan (IAP) development, and mobilisation of field response capabilities. The BROPEP outlines the EPOs and EPSs related to the implementation of response strategies.

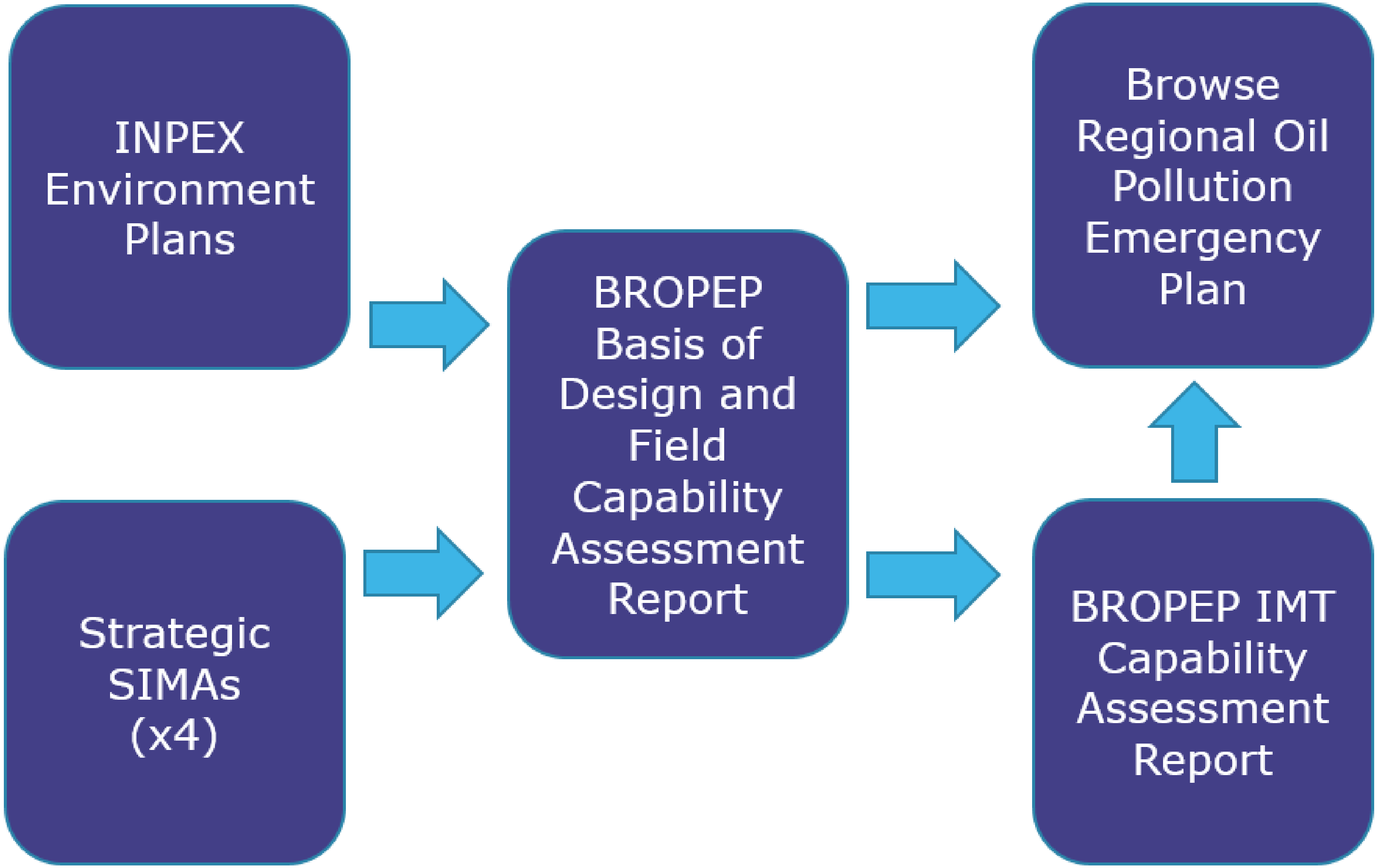

Figure 1-1: BROPEP document structure

2 FIELD CAPABILITY ASSESSMENT

This section provides a summary of the outcomes of the BROPEP BOD/FCA.

As summarised in Table 1-1, the BROPEP BOD/FCA describes the following:

- a summary of INPEX Australia's exploration and production activities in Commonwealth waters offshore of Broome to Darwin, out to the Australian Exclusive Economic Zone
- a summary of the WCSS associated with the exploration and production activities
- a summary of the worst credible spill outcomes (such as the greatest area of actionable oil on water, the greatest length of shoreline oiled, the greatest volume of oil ashore) from the WCSSs
- the process used for the selection of two specific WCSSs, for detailed assessment of the required oil spill response strategies and scale of the required field response capabilities
- a 'tiered preparedness wheel' for the two selected WCSSs.

A summary of the field capability assessment outcomes is presented in Table 2-1, and the two WCSS tiered preparedness wheels (qualitative representations of the preparedness capability associated with the two selected WCSSs) are provided in Figure 2-1 and Figure 2-2.

Table 2-1: Summary of field capability

Response strategy	Well blowout – condensate	Vessel collision –HFO
Aerial surveillance	Tier 3 • During initial 24 hours: within 5 hours of INPEX IMT activation, crew-change helicopter mobilisation to commence surveillance activities at the spill location. Second pilot using the INPEX Oil Spill Observation Guide (daylight operations only) • 24 – 72 hours: 1 x fixed wing aircraft. Multiple overflights per day. Second pilot/observer using the INPEX Oil Spill Observation Guide; or Australian Marine Oil Spill Centre (AMOSC) Core-Group trained aerial observers from 48 hours onwards. • 48 hours onwards: AMOSC Core-Group trained aerial observers available in Broome • 72 hours onwards: 2-3 x fixed wing aircraft. Multiple overflights per day, using trained aerial observers.	Tier 3 • During initial 24 hours: within 5 hours of INPEX IMT activation, crew-change helicopter mobilisation to commence surveillance activities at the spill location. Second pilot using the INPEX Oil Spill Observation Guide (daylight operations only) • 24 – 72 hours: 1 x fixed wing aircraft. Multiple overflights per day. Second pilot/observer using the INPEX Oil Spill Observation Guide; or AMOSC Core-Group trained aerial observers from 48 hours onwards. • 48 hours onwards: AMOSC Core-Group trained aerial observers available in Broome • 72 hours onwards: 2 x fixed wing aircraft. Multiple overflights per day, using trained aerial observers.
Vessel surveillance	Tier 1 • Opportunistic use of facilities and vessels for observations during first day or two only. • Primarily rely upon aerial surveillance and other operational monitoring strategies for situational awareness.	Tier 1 • Opportunistic use of facilities and vessels for observations during first day or two only. • Primarily rely upon aerial surveillance and other operational monitoring strategies for situational awareness.
Oil spill trajectory modelling (OSTM)	Tier 3 • Multiple OSTM runs ongoing over a period of weeks/months. • Volatile organic compound (VOC) modelling and dispersant effectiveness modelling also required.	Tier 3 • Multiple OSTM runs ongoing over a period of weeks. • Dispersant effectiveness modelling potentially also required.

Response strategy	Well blowout – condensate	Vessel collision –HFO
Satellite tracker buoys	Tier 3 • Deployment of multiple batches of tracker buoys over weeks/months. • Tracker buoys required from Australia-wide stockpiles.	Tier 2 • Deployment of locally available (e.g. Broome, Ichthys Field or Darwin) batches of tracker buoys for multiple weeks.
Satellite imagery	Tier 3 • Multiple satellite images required over weeks/months.	Tier 3 • Multiple satellite images required over weeks/months.
At sea containment and recovery (C&R)	Not applicable.	Tier 2 • One or two basic C&R strike teams, or one or two advanced booming configuration strike teams. • Regionally sourced vessels (Western Australia (WA) or Northern Territory (NT) and regionally sources C&R equipment from Broome, Darwin and Exmouth/North-west Shelf required. • Response duration 1-2 weeks.
Surface dispersant - vessel	Not applicable.	Tier 2 • Multiple locally sourced vessels conducting dispersant spraying over several days. • Regional (WA/NT based) dispersant stockpiles required for re-supply.
Surface dispersant – aerial	Not applicable.	Tier 2 • Two regionally located (Exmouth/Batchelor) fixed wing aerial dispersant (FWAD) air tractors utilised over several days. • Utilise Broome, Mungalalu-Truscott or Lombadina air-bases.

Response strategy	Well blowout – condensate	Vessel collision –HFO
		• Regional (WA/NT based) dispersant stockpiles required for re-supply.
Offshore subsea dispersant	Tier 3 • Subsea dispersant injection (SSDI) spread required for up to one or two months, to reduce VOC risks during source control direct intervention activities such as debris clearance and capping stack deployment. • AMOSC Subsea First Response Toolkit (Fremantle) SSDI spread required. • National/international dispersant stockpile required.	Not applicable.
Controlled in-situ burning	Not applicable.	Not applicable.
Shoreline clean-up assessment technique (SCAT)	Tier 3 • 1 x remote SCAT teams (including: 2 x SCAT, 1 X OWR specialist) utilising small vessel departing Broome/Darwin within 48 hours. • 2 additional x remote SCAT teams within 7 days. • Peak of 6 x remote SCAT teams operating within 30 days (3 x roving, 3 x embedded within remote shoreline response units).	Tier 3 • 1 x remote SCAT teams (including 2 x SCAT, 1 X oil wildlife response (OWR) specialist) utilising small vessel departing Broome/Darwin within 48 hours. • 2 additional x remote SCAT teams within 7 days • Peak of 6 x remote SCAT teams operating within 30 days (3 x roving, 3 x embedded within remote shoreline response unit).
Protection of sensitive resources	Not applicable.	Tier 1 • Not expected to be used, but contingency is allowed for shoreline protection equipment to be mobilised as part of a remote shoreline response unit, if required.
Shoreline clean-up	Tier 3	Tier 3

Response strategy	Well blowout – condensate	Vessel collision –HFO
	• 1 x remote shoreline response unit departing Broome/Darwin within 6 days. • 2nd remote shoreline response unit mobilised within 14 days. • Peak of 3 remote shoreline response units mobilised within 1 month.	• 1 x remote shoreline response unit departing Broome/Darwin within 6 days. • 2nd remote shoreline response unit mobilised within 14 days. • Peak of 3 remote shoreline response units mobilised within 1 month.
OWR	Tier 3 • 1 x remote shoreline response unit departing Broome/Darwin within 6 days. • 2nd remote shoreline response unit mobilised within 14 days • Peak of 3 remote shoreline response units mobilised within 1 month.	Tier 3 • 1 x remote shoreline response unit departing Broome/Darwin within 6 days. • 2nd remote shoreline response unit mobilised within 14 days • Peak of 3 remote shoreline response units mobilised within 1 month.
Waste Management	Up to 4300 m^3 solid oily waste to be recovered over several months.	Up to 5500 m^3 solid oily waste to be recovered over weeks to 1-2 months.
Remote Shoreline Response Support	Tier 3 Remote SCAT: • 1 x small support vessel within 48 hours • 2nd and 3rd small support vessel within 1 week Remote Shoreline Response Unit – including SCAT, Shoreline Clean-up and OWR: • 1 x large floating remote response platform within 6 days. • 2nd large floating remote response platform within 14 days. • 3rd large floating remote response platform within 1 month.	Tier 3 Remote SCAT: • 1 x small support vessel within 48 hours • 2nd and 3rd small support vessel within 1 week Remote Shoreline Response Unit – including SCAT, Shoreline Clean-up and OWR: • 1 x large floating remote response platform within 6 days. • 2nd large floating remote response platform within 14 days. • 3rd large floating remote response platform within 1 month.

Response strategy	Well blowout – condensate	Vessel collision –HFO
	Each large floating remote response platform typically consisting of: • accommodation support vessel (10 command personnel, 50 field responders, 20 vessel support crew) • multiple small vessels/tenders/landing barges • light utility helicopter (optional).	Each large floating remote response platform typically consisting of: • accommodation support vessel (10 command personnel, 50 field responders, 20 vessel support crew) • multiple small vessels/tenders/landing barges • light utility helicopter (optional)

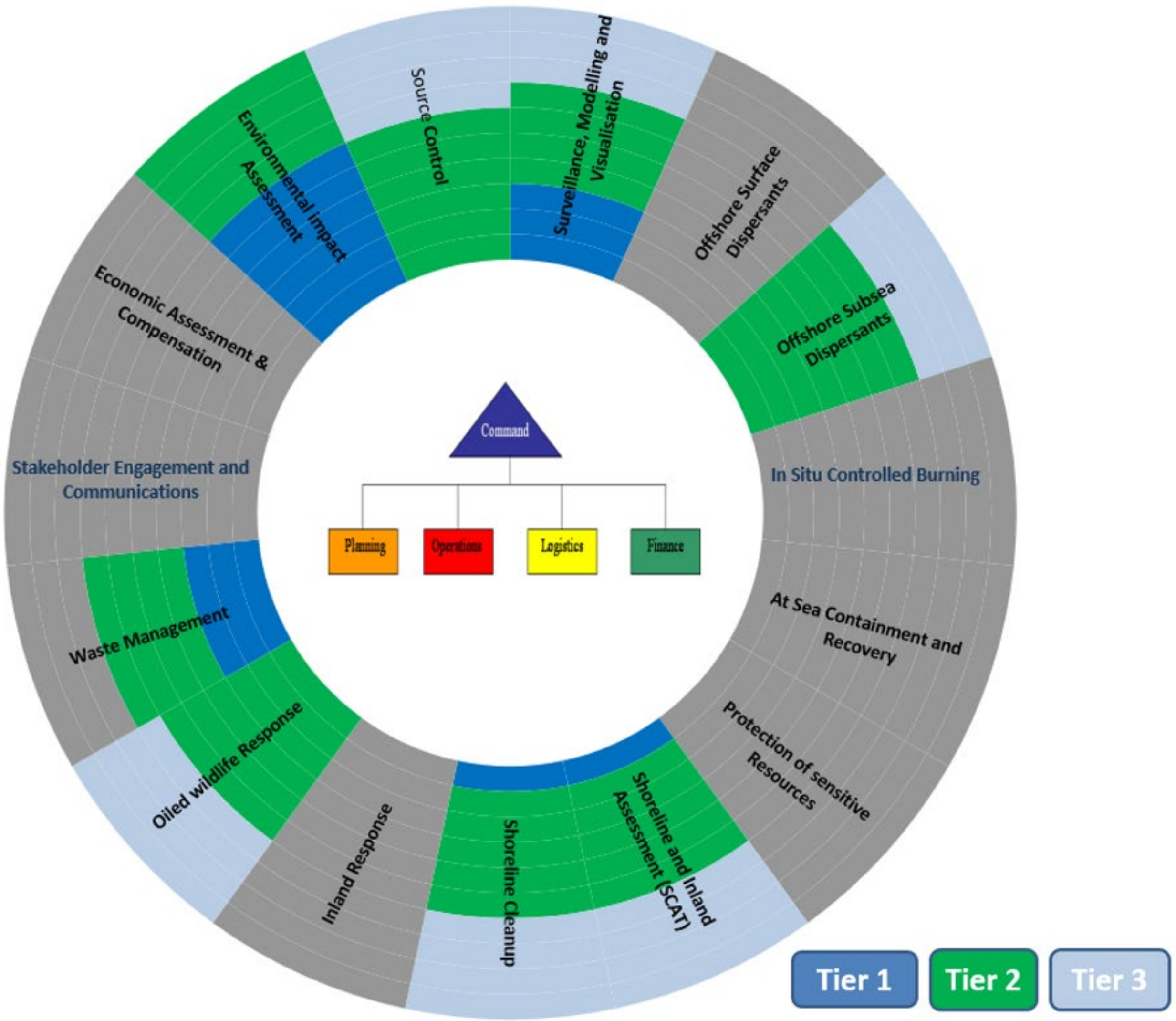

Figure 2-1: Tiered preparedness wheel – well blowout – Brewster condensate

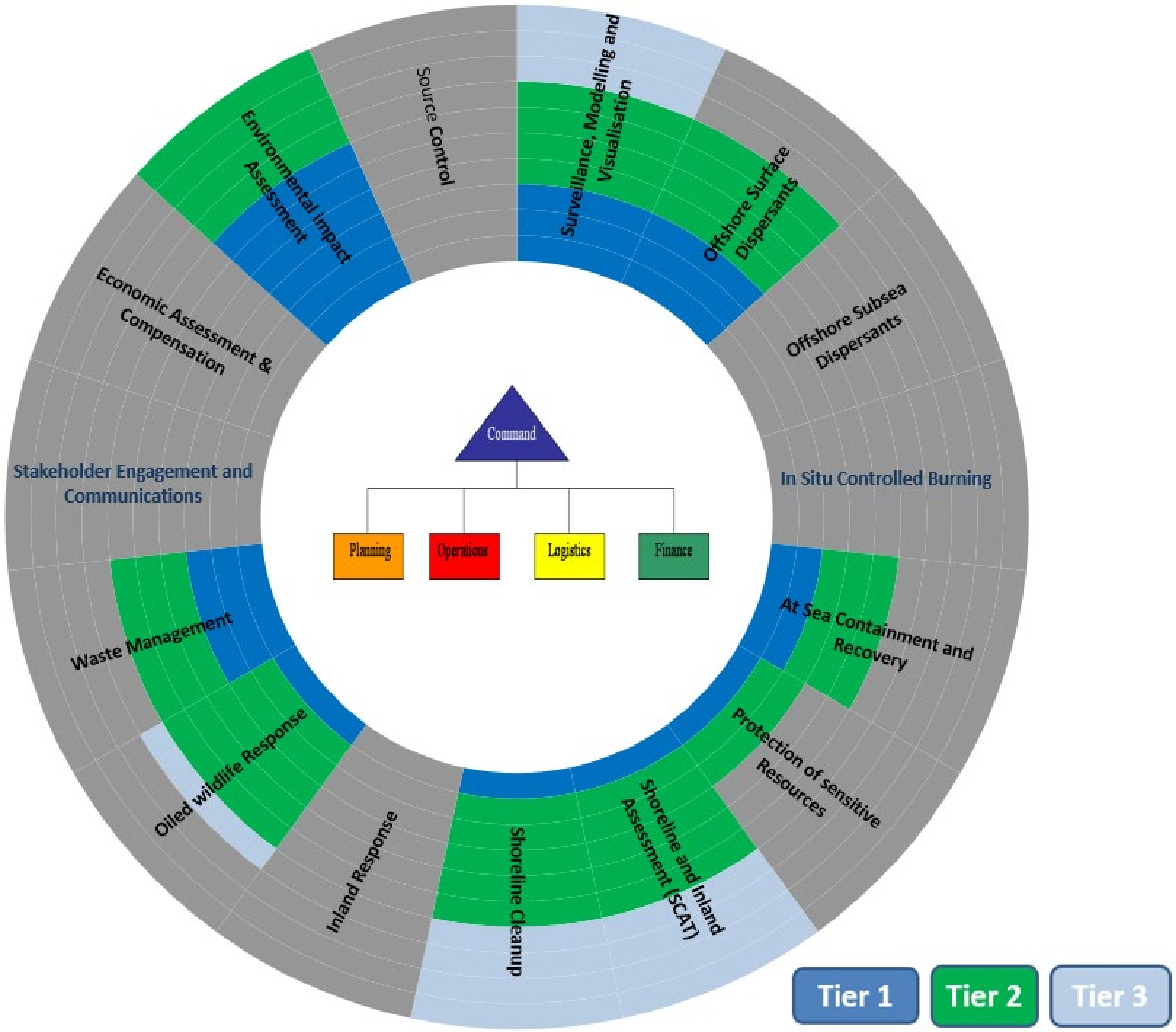

Figure 2-2: Tiered preparedness wheel – vessel collision – heavy fuel oil

3 IMT CAPABILITY ASSESSMENT

This section describes the process for conducting an IMT capability assessment, presents the completed BROPEP IMT capability assessment and evaluates IMT capability requirements for a cross jurisdiction response scenario.

3.1 IMT capability assessment process

The IMT capability assessment examines the IMT objectives and IMT outputs required to mobilise and/or maintain a required field capability at different time steps during the ramp-up of the IMT capability.

An evaluation of the IMT outputs is then conducted to determine the number of personnel required within each IMT function.

The IMT functions presented in Table 3-2 are based on the functions as defined in the Australian Petroleum Production and Exploration Association (APPEA) *Guidance Document: Incident Management Teams Knowledge Requirements for Responding to Marine Oil Spills* (APPEA 2021).

The IMT capability assessment process is undertaken utilising the following steps:

1. Define the IMT objectives for the first week (or until peak IMT capability would be required) for response to a WCSS (presented in Table 3-1).
2. Define the IMT outputs required at defined periods during IMT ramp-up (presented in Table 3-2). The periods defined for this IMT capability assessment are:
   - 0 – 24 hours
   - 24 – 72 hours
   - 72 hours onwards (peak/steady-state).
3. Define the number of personnel required in each IMT function, to manage the workload during the defined periods (presented in Table 3-2).

3.2 IMT capability assessment outcome

The information presented in this section is intended to be generic in nature, presenting a generic IMT capability assessment, and generic IMT structures, as related to the two WCSSs defined in the BROPEP BOD/FCA.

This section does not consider factors such as a THs specific IMT all-hazards structure, or other factors such as which agency (TH, or State/Territory government agency) is the Control Agency for the various response strategies.

Section 3.3 provides an assessment of the impact of a WA cross-jurisdiction response on the generic IMT capability assessment presented in Table 3-2.

In summary, the output of the generic IMT capability assessment (Table 3-2)concluded a total numbers of IMT personnel required for each defined period is as follows:

- 0 – 24 hours; 40 personnel
- 24 – 72 hours; 48 personnel
- 72-hours into steady-state operations – 60 personnel

Example or generic IMT structures (aligned with APPEA 2021) which could be used for the two WCSSs are presented in Figure 3-1 and Figure 3-2.

Section 4 describes how INPEX will achieve the IMT capability requirements. Note, the number of 60 personnel required for steady-state operations does not account for IMT personnel rotations/swings into and out of the IMT. These capability considerations are also addressed in Section 4.

Table 3-1: IMT spill response objectives

Operational period	IMT spill response objectives	Rational / justification
0 – 24 Hours	1. Establish/maintain an IMT with appropriate oil spill response trained personnel including mutual aid capabilities for specialist oil spill roles. 2. Gain situational awareness of spill trajectory, weathering, and potential environmental impact (use of response strategies/tactics including OSTM, visual surveillance, satellite imagery, SCAT surveys, and use of IMT tools including SIMA, resources at risk evaluation, and common operating picture (COP). 3. Establish forward operational Bases (FOBs)/Staging Areas for aviation, shore and marine response strategies (e.g. establish FOBs at Broome Airport, Darwin Airport, Broome Port, Darwin Port, as required). 4. Pre-deploy shoreline assessment/response capabilities including SCAT, OWR, resource protection and shoreline clean-up resources to FOB in anticipation of future deployment. 5. [Group IV spill only] – Mobilise/activate at sea response strategies, including: • Activate in-field vessel based dispersant and commence dispersant spraying • Mobilise FWAD capability to a nominated airfield along Kimberley coastline • Mobilise C&R capability at Broome/Darwin port. 6. [Well blow-out only] – Mobilise SSDI spread to FOB. 7. Undertake risk assessments and develop health, safety and environment (HSE) plan(s). 8. Activate and mobilise OSRO's and mutual aid organisations. 9. Conduct regulatory and other stakeholder notifications.	1. Establishing and maintaining an IMT is required to ensure that field response activities are undertaken consistent with INPEX's regulatory obligations (BROPEP) and are appropriately scaled to the spill scenario at the time. 2. This is the primary spill response needed for the first 24 – 96 hours, and then acts as a foundation/principle objective for the duration of the spill. It enables all other decisions to be made in regards to field or actions around the spilt hydrocarbon, on the basis of predicted and observed environmental and other impacts, and weathering of the spill. 3. Establishment of FOBs is required to support the mobilisation/deployment and execution of marine, aviation and shoreline response strategies. 4. The Strategic SIMA and BROPEP BOD/FAC identified that these strategies may be required to be executed early in the response (depending on the scenario). Noting the long-lead times for deployment of these response strategies, pre-deployment of equipment and personnel to a FOB will reduce timeframes between 'need identified' and 'response strategy deployed', which is especially important given the geographic isolation of the Browse/Bonaparte basins. 5. The Strategic SIMA and BROPEP BOD/FAC determined that these response strategies can (under the right circumstances) be used to reduce the environmental impact of a Group IV spill. Rapid deployment provides the highest likelihood of successful use of these strategies. 6. SSDI may be required for condensate spills, primarily to reduce VOC risks for debris clearance/capping stack deployment activities. Early mobilisation of SSDI spread ensures this activity is not on 'critical path' for other source control activities. 7. A risk assessment and HSE plan is required to be prepared, in order to assess the particular HSE risks associated with each relevant response strategy for the spill scenario. 8. OSRO's and mutual aid organisations provide expertise and additional manpower into the IMT and field response capability. 9. It is important to maintain regulatory and stakeholder relationships.
24 – 72 Hours	1. Maintain and reinforce an IMT with appropriate oil spill response trained personnel including mutual aid capabilities for specialist oil spill roles 2. Maintain situational awareness of spill trajectory, weathering, and any potential environmental impacts. 3. Support the mobilisation/deployment of response strategies/field capabilities through FOBs. 4. Continue the pre-deployment of shoreline assessment/response capabilities including SCAT, OWR, resource protection, and shoreline clean-up resources to FOB in anticipation of future deployment. 5. [Group IV spill only] – Mobilise/activate at sea response strategies, including: • continue in-field vessel based dispersant spraying • continue mobilisation and/or commence FWAD spraying from a nominated airfield along Kimberley coastline • continue mobilisation of C&R capability from Broome/Darwin port – commence operations in the field if possible. 6. [Well blow-out only] – Mobilise SSDI spread to FOB. 7. Review hazard assessments and execute HSE plans for operational activities.	1. As above – ongoing. 2. As above – ongoing. 3. The IMT objective has shifted from establishing the FOBs to the operational activity taking place from these locations. 4. As above – ongoing. 5. Ongoing at sea response strategy operations should continue, based on a positive demonstrable environmental outcomes and weather conditions conducive to safe operations. 6. As above – ongoing. 7. The IMT objective now includes the ongoing conduct of risk assessments and preparation of a HSE plans, as well as the execution and ongoing review of the HSE plan for operational response strategies.
72 – onwards	1. Maintain an IMT with appropriate oil spill response trained personnel including mutual aid capabilities for specialist oil spill roles. 2. Maintain situational awareness of spill trajectory, weathering, and potential environmental impacts. 3. Support the mobilisation/deployment of response strategies/field capabilities through FOBs.	1. As above – ongoing. 2. As above – ongoing. 3. The IMT objective has shifted from establishing the FOBs to the operational activity taking place from these locations. 4. As above – ongoing.

Operational period	IMT spill response objectives	Rational / justification
	4. Continue the pre-deployment of shoreline assessment/response capabilities including SCAT, OWR, resource protection and shoreline clean-up resources to FOB in anticipation of future deployment. As directed by the relevant State/Territory Control Agency, commence deployment of shoreline assessment/response capabilities into the field. 5. [Group IV spill only] – Mobilise/activate at sea response strategies, including: • continue in-field vessel-based dispersant spraying. • continue mobilisation and/or commence FWAD spraying from a nominated airfield along Kimberley coastline. • commence/continue with C&R activities in the field. 6. [Well blow-out only] – Mobilise SSDI spread to FOB. 7. Review hazard assessments and execute HSE plan for operational activities.	5. The pre-deployment of resources to the FOB is ongoing. The relevant State/Territory Control Agency will determine the timing for actual activation of shoreline assessment and response capabilities from the FOB to the field. 6. As above – ongoing. 7. As above - ongoing.

Table 3-2: IMT capability assessment

IMT Function	IMT Outputs 0-24 hours	IMT composition 0 – 24 hours	IMT Outputs 24 – 72 hours	IMT composition 24 – 72 hours	IMT Outputs 72 hours – steady-state	IMT composition 72 hours – steady-state
Control / Leadership Function	24/7 coverage (night & day shift) Lead the IMT to safely undertake oil spill preparedness and response consistent with plans, scenario and stakeholder needs.	4 x IMT Leader personnel (1 x IMT Leader + 1 x Deputy per day shift and per night shift,	As per previous shift.	As per previous shift.	As per previous shift.	As per previous shift.
Liaison Function	Liaison Officer (LO) movement to required agencies. Ensure that operations are responsive to State/Territory and Commonwealth government's and other stakeholder needs. Ensure timely mechanisms are in place to communicate these needs between INPEX IMT and the relevant external agencies/stakeholders.	1 x LO with relevant WA/NT Control Agency 1 x LO with National Offshore Petroleum Safety and Environmental Authority (NOPSEMA)/Offshore Petrolium Incident Coordination Committee	As per previous shift. Ensure lines of communication and schedules of meetings are established. Ensure any INPEX IMT support required to relevant State/Territory Control Agency is defined. Provide ongoing briefings/updates back to the INPEX IMT.	1 x LO with relevant WA/NT Control Agency 1 x LO with NOPSEMA / OPICC	As per previous shift.	As per previous shift.
Safety Function	Initial risk assessments of surveillance, monitoring and visualisation (SMV) and at sea response strategies. Commence preparation of HSE plans for SMV and at sea response strategies.	2 x Safety Function personnel	SMV and at sea response strategy HSE Plans completed and communicated to site. Establish system for ongoing monitoring/review of safety of field response activities. As required, commence risk assessment for other response strategies (e.g. shoreline, OWR and operational and scientific montioring program (OSMP)).	3 x Safety Function personnel (2 x day-shift and 1 x night-shift)	Continue to communicate any updated HSE plans to site. Continue to monitor/review safety of field response activities. Establish HSE communication and reporting with FOBs.	As per previous shift.
Media & Public Information Function	Preparing and releasing media holding statements. Assisting with press-conference preparation. Engagement with regulatory agency media/communications personnel. Engagement with general press-media.	2 x Media/Public Affairs personnel (day-shift only)	As per previous shift.	As per previous shift.	As per previous shift.	As per previous shift.
Planning Function	Situation awareness processes established.	3 x Planning Function Lead (2 x day-shift & 1 x night-shift)	Ongoing facilitation of planning 'P' process. Ongoing development/review of IAP documentation.	As per previous shift.	As per previous shift.	As per previous shift.

IMT Function	IMT Outputs 0-24 hours	IMT composition 0 – 24 hours	IMT Outputs 24 – 72 hours	IMT composition 24 – 72 hours	IMT Outputs 72 hours – steady-state	IMT composition 72 hours – steady-state
	Establish chain of communication within the Planning Function, arrange meetings schedules and drive the planning 'P' process. Commence IAP development and distributed for the following operational period (aims, objectives, strategies, tactics, tasks and resources appropriately detailed for the scenario – typically starting with SMV and at-sea response).		As required, commence IAP process for other response strategies (e.g. shoreline, OWR and OSMP). Termination end points established and agreed for selected/activated response strategies.			
Intelligence/Situation Unit (including Common Operating Picture/GIS function)	Gain and maintain situational awareness, via updating the situational tools. Establish COP including: • field assets (facilities, vessels, aviation) • OSTM • surveillance outputs • environmental sensitivities. Spill tracking buoys outputs Develop maps/diagrams as requested by IMT, for internal planning, and external communications.	2 x Intelligence/Situation Unit (1 x day-shift and 1 x night-shift)	Ongoing receipt, recording and distribution of infield response information updates. Ongoing use/update of the COP. Ongoing development of maps/diagrams as requested.	3 x Situation Unit (2 x day-shift and 1 x night-shift)	As per previous shift.	As per previous shift.
Environment Function (including OSTM and Resources at Risk functions)	Support initial notifications to regulators/stakeholders. Complete initial Operational SIMA. Activate OSTM, and analyse initial results. Support activation of other SMV (satellite tracker buoys, satellite imagery, etc.) Conduct resources at risk assessment. Assist Planning Function Lead with development of IAP tasking for SMV and at-sea response strategies. Review BROPEP commitments and compliance. Group IV spills only: • Support Operations with activation of vessel dispersant capability. • Support Operations and Logistics with activation of FWAD capability.	3 x Environment Function (2 x day-shift and 1 x night-shift)	Provide SMV data to OSTM provider – ongoing OSTM runs/model validation. Utilise SMV, OSTM outputs and other situational awareness data to inform ongoing re-validation of Operational SIMA / response strategy selection. Continue to support IAP development. Discuss/agree termination end points for activated response strategies. Ongoing review of BROPEP commitments and compliance.	As per previous shift.	As per previous shift. Assist Operations to monitor the ongoing effectiveness of at sea response strategies against termination criteria.	As per previous shift.

IMT Function	IMT Outputs 0-24 hours	IMT composition 0 – 24 hours	IMT Outputs 24 – 72 hours	IMT composition 24 – 72 hours	IMT Outputs 72 hours – steady-state	IMT composition 72 hours – steady-state
	• Support Logistics with identification of suitable at-sea C&R vessels and mobilisation of C&R capability.					
SCAT Function	In consultation with LO, establish direct liaison with relevant State/Territory Control Agency SCAT personnel. Agree SCAT data recording processes,systems andtools. Agree industry vs State/Territory Control Agency available SCAT/shoreline response resources/personnel. Provide logistics with specifications of suitable remote response SCAT/shoreline vessels/platforms. Commence early mobilisation of SCAT/shoreline response resources/personnel to FOB.	1 x SCAT Function (day-shift only)	Support Planning and Safety with development of SCAT and shoreline response HSE plans and IAP documentation. Support logistics with identification/selection of suitable remote response SCAT/shoreline response vessels/platforms. As relevant, support ongoing mobilisation of SCAT response resources/personnel to FOB. Support relevant Control Agency with any requested tasks (e.g. commence sectorisation/segmentation of any potentially affected shorelines).	2 x SCAT Function (day-shift only)	Continue to support Planning and Safety with development of SCAT HSE plans and IAP documentation. As relevant, ongoing mobilisation of SCAT resources/personnel to FOB or into the field as required. Commence monitoring/assessment of incoming SCAT data, to inform shoreline response and OWR planning.	3 x SCAT Function (2 x day-shift and 1 x night-shift)
Shoreline Response Program Function		1 x Shoreline Response Program Function (day-shift only)	As relevant, support ongoing mobilisation of shoreline response resources/personnel to FOB. Support relevant Control Agency with any requested tasks (e.g. preparation of shoreline treatment recommendations, or review of tactical response plans for potentially affected shorelines).	4 x Shoreline Response Programme Function (2 x day-shift and 2 x night-shift)	Continue to support Planning and Safety with development of shoreline response HSE plans and IAP documentation. As relevant, ongoing mobilisation of shoreline response resources/personnel to FOB or into the field as required. Support Operations and Shoreline Response Function with ongoing execution of shoreline response activities.	6 x Shoreline Response Program Function (4 x day-shift and 2 x night-shift)
OSMP Program Coordinator	Commence notification/activation of OSMP Contractor. Evaluate situational awareness information against OSMP activation triggers to determine relevant operational monitoring programs (OMs) for immediate activation. Provide logistics with specifications of suitable OSMP vessels/platforms.	1 x OSMP Function (day-shift only)	Support Planning and Safety with development of OSMP HSE plans and IAP documentation. As relevant, support ongoing mobilisation of OSMP resources/personnel to FOB.	1 x OSMP Function (day-shift only)	Continue to support Planning and Safety with development of shoreline response HSE plans and IAP documentation. As relevant, ongoing mobilisation of shoreline response resources/personnel to FOB or into the field as required.	1 x OSMP Function (day-shift only)

IMT Function	IMT Outputs 0-24 hours	IMT composition 0 – 24 hours	IMT Outputs 24 – 72 hours	IMT composition 24 – 72 hours	IMT Outputs 72 hours – steady-state	IMT composition 72 hours – steady-state
					Support OSMP contractor with ongoing execution of OM mobilisation/activation activities.	
Operations Function Lead	Establish chain of communication within the Operations Function. Support Planning as required with the planning 'P' process. All spills – immediately activate SMV: • Opportunistic visual surveillance from helicopters, vessel and facilities. • Coordinate satellite tracker buoy deployments. Group IV spills only: • Activation of vessel-based dispersant capability. • Activation of FWAD capability. • Activation of at-sea C&R capability.	3 x Operations Function Leads (2 x day-shift and 1 x night-shift)	Ensure ongoing field operations are undertaken consistent with the IAP (connection from the high-level objectives / strategies to tactics / tasks / resources). Ensure ongoing field operations are conducted safely, in accordance with the HSE plans. Provide Operations Function support as part of IAP and HSE plan development for the following operational period. Ensure IAP and HSE plans are effectively communicated to field teams for the following operational period.	As per previous shift.	As per previous shift.	As per previous shift.
Aviation Function NOTE: FWAD only required for Group IV spills	Coordinate/execute opportunistic aerial surveillance during the first daylight period. Support Planning and Safety with development of IAP and HSE plans for ongoing aerial surveillance and FWAD, including development of FWAD operations/tactical plans. Determine and commence liaison with nominated air-field for FWAD activities. Consult with other relevant aviation agencies (e.g. Australian Maritime Safety Authority (AMSA) and Civil Aviation Safety Authority) as required. Support Logistics to identify and mobilise suitable fixed-wing aircraft for air surveillance and FWAD Air Attack and SAR platforms, and relevant air operations personnel (oil spill aerial observers, air attack supervisors, etc.).	2 x Aviation Function (day-shift only)	Oversee/monitor execution of fixed-wing aerial surveillance flights. Continue mobilisation and commence execution of FWAD capability from nominated air-field. Monitor aerial dispersant usage and coordinate resupply. Coordinate aviation support for remote shoreline response operations. Ensure all aviation operations are undertaken in accordance with the IAP and HSE plans. Provide support to Planning and Safety as part of ongoing IAP and HSE plan development/review for the following operational period.	4 x Aviation Function (3 x day-shift and 1 x night-shift)	As per previous shift.	As per previous shift.
Marine Function	Directly supervise activation of vessel dispersant capability.	2 x Marine Function (day-shift only)	Oversee/monitor ongoing execution of vessel-based dispersant activities.	3 x Marine Function (2 x day-shift and 1 x night-shift)	As per previous shift.	4 x Marine Function (3 x day-shift and 1 x night-shift)

IMT Function	IMT Outputs 0-24 hours	IMT composition 0 – 24 hours	IMT Outputs 24 – 72 hours	IMT composition 24 – 72 hours	IMT Outputs 72 hours – steady-state	IMT composition 72 hours – steady-state
NOTE: Vessel Dispersant and At-Sea Containment and Recovery only required for Group IV spills.	Support Logistics with activation/mobilisation of C&R capability. Support Planning and Safety with development of IAP and HSE plans for ongoing marine operations.		Monitor vessel-based dispersant usage and coordinate resupply. Coordinate marine support for remote shoreline response operations. Continue mobilisation and commence execution of at-sea C&R capability. Monitor and support waste recovery and backload. Ensure all marine operations are undertaken in accordance with the IAP and HSE plans. Provide support to Planning and Safety as part of ongoing IAP and HSE plan development/review for the following operational period. Provide support as needed / directed by relevant State/Territory Control Agency.		Oversee/monitor ongoing execution of at-sea response strategies (dispersant / C&R). Support mobilisation and oversee ongoing execution of remote shoreline response activities supported by vessel logistics.	
Shoreline Response Function (including protection of sensitive resources, and shoreline clean-up function)	Not applicable during first operational period – covered by Planning Shoreline Response Function.	Not applicable.	Provide support to Planning and Safety as part of IAP and HSE plan development/review for the following operational period. Provide support as needed / directed by relevant State/Territory Control Agency.	1 x Shoreline Response Function (day-shift only)	Oversee/monitor ongoing execution of shoreline response activities. Monitor usage and coordinate resupply of shoreline response consumables. Monitor and support waste recovery and backload. Continue mobilisation and commence execution of at-sea C&R capability. Ensure all marine operations are undertaken in accordance with the IAP and HSE plans. Provide support to Planning and Safety as part of ongoing IAP and HSE plan development/review for the following operational period.	4 x Shoreline Response Function (3 x day-shift and 1 x night-shift)
Oiled Wildlife Response Function	Coordinate initial OWR personnel to support first remote SCAT team	1 x OWR Function Day-shift only.	Interace with relevant govt agencies to acquire wildlife permits	2 x OWR Function Day-shift only.	As per previous shift. Provide ongoing support to in-field OWR activities.	2 x OWR Function Day-shift only.

IMT Function	IMT Outputs 0-24 hours	IMT composition 0 – 24 hours	IMT Outputs 24 – 72 hours	IMT composition 24 – 72 hours	IMT Outputs 72 hours – steady-state	IMT composition 72 hours – steady-state
	Interface and arrange communicaiton protocols with relevant State/Territory Control Agency/wildife agency Interface with relevant wildlife experts/subject matter experts, to assist in defining OWR priorities and provide input to SIMA processes.		Development OWR implementation documentation, including IAP/tasking assignments, and other key OWR implementation tools. Interface with HSE to assist with development of safety plans for OWR. Interface with waste mgt, to coordinate OWR waste management plans. Interface with logistics to define OWR logistical support requirements. Interface with OSROs and government agencies to identify and mobilse additional personnel for OWR SCAT support and other OWR field response personnel.		Ensure operations remain consistent with permits and other OWR IAP and implementation tools. Provide support to Planning and Safety as part of ongoing IAP and HSE plan development/review for the following operational period.	
Waste Function	Support Marine Function and Logistics with planning and establishment of liquid waste logistics chain, in support of C&R activities.	1 x Waste Function (day-shift only)	Provide ongoing support to C&R liquid waste management. Support Planning, Operations, Shoreline Response Functions and Logistics with establishment of solid, liquid and bio-hazard waste logistics chains, in support of shoreline and wildlife response activities. Execute third-part waste management capabilities, as required for receipt of various waste streams. Provide input into IAP and HSE plans, as related to waste management issues.	As per previous shift.	Track/monitor waste volumes generated from response strategies. Provide ongoing support including oversight of third-party waste management contractors for the onshore receival and disposal of various waste streams. Ensure operations remain compliant with relevant State/Territory waste management regulations. Provide input into IAP and HSE plans, as related to waste management issues.	As per previous shift.

IMT Function	IMT Outputs 0-24 hours	IMT composition 0 – 24 hours	IMT Outputs 24 – 72 hours	IMT composition 24 – 72 hours	IMT Outputs 72 hours – steady-state	IMT composition 72 hours – steady-state
Logistics Function	Establish marine, shoreline and aviation FOBs. Support execution of SMV and at-sea response strategies during first operational period. Commence sourcing/mobilisation of marine, aviation and shoreline assets, equipment and personnel, as required.	2 x Logistics Function Leads (1 x day-shift and 1 x night-shift) 8 x general logistics support personnel (all-hazards IMT training only) (4 x day-shift and 4 x night-shift)	Continue to mobilise marine, aviation and shoreline assets, equipment and personnel, as required. Ensure waste management contracts established.	As per previous shift.	As per previous shift.	As per previous shift.
Finance & Admin Section Chief	As part of all-hazards response processes: • Ensure financial Delegation Of Authorities are in established for the duration of the response. • Establish cost-codes and coordinate emergency purchase order approvals using INPEX Business management system processes, for the duration of the response. • Establish and maintain cost-tracking processes within the INPEX business management system, for duration of the response.	1 x Finance/Admin Lead 1 x Finance/Admin support (day-shift only).	As per previous shift. Ensure funding sources are available for long-duration response. Ensure relevant insurance arrangements are considered/activated.	As per previous shift.	As per previous shift.	As per previous shift.

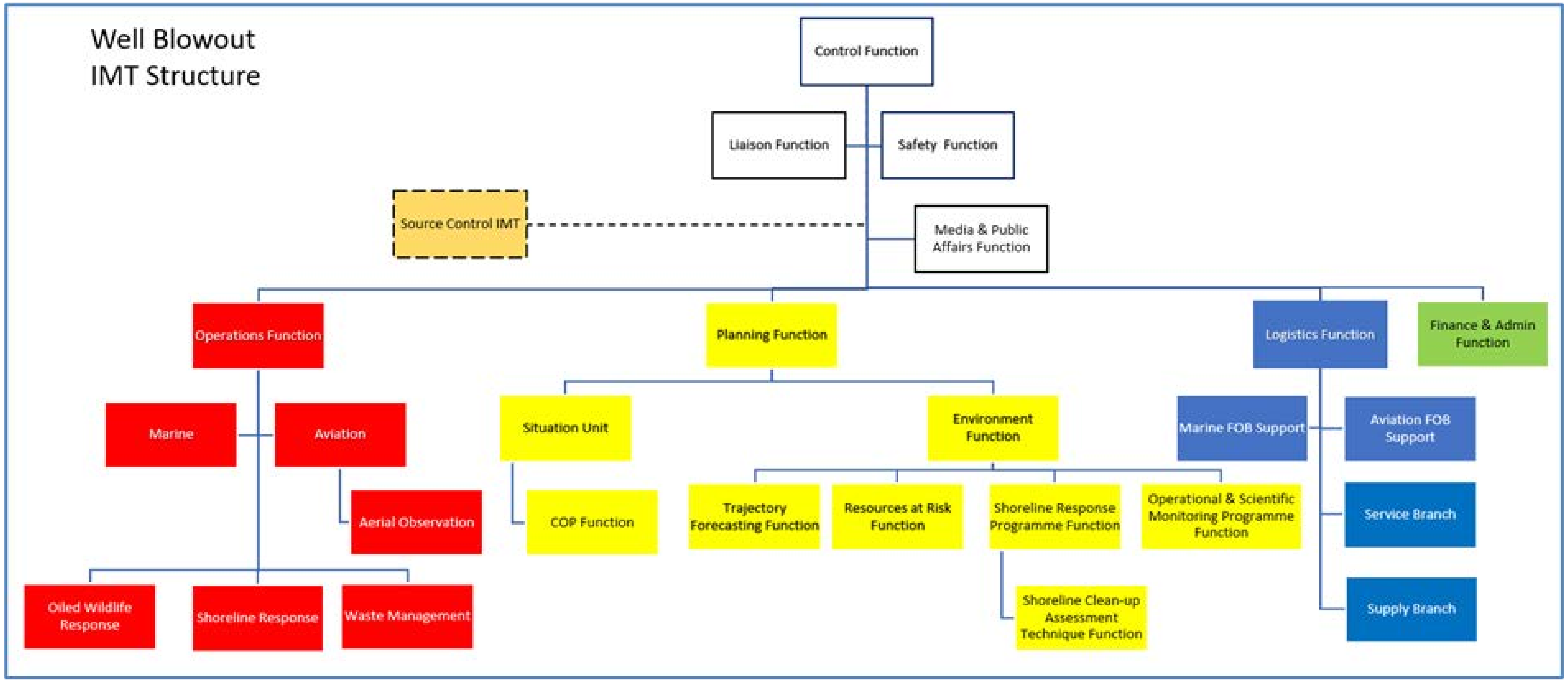

Figure 3-1: Example IMT structure – condensate well blowout scenario

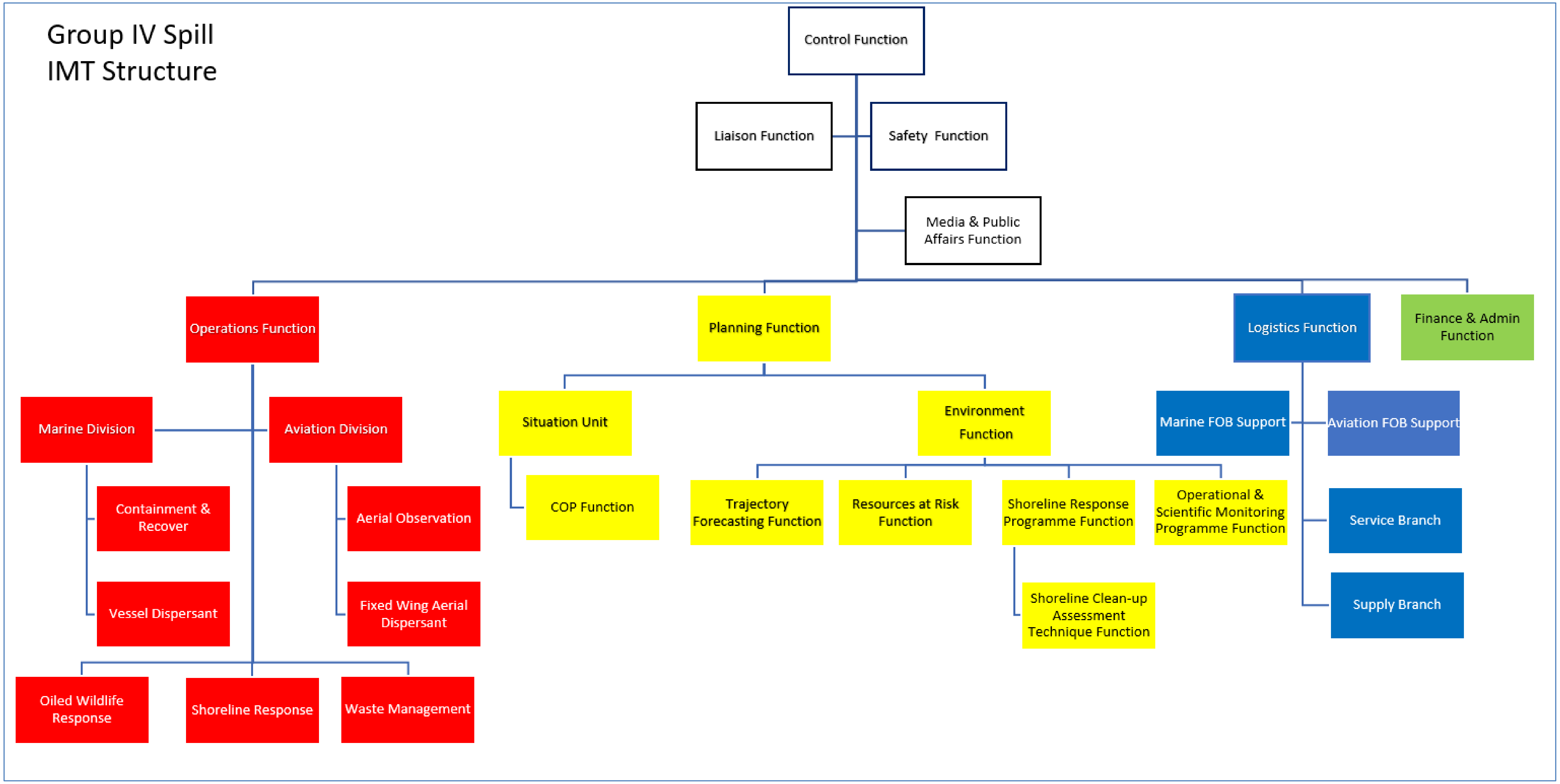

Figure 3-2: Example IMT structure – Group IV spill scenario

3.3 WA DoT cross-jurisdiction response – IMT capability evaluation

The IMT capability assessment presented in Table 3-2 has assessed the full IMT capability required to develop all the IMT outputs required to support all possible response strategies for the WCSSs, including all shoreline-based response activities. The full IMT may need to be provided by the TH IMT; for example if responding at Ashmore Reef/Cartier Island (where the TH is the Control Agency for shoreline response), or in the Northern Territory (NT) where significant IMT support from the NT government isn't expected to be provided.

However, during a WA cross-jurisdiction response scenario with a spill from TH activities entering WA State waters, the WA DoT is the Control Agency for the relevant shoreline based response strategies/tactics. Further details of WA DoT and TH responsibilities during a cross-jurisdiction response are defined in WA DoT IGN Rev 5 (WA DoT 2020), Appendix 2 *IMT Functions and 'Lead IMT' Designations*.

During a cross-jurisdiction response, a number of the IMT outputs and capabilities defined in Table 3-2 would typically be conducted by the WA DoT. However, the WA DoT would still be supported by with key TH IMT personnel. WA DoT (2020) Appendix 3 *Initial DoT IMT Personnel Requirements upon Petroleum Titleholder* specifically requires the TH to provide 11 initial personnel to fulfill specific roles within the WA DoT incident management structures.

Table 3-3 presents an evaluation of the impact of WA DoT (2020) Appendix 3 requirements on the IMT capability assessment presented in Table 3-2. Specifically Table 3-3;

- defines the WA DoT IMT roles to be filled by TH IMT
- reviews IMT personnel/capability specified in Table 3-2
- evaluates if sufficient IMT capability has already been accounted for in Table 3-2 to meet the WA DoT IMT requirements, or if additional capability would be required.

The outcome of the evaluation presented in Table 3-3 identified that additional personnel would be required in the following roles:

- Deputy Intelligence Officer
- Environment Support Officer
- Deputy Public Information Officer
- Deputy Finance Officer
- Deputy Division Commander

Table 3-3: WA DoT cross-jurisdiction scenario evaluation against the IMT capability assessment

WA DoT Requirement	Table 3-2 capability assessment	Outcome
CMT Liaison Officer	Table 3-2 already includes the WA DoT Liaison Officer role.	No additional Liaison Officer required, as sufficient depth of capability is already accounted for in Table 3-2.
Deputy Incident Controller	Table 3-2 includes 4 x IMT Lead/Deputy, of which one could be appointed to WA DoT, as related to the shoreline response elements of the response.	No additional IMT Leaders required, as sufficient depth of capability is already accounted for in Table 3-2.
Deputy Intelligence Officer	Table 3-2 provides for 3 x intelligence/situation unit personnel, managing the whole response.	One additional Intelligence Office/Situation Unit person would be required to support the WA DoT IMT.
Environment Support Officer	Table 3-2 provides for 3 x Environment Team personnel, managing the whole response.	One additional Environment Support Officer would be required to support the WA DoT IMT.
Deputy Planning Officer	Table 3-2 provides for 3 x planning function leads (two dayshift, one night-shift). However it also provides for provides a total of 3 x Planning-SCAT and 6 x Planning - shoreline response programme function. Trained shoreline response program function personnel would be able to provide deputy planning officer support to the WA DoT for shoreline response planning activities.	No additional Planning Officer required, as sufficient depth of shoreline response planning capability is already accounted for in Table 3-2.
Deputy Public Information Officer	Table 3-2 provides for 2 x media/public affairs personnel working dayshift only managing the whole response.	One additional media/public affairs officer would be required to support the WA DoT IMT.
Deputy Logistics Officer	Table 3-2 provides for 10 x logistics personnel. One would be appointed to the WA DoT, to support shoreline response logistics.	No additional Logistics Officer required, as sufficient depth of shoreline response logistics capability is already accounted for in Table 3-2.
Deputy Finance Officer	Table 3-2 provides for 2 x Finance/Admin team managing the whole response.	One additional Finance Officer would be required to support the WA DoT IMT.
Deputy Operations Officer	Table 3-2 provides 4 x Ops – Shoreline Response Function. One would be appointed to the WA DoT, to support shoreline response operational activities.	No additional Operations Officer required, as sufficient depth of shoreline response operations capability is already accounted for in Table 3-2.

Deputy Waste Management Coordinator	Table 3-2 provides for 1 x waste management but also 10 x logistics personnel. Logistics trained personnel typically are able to undertake/manage waste management, and therefore logistics personnel could be appointed to WA DoT.	No additional Waste Management Coordinator required, as sufficient Logistics/Waste Management capability is already accounted for in Table 3-2.
Deputy Division Commander	Not considered as part of the IMT capability assessment.	One additional Deputy Division Commander would be required to support the WA DoT IMT.

4 INPEX IMT CAPABILITY AND ARRANGEMENTS

INPEX adopts the emergency management principles of prevention, preparedness, response, recovery (PPRR). The aim of PPRR is to ensure that risks are identified and minimised; plans to respond are developed and practised; and recovery plans are in place.

Preparedness also includes ensuring that there are competent personnel available to respond to and manage emergency events and that their competence is maintained through regular training. INPEX achieves this through its adoption of competency-based training and annual 'crisis and emergency' exercise plans.

4.1 INPEX IMT process overview

INPEX maintains a trained and ready IMT and CMT and are guided by the Incident Management Plan (0000-AH-PLN-60005) and the Crisis Management Plan (0000-AH-PLN-60004). The structures and processes described in these plans are aligned to the Australian Interagency Incident Management System.

The IMT Leader is responsible, and has the financial authority, for the activation and mobilisation of all necessary emergency response capabilities under the 'manual of authority'.

The IMT provides operational management support, and the CMT provides strategic direction to protect reputation and sustain business continuity. The IMT and CMT teams are large enough so that, during an emergency event, a roster can be operated to avoid fatigue and maintain staff health and well-being.

INPEX maintain an IMT capability of over 100 personnel, between the Perth and Darwin IMTs, all of whom are trained as 'all-hazards' personnel. Selected personnel have also been provided with additional oil spill training, aligned with the IMO-II/III courses, also including course elements tailored to INPEX's previous OPEP arrangements, and capability sufficient to meet INPEX's previous IMT oil spill capability commitments.

There are Emergency Response Plans (ERP) for the Ichthys central processing facility (CPF), floating production storage and offloading facility (FPSO) and any mobile offshore drilling unit (MODU; Drilling Contractor ERP) and all contractor vessels that are implemented by the relevant facility/vessel ERT.

Communication between INPEX CMT, IMT and ERTs utilise normal business communication processes. A fibre-optic cable is connected between the Ichthys CPF & FPSO and mainland, to ensure high-speed and reliable communication between Perth and offshore assets. MODUs and large vessels will use high-speed satellite communication links. Secure communication between vessels and offshore platforms can be managed via the TETRA VHF radio systems.

INPEX and contractors nominate and train workplace personnel to form facility and vessel-based ERTs. These will be coordinated by the relevant person in charge (Offshore Installation Manager (OIM) or vessel master) to ensure that there is adequate emergency service cover on board at all times.

The INPEX senior site representatives, and Contractor OIMs and vessel masters will be the points of contact between assets within the petroleum permits and licence areas and the INPEX IMT.

The IMT leader is the point of contact between the IMT and the CMT.

Contractors are required to notify the relevant INPEX field manager/client representative of any emergency.

The INPEX all-hazards emergency response structure (as defined in the INPEX Incident Management Plan (0000-AH-PLN-60005), is presented in Figure 4-1. The exact IMT structure which would be used during an oil spill event would be driven by a number of factors including:

- the nature of the incident/event which caused the oil spill (and any associated safety/people related hazards being managed simultaneously)
- type, nature and scale of the oil spill event
- cross-jurisdictional situations; such as requirement for INPEX as the Control Agency to manage shoreline response at Ashore Reef/Cartier Island, or to provide significant shoreline response IMT capability for spills on NT shorelines, compared with a WA shoreline scenario, where the WA DoT IMT will be the Control Agency for shoreline response activities.

The INPEX IMT Leader may, at their discretion, appoint functional 'Deputy Lead' personnel within the INPEX IMT structure, depending on the complexity, nature and scale of the event.

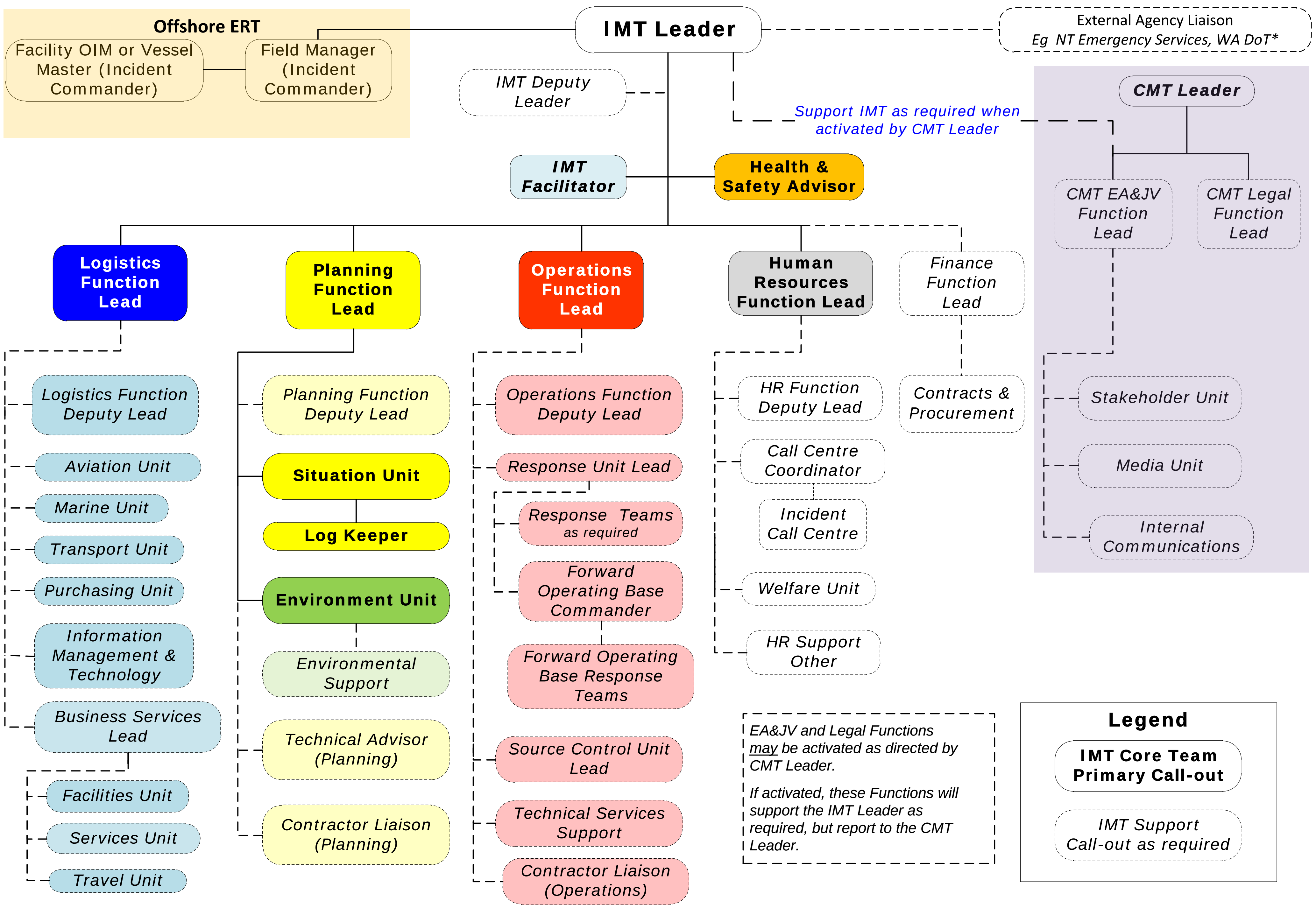

Figure 4-1: INPEX IMT structure

* Department of Transport (WA) NT Department of Infrastructure, Planning and Logistics (NT DIPL) have the legal right to transfer Control Agency from Titleholder to DoT for level 2/3 oil spills impacting within State or Territory waters. WA DoT will appoint a WA DoT IMT Leader responsible for managing an oil spill impacting WA state waters in accordance with the State Hazard Plan Maritime Environmental Emergencies. INPEX resources will be made available to support the WA DoT 'cross jurisdictional arrangements', as specified under the State Hazard Plan Maritime Environmental Emergencies (WA DoT 2021), if requested by WA DoT. NT DIPL will appoint a NT DIPL Incident Controller (in accordance with the NT Oil Spill Contingency Plan cross jurisdiction interim arrangements) to interface with the INPEX IMT where NT waters may be impacted by a spill. The NT DIPL Incident Controller will become the control agency, supported by the INPEX IMT, if a spill reaches NT shorelines.

Note, the IMT structure presented is flexible and is to be collapsed or expanded at the discretion of the IMT Leader depending on the nature and scale of an emergency.

4.2 OSRO Arrangements

As presented in Section 3 of this document, INPEX may require up to 60 personnel over a 24 hour period in the IMT, for a WCSS. Additional personnel would be required to support the WA DoT during a WA cross-jurisdiction response scenario, as discussed in Section 3.3. Under a WCSS, the response may be ongoing for several weeks/months, and therefore, a total of approximately 100 personnel may be required (assuming IMT personnel work 2 weeks on, 1 week off).

Therefore, INPEX maintains contractual arrangements with the OSRO's of AMOSC and Oil Spill Response Limited (OSRL), which include the provision of technical specialists to supplement the INPEX IMT.

4.2.1 AMOSC Arrangements

INPEX maintains an 'associate' membership with AMOSC. This arrangement provides INPEX will access to the AMOSC personnel and the AMOSC Core-Group, under AMOSPlan.

The AMOSC Core-Group is an Australian industry initiative that was initially crafted in 1992. It is unique within the international context and is noted for being innovative and effective to rapidly expand and surge well trained personnel into a spill response. The AMOSC Core-Group has attended most Australian-based spills and also several offshore spills.

The AMOSC Core-Group has around 30-40 IMT personnel and 50-70 field operators.

AMOSC Core Group policy requires all Core-Group personnel to undertake initial training, followed by competency re-validation/training every 2 years.

Typically, AMOSC manage the Core-Group re-validation/training by conducting 3 x 1 week Core-Group training/workshops per year.

AMOSC coordinates the routine testing, monitoring and monthly reporting of Core-Group personnel availability.

4.2.2 OSRL Arrangements

INPEX Corporation (based in Tokyo) maintains a contract with OSRL. This provides all INPEX global companies, including INPEX Australia, with access to OSRL's additional IMT capability.

The OSRL service level statements provides for:

- 24/7 call-out arrangements.
- Guaranteed initial response from OSRL of 5 technical support personnel (IMT or field personnel) for 5 days.
- Surge to 18 OSRL personnel, upon request from the INPEX IMT.
- Depending on size/complexity, OSRL maintain 80 response team personnel globally, who are potentially able to be provided to support an ongoing Level 3 event, on a best-endeavours basis.

OSRL service level statement defines the types of services provided by the 18 person surge capability as:

- Technical advice and incident management coaching within the command centre.
- Development of an Incident Management Plan.
- Tier 1 / 2 equipment readiness and training of contractors.

- In-country logistics planning and support for inbound equipment.
- Impact assessment and advice on response strategy selection.
- SCAT and aerial surveillance / quantification surveys.
- Tactical response planning.

4.3 INPEX and OSRO IMT capability

INPEX will not maintain the in-house capability to fulfill all of the roles expected to be needed in an oil spill, but will instead call upon the OSRO's to fulfil certain roles within the INPEX IMT.

INPEX's all hazards IMT structure is presented in Figure 4-1. INPEX's IMT structure would be amended, as required, to address the spill response scenario, depending on the nature and scale of the event. This includes the incorporation of OSRO IMT personnel within the INPEX IMT, and in support of other external agencies (e.g. WA DoT during a cross-jurisdiction response, as required).

Table 4-1 presents an analysis of the total IMT capability requirement, using the IMT personnel numbers defined in Table 3-2, and the additional personnel requirements defined in Table 3-3 for WA cross-jurisdiction response arrangements. The peak IMT capability column in Table 4-1 includes 1.5 x multiplication factor (rounded up to the next whole number), to account for a 2 week-on, 1 week-off shift arrangement. Table 4-1 also defines where the IMT personnel will be sourced, either via the INPEX IMT or OSRO capabilities.

Table 4-2 presents a high level overview of the responsibilities between the INPEX IMT and OSRO personnel as related to each spill response strategy.

Figure 4-2 presents an indicative/example IMT resourcing curve, demonstrating how the INPEX and OSRO resources could be utilised to fulfill the IMT personnel requirements. Note, the numbers presented represent the combined day-shift and night-shift, over a 5 day ramp-up only.

The initial 24 hours would be dominated by INPEX and a small contingent of AMOSC and possibly OSRL (if required). As the IMT capability increases over the coming days, more of the OSRO support can be brought into the IMT, to facilitate the rotation of INPEX IMT personnel in and out of the IMT (commencing two week-on and one week-off rotations).

Table 4-1: INPEX and OSRO IMT capability requirements

Function	Total IMT capability requirement	INPEX IMT capability	INPEX IMT personnel requirement	OSRO capability requirement	OSRO personnel requirement
Control / Leadership Function	6	Provided by INPEX IMT Leaders.	4	Additional/supporting capability provided as required.	2
Liaison Function	3	Provided by INPEX IMT/CMT Leaders.	3	OSRO support not expected to be required.	0
Safety Function	5	Provided by INPEX IMT Health & Safety personnel.	5	OSRO support not expected to be required.	0
Media & Public Affairs Function	5	Provided the INPEX External Affairs/Joint Venture (EA/JV) Function.	5	OSRO support not expected to be required.	0
Operations Function	5	Provided by INPEX IMT Operations Function Leads.	3	Additional/supporting capability provided as required.	2
Operations Marine Function	6	Provided by INPEX IMT Operations Function personnel.	3	Additional/supporting capability provided as required.	3
Operations Aviation Function	6	Some capability provided by INPEX IMT Operations Function personnel.	1	Majority of capability provided by OSRO (only if FWAD capability activated).	5
Operations Shoreline Response Function	6	Not provided by INPEX IMT.	0	Capability provided by OSRO.	6

Function	Total IMT capability requirement	INPEX IMT capability	INPEX IMT personnel requirement	OSRO capability requirement	OSRO personnel requirement
Oiled Wildlife Response Function	3	Not provided by INPEX IMT.	0	Capability provided by OSRO.	3
Planning Function	6	Provided by INPEX IMT Planning Function Leads.	4	Additional/supporting capability provided as required.	2
Environment Function (including OSTM and resources at risk)	6	Provided by INPEX IMT Environment Function personnel.	5	Additional/supporting capability provided as required.	1
Shoreline Clean-up Assessment Technique Function	5	Not applicable.	0	Capability provided by OSRO.	5
Shoreline Response Programme Function	9	Not applicable.	0	Capability provided by OSRO.	9
Operational & Scientific Monitoring Programme Function	2	Provided by INPEX IMT Environment Function personnel.	2	OSRO support not expected to be required.	0
Situation Unit Function (including common operating picture/GIS)	6	Provided by INPEX IMT Situation Unit personnel.	4	Additional/supporting capability provided as required.	2
Logistics Function Lead	5	Provided by INPEX IMT Logistics Function Leads.	3	Additional/supporting capability provided as required.	2

Function	Total IMT capability requirement	INPEX IMT capability	INPEX IMT personnel requirement	OSRO capability requirement	OSRO personnel requirement
Logistics support (all-hazards trained only)	12	Provided by INPEX IMT Logistics 'all-hazards' personnel.	6	Additional/supporting capability provided as required.	6
Finance and Admin Function	5	Provided by INPEX IMT Finance and Admin Function personnel.	5	OSRO support not expected to be required.	0
TOTAL	**103**		**54**		**49**

Table 4-2: INPEX and OSRO responsibilities for each response strategy

Response strategy	INPEX IMT responsibilities	OSRO assistance tasks
Aerial surveillance	IAP/operational tasking document development Provision of aerial surveillance platforms (rotary wing and fixed wing). Provision of aviation FOB.	Assist INPEX IMT with IAP / operational tasking document development. Coordination of trained aerial observers (including AMOSC Core-Group and other industry mutual aid trained aerial observers). Review and interpretation of aerial surveillance reports. Communication of key aerial surveillance report information to INPEX IMT Planning team.
Vessel surveillance	Identification and tasking of opportunistic vessel/facility surveillance platforms.	Review and interpretation of vessel/facility surveillance reports. Communication of key vessel surveillance report information to INPEX IMT Planning team.
OSTM	Activate OSTM contractor. Facilitate information flow between OSTM contractor and any other relevant organisations.	Assist INPEX IMT with review of OSTM results, in consideration of resource protection priorities and response strategies selection (Operational SIMA).
Satellite tracker buoys	Activate satellite tracker buoy deployments. Access INPEX tracker buoy data and provide to OSTM contractor.	Coordination of additional satellite tracker buoys from AMOSC or other mutual aid sources. Access AMOSC/other tracker buoy data and provide to OSTM contractor via INPEX IMT.
Satellite imagery	Request satellite imagery acquisition via AMOSC, AMSA and/or OSRL.	Facilitate provision of satellite imagery from third-party satellite imagery providers. Assist with interpretation of the satellite imagery information, as related to response planning.
Vessel Dispersant	Authorise/activate initial vessel-based dispersant activities in Ichthys Field.	Provision of vessel dispersant re-supply stockpiles. Provision of ongoing operations support during vessel-based dispersant operations.
FWAD	Provision of FWAD air attack aircraft and SAR platform.	Provision of broader FWAD capability, and operational oversight of the FWAD activity.

Response strategy	INPEX IMT responsibilities	OSRO assistance tasks
SSDI	Water quality monitoring associated with SSDI is undertaken via the INPEX OSMP, coordinated by the INPEX IMT OSMP Function SSDI operations will be managed by Source Control IMT, as SSDI is used by INPEX as a safety control only, in support of other source control activities (debris clearance and capping stack installation).	Not applicable.
At Sea Containment and Recovery	Provision of support vessels with open/rolled stern, and other vessels as required. Overall supervision of at sea C&R activities.	Provision of C&R trained personnel. Provision of C&R equipment from OSRO stockpiles. Provide operational oversight of the in-field at sea C&R activities.
SCAT	Not applicable.	Support as requested by the relevant Control Agency. Provision of SCAT specialist.
Protection of Sensitive Resources	Provision of labour-hire personnel for remote protection and deflection (P&D) activities. Support as requested by the relevant Control Agency.	Provision of specialist P&D personnel.
OWR	Provision of labour-hire personnel for remote OWR activities.	Provide OWR Function specialist personnel. Support as requested by the relevant Control Agency. Provision of labour-hire personnel for remote OWR activities. Provision of OWR equipment from OSRO stockpiles.
Waste management	Provision of logistical support (vessels) to transport waste from at sea or remote shoreline locations, to port. Provision of land-based licenced waste contractor capability for onshore treatment/disposal of oily waste.	Provision of planning advice regarding likely waste volumes likely to be generated. Provision of at sea and shoreline waste management equipment and consumables.
Remote response support	Provision of multiple small support vessels for remote SCAT activities. Provision of multiple floating remote response platforms for large remotes shoreline clean-up/OWR/P&D activities.	Assist with selection of suitable vessels for remote response operations.

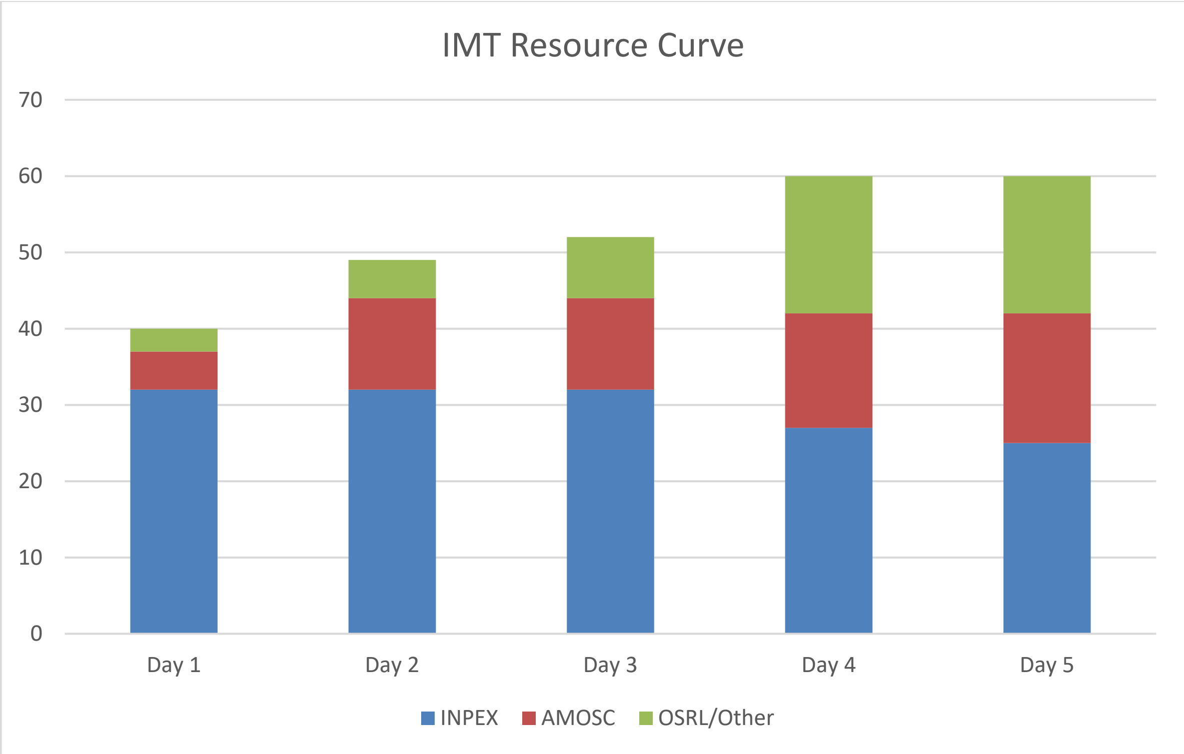

Figure 4-2: Indicative IMT resourcing curve

4.4 INPEX IMT training overview

The following section describes the training that will be provided to the INPEX CMT, IMT and relevant offshore personnel (facility and support vessels). of INPEX Australia's offshore exploration and production activities.

4.4.1 INPEX IMT and CMT training all hazards training

The INPEX Crisis Management Team all receive an in-house training package, which is tailored to align with the requirements of the INPEX Australia Crisis Management Plan (0000-AH- PLN-60004).

Specific functions identified within the IMT receive nationally accredited training in-line with the Australian Quality Training Framework.

The minimum training provision for an IMT Leader is *PMAOMIR418 – Coordinate Incident Response*, with the course material tailored to align with the INPEX Australia Incident Management Plan (0000-AH-PLN-60005).

The minimum training provision for the IMT Core Team (positions as defined in Figure 4-1) is *PMAOMIR320/322 - Manage Incident Response Information*, with the course material tailored to align with the INPEX Australia Incident Management Plan (0000-AH-PLN-60005).

4.4.2 INPEX IMT oil spill training

INPEX has utilised an IMO 2/3 aligned, bespoke oil spill training course, to train selected IMT personnel in spill response since 2016.

In 2021, the APPEA Oil Spill Preparedness and Response Working Group developed a new *APPEA Guidance Document: Incident Management Teams Knowledge Requirements for Responding to Marine Oil Spills* (APPEA 2021). At the time of preparation of this document, the APPEA (2021) guidance document was in a final draft version.

To ensure continuous improvement of all TH's individual IMT oil spill response capabilities, and to facilitate improved IMT oil spill mutual aid capabilities, APPEA (2021) Addendum #2 recommends all THs should develop an IMT oil spill training implementation program. Specifically, APPEA (2021) Addendum #2 recommends the following actions be undertaken:

1. mapping of THs current IMT oil spill training course to the APPEA (2021) knowledge requirements (including a review of current TH IMT oil spill course content against the APPEA (2021) Table 2 and Table 3 content, to identify gaps in THs current training materials)
2. updating of THs IMT oil spill training course materials, to align to the APPEA (2021) knowledge requirements, including the development of new training materials, development of updated oil spill exercises and competency assessment processes, updates to HR/training records systems etc
3. roll out of THs updated IMT oil spill training course to THs IMT personnel.

APPEA (2021) Addendum #2 has identified 24 months an appropriate maximum timeframe in which THs should take to complete the three steps above. Steps 1 and 2 combined should be undertaken within approximately 6 months, whilst the training roll-out (step 3) may take considerably longer (up to 18 months), depending on the numbers of TH IMT personnel who are required to undertake the new oil spill training.

INPEX is committed to the continuous improvement of its IMT oil spill capability. The INPEX IMT oil spill improvement work program will be developed, and will be aligned with the APPEA 2021 recommended timeframes.

APPEA (2021), Section 8 *EP Implementation* recommends all TH evaluate the range of training options available to impart the knowledge requirements to the various IMT functions. INPEX has undertaken an internal review of the various training and skills maintenance options, and has selected the following combination to maintain INPEX's IMT oil spill skills and competencies:

- online E-learning course
- function specific workshops
- 3 day BROPEP IMT oil spill training course
- IMT exercises

The training and skills maintenance tools will be mapped against the general and function specific knowledge requirements defined in Table 2 and 3 respectively of APPEA (2021).

The internal review determined that the majority of the INPEX IMT oil spill functions will be required to complete the 3 day IMT oil spill training course, with the exception of the following three functions:

- liaison function
- safety function
- media and public information function (INPEX EA/JV function)

These three functions will be initially trained via E-learning and function specific workshops only.

In addition, Finance and admin function personnel also require no oil spill specific training, and some logistics support capability can be provided by personnel with ‘all-hazards’ training only (as defined in Table 3-2).

Table 4-1 calculates the INPEX IMT requirement as 54 personnel (including coverage for 2 week-on, 1 week-off shift rosters and the WA DoT support personnel). When removing the INPEX IMT requirements for liaison function (3 personnel), safety function (5 personnel), media and public information function (5 personnel), finance and admin function (5 personnel), and logistics support personnel (6 x all-hazards only logistics trained personnel), the minimum number of INPEX IMT personnel requiring the 3 day IMT oil spill training course is 30 personnel. To ensure some redundancy, INPEX will train between 30 and 40 IMT personnel in the APPEA (2021) aligned 3 day BROPEP IMT oil spill training course.

It should be noted that INPEX maintains >100 IMT ‘all hazards’ personnel, and this additional capability would be able to be inducted/trained in the oil spill response functions, as the response transitions from a rapidly evolving reactive response phase to a more proactive, steady-state, project phase response.

Environmental Performance Outcomes and Standards which will be implemented for the INPEX CMT and IMT all-hazards and oil spill training program, aligned with the recommendations of APPEA (2021), are defined in Table 4-3.

4.4.3 Facility and vessel ERT training

Each facility and vessel ERT will maintain its own oil spill response training , commensurate with the risks and responses required. Vessel masters and the OIM will complete mandatory minimum requirements under the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 , which includes oil spill response training.

Vessel masters and OIMs will also ensure facility/vessel ERTs complete drills as scheduled in their relevant Contractor ERP, including shipboard oil pollution emergency plan (SOPEP) drills.

In addition, vessel bridge crews will be required to complete an the INPEX Support Vessels oil spill induction program.

4.4.4 CMT, IMT and ERT training, drills and exercises

The EPOs and EPSs associated with CMT, IMT and ERT training are presented in Table 4-3, with EPOs and EPSs associated with the testing of IMT response arrangements (i.e. IMT drills and exercises) presented in Table 4-4. EPOs and EPSs associated with the maintenance of IMT oil spill response tools are presented in Table 4-5.

Table 4-3: Environmental performance outcomes, standards and measurement criteria for emergency response training

Environmental performance outcome	Environmental performance standard	Measurement criteria
INPEX will be prepared and ready to respond to oil spill events.	OIM/vessel masters will complete mandatory minimum training requirements under the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 which includes oil spill response training.	Records of training
	Facility ERTs – conduct routine drills in accordance with the Facility ERPs, including SOPEP drills.	Records of training
	Vessel ERTs - conduct routine drills in accordance with the Vessel Contractor ERPs, including SOPEP drills.	Records of training
	All contracted support vessel ERT personnel will complete an INPEX oil spill induction.	Records of training
	INPEX CPF/FPSO senior leadership positions will complete the INPEX Offshore Facility and GEP EP and OPEP awareness training (e-learning), which includes the initial actions to be completed under any oil spill emergency situation.	Records of training
	INPEX CMT personnel will receive INPEX in-house CMT training, which is tailored to align with the requirements of the INPEX Australia Crisis Management Plan (0000-AH- PLN-60004).	Records of training
	INPEX IMT Leaders will have completed the INPEX tailored, nationally accredited course - PMAOMIR418 – *Coordinate incident response*.	Records of training
	INPEX IMT Core Team personnel will have completed the INPEX tailored, nationally accredited course - PMAOMIR320/322 - *Manage Incident Response Information*	Records of training
	INPEX IMT personnel will maintain their 'all hazards' skills through the following program:	Records of training

Environmental performance outcome	Environmental performance standard	Measurement criteria
	• complete an ‘all hazards’ desktop refresher training and desktop exercise annually • participate in a INPEX IMT activation exercise, every two years.	
	INPEX will develop a BROPEP tailored oil spill IMT training program, mapped to demonstrate the inclusion of the ‘general’ and ‘function specific’ knowledge requirements of the *APPEA Guidance Document: Incident Management Teams Knowledge Requirements for Responding to Marine Oil Spills* (APPEA 2021). The training program will include: • a training matrix of Functional positions, and oil spill initial and ongoing training requirements • an E-learning course ‘Introduction to the INPEX BROPEP’ • a 3-day BROPEP IMT oil spill training course • function specific workshops • other IMT oil spill drills/exercises. The training program will be developed over 6 months, commencing from the date of issuance of a Regulatory Advice Statement from NOPSEMA in relation to the APPEA (2021) document.. The roll-out of the initial training program will be completed 18 months after the completion of the development of the training program.	IMT oil spill training matrix BROPEP training program mapping against Table 2 & Table 3 of APPEA (2021) Training materials including E-Learning and 3-day course content Records of initial IMT oil spill training
	INPEX will develop an INPEX BROPEP 3-day training course, which is aligned with the APPEA (2021), Table 3 – Function Specific Oil Spill Knowledge Requirements & Skills.	INPEX BROPEP initial training course materials
	A minimum of four INPEX IMT Leaders will be provided initial IMT oil spill training, in the Leader/Command function, using the 3-day BROPEP IMT oil spill training course.	Records of training

Environmental performance outcome	Environmental performance standard	Measurement criteria
	26 - 36 INPEX IMT Core Functions personnel will be provided initial IMT oil spill training, in their relevant IMT Function, using the 3-day BROPEP IMT oil spill training course.	Records of training
	INPEX IMT Safety and Liaison Function personnel will complete the E-learning, plus a function specific workshop, as their initial training	Records of training
	INPEX IMT EA/JV personnel (media and public affairs function) will complete the E-learning only as their initial training.	Records of training
	All INPEX IMT oil spill trained personnel (except EA/JV and Liaison Function) will maintain their oil spill competency through the following competency/skills maintenance program: 1. Theory: • every second year, complete the online 'Introduction to the INPEX BROPEP' E-learning course; AND • every second year (alternate year to E-learning) – complete a function specific workshop, which is aligned with the APPEA (2021) Table 3 'Function specific knowledge requirements'. 2. Practical: • every second year, participate, in the oil spill functional position, within an INPEX desktop or activation exercise, using a BROPEP WCSS; OR • every second year, participate in a joint Titleholder, industry, AMOSC or government IMT exercise.	Records of training
	• INPEX IMT EA/JV oil spill personnel (media and public affairs function) will maintain their oil spill competency by repeating the Introduction to INPEX BROPEP E-learning course every two years.	Records of training

Environmental performance outcome	Environmental performance standard	Measurement criteria
	INPEX IMT Liaison function oil spill personnel will maintain their oil spill competency by: • every second year, complete the online 'Introduction to the INPEX BROPEP' E-learning course; AND • every second year (alternate year to E-learning) – complete a 'function specific' workshop, which is aligned with the APPEA (2021) Table 3 Function specific knowledge requirements.	Records of training
	• Any INPEX IMT Oil Spill personnel who over a 3 year period do not complete ongoing competency/training requirements will be required to repeat their initial training.	Records of training
	During any oil spill response, mutual aid personnel joining the INPEX IMT will be provided the following onboarding/induction: • E-learning 'Introduction to the INPEX BROPEP' prior to arrival/joining the IMT scenario specific briefing on arrival/upon joining the IMT.	Training/induction records

Table 4-4: Environmental performance outcomes, standards and measurement criteria for testing IMT response arrangements

Environmental performance outcome	Environmental performance standard	Measurement criteria

INPEX will be prepared and ready to respond to oil spill events.	The INPEX Australia (Perth) IMT will conduct a minimum of two oil spill exercises per calendar year, using NOPSEMA accepted OPEPs.
	Oil spill exercises will be scheduled in the INPEX Australia Emergency Exercise and Training Schedule.
	IMT exercise objectives will include the IMT's ability to:
	• identify and notify relevant stakeholders within timeframes specified in the OPEP
	• develop an incident action plan, including:
	  • appropriate use of SMV data to inform response decision making
	  • identification of sensitive receptors and protection priorities
	  • completion of an Operational SIMA to determine secondary response strategies
	  • assessment and activation of relevant operational and scientific monitoring programs.
	• identify relevant (scenario specific) response strategy capabilities and practice mechanisms/arrangements to activate them, within timeframes specified in the OPEP.
		INPEX Australia Emergency Exercise and Training Schedule
		Exercise reports.

	INPEX will maintain access to additional IMT mutual aid capability, via contracts with AMOSC and OSRL.	INPEXs memberships/contractual arrangements with AMOSC and OSRL
	The INPEX Australia (Perth) IMT will conduct an Annual Emergency Call-Centre Activation Exercise at least once per calendar year. The objectives of this test will be: • ability of a field asset (CPF, FPSO, MODU or other Facility) to contact the IMT Leader, via the Emergency Call-Centre • Emergency call-centre contacts the rostered IMT personnel	Exercise reports. Real-life activation event records.

Environmental performance outcome	Environmental performance standard	Measurement criteria
	Should a real-life activation occur, evidence of the real-life activation can be used to demonstrate compliance with the test objectives for the relevant calendar year.	
	A minimum of one IMT exercise will be conducted in conjunction with AMOSC every 2 years. The objectives of this joint exercise will be to: • practice the INPEX IMT activation of the AMOSC IMT • practice the interface between the INPEX IMT and AMOSC IMT personnel.	Exercise reports.

Table 4-5: Environmental performance outcomes, standards and measurement criteria for maintenance of IMT oil spill tools

Environmental performance outcome	Environmental performance standard	Measurement criteria
INPEX will be prepared and ready to respond to oil spill events.	The INPEX Australia Emergency Contacts Directory (C075-AH-LIS-10002) will be reviewed on an annual basis, to ensure it is maintained with current and relevant contact details for oil pollution events.	Records demonstrate that the INPEX Australia Emergency Contacts Directory is reviewed annually and updated as required.
	The INPEX Oil Spill Forms List (C075-AH-LIS-10006) is reviewed annually and maintained with current and relevant forms for oil spill response.	Records demonstrate that forms list INPEX Oil Spill Forms List is reviewed annually and updated as required.
	The Oil Spill Preparedness and Response Register (X060-AH-LIS-70002) will be reviewed on an annual basis, to ensure the data requirements are maintained, including the following: • Report of INPEX IMT personnel trained in oil spill response • INPEX oil spill satellite tracking buoy details, including tracker buoy current location, servicing schedule and log-in details to the satellite tracking website • Log-in to AMOSC website, to enable access to AMOSC stockpile equipment lists • INPEX oil spill aviation support activation processes.	Records demonstrate that the Oil Spill Preparedness and Response Register is reviewed annually and updated as required.

5 REFERENCES

Australian Petroleum Production and Exploration Association. 2021. *Guidance Document; Incident Management Teams Knowledge Requirements for Responding to Marine Oil Spills*. Prepared by APPEA in consultation with AMOSC. Perth. Australia. (In Prep).

WA DoT – *see* Department of Transport (WA)

WA DoT (2020) *Offshore Petroleum Industry Guidance Note Marine Oil Pollution: Response and Consultation Arrangements. Revision 5.* Prepared by WA DoT, Fremantle.

WA DoT. 2021. State Hazard Plan Maritime Environmental Emergencies. Prepared by WA Department of Transport. Approved by State Emergency Management Committee.

X060-AH-LIS-60031 - Spill Impact Mitigation Assessment - Instantaneous Surface Condensate Release

Revision	2
Date	31-Aug-21

Location	Browse Region including adjacent WA/NT shorelines	Spill Scenario	Vessel Collision 5700m3 Condensate Spill

Resource Compartment (including values dependent on the resource compartment)	SIMA Stage 2: Predict Outcomes – Potential Relative Impact – No Intervention (natural weathering)		SIMA Stage 3: Balance Trade-Offs - Impact Modification Factors – Prediction of the effectiveness and impact modification potential of the response options – At Sea Contain and Recover		Protect of Sensitive Resources		Shoreline Clean-up		Surface Dispersant		Pre-Contact Oiled Wildlife Response (Hazing & Translocation)		Post Contact Oiled Wildlife Response		Controlled In-situ Burning	Survillance, Monitoring and Visualisation (SMV)
		A	B1	A x B1	B2	A x B2	B3	A x B3	B4	A x B4	B5	A x B5	B6	A x B6		
Subtidal Benthic Communities															Controlled In-Situ Burning is not considered to be safe, effective or feasible.	SMV is implemented under all oil spill scenarios
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging within this habitat)	Moderate	3	0	0	0	0	0	0	-1	-3	0	0	0	0		
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Deep-sea unconsolidated muds and sands	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Intertidal seabed																
Intertidal Coral Reef	Moderate	3	0	0	-2	-6	-1	-3	-1	-3	0	0	0	0		
Mangrove/Mudflats/Samphires	Moderate	3	0	0	-1	-3	-1	-3	-1	-3	0	0	0	0		
Sandy Beach	Minor	2	0	0	0	0	1	2	-1	-2	0	0	0	0		
Rocky Shoreline	Minor	2	0	0	0	0	1	2	-1	-2	0	0	0	0		
Macro-Algae and Seagrass	Moderate	3	0	0	-1	-3	-1	-3	-1	-3	0	0	0	0		
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Significant	4	0	0	-1	-4	1	4	-1	-4	1	4	1	4		
Water column																
Lower water column (below photic zone)	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Upper water column (in photic zone, including plankton and EPBC foraging in the photic zone)	Significant	4	0	0	0	0	0	0	-1	-4	0	0	0	0		
Water surface, including foraging areas for EPBC listed species.	Moderate	3	0	0	0	0	0	0	-1	-3	0	0	1	3		
Air	Minor	2	0	0	0	0	0	0	0	0	0	0	0	0		
Socio-economic																
Commercial demersal fisheries	Minor	2	0	0	0	0	0	0	0	0	0	0	0	0		
Shallow commercial fisheries (including aquaculture)	Moderate	3	0	0	0	0	1	3	-1	-3	0	0	0	0		
Recreational fisheries	Minor	2	0	0	0	0	1	2	-1	-2	0	0	0	0		
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor	2														
Cultural heritage																
Aboriginal heritage (cultural practices, sites and fishing / foraging)	Minor	2	0	0	0	0	1	2	0	0	0	0	0	0		
Indonesian traditional fishing	Moderate	3	0	0	0	0	1	3	-1	-3	0	0	0	0		
									0	0						
Total Impact Mitigation Score				0		-16		9		-35		4		7		
Carried to Field Capability Evaluation yes/no				No		No		Yes		No		Yes		Yes	No	Yes

Resource Compartment (including values dependent on the resource compartment)	No Intervention (natural weathering)		Justification for Potential Relative Impact Score
		A	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging within this habitat)	Moderate	3	Subtidal benthic primary producer habitat (BPPH) may be exposed to entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. The effect of the toxic fractions of entrained/dissolved oil on intertidal coral includes partial mortality of colonies, reduced growth rates, bleaching, reduced photosynthesis, interruption of chemical communication necessary for mass spawning, premature explosion of larvae, decreased growth rates, decreased lipid content, decreased survival of larvae, decreased gonadal development, negative impacts to coral settlement, increased susceptibility to algae colonisation, epidemic diseases, localised tissue rupture, reduced reef resilience and mortality (Hayes et al 1992; Peters et al 1997; Negri & Heyward 2000; Shigenaka 2001; CSIRO 2016). WA DoT (2018) note that coral is sensitive to dissolved hydrocarbons as it causes toxicity at a cellular level. Corals accumulate oil from the water column (Pie et al 2015) making it biologically available to EPBC species foraging in this habitat. Seagrass and macroalgae may be subject to lethal or sublethal toxic effects, including mortality, reduced growth rates and impacts to seagrass flowering. BPPH is collectively considered to be an important resource as it supports a high biomass of fish, cetaceans and seabirds, including foraging EPBC species (DEWHA 2008). Several studies have indicated rapid recovery rates for seagrass and macroalgae may occur even in cases of heavy oil contamination (Connell et al, 1981; Burns et al. 1993; Dean et al. 1998; Runcie & Riddle 2006), but coral is sensitive to oil (and dispersants), making recovery from spills potentially slow (Guzman et al 1994). The consequence to benthic primary producer habitat is considered to be Significant.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	None / Insignificant	1	Filter feeding communities, deep water EPBC species and KEFs would have only a remote likelihood of being exposed to entrained and dissolved condensate, above impact thresholds from a surface releaes of condensate. The depth of entrained oil from a surface spill is generally restricted to the top 30 m of the water column, with the highest percentage of entrained oil in the top 10 m of the water column. Hydrocarbons may cause chemical toxicity (i.e. lethal or sub-lethal effects, or impairing cellular functions) and ecological changes (i.e. losing key organisms then opportunistic species take over). Benthic marine invertebrates can take up oil via diffusion from dissolved oil, ingesting of contaminated food items and contact with contaminated sediment. Entrained/dissolved oil (including dispersed oil) affects the health of filter feeding communities, leading to potential accumulation (Law et al 2011) which makes them a poorer food source for higher trophic level organisms including deep water EPBC foraging species. The toxic fractions of oil can be detrimental to marine invertebrates as they are susceptible to its narcotic impacts due to their high surface to volume ratio, often resulting in outright mortality, as well as decreases in reproduction rates (Hook et al 2014), oxidative damage to macromolecules, altered lipid ratios, deleterious effects on embryo development (Lee et al 2004) and changes to community structure (CSIRO 2016). Filter feeding communities are commonly, but sparsely distributed, throughout the region and WA DoT (2018) note that they play an important role in purifying water and creating habitat. The consequence of a surface condensate spill to deep sea features is considered to be Insignificant.
Deep-sea unconsolidated muds and sands	None / Insignificant	1	Species that inhabit or rely on deep-sea unconsolidated muds and sands would have only a remote likelihood of being exposed to entrained and dissolved condensate, above impact thresholds from a surface releaes of condensate. The depth of entrained oil from a surface spill is generally restricted to the top 30 m of the water column, with the highest percentage of entrained oil in the top 10 m of the water column. CSIRO (2016) notes that benthic marine invertebrates can take up oil via diffusion from dissolved oil, ingesting contaminated food and contact with contaminated sediment. Small invertebrates (micro and meiofauna) are considered very susceptible to the narcotic impact of oil due to their high surface to volume ratio, often resulting in outright mortality, as well as decreases in reproduction rates (Hook et al 2014). Further deleterious effects to invertebrate embryo development result from exposure to sediments affected by entrained and dissolved oil (Lee et al 2004). Communities in the Browse Basin region are considered low in diversity and abundance, but generally common throughout the area. Large sand waves and local strong seabed currents exist in the area and are likely to move seasonally causing substrate instability that limits development of infaunal communities. The area is expected to recover, though recovery times in the deep sea are generally slow due to the low levels of recruitment and slow growth of biota (Montagna et al 2013). The potential consequence of a surface condensate spill to deep sea unconsolidated sands and muds is considered to be Insignificant.
Intertidal seabed			
Intertidal Coral Reef	Moderate	3	Intertidal coral reefs could be impacted by surface fresh, weathered, entrained and dissolved condensate from a surface release in the Browse Basin. The effect of condensate on intertidal coral is unlikely to result in significant smothering as condensate is expected to be weathered and in the form of wax flakes/residues when it arrives in intertidal coral areas. In this form, toxicity is less than fresh condensate (Woodside 2014). The effect of the toxic fractions of entrained/dissolved oil on intertidal coral include partial mortality of colonies, reduced growth rates, bleaching, reduced photosynthesis, interruption of chemical communication necessary for mass spawning, premature explosion of larvae, decreased growth rates, decreased lipid content, decreased survival of larvae, decreased gonadal development, negative impacts to coral settlement, increased susceptibility to algae colonisation, epidemic diseases, localised tissue rupture, reduced reef resilience and mortality (Hayes et al 1992; Peters et al 1997; Negri & Heyward 2000; Shigenaka 2001; CSIRO 2016). WA DoT (2018) note that coral is sensitive to dissolved hydrocarbons as it causes toxicity at a cellular level. Coral reefs are found close to the permit areas in isolated locations and are considered to be significant benthic primary producers that play a key role in the ecosystem and have an iconic status in the environment (WA DoT 2018). They are considered of high importance to EPBC species that aggregate, nest, roost and forage in the area, hence isolated populations could potentially be exposed in the event of a spill. As spills disperse, intertidal communities are expected to recover (Dean et al. 1998), though the rate of recovery of coral reefs depends on the level or intensity of the disturbance, with recovery rates ranging from 1 or 2 years, to decades (Fucik et al. 1984, French McCay 2009). Impact on the receptor is considered to be Moderate.
Mangrove/Mudflats/Samphires	Moderate	3	Mangrove, mudflats and samphire communities may be exposed to entrained/dissolved condensate above impact thresholds from a surface condensate release in the Browse Basin. Given that mangroves are remote from permit areas, fresh or weathered condensate is unlikely to reach this receptor. The potential effects of entrained and dissolved oil include defoliation and mortality of mangroves (Burns et al. 1993; Duke et al. 2000). Entrained and dissolved oil exposure is only likely to occur at isolated locations amongst a very large and generally contiguous population. The recovery of mangroves from shoreline oil accumulation can be a slow process, due to the long-term persistence of oil trapped in anoxic sediments and subsequent release into the water column (Burns et al. 1993). Any impacts to benthic habitats are expected to be localised and of short to medium term with a Moderate consequence.
Sandy Beach	Minor	2	Sandy beaches may be exposed to weathered waxy flakes and residues above impact thresholds from a surface release in the Browse Basin. The effect of gradual accumulation of oil on the receptor could lead to harm including the increased prevalence of tumours in species (CSIRO 2016). Sandy beaches are the dominant shoreline habitat on offshore islands in the Browse Basin and are considered significant habitat for turtles and seabird nesting. Organisms such as polychaete worms, bivalves and crustaceans generally inhabit sandy beaches but the mobile nature of the sands generally limits diversity. These species provide a valuable food source for resident and migratory sea and shorebirds (DEC/MPRA 2005). Law et al (2011) note that when grain size is between 2 and 64 mm, beaches are not considered especially sensitive to oil spills as they are regularly cleaned by wave action and oil is generally not retained. Offshore island beaches of the Browse Basin are generally coarse grained, due to high wave energy. WA DoT (2018) assessed Kimberley sandy beaches and concluded that they are moderately ecologically sensitive and are moderately difficult to rehabilitate from an oil spill. The potential consequence is considered to be Minor.
Rocky Shoreline	Minor	2	Rocky shorelines may be exposed to weathered, entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. This receptor is typically characterised as being a high wind and wave energy environment (CSIRO 2016). Condensate from a spill has the potential to coat the substrate or become stranded by receding tides – but incoming tides also have the potential to remove deposited condensate (Law et al 2011). CSIRO (2016) note that rocky shorelines are not considered sensitive environments, and IPIECA (2017) state that rocky shorelines generally have a diverse and productive intertidal community which are considered resilient to oil spills and short-term oil persistence. WA DoT (2018) note that rocky shorelines are the least susceptible of shoreline types to long term impacts from a spill of both floating and dissolved oil. As such, this receptor is not expected to have issues relating to recovery from an oil spill. The potential consequence for rocky shorelines is considered to be Minor.
Macro-Algae and Seagrass	Moderate	3	Macroalgae and seagrass may be exposed to entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. This receptor is unlikely to come into contact with significant amounts of fresh floating surface hydrocarbons, but could potentially be exposed to weathered waxy flakes and residues. WA DoT (2018) note that dissolved oil causes more impacts to algae than floating oil, as it results in cellular level poisoning. The effect of subjecting seagrass and macroalgae to lethal or sublethal toxic effects of condensate can result in mortality, reduced growth rates and impacts to seagrass flowering. Several studies have indicated rapid recovery rates may occur even in cases of heavy oil contamination (Connell et al, 1981; Burns et al. 1993; Dean et al. 1998; Runcie & Riddle 2006). Taylor and Rasheed (2011) reported that seagrass meadows were not significantly affected by an oil spill when compared to a non-impacted reference seagrass meadow. Macroalgae support diverse small invertebrates that are the principal food source for a number of inshore fish (WA DoT 2018). Seagrasses provide energy and nutrients for detrital grazing food webs (WA DoT 2018), act as a refuge for fish and invertebrates, and provide a food source for EPBC species such as dugongs and green turtles (DEC 2007). The potential consequence is considered to be Moderate.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Significant	4	Intertidal habitat may be exposed to weathered, entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. The effect of condensate on this receptor can result in mortality or harm to benthic primary producers and organisms such as EPBC species that rely on these species for food, or rely on the habitat for nesting and roosting. IPIECA (2014) note that dehydration, gastrointestinal problems and anaemia are commonly found in oiled animals, causing potential long-term effects on reproductive success. They further note that the toxic effects of ingested oil generally impacts the liver, whilst volatile fumes damage lungs resulting in debilitating effects (IPIECA 2014). Oiled aquatic EPBC fauna can further suffer hypothermia, irritations, burns, respiratory problems and loss of waterproofing, leading to them moving onto land (i.e. away from their food source) where they have further difficulty thermoregulating and feeding (IPIECA 2017). Specifically, marine reptiles, including turtles and crocodiles can be exposed to hydrocarbons externally in intertidal areas through direct contact; or internally, by ingesting oil, consuming prey containing oil, or inhaling volatile compounds (Milton et al. 2003). Turtle hatchlings may be particularly vulnerable to toxicity and smothering, as they emerge from nests and make their way over the intertidal area to the water (AMSA 2015; Milton et al. 2003). Birds coated in hydrocarbons can suffer damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs (AMSA 2015; WA DoT 2018). Toxic effects may also result where the product is ingested, either through birds' attempts to preen their feathers (Jenssen 1994; Matcott et al. 2019) or ingested as weathered waxy flakes/residues present on shorelines. There is the potential for short to medium term impacts; however, it is not expected that the overall population viability for any protected species would be threatened from a surface release. The cumulative potential consequence is considered to be Significant.

Water column			
Lower water column (below photic zone)	None / Insignificant	1	The lower water column would be highly unlikely to be exposed to entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. EPBC species that use this habitat could be negatively impacted by entrained and dissolved oil including impacts to juvenile fish, larvae and planktonic organisms due to their sensitivity during these life stages, with the worst impacts predicted to occur in smaller species (WA DoT 2018). In the Gulf of Mexico, Murawski et al (2014) found that spilled oiled resulted in an increased incidence of skin lesions in fish attributed to PAH. The lower water column has a high level of species diversity and endemism for demersal fish communities in the Browse Basin region, as cold nutrient-rich deep ocean current upwellings are found in canyon areas and attract fish aggregations, which in turn attract larger predatory fish, sharks, toothed whales and dolphins (DEWHA 2008). Given a surface release is highly unlikely to result in entrained/dissolved oil reaching the deep/lower water column above impact thresholds, there is very low likelihood of short–to-medium term impacts on the environment from entrained and dissolved condensate. Overall population viability for any protected species would not be threatened. The potential consequence is considered to be Insignificant.
Upper water column (in photic zone, including plankton and EPBC foraging in the photic zone)	Significant	4	The upper water column may be exposed to entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. The effect of entrained and dissolved oil on this receptor include chronic impacts to juvenile fish, larvae and planktonic organisms due to their sensitivity during these life stages, with the worst impacts predicted to occur in smaller species (WA DoT 2018). Whale sharks are filter feeders and are expected to be highly vulnerable to entrained hydrocarbons (Campagna et al 2011) with potential effects including damage to the liver and lining of the stomach and intestines, as well as toxic effects on embryos (Lee 2011). Marine mammals, marine reptiles and marine avifauna could also be impacted through entrained and dissolved hydrocarbon exposure, primarily through ingestion during foraging activities (AMSA 1998). The upper water column is considered to be very important habitat for EPBC species as a large number of BIAs for marine fauna are present in the Browse Basin. Whilst it is expected that the upper water column will recover with time, it is likely that there will be cumulative impacts such as bioaccumulation up the food chain. The consequence is considered to be Significant.
Water surface, including foraging areas for EPBC listed species.	Moderate	3	The water surface may be exposed to fresh and weathered surface condensate above impact thresholds from a surface release in the Browse Basin. Fresh condensate and weathered waxy flakes/residues can impact marine mammals surfacing, as they are vulnerable to oil exposure. Blue whales and humpback whales (baleen whales), that filter-feed near the surface, could potentially ingest condensate. Spilled hydrocarbons may also foul the fibres of baleen whales impairing food gathering efficiency or fouling prey with hydrocarbons (AMSA 2015). Turtles can be exposed to hydrocarbons if they surface within the spill, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (Milton et al. 2003). Floating oil is considered to impact reptiles more than entrained/dissolved oil because reptiles hold their breath underwater and are unlikely to directly ingest dissolved oil (WA DoT 2018). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large, pre dive inhalations, make them vulnerable to spilled oil (AMSA 2015). Hatchlings spend more time on the surface than older turtles, thus increasing the potential for contact with oil slicks (Milton et al. 2003). Aquatic migratory birds are among the most vulnerable and visible species to be affected by surface oil, with oil impacts frequently leading to long-term physiological changes potentially resulting in lower reproductive rates or survival rates (Fingas 2012). The probability of lethal effects is dependent on factors such as timing, location, oceanographic and weather patterns, and the movements of species that forage, feed, nest and inhabit that area (IPIECA 2014), the amount of time spent on the water surface as well as any oil avoidance behaviour (French-McCay 2009). Direct contact with surface hydrocarbons may break down the ability of plumage to maintain body heat, resulting in direct and indirect impacts such as hypothermia, dehydration, drowning and starvation (AMSA 2015; Matcott et al, 2019; Jenssen 1994; IPIECA 2014; ITOPF 2011). Birds resting at the sea surface or surface plunging can be impacted by oil resulting in damage to external tissues, including skin and eyes, and internal tissue irritation in lungs and stomachs (Clark 1984; WA DoT 2018). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (Jenssen 1994; Matcott et al. 2019). The water surface is considered an important receptor where EPBC listed species forage. It is expected to recover from oil impacts with time, though there may be cumulative impacts through bioaccumulation up the food chain. The consequence is considered to be Moderate.
Air	Minor	2	Air may be exposed to fresh surface condensate above impact thresholds from a surface release in the Browse Basin. Due to the high evaporation rate of condensate at the water surface, there is a high probability of local concentrations of atmospheric volatiles that have the potential to cause harmful impacts to species such as cetaceans if inhaled. Turtles could also be affected by harmful vapours during pre-dive inhalations (Milton et al. 2003). The receptor is not considered to be sensitive, thus is expected to recover in a very short period of time, as the evaporated hydrocarbons are rapidly dispersed by the wind, and evaporation rapidly reduce with time as oil weathers and entrains. Only a very localised area, immediately above the freshest parts of the oil slick would be impacted by evaporating hydrocarbons. The potential consequence is considered to be Minor.
Socio-economic			
Commercial demersal fisheries	Minor	2	Commercial demersal fisheries may, but are unlikely (due to shallow depths of entrainment from a surface spill), to be exposed to surface, weathered, entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. The effect of condensate on this receptor includes the ability to cause economic loss (through indirect loss of stock and perceived tainting of stock by oil) (WA DoT 2018), impede access to fishing areas from the implementation of an exclusion zone during a spill response; impact seafood quality and employment; plus negatively impact lines and nets (ITOPF 2011). The economic impact from an oil spill is dependent on the species being cultured, as species have different recovery rates. WA DoT (2018) note that dissolved oil will impact finfish, taking 6-8 years for fisheries to recover (due to the time it takes for hatchlings to reach maturity) (WA DoT 2018). This receptor is considered to be important, and effects from a spill can vary depending on factors such as seasonal timing and natural fluctuations in species levels. Due to the shallow depths of entrainment from a surface spill, contact and associated impacts to commercial demersal fisheries (if any) is expected to be highly localised, and short to medium term. The real and perceived consequence is considered to be Minor.
Shallow commercial fisheries (including aquaculture)	Moderate	3	Shallow commercial fisheries (including aquaculture) may be exposed to surface, weathered, entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. The effect of condensate on this receptor includes the ability to cause economic loss (through indirect loss of stock and perceived tainting of stock by oil) (WA DoT 2018), impede access to fishing areas from the implementation of an exclusion zone during a spill response; impact seafood quality and employment; plus negatively impact lines and nets (ITOPF 2011). The economic impact from an oil spill is dependent on the stock being cultured, as species have different recovery rates. DoT (2018) note that dissolved oil will have the greatest impact with oyster farms potentially taking 3-4 years to recover from a spill (DoF 2013), whilst finfish farms could take 6-8 years to recover due to the time it takes for hatchlings to reach maturity. WA DoT (2018) note that the pearling industry relies almost exclusively on sourcing pearl oysters from Eighty Mile Beach (south of Broome) and an area off the Lacepede Islands. There is also other aquaculture in the region including trochus and barramundi (Fletcher et al 2017). WA DoT (2018) note that some wild stocks aquaculture species such as mussels are impacted more by dissolved oil than floating oil due to being filter feeders. This receptor is considered to be important, and effects from a surface release can vary depending on factors such as seasonal timing and natural fluctuations in species levels. Impacts to shallow commercial fisheries (including aquaculture) are expected to be short to medium term. The real and perceived consequence is considered to be Moderate.
Recreational fisheries	Minor	2	Recreational fisheries may be exposed to surface, weathered, entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. The effect of condensate on this receptor includes negatively impacting nets and lines (ITOPF 2011), impeding access to fishing areas from the implementation of an exclusion zone during a spill response and impacting seafood quality and quantity. Recreational fishing is generally concentrated around readily accessible coastal settlements along the Kimberley and NT coastlines (such as Broome, Wyndham and Darwin) and there is little recreational fishing around the offshore Browse Basin due to the distance from land, lack of features of interest and deep waters. Offshore islands, coral reef systems and continental shelf waters of the Browse Basin however are increasingly being targeted by fishing based charter vessels (Fletcher and Santoro 2014) with extended fishing charters operating during certain times of the year. This receptor is considered to be important, and effects from a surface release can vary depending on factors such as seasonal timing and natural fluctuations in species levels. Impacts to shallow recreational fisheries are expected to be short to medium term. The real and perceived consequence is considered to be Minor.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor	2	Floating condensate (which is not an adhesive oil and will rapidly evaporative) is unlikley to adhere to an offshore facility/vessel or require any post-spill cleaning. Some offshore production assets have shallow seawater intakes (hull mounted, or within <10m of ocean surface). Other facilities only have deep (>50m water depth) seawater intakes. Depending on the depth of the seawater intakes, entrained/dispersed condensate may be drawn into the intakes. Experience has shown that spill response and source control vessels/facilities assocaited with a large number of significant oil spills (including the 2010 Macondo/Gulf of Mexico oil spill), were exposed to significant entrained (including dispersed) oil, yet did not suffer from significant mechanical/operational issues assocaited with drawing entrained/dispersed oil in their internal seawater systems. Stakeholder consultation with Wild-Well, OSRL and AMOSC in 2021 has concluded that the exposure of offshore vessels/facilities to entrained/dispersed oil is unlikely to result in any signficant risk to the facility. The only recommendation was for vessels/facilities to monitor, and if necessary, to conduct additional maintenance on internal seawater systems (e.g. monitor/clean the reverse-osmosis filters for potable water generation and heat-exchanger plates on cooling water systems), potentially resulting in the need for more frequent inspection/maintenance of desalination systems (reverse osmosis filters) and cooling water systems (heat exchanger plates). Due to rapid rates of entrainment of condensate into the shallow water column from any surface condensate spill, and therefore potential for some additional maintenance on seawater systems to be needed, the consequence is considered to be Minor.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	Minor	2	Aboriginal heritage including special places, cultural landscapes, practices and fishing/foraging along the Kimberley and NT coastline may be impacted by surface and weathered condensate above impact thresholds from a surface release in the Browse Basin. The effect of surface condensate on this receptor includes physically degrading a site, disrupting the harvesting of fish, and area closures could displace Aboriginal people and have implications on cultural identity, health and wellbeing. The receptor is important and the potential for recovery is expected to be short to medium term and the receptor is generally remote from any potential surface release location. The consequence is considered to be Minor.
Indonesian traditional fishing	Moderate	3	Indonesian traditional fishing may be impacted by weathered, entrained and dissolved condensate above impact thresholds from a surface release in the Browse Basin. Indonesian traditional fishing occurs within the MoU box which covers Scott Reef and surrounds, Seringapatam Reef, Browse Island, Ashmore Reef, Cartier Island and various banks and shoals. The effect of condensate on these receptor could include reduction and contamination of target species such as sea cucumbers (bêche-de-mer), trochus (top shell snail), reef fish and sharks. Exclusion zones during the spill response may also affect access to fishing locations, even if the target species are not affected by the condensate. This receptor is considered to be important, and effects from a surface release can vary depending on factors such as seasonal timing and natural fluctuations in species levels. Impacts are expected to be short to medium term. The real and perceived consequence is considered to be Moderate.

At Sea Contain and Recovery

Overall statement of likelihood of success of At Sea Contain and Recovery (C&R):

Aim: This strategy aims to collect oil from the ocean surface using booms and skimmers, generally at or near the release location, where oil concentrations are highest. Floating booms are used to corral and concentrate spilled floating oil into a surface thickness that will allow for mechanical removal (i.e. skimming and pumping oil into temporary storage) (IPIECA 2015).

Type of slick: Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered condensate which could accumulate over time. Surface oil concentrations will be up to approximately 25 g/m2 for up to 200 km, and weathered oil at 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) for up to 400 km and further reduced down to below 1 g/m2 up to approximately 700 km from the spill site (RPS 2021). Due to the high evaporation rates from condensate, the condensate will rapidly weather, with high rates of evaporation of toxic fractions such as BTEX very early in the spill event. Weathered oil would be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than fresh oil (Woodside 2014).

Likely success/effectiveness against slick: O'Brien (2002) notes that spreading of oil is the main obstacle to a successful at sea contain and recovery response, with this type of oil tending to spread so thinly and quickly that skimmers are unable to efficiently skim and recover meaningful quantities. Generally oil needs to be >100 g/m^2 (>0.1mm, which equates to Bonn code 4/5) to feasibly corral oil with a boom and achieve any significant level of oil recovery with skimmers (O'Brien 2002), as booms have limited effect against thin oil films and no effect against a subsurface plume (ITOPF 2011). Condensate spills from a surface release in the open ocean would be unlikely to remain for a long duration at >100g/m^2, and would rapidly evaporate and spread, resulting in very thin surface slicks making this technique inefficient and impractical (IPIECA 2017). Where there is any significant condensate slick, flammable/toxic vapours will also be present, and will likely exceed safe exposure thresholds, further reducing response efficiency (as vessels will not be permitted to operate in areas where explosive limits or VOC exposure thresholds are exceeded). Due to the very thin surface slicks, very low rates of recovery would be expected. Note that IPIECA (2015) state that efficiency of contain and recover operations (for any oil type) can vary widely due to operational, environmental and logistical constraints, but usually it is limited to recovering approximately only 5-20% of the initial spilled volume. Contain and recovery is therefore unlikely to be an effective response strategy, with limited chance of any significant surface slick recovery from a Group I spill.

Resource Compartment (including values dependent on the resource compartment)	Contain and Recovery - Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting fully submerged benthic primary producer habitat.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting deep sea features.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting deep sea unconsolidated muds and sands.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction of surface/floating oil and no effect on entrained oil at the spill location, thus resulting in no change to the amount of oil reaching the intertidal/shoreline zones.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	
Sandy Beach	No or insignificant alteration of impact	0	
Rocky Shoreline	No or insignificant alteration of impact	0	
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	No or insignificant alteration of impact	0	
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	C&R occurs on the surface and would result in an insignificant reduction in condensate on the surface which could potentially become entrained in the future. Therefore C&R would result in no reduction in the volume of entrained oil affecting the upper water column.
Water surface	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction of surface/floating oil on the water surface due to inability of booms and skimmers to revcovery very thin slicks.
Air	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction of oil on surface, and therefore no significant change to the evaporation of oil into the local atmosphere. VOC concentrations at locations where fresh oil slicks are present would likely be above safe exposure levels. Collection of condensate on vessels would likely result in further increase in exposure of workers to high concentrations of VOCs, above safe exposure levels.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to demersal fish communities.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to shallow commercial fisheries including aquaculture.
Recreational fisheries	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to recreational fishing areas.
Offshore Oil and Gas Exploration and Production Facilties (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to offshore facilities.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to Aboriginal cultural heritage receptors.
Indonesian traditional fishing	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to traditional fishing areas.

Protection of Sensitive Resources

Overall statement of likelihood of success of Protect of Sensitive Resources (Protect and Deflect / P&D):

Aim: This strategy aims to use physical barriers to exclude or restrict the spill contacting specific sensitive receptors or to deflect the spill from these locations; typically onto less sensitive areas.

Type of slick: Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered condensate which could accumulate over time**.** Surface oil concentrations will be up to approximately 25 g/m2 for up to 200 km, and weathered oil at 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) for up to 400 km and further reduced down to below 1 g/m2 up to approximately 700 km from the spill site (RPS 2021). Due to the high evaporation rates from condensate, the condensate will rapidly weather, with high rates of evaporation of toxic fractions such as BTEX very early in the spill event. Weathered oil would be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than fresh oil (Woodside 2014).

Likely success/effectiveness against slick: Booms could be used to protect and deflect surface spills away from sensitive habitats, but they have limited effect against thin Group I oil films and no effect against subsurface entrained plumes (ITOPF 2011). Generally oil needs to be >100 g/m2 (>0.1mm, which equates to Bonn Code 4/5) to feasibly corral oil with a boom (O'Brien 2002), as would be required for an oat sea containment and recovery response. However, P&D could feasibly work on lower concentraion slicks, to prevent oil accumulating on a shoreline receptor. A surface condensate spill not remain for a significant amount of time at >100 g/m^2, and would generally very rapidly spread to <10g/m^2. Even in a scenario where the best equipment is available, shoreline P&D activities at Browse Island or other exposed remote shoreline locations, would be technically challenging due to the general exposure to unfavourable sea conditions, large tidal range and shallow coral reefs. Generally P&D is limited to sheltered waters, not exposed reef/beach environments. Only under exceptionally calm sea-states and appropriate tides would it be safe to conduct vessel activities to carry-out an effective P&D operations at remote shorelines. MetOcean conditions required for this technique to be successful include <1 m sea-state and low surface currents - but these are frequently exceeded at remote offshore locations in the Browse/Bonaparte Basin region. In addition, given the size of the offshore island shorelines (e.g. Browse Island, one of the smallest offshore islands, has an intertidal zone 3km in diameter, 7km in circumference), a substantial number of booms would be needed to be deployed to protect offshore island shorelines, or deflect oil into a collection point on a beach. Anchoring of booms would most likely result in additional damage to the subtidal and intertidal environment (coral reef) surrounding most offshore and outer Kimberley/NT islands, due to anchor chain drag. Booms themselves would also drag around on the coral intertidal reef during periods of lower tides, potentially resulting in significant physical damage to the benthos of the reef platform and also result in damage to booms. Booms could potentially be held in place by vessels however due to widths of shorelines requiring protection this would most likely require an unfeasibly large number of vessels, and at low tide this isn't practicable in intertidal zones. Most offshore island shorelines would be expected to 'self clean' any accumulated Group I oil due to the lack of adhesiveness, the coarse substrate, the high wave energy and high tidal regime (Fingas 2012), further reducing the impact mitigation potential of P&D at these locations. There would also be potential for significant damage to mangrove root-systems, if conducting P&D in mangrove environments. Any accumulated weathered condensate on rocky shorelines and sandy beaches will likely rapidly natural weather/degrade, due to generally high/very high temperatures and UV exposure in the region. As a result of the above mentioned factors, P&D would be unlikely to result in any significant deflection or recovery of Group I condensate, or tangible enviornmental benefit, at remote intertidal/shoreline habitats.

Resource Compartment (including values dependent on the resource compartment)	Contain and Recovery - Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and will have insignificant impact on entrained oil affecting subtidal benthic primary producer habitat.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and has insignificant impact on entrained oil affecting deep sea features.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and has insignificant impact on entrained oil affecting deep sea unconsolidated muds and sands.
Intertidal seabed			
Intertidal Coral Reef	Moderate additional impact	-2	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline. Anchoring extensive boom arrays would most likely result in physical damage to subtidal and intertidal coral reefs.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	Prevention of oil entering mangroves/samphires would be of benefit, however due to the thin surface slick, the extensive scale of mangrove communities along the mainland and islands of the Kimberley and NT coastline, the ability to successfully achieve a benefit from P&D is extremely limited. Anchors/anchor chains also have the potential to damage mangrove aerial root structures and disturb other fragile low-energy shorelines.
Sandy Beach	No or insignificant alteration of impact	0	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline
Rocky Shoreline	No or insignificant alteration of impact	0	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline
Macro-Algae and Seagrass	Minor additional impact	-1	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline. Anchors/anchor chains would also most likely result in physical damage to seagrass / algal beds.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor additional impact	-1	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline. Additional impacts could also occur to sensitive habitats such as coral reefs and fragile low energy environments such as mangroves and mudflats. Therefore, additional impacts could occur to habitats which support protected species.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	P&D does not reduce the amount of entrained oil affecting the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	P&D does not reduce the amount of entrained oil affecting the upper water column.
Water surface	No or insignificant alteration of impact	0	P&D would only occur near shorelines and would not result in any significant reduction to the volume of oil on the water surface.
Air	No or insignificant alteration of impact	0	
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in entrained oil, resulting in no change to oil exposure to commercial demersal fisheries.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to shallow commercial fisheries including aquaculture sites.
Recreational fisheries	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to fish communities, thus no change to recreational fishing.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to offshore facilities.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface and entrained oil, resulting in no change to impacts on Aboriginal heritage.
Indonesian traditional fishing	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface and entrained oil, resulting in no change to impacts on Indonesian traditional fishing areas.

Shoreline Clean-Up

Overall statement of likelihood of success of Shoreline Clean-Up:

Aim: Using various physical means to clean up oil from affected shorelines to reduce impacts on sensitive receptors or to avoid any reintroduction of the hydrocarbon to the marine environment. It is often viewed as a three step process, with the first phase involving bulk collection of oil floating against the shoreline or stranded on it; phase two involving in-situ treatment of shoreline substrate and phase three involving removal of any remaining residues (final polish) (IPIECA 2015).

Type of slick: Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered oil which could accumulate over time. Given the time to reach shorelines, a condensate spill is expected to have undergone several physical and biological weathering processes, such as photo oxidation and biodegradation. Impacts to ecological receptors from exposure to weathered oil (waxy flakes and residues) are far less than those associated with exposure to fresh oils, which have higher levels of toxicity (Milton et al, 2003; Hoff & Michel 2014; Woodside 2014). Group I oils are relatively non-adhesive and will not form a thick adhesive barrier on a shoreline (Fingas 2012).

Likely success/effectiveness against slick: Shoreline clean-up has been consistently found to not enhance ecological recovery of oiled coastlines (Sell et al 1995) but it may protect other resources in the area, such as birds, marine mammals or subtidal habitats including coral reefs or fish farms (CSIRO 2016). Choosing a particular clean-up technique is dependent on factors such as shoreline type, exposure, sensitivity, amount of oil, persistence of oil, toxicity of oil and rate of natural oil removal (IPIECA 2015). Mechanical cleaning is generally not an appropriate technique for offshore/remote shorelines, and manual techniques involving rakes and shovels would likely be required. The clean-up of Group I spills from a beach or shoreline is likely to be difficult, generating high volumes of waste in comparison to the oil recovered. Browse Island and other similar offshore shorelines would be expected to naturally 'self-clean' any accumulated Group I oils, due to factors such as the lack of adhesiveness of these oil types, the coarse substrate present and the high wave energy and high tidal regime (Fingas 2012). Typically, inaccessible rocky coves are highly exposed and are best left to naturally clean (IPIECA 2015). ITOPF (2011) also note that for a number of sensitive shoreline types, such as mangroves, natural cleaning is the preferred option in order to minimise the damage caused from clean-up activities. Thus shoreline clean-up would be most effective in areas which are expected to receive large amounts of shoreline oil; where chosen activities don't physically break/damage sensitive habitat such as coral or mangroves; and in areas which are not expected to self clean. In addition, any accumulated weathered condensate on rocky shorelines and sandy beaches will likely rapidly natural weather/degrade, due to generally high/very high temperatures and UV exposure in the region.

Resource Compartment (including values dependent on the resource compartment)	Contain and Recovery - Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil in benthic primary producer habitat within subtidal areas.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil affecting filter feeding communities within subtidal areas.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil affecting deep-sea unconsolidated muds and sands in subtidal areas.
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	Shoreline clean-up on an intertidal coral reef would result in physical damage/breaking of coral structures, therefore a net damage to the coral eco-system.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	Shoreline clean-up within mangrove/low energy ecosystems is likely to result in more physical damage/breaking of mangrove root structures than benefit from any oil removed.
Sandy Beach	Minor mitigation of impact	1	Shoreline clean-up of sandy beaches is a well understood, well documented spill response technique, which can reliably remove thick oil from the eco-system. This is beneficial for species such as turtles who nest on sandy beaches. However, in the case of a condensate spill, the likely oil accumulating on a shoreline remote from the release location is likely to be very thin, and possibly not recoverable. Natual weathering on high energy beaches may be just as effective as attempting to clean-up very thin, non-adhesive slicks.
Rocky Shoreline	Minor mitigation of impact	1	Shoreline clean-up of rocky shorelines is a well understood, well documented spill response technique, which has the ability to remove some oil from the eco-system. However, certain techniques like steam cleaning and high pressure blasting are known to cause more harm than allowing the oil to naturally weather. Therefore, this technique would likely be successful, provided the correct clean-up techniques are chosen.
Macro-Algae and Seagrass	Minor additional impact	-1	Shoreline clean-up within intertidal macro-algae/seagrass ecosystems would likely result in more physical disturbance to plant/root structures than benefit from any oil removed.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	If it is deemed that the amount of hydrocarbons expected to impact shorelines is large enough that a shoreline clean up will have positive impacts, then the removal of oil from the intertidal zones would likley result in reduction in harm to the benthic primary producers and associated food sources utilised by foraging protected fauna such as seabirds. Also, removal of oil reaching a turtle nesting beach would be of benefit to turtle nesting success. However, due to the type (generally non-toxic and non-adhesive weathered oil), shoreline clean-up of weathered condensate may only have limited positive effect compared to natural weathering. Caution is required, as additional physical damage can occur in sensitive intertidal environments, and the general presence of responders can result in additional disturbance to natural wildlife behaviours and processes, espeically seabirds and turtle nesting etc.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on entrained oil in the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on entrained oil in the upper water column.
Water surface	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on thin surface slicks on the water surface.
Air	No or insignificant alteration of impact	0	As oil will have significantly weathered by the time it reaches a shoreline, clean-up activities will result in no net change to impacts to air quality.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	There would be no reduction in entrained oil, resulting in no significant change to fish communities, and thus commercial demersal fisheries.
Shallow commercial fisheries (including aquaculture)	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Recreational fisheries	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor mitigation of impact	1	There would be no reduction in entrained oil, resulting in no significant change to exposure to offshore faciltiies.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	Minor mitigation of impact	1	Shoreline clean-up may reduce oil damage to Aboriginal heritage sites along the Kimberley / NT coastline, however care would be required to ensure important sites are not damaged during the clean-up process.
Indonesian traditional fishing	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.

Surface Dispersants

Overall statement of likelihood of success of Surface Dispersants:

Aim: To remove oil from the sea's surface via dispersant spraying from vessels and aircraft, thus reducing the amount of oil reaching birds, mammals and other organisms - as well as coastal habitats, socioeconomic features and shorelines (IPIECA 2015).

Type of slick: Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered condensate which could accumulate over time. Surface oil concentrations will be up to approximately 25 g/m2 for up to 200 km, and weathered oil at 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) for up to 400 km and further reduced down to below 1 g/m2 up to approximately 700 km from the spill site (RPS 2021). Weathered oil would be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than fresh oil (Woodside 2014).

Likely success/effectiveness against slick: The National Research Council (2010) notes that the window to use dispersants is early, typically within hours to 2 days of a spill, then after that, weathering makes oil more difficult to disperse (due to increased viscosity). Rapid dispersion of dispersant-treated oil begins at a wind speed of approximately 7 knots with wave heights of 0.2 to 0.3 metres (IPIECA 2015). Conditions where wave energy is too low, oil droplets may resurface after being applied with dispersant due to oil not being effectively dispersed into the water column. Dispersant becomes challenging in high winds and rough seas, where floating oil will be over-washed or temporarily submerged (IPIECA 2015). Whilst dispersants reduce the amount of oil on the surface that can affect wildlife, they also increase the exposure of dispersed oil in the upper water column to other wildlife. It is expected that dispersant will not significantly change the proportion of surface oil/condensate which would become entrained as the sea-state changes.

Generally oil slicks needs to be >100 g/m^2 (>0.1mm, which equates to Bonn code 4/5) to feasibly achieve a successfuly dispersant operation. However condensate from a surface release will by highly unlikely to appear in slicks >100 g/m^2, due to the rapid spreading properties of this oil, and would generally be <10 g/m^2. Where there are any significant condensate slick, flammable/toxic vapours will also be present, and will likely exceed safe exposure thresholds, further reducing response efficiency (as vessels will not be permitted to operate in areas where explosive limits or VOC exposure thresholds are exceeded). Due to the very thin surface slicks, very low rates of succesful dispersal would be expected. Therefore, surface dispersant application on a condensate slick would not be a safe or effective response strategy.

Resource Compartment (including values dependent on the resource compartment)	Contain and Recovery - Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to shallow water BPPH. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Chemical dispersant would result in an insignificant increase in any additional oil reaching deep water locations, regardless of chemical dispersant application on the surface.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	Dispersant is generally considered ineffective at significantly increasing entrainment of thin sheens of condensate, compared to natural rates of entrainment. A significant volume of dispersant would need to be applied to result in any change, therefore this would result in negative impacts, due to additional chemicals on the surface and in the shallow water column, which could negatively impact on sensitive shallow/intertidal receptors such as corals, seagrass etc, and the biota who depend on them, including invertebrates, and mega-fauna who forage in these zones.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	
Sandy Beach	Minor additional impact	-1	
Rocky Shoreline	Minor additional impact	-1	
Macro-Algae and Seagrass	Minor additional impact	-1	
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor additional impact	-1	
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	No oil reaching deep water locations, regardless of dispersant application on surface.
Upper water column (in photic zone)	Minor additional impact	-1	Dispersed oil can cause marine organisms inhabiting the upper water column to be briefly exposed to dispersed oil which can potentially have toxic effects. Dispersant is generally considered ineffective at significantly increasing entrainment of thin sheens of condensate, compared to natural rates of entrainment. A significant volume of dispersant would need to be applied to result in any change, therefore this would result in negate impacts, due to additional chemicals on the surface and in the shallow water column.
Water surface	Minor additional impact	-1	
Air	No or insignificant alteration of impact	0	A very slight reduction in VOCs in local atmosphere could occur as a result of dispersant application and additional entrainment. However additional chemical dispersant mist in the local atmosphere would likely offset any reduction in VOCs.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	No oil reaching deep water locations, including demersal fish habitat, regardless of chemical dispersant application on surface.
Shallow commercial fisheries (including aquaculture)	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to shallow commercial fisheries.
Recreational fisheries	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to recreational fisheries.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Due to the naturally high rates of entrainment of floating condensate, surface chemical dispersant application would be unlikely to result in any significant increase in the rates of entrainment, and therefore no change to risk to an offshore facility seawater intakes.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	As any dispersant application would occur within offshore waters, and as there would be significant oil entrained from any well-blowout event, surface dispersant application would result in an insignificant change in dispersed oil reaching traditional Aboriginal areas of the Kimberley and NT coastline.
Indonesian traditional fishing	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to shallow water BPPH which support indonesian traditional fishing target species. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH.

Pre-Contact Oiled Wildlife Response (Hazing and Translocation/Displacement)

Overall statement of likelihood of success of Pre-Contact OWR (hazing and translocation):

Aim: Hazing involves discouraging animals from entering oiled areas by encouraging them to move into low-risk unoiled areas, in an attempt to prevent them from becoming oiled (IPIECA 2017). Hazing techniques include vessels generating underwater noise and motion, vessel air horns making above-water noise and fire hoses directing streams in front of fauna. Translocation/displacement involves removing wildlife who are at risk of becoming oiled from the spill environment in an attempt to prevent them from becoming oiled (IPIECA 2017). This includes holding animals in captivity until the risk of oiling is over, or relocating them to another area not affected by the oil spill (IPIECA 2017).

Type of slick: Floating oil is in the form of Group I slicks which have a low viscosity and rapidly spread into a thin sheen. Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered condensate which could accumulate over time. Surface oil concentrations will be up to approximately 25 g/m2 for up to 200 km, and weathered oil at 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) for up to 400 km and further reduced down to below 1 g/m2 up to approximately 700 km from the spill site (RPS 2021). Due to the high evaporation rates from condensate, the condensate will rapidly weather, with high rates of evaporation of toxic fractions such as BTEX very early in the spill event. Group I oils are relatively non-adhesive, and oil reaching shorelines is likely to have undergone weathering and will be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than their unweathered counterparts (Milton et al, 2003; Hoff & Michel 2014; Woodside 2014). Note that Group I hydrocarbons are relatively non-adhesive compared to crude oils, and are generally not considered an oil product that would 'coat' the feathers of birds, requiring a full wildlife cleaning response on a shoreline.

Likely success/effectiveness against slick: Wildlife hazing in the open ocean is inherently unlikely to be effective due to a number of limitations;

1) effectiveness depends upon the deployment of numerous ocean-going vessels (as opposed to smaller vessels which can be used near to the shore);
2) against a spreading plume (i.e. away from the immediate source of the spill), the technique becomes entirely impracticable;
3) there are significant safety issues associated with a spill of condensate and vessel masters will not approach the source of the spill, or fresh areas of slick; and
4) without the constraints of a shoreline or other geographical feature, the technique may cause wildlife to move into other areas of the spill area instead of away from it.

Wildlife hazing is most suitable when used near sensitive shoreline habitats against persistent oily slicks, such as IFO, HFO or crude oil spills - but in the case of a surface condensate release, oil slicks are thin and not considered particularly adhesive, therefore reducing the likelihood and severity of impacts on wildlife. Additionally, hazing isn't considered an effective measure against volatile spills which rapidly evaporate.

In regard to wildlife translocation**,** IPIECA (2014) advise that the difficulty of capturing wildlife safely and maintaining their health during relocation should not be underestimated, and that working with live or dead animals has health and safety issues including potential injuries (bites, scratches) or zoonotic diseases. Risks to wildlife are high during pre-emptive capture and the risks of oiling need to be weighed against the risk of injury, death etc. (IPIECA 2014). The translocation of turtles from beaches and islands would likely require the capture of large numbers of hatchlings, followed by translocation to a location far from the slick (to prevent surface oil impacts on released hatchlings). The prolonged retention of hatchlings has been demonstrated to be detrimental to hatchling swimming speed and survival, even in short periods (6 hours) of retention (Pilcher and Enderby 2001). Attempting to capture large numbers (or an entire flock) of healthy seabirds would be very challenging, if not impossible (DPaW 2014), especially at a remote shoreline location (such as Browse or Cartier Island). There is no practicable method to capture healthy seabirds at sea (DPaW 2014). Potential harm to healthy seabirds could occur during the capture process. Any seabirds released would likely fly back to the shoreline from which they originally were captured. Therefore, long term veterinary care (feeding etc.) would be required for any successfully captured birds, until spill weathering or remediation has occurred and it was safe to release the animals. An evaluation would need to be undertaken, to ensure the released animals do not pose a disease risk (human/zoonotic diseases), to the wild population into which they are released.

Resource Compartment (including values dependent on the resource compartment)	Contain and Recovery - Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Sandy Beach	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Rocky Shoreline	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	Wildlife hazing of flocks of seabirds may temporarily prevent oiling of individuals or small proportions of a local/regional populations, however it is not likely effective across a broad geographical area. Even conducting wildlife hazing in the nearshore environment at an isolated location such as Browse Island would be of logistically challenging and potentially not result in any significant impact mitigation. Hazing of seabirds to prevent them landing on an oiled shoreline may temporarily prevent impacts, whilst shoreline clean-up is occurring. Capture and translocation of turtle hatchlings away from the oiled shoreline, and release in the open ocean is potentially feasible. Therefore, undertaking pre-contact oiled wildlife response at a shoreline may reduce the number of protected species of a local population from being oiled.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Water surface	No or insignificant alteration of impact	0	Wildlife hazing and/or translocation of seabirds or other megafauna, such as cetaceans and turtles in the open ocean, using vessel presence, vessel noise or at sea capture is highly unlikely to be successful. It may be possible to temporarily (minutes / hours), prevent a few individuals of a protected species from entering a small geographic area affected by a slick. However, over the longer term duration and geographic area of a well-blowout scenario, there would be no alteration to the level of oiling of wildlife populations using this strategy in the open ocean.
Air	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Recreational fisheries	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Indonesian traditional fishing	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.

Post Contact Oiled Wildlife Response

Overall statement of likelihood of success of Post-Contact OWR:

Aim: Post-contact oiled wildlife response involves capturing oiled wildlife - and if necessary, cleaning, rehabilitating and releasing them.

Type of slick: Floating oil is in the form of Group I slicks which have a low viscosity and rapidly spread into a thin sheen. Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered condensate which could accumulate over time. Surface oil concentrations will be up to approximately 25 g/m2 for up to 200 km, and weathered oil at 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) for up to 400 km and further reduced down to below 1 g/m2 up to approximately 700 km from the spill site (RPS 2021). Due to the high evaporation rates from condensate, the condensate will rapidly weather, with high rates of evaporation of toxic fractions such as BTEX very early in the spill event. Group I oils are relatively non-adhesive, and oil reaching shorelines is likely to have undergone weathering and will be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than their unweathered counterparts (Milton et al, 2003; Hoff & Michel 2014; Woodside 2014). Note that Group I hydrocarbons are relatively non-adhesive compared to crude oils, and are generally not considered an oil product that would 'coat' the feathers of birds, requiring a full wildlife cleaning response on a shoreline.

Likely success/effectiveness against slick: Capture, relocation, assessment, cleaning and rehabilitation of oiled wildlife has the ability to increase the survival of individuals. ITOPF (2011) note that there are many cases where oiled turtles have been cleaned successfully and returned to the water. Any seabirds captured, cleaned and released would likely fly back to the shoreline from which they originally were captured. Once oiled, it is generally agreed that birds have a very low survival rate, even when rescue and cleaning is attempted (Bourne et al. 1967; Holmes and Cronshaw 1977; Croxall 1977; Ohlendorf et al. 1978; Chapman, 1981; Ford et al., 1982; Samuels and Lanfear, 1982; Varoujean et al., 1983; Ford, 1985; Evans and Nettleship 1985; Fry 1987; Seip et al. 1991; Anderson et al. 2000). French-McCay (2009) produced mortality estimates of 99% for surface swimmers, 35% for aerial divers and raptors, and 5% for aerial seabirds. Samuels and Lanfear (1982) estimated that 95% of oiled seabirds die. ITOPF (2011) note that penguins and pelicans are often the exception as they are generally more resilient than many other species, however they are not present in the Browse Basin. IPIECA (2014) advise working with live or dead animals has health and safety issues including potential injuries (bites, scratches) or zoonotic diseases. An evaluation would need to be undertaken, to ensure any released animals do not pose a disease risk (human/zoonotic diseases), to the wild population into which they are released.

Resource Compartment (including values dependent on the resource compartment)	Contain and Recovery - Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Sandy Beach	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Rocky Shoreline	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	Post-contact OWR has the ability to increase the likelihood of survival of oil-affected EPBC species (individuals, or small proportion of a local population) in the intertidal/shoreline habitats. However, the seabird species of the Browse Basin are generally not expected to survive the capture, cleaning and rehabilitation process. Capture, cleaning and release of marine turtles would have a greater likelihood of success.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Water surface	Minor mitigation of impact	1	It is possible that some individuals of protected species, which have been oiled and are unable to fly, could be captured in the open ocean and relocated to an oiled wildlife treatment facility. Therefore, whilst there is a very low probability of survival, under the right circumstances a positive environmental outcome, for a limited number of individuals of a protected species could be achieved.
Air	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Recreational fisheries	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Indonesian traditional fishing	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.

Controlled In-situ Burning

Overall statement of likelihood of success of Controlled In-Situ Burning (ISB):

Aim: In-situ burning rapidly removes the volume of spilled oil's hydrocarbon vapours in place, via combustion or burning (IPIECA 2016). This technique reduces the need to collect, store, transport and dispose recovered oil, plus it can shorten the overall response time (IPIECA 2016).

Type of slick: Floating oil is in the form of Group I floating slicks which have a low viscosity and rapidly spread into a thin sheen. Slicks will be approximately 10 g/m^2 up to approximately 400 kilometres from the spill site, reducing to weathered oil below 1 g/m2 up to approximately 700 km from the spill sit (RPS 2021).

Likely success/effectiveness against slick: ISB requires wave heights typically below 1 m and wind speeds below 10 knots (IPIECA 2016) which are frequently exceeded at remote offshore locations in the Browse Basin region. Overseas experience shows that burns can be conducted safely, but the most discernible disadvantage is the resulting dark smoke plumes caused by the combustion of oil (IPIECA 2016). Carbon dioxide, soot (PM 2.5), water, polyaromatic hydrocarbons, volatile organic compounds, carbonyls, carbon monoxide, sulphur dioxide and potentially other gases can result from an in-situ burn, which has the potential to affect human and animal health (IPIECA 2016). IPIECA (2016) note that tests and information from previous burns indicate that ISB has little effect on water quality. Burn residue (i.e. burned oil depleted of volatiles and precipitated soot) rarely sinks and smothers benthic species (IPIECA 2016). Plus it is unlikely that Group I burn residue will cause smothering as this generally only occurs for heavier crudes (IPIECA 2016). IPIECA (2016) further note that burn residue is less toxic to aquatic biota than weathered oil.

To implement an effective in-situ burn response, a minimum surface hydrocarbon thickness of 2-5 mm (2000 - 5000 g/m^2) is required to be present. In the case of a surface condensate release, the surface slick is not expected to meet the required thickness (i.e. only 100 - 10 g/m^2 or 0.1 mm expected thickness in the immediate area of the release). Booms would be required to corral the spill, in an attempt to generate additional oil thickness, but this in turn is expected to exceed the VOC exposure thresholds for the workforce, and also may result in concentrations exceeding the lower explosive limit. Given this, and the lack of suitable booms available for in-situ burns in Australia, implementation of this response in an open ocean, high current environment is not considered to be safe, effective or feasible, especially against the thin sheen and hazardous atmospheric conditions associated with a surface condensate spill.

Resource Compartment (including values dependent on the resource compartment)	Contain and Recovery - Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)			
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)			
Deep-sea unconsolidated muds and sands			
Intertidal seabed			
Intertidal Coral Reef			
Mangrove/Mudflats/Samphires			
Sandy Beach			
Rocky Shoreline			
Macro-Algae and Seagrass			
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)			
Water column			
Lower water column (below photic zone)			
Upper water column (in photic zone)			
Water surface			
Air			
Socio-economic			
Commercial demersal fisheries			
Shallow commercial fisheries (including aquaculture)			
Recreational fisheries			
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)			
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)			
Indonesian traditional fishing			

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X060-AH-LIS-60032 Spill Impact Mitigation Assessment Instantaneous Surface Diesel Release

Revision	2
Date	18-Jan-22

Location	Browse Region including adjacent WA/NT shorelines	Spill Scenario	Vessel Collision Marine Diesel Spill

	SIMA Stage 2: Predict Outcomes		SIMA Stage 3: Balance Trade-Offs - Impact Modification Factors													
	Potential Relative Impact		Prediction of the effectiveness and impact modification potential of the response options													
Resource Compartment (including values dependent on the resource compartment)	No Intervention (natural weathering)		At Sea Contain and Recover		Protect of Sensitive Resources		Shoreline Clean-up		Surface Dispersant		Pre-Contact Oiled Wildlife Response (Hazing & Translocation)		Post Contact Oiled Wildlife Response		Controlled In-situ Burning	Survillance, Monitoring and Visualisation (SMV)
		A	B1	A x B1	B2	A x B2	B3	A x B3	B4	A x B4	B5	A x B5	B6	A x B6		
Subtidal Benthic Communities																
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging within this habitat)	Moderate	3	0	0	0	0	0	0	-1	-3	0	0	0	0		
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Deep-sea unconsolidated muds and sands	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Intertidal seabed																
Intertidal Coral Reef	Moderate	3	0	0	-2	-6	-1	-3	-1	-3	0	0	0	0		
Mangrove/Mudflats/Samphires	Minor	2	0	0	-1	-2	-1	-2	-1	-2	0	0	0	0		
Sandy Beach	Minor	2	0	0	1	2	1	2	-1	-2	0	0	0	0		
Rocky Shoreline	Minor	2	0	0	1	2	1	2	-1	-2	0	0	0	0		
Macro-Algae and Seagrass	Minor	2	0	0	1	2	-1	-2	-1	-2	0	0	0	0		
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Moderate	3	0	0	1	3	1	3	-1	-3	1	3	1	3	**Controlled In-Situ Burning is not considered to be safe, effective or feasible.**	**SMV is implemented under all oil spill scenarios**
Water column																
Lower water column (below photic zone)	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Upper water column (in photic zone, including plankton and EPBC foraging in the photic zone)	Minor	2	0	0	0	0	0	0	-1	-2	0	0	0	0		
Water surface, including foraging areas for EPBC listed species	Moderate	3	0	0	0	0	0	0	-1	-3	0	0	1	3		
Air	Minor	2	0	0	0	0	0	0	0	0	0	0	0	0		
Socio-economic																
Commercial demersal fisheries	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Shallow commercial fisheries (including aquaculture)	None / Insignificant	1	0	0	0	0	1	1	-1	-1	0	0	0	0		
Recreational fisheries	None / Insignificant	1	0	0	0	0	1	1	-1	-1	0	0	0	0		
Offshore Oil and Gas Exploration and Production Facilties (Platforms, Drilling Rigs etc)	Minor	2	0	0	0	0	0	0	-1	-2	0	0	0	0		
Cultural heritage																
Aboriginal heritage (cultural practices, sites and fishing / foraging)	None / Insignificant	1	0	0	0	0	1	1	0	0	0	0	0	0		
Indonesian traditional fishing	None / Insignificant	1	0	0	0	0	1	1	-1	-1	0	0	0	0		
		Total Impact Mitigation Score		0		1		4		-27		3		6	-	-
		Carried to Field Capability Evaluation yes/no		No		Yes		Yes		No		Yes		Yes	No	Yes

Resource Compartment (including values dependent on the resource compartment)	No Intervention (natural weathering)		Justification for Potential Relative Impact Score
		A	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging within this habitat)	Moderate	3	Subtidal benthic primary producer habitat (BPPH) may be exposed to entrained/dissolved diesel above impact thresholds from a vessel collision in the Browse Basin. The effect of the toxic fractions of entrained/dissolved oil on intertidal coral includes partial mortality of colonies, reduced growth rates, bleaching, reduced photosynthesis, interruption of chemical communication necessary for mass spawning, premature explosion of larvae, decreased growth rates, decreased lipid content, decreased survival of larvae, decreased gonadal development, negative impacts to coral settlement, increased susceptibility to algae colonisation, epidemic diseases, localised tissue rupture, reduced reef resilience and mortality (Hayes et al 1992; Peters et al 1997; Negri & Heyward 2000; Shigenaka 2001; CSIRO 2016). WA DoT (2018) note that coral is sensitive to dissolved hydrocarbons as it causes toxicity at a cellular level. Corals accumulate oil from the water column (Pie et al 2015) making it biologically available to EPBC species foraging in this habitat. Seagrass and macroalgae may be subject to lethal or sublethal toxic effects, including mortality, reduced growth rates and impacts to seagrass flowering. BPPH is collectively considered to be an important resource as it supports a high biomass of fish, cetaceans and seabirds, including foraging EPBC species (DEWHA 2008). Several studies have indicated rapid recovery rates for seagrass and macroalgae may occur even in cases of heavy oil contamination (Connell et al, 1981; Burns et al. 1993; Dean et al. 1998; Runcie & Riddle 2006), but coral is sensitive to oil (and dispersants), making recovery from spills potentially slow (Guzman et al 1994). RPS (2021b) modelling of a 250m3 MGO spill confirmed that dissolved oil exceeding the 100 ppb impact threshold could occur out to approximately 420km from the spill, and up to 45m down into the water column. Therefore, the consequence to benthic primary producer habitat is considered to be Moderate.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	None / Insignificant	1	No impact from surface spill of diesel below 45m (RPS 2021b).
Deep-sea unconsolidated muds and sands	None / Insignificant	1	No impact from surface spill of diesel below 45m (RPS 2021b).
Intertidal seabed			
Intertidal Coral Reef	Moderate	3	Intertidal coral reefs could be impacted by surface fresh, weathered, entrained and dissolved diesel from a vessel collision in the Browse Basin. RPS (2021b) modelling of a 250 m3 MGO spill confirmed that entrained oil exceeding the 100 ppb impact threshold could occur out to approximately 420km from the spill, and up to 45m down into the water column. The effect of diesel on intertidal coral is unlikely to result in significant smothering as diesel is expected to be weathered and in the form of waxy flakes/residues when it arrives in intertidal coral areas. In this form, toxicity is less than fresh diesel (Woodside 2014). The effect of the toxic fractions of entrained/dissolved oil on intertidal coral include partial mortality of colonies, reduced growth rates, bleaching, reduced photosynthesis, interruption of chemical communication necessary for mass spawning, premature explosion of larvae, decreased growth rates, decreased lipid content, decreased survival of larvae, decreased gonadal development, negative impacts to coral settlement, increased susceptibility to algae colonisation, epidemic diseases, localised tissue rupture, reduced reef resilience and mortality (Hayes et al 1992; Peters et al 1997; Negri & Heyward 2000; Shigenaka 2001; CSIRO 2016). WA DoT (2018) note that coral is sensitive to dissolved hydrocarbons as it causes toxicity at a cellular level. Coral reefs are found in isolated locations within the Browse/Bonaparte Basins and extensively along the Kimberly coastline. Corals are considered to be significant benthic primary producers that play a key role in the ecosystem and have an iconic status in the environment (WA DoT 2018). They are considered of high importance to EPBC species that aggregate, nest, roost and forage in the area, hence isolated populations could potentially be exposed in the event of a spill. As spills disperse, intertidal communities are expected to recover (Dean et al. 1998), though the rate of recovery of coral reefs depends on the level or intensity of the disturbance, with recovery rates ranging from 1 or 2 years, to decades (Fucik et al. 1984, French McCay 2009). Impact on the receptor is considered to be Moderate.
Mangrove/Mudflats/Samphires	Minor	2	Mangrove, mudflats and samphire communities may be exposed to entrained/dissolved diesel above impact thresholds from a vessel collision in the Browse Basin.RPS (2021b) modelling of a 250m3 MGO spill confirmed that entrained oil exceeding the 100 ppb impact threshold could occur out to approximately 420km from the spill, and up to 45m down into the water column. Given that mangrove habitats are typically remote from permit areas, generally located along mainland shorelines, only weathered diesel (both surface and entrained) may reach this receptor. The potential effects of entrained and dissolved oil include defoliation and mortality of mangroves (Burns et al. 1993; Duke et al. 2000). Entrained and dissolved oil exposure is only likely to occur at isolated locations amongst a very large and generally contiguous mangrove populations along mainland shorelines. The recovery of mangroves from shoreline oil accumulation can be a slow process, due to the long-term persistence of oil trapped in anoxic sediments and subsequent release into the water column (Burns et al. 1993). Any impacts to benthic habitats are expected to be localised and of short to medium term. The potential consequence is considered to be Minor.
Sandy Beach	Minor	2	Sandy beaches could be impacted by surface fresh, weathered, entrained and dissolved diesel from a vessel collision in the Browse Basin. RPS (2021b) modelling of a 250m3 MGO spill confirmed that shoreline accumulation concentrations exceeding 3000 g/m2, and volumes up to 50 m3 could accumulate on a single shoreline. The effect of gradual accumulation of oil on the receptor could lead to harm including the increased prevalence of tumours in species (CSIRO 2016). Sandy beaches are the dominant shoreline habitat on offshore islands in the Browse Basin and are also extensive on mainland shorelines and nearshore islands. Sandy beaches are considered significant habitat for turtles and seabird nesting. Organisms such as polychaete worms, bivalves and crustaceans generally inhabit sandy beaches but the mobile nature of the sands generally limits diversity. These species provide a valuable food source for resident and migratory sea and shorebirds (DEC/MPRA 2005). Law et al (2011) note that when grain size is between 2 and 64 mm, beaches are not considered especially sensitive to oil spills as they are regularly cleaned by wave action and oil is generally not retained. Offshore island beaches of the Browse Basin are generally coarse grained, due to high wave energy, however inshore shorelines/beaches are oftem finer grained. WA DoT (2018) assessed Kimberley sandy beaches and concluded that they are moderately ecologically sensitive and are moderately difficult to rehabilitate from an oil spill. The potential consequence is considered to be Minor.
Rocky Shoreline	Minor	2	Rocky shorelines could be impacted by surface fresh, weathered, entrained and dissolved diesel from a vessel collision in the Browse Basin. RPS (2021b) modelling of a 250m3 MGO spill confirmed that shoreline accumulation concentrations exceeding 3000 g/m2, and volumes up to 50 m3 could accumulate on a single shoreline (if the diesel spill occured in close proximity to the receptor). This receptor is typically characterised as being a high wind and wave energy environment (CSIRO 2016). Diesel from a spill has the potential to coat the substrate or become stranded by receding tides – but incoming tides also have the potential to remove deposited diesel (Law et al 2011). CSIRO (2016) note that rocky shorelines are not considered sensitive environments, and IPIECA (2017) state that rocky shorelines generally have a diverse and productive intertidal community which are considered resilient to oil spills and short-term oil persistence. WA DoT (2018) note that rocky shorelines are the least susceptible of shoreline types to long term impacts from a spill of both floating and dissolved oil. As such, this receptor is not expected to have issues relating to recovery from an oil spill. The potential consequence for rocky shorelines is considered to be Minor.
Macro-Algae and Seagrass	Minor	2	Macroalgae and seagrass may be exposed to entrained and dissolved diesel above impact thresholds from a vessel collision in the Browse Basin. RPS (2021b) modelling of a 250m3 MGO spill confirmed that entrained oil exceeding the 100 ppb impact threshold could occur out to approximately 420km from the spill, and up to 45m down into the water column. Therefore, small proportions of the overall population of this receptor in the region may potentially be affected by entrained/dissolved hydrocarbons. Macroalgae support diverse small invertebrates that are the principal food source for a number of inshore fish (WA DoT 2018). Seagrasses provide energy and nutrients for detrital grazing food webs (WA DoT 2018), act as a refuge for fish and invertebrates, and provide a food source for EPBC species such as dugongs and green turtles (DEC 2007). WA DoT (2018) note that dissolved oil causes more impacts to algae than floating oil, as it results in cellular level poisoning. The effect of subjecting seagrass and macroalgae to lethal or sublethal toxic effects of oil can result in mortality, reduced growth rates and impacts to seagrass flowering. However, Taylor and Rasheed (2011) reported that seagrass meadows were not significantly affected by an oil spill when compared to a non-impacted reference seagrass meadow and several studies have indicated rapid recovery rates may occur even in cases of heavy oil contamination (Connell et al, 1981; Burns et al. 1993; Dean et al. 1998; Runcie & Riddle 2006). Therefore, the potential consequence is considered to be Minor.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Moderate	3	Intertidal habitat may be exposed to fresh, weathered, entrained and dissolved diesel above impact thresholds from a vessel collision in the Browse Basin. RPS (2021b) modelling of a 250m3 MGO spill confirmed that shoreline accumulation concentrations exceeding 3000 g/m2, and volumes up to 50 m3 could accumulate on a single shoreline (if the diesel spill occured in close proximity to the receptor). The effect of diesel on intertidal habitats can result in mortality or harm to benthic primary producers and organisms such as EPBC species that rely on these species for food, or rely on the habitat for nesting and roosting. IPIECA (2014) note that dehydration, gastrointestinal problems and anaemia are commonly found in oiled animals, causing potential long-term effects on reproductive success. They further note that the toxic effects of ingested oil generally impacts the liver, whilst volatile fumes damage lungs resulting in debilitating effects (IPIECA 2014). Oiled aquatic EPBC fauna can further suffer hypothermia, irritations, burns, respiratory problems and loss of waterproofing, leading to them moving onto land (i.e. away from their food source) where they have further difficulty thermoregulating and feeding (IPIECA 2017). Specifically, marine reptiles, including turtles and crocodiles can be exposed to hydrocarbons externally in intertidal areas through direct contact; or internally, by ingesting oil, consuming prey containing oil, or inhaling volatile compounds (Milton et al. 2003). Turtle hatchlings may be particularly vulnerable to toxicity and smothering, as they emerge from nests and make their way over the intertidal area to the water (AMSA 2015; Milton et al. 2003). Birds coated in hydrocarbons can suffer damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs (AMSA 2015; WA DoT 2018). Toxic effects may also result where the product is ingested, either through birds' attempts to preen their feathers (Jenssen 1994; Matcott et al. 2019) or ingested as weathered waxy flakes/residues present on shorelines. There is the potential for short to medium term impacts; however, the overall population viability for any protected species would not be threatened from a vessel collision spill. The cumulative potential consequence is considered to be Moderate.

Water column			
Lower water column (below photic zone)	None / Insignificant	1	No impact from surface spill of diesel below 45m (RPS 2021b).
Upper water column (in photic zone, including plankton and EPBC foraging in the photic zone)	Minor	2	The upper water column may be exposed to entrained and dissolved diesel above impact thresholds from a vessel collision in the Browse Basin. RPS (2021b) modelling of a 250m3 MGO spill confirmed that entrained oil exceeding the 100 ppb impact threshold could occur out to approximately 420km from the spill, and up to 45m down into the water column. The effect of entrained and dissolved oil on this receptor include chronic impacts to juvenile fish, larvae and planktonic organisms due to their sensitivity during these life stages, with the worst impacts predicted to occur in smaller species (WA DoT 2018). Whale sharks are filter feeders and are expected to be highly vulnerable to entrained hydrocarbons (Campagna et al 2011) with potential effects including damage to the liver and lining of the stomach and intestines, as well as toxic effects on embryos (Lee 2011). Marine mammals, marine reptiles and marine avifauna could also be impacted through entrained and dissolved hydrocarbon exposure, primarily through ingestion during foraging activities (AMSA 1998). The upper water column is considered to be very important habitat for EPBC species as a large number of BIAs for marine fauna are present in the Browse Basin. It is expected that the upper water column will recover quickly as a vessel collision spill is unlikely to cause significant or cumulative impacts. The consequence is considered to be Minor.
Water surface, including foraging areas for EPBC listed species	Moderate	3	The water surface may be exposed to fresh and weathered surface diesel above impact thresholds from a vessel collision in the Browse Basin. Fresh diesel and weathered waxy flakes/residues can impact marine mammals surfacing, as they are vulnerable to oil exposure. Blue whales and humpback whales (baleen whales), that filter-feed near the surface, could potentially ingest diesel. Spilled hydrocarbons may also foul the fibres of baleen whales impairing food gathering efficiency or fouling prey with hydrocarbons (AMSA 2015). Turtles can be exposed to hydrocarbons if they surface within the spill, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (Milton et al. 2003). Floating oil is considered to impact reptiles more than entrained/dissolved oil because reptiles hold their breath underwater and are unlikely to directly ingest dissolved oil (WA DoT 2018). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large, pre dive inhalations, make them vulnerable to spilled oil (AMSA 2015). Hatchlings spend more time on the surface than older turtles, thus increasing the potential for contact with oil slicks (Milton et al. 2003). Aquatic migratory birds are among the most vulnerable and visible species to be affected by surface oil, with oil impacts frequently leading to long-term physiological changes potentially resulting in lower reproductive rates or survival rates (Fingas 2012). The probability of lethal effects is dependent on factors such as timing, location, oceanographic and weather patterns, and the movements of species that forage, feed, nest and inhabit that area (IPIECA 2014), the amount of time spent on the water surface as well as any oil avoidance behaviour (French-McCay 2009). Direct contact with surface hydrocarbons may break down the ability of plumage to maintain body heat, resulting in direct and indirect impacts such as hypothermia, dehydration, drowning and starvation (AMSA 2015; Matcott et al, 2019; Jenssen 1994; IPIECA 2014; ITOPF 2011). Birds resting at the sea surface or surface plunging can be impacted by oil resulting in damage to external tissues, including skin and eyes, and internal tissue irritation in lungs and stomachs (Clark 1984; WA DoT 2018). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (Jenssen 1994; Matcott et al. 2019). The water surface is considered an important receptor where EPBC listed species forage. It is expected to recover from oil impacts with time, and it is unlikely that there will be cumulative impacts through bioaccumulation up the food chain. The consequence is considered to be Moderate.
Air	Minor	2	Air may be exposed to fresh surface diesel above impact thresholds from a vessel collision in the Browse Basin. Surface oil may lead to high local concentrations of atmospheric volatiles that have the potential to cause harmful impacts to species such as cetaceans if inhaled. Turtles could also be affected by harmful vapours during pre-dive inhalations (Milton et al. 2003). The receptor is not considered to be sensitive, thus is expected to recover in a very short period of time, as the evaporated hydrocarbons are rapidly dispersed by the wind, and evaporation rapidly reduce with time as oil weathers and entrains. Only a very localised area, immediately above the freshest parts of the oil slick would be impacted by evaporating hydrocarbons. The potential consequence is considered to be Minor.
Socio-economic			
Commercial demersal fisheries	None / Insignificant	1	No impact to fish stocks deeper than 45 metres (RPS 2021b). Commercial demersal fisheries may be exposed to surface, weathered, entrained and dissolved diesel above impact thresholds from a vessel collision in the Browse Basin. RPS (2021b) modelling of a 250m3 MGO spill confirmed that entrained oil exceeding the 100 ppb impact threshold could occur out to approximately 420km from the spill, and up to 45m down into the water column. The effect of diesel on this receptor includes the ability to cause economic loss (through indirect loss of stock and perceived tainting of stock by oil) (WA DoT 2018), impede access to fishing areas from the implementation of an exclusion zone during a spill response; impact seafood quality and employment; plus negatively impact lines and nets (ITOPF 2011). The economic impact from an oil spill is dependent on the species being cultured, as species have different recovery rates. WA DoT (2018) note that dissolved oil will impact finfish, taking 6-8 years for fisheries to recover (due to the time it takes for hatchlings to reach maturity) (WA DoT 2018). This receptor is considered to be important, however a vessel collision spill is unlikely to cause significant impacts to demersal fisheries due to the shallow and localised entrained oil affected area. The real and perceived consequence is considered to be Insignificant.
Shallow commercial fisheries (including aquaculture)	None / Insignificant	1	Shallow commercial fisheries including aquaculture (shallower than 45m, (RPS 2021b)) may be exposed to surface, weathered, entrained and dissolved diesel above impact thresholds from a vessel collision in the Browse Basin. The effect of diesel on this receptor includes the ability to cause economic loss (through indirect loss of stock and perceived tainting of stock by oil) (WA DoT 2018), impede access to fishing areas from the implementation of an exclusion zone during a spill response; impact seafood quality and employment; plus negatively impact lines and nets (ITOPF 2011). The economic impact from an oil spill is dependent on the stock being cultured, as species have different recovery rates. DoT (2018) note that dissolved oil will have the greatest impact, with oyster farms potentially taking 3-4 years to recover from a spill (DoF 2013), whilst finfish farms could take 6-8 years to recover due to the time it takes for hatchlings to reach maturity. WA DoT (2018) note that the pearling industry relies almost exclusively on sourcing pearl oysters from Eighty Mile Beach (south of Broome) and an area off the Lacepede Islands. There is also other aquaculture in the region including trochus and barramundi (Fletcher et al 2017). WA DoT (2018) note that some wild stocks aquaculture species such as mussels are impacted more by dissolved oil than floating oil due to being filter feeders. This receptor is considered to be important however a vessel collision spill in the Browse Basin unlikely to cause any significant impacts to shallow commercial fisheries (including aquaculture) due to the general remoteness of the shallow commercial fishing areas and aquaculture to potential release locations. Therefore, the real and perceived consequence is considered to be Insignificant.
Recreational fisheries	None / Insignificant	1	Recreational fisheries (shallower than 45m, (RPS 2021b)) may be exposed to surface, weathered, entrained and dissolved diesel above impact thresholds from a vessel collision in the Browse Basin. The effects of diesel on this receptor includes negatively impacting nets and lines (ITOPF 2011), impeding access to fishing areas from the implementation of an exclusion zone during a spill response and impacting seafood quality and quantity. Recreational fishing is generally concentrated around readily accessible coastal settlements along the Kimberley and NT coastlines (such as Broome, Wyndham and Darwin) and there is little recreational fishing around the offshore areas of the region, due to the distance from land, lack of features of interest and deep waters. Offshore islands, coral reef systems and continental shelf waters of the region however are increasingly being targeted by fishing based charter vessels (Fletcher and Santoro 2014) with extended fishing charters operating during certain times of the year, but still at very low levels of use. This receptor is considered to be important, however a vessel collision spill is unlikely to cause significant impacts to recreational fisheries due to the limited and localised surface and shallow entrained oil affected area and very limited recreational fishing in the offshore areas of the region. The real and perceived consequence is considered to be Insignificant.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor	2	Floating diesel (which is not a particularly adhesive oil and will rapidly evaporative) is unlikley to adhere to an offshore facility/vessel or require any post-spill cleaning. Some offshore production assets have shallow seawater intakes (hull mounted, or within <10m of ocean surface). Other facilities only have deep (>50m water depth) seawater intakes. Depending on the depth of the seawater intakes, entrained/dispersed condensate may be drawn into the intakes. Experience has shown that spill response and source control vessels/facilities assocaited with a large number of significant oil spills (including the 2010 Macondo/Gulf of Mexico oil spill), were exposed to significant entrained (including dispersed) oil, yet did not suffer from significant mechanical/operational issues assocaited with drawing entrained/dispersed oil in their internal seawater systems. Stakeholder consultation with Wild-Well, OSRL and AMOSC in 2021 has concluded that the exposure of offshore vessels/facilities to entrained/dispersed oil is unlikely to result in any signficant risk to the facility. The only recommendation was for vessels/facilities to monitor, and if necessary, to conduct additional maintenance on internal seawater systems (e.g. monitor/clean the reverse-osmosis filters for potable water generation and heat-exchanger plates on cooling water systems), potentially resulting in the need for more frequent inspection/maintenance of desalination systems (reverse osmosis filters) and cooling water systems (heat exchanger plates). Given some diesel from a surface spill may entrain in the shallow water column, the consequence is considered to be Minor.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	None / Insignificant	1	Aboriginal heritage including special places, cultural landscapes, practices and fishing/foraging along the Kimberley and NT coastline are unlikely to be impacted by surface and weathered diesel above impact thresholds from a vessel collision in the Browse Basin. The effect of surface weathered diesel on this receptor includes physically degrading a site, disrupting the harvesting of fish, and area closures could displace Aboriginal people and have implications on cultural identity, health and wellbeing. The receptor is important however is generally remote from any potential vessel collision locations, limiting the scale of imact, and the recovery is expected to be short to medium term. Therefore, consequence is considered to be Insignificant.
Indonesian traditional fishing	None / Insignificant	1	Indonesian traditional fishing areas shallower than 45m (RPS 2021b) may be exposed to fresh, weathered surface oil and entrained/dissolved diesel above impact thresholds from a vessel collision in the Browse Basin. Indonesian traditional fishing occurs within the MoU box which covers Scott Reef and surrounds, Seringapatam Reef, Browse Island, Ashmore Reef, Cartier Island and various banks and shoals. The effect of diesel on these receptor could include reduction and contamination of target species such as sea cucumbers (bêche-de-mer), trochus (top shell snail), reef fish. Exclusion zones during the spill response may also affect access to fishing locations, even if the target species are not affected by diesel. This receptor is considered to be important however a vessel collision spill is unlikely to cause significant impacts to Indonesian traditional fishing due to the limited and localised surface and shallow entrained oil affected area. The real and perceived consequence is considered to be Insignificant.

At Sea Containment and Recovery

Overall statement of likelihood of success of At Sea Contain and Recovery (C&R):

Aim: This strategy aims to collect oil from the ocean surface using booms and skimmers, generally at or near the release location, where oil concentrations are highest. Floating booms are used to corral and concentrate spilled floating oil into a surface thickness that will allow for mechanical removal (i.e. pumping oil into temporary storage) by devices such as skimmers (IPIECA 2015).

Type of slick: Surface oil is in the form of Group II floating slicks which have a low viscosity and rapidly spread into a thin sheen. Surface oil concentrations will be approximately 50 g/m2 (Bonn code 3/4) for <2km from the spill location, 10 g/m^2 (~0.01mm, which equates to Bonn code 1/2) up to approximately 160 km from the spill site and weathered oil concentrations reduce down to below 1 g/m^2 up to approximately 500 km from the spill site (RPS 2021a, RPS 2021b).

Likely success/effectiveness against slick: O'Brien (2002) notes that spreading of oil is the main obstacle to a successful at sea contain and recovery response, with this type of oil tending to spread so thinly and quickly that skimmers are unable to efficiently skim and recover meaningful quantities. Generally oil needs to be >100 g/m^2 (>0.1mm, which equates to Bonn code 4/5) to feasibly corral oil with a boom and achieve any significant level of oil recovery with skimmers (O'Brien 2002), as booms have limited effect against thin oil films and no effect against a subsurface plume (ITOPF 2011). The initial, gravity-dominated spreading of MGO is generally complete within minutes to hours after a release (O'Brien 2002)). In the context of the Browse Basin, with high sea surface and air temperatures in all seasons, the spreading of any diesel spill would be very rapid. Diesel spilled from a vessel collision would therefore remain at a thickness of >100g/m^2 for only a very brief period of time, before evaporation and spread effects generating very thin surface slicks, making C&R inefficient and impractical (IPIECA 2017). Where there is any significant diesel slick, flammable/toxic vapours will also be present, and will likely exceed safe exposure thresholds, further reducing response efficiency (as vessels will not be permitted to operate in areas where explosive limits or VOC exposure thresholds are exceeded). Due to the very thin surface slicks, very low rates of recovery would be expected. Note that IPIECA (2015) state that efficiency of contain and recover operations (for any oil type) can vary widely due to operational, environmental and logistical constraints, but usually it is limited to recovering approximately only 5-20% of the initial spilled volume. Contain and recovery is therefore unlikely to be an effective response strategy, with limited chance of any significant surface slick recovery from a Group II spill.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	If successful, C&R theoretically could result in a minor reduction in localised surface oil. However due to rapid spreading, health and safety risks it is considered that there is no reasonable chance of significant volumes of oil recovery. Therefore, there would be no or insignificant alteration in the volume of future entrained oil entering the upper water column including submerged BBPH habitat.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting deep sea features.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting deep sea unconsolidated muds and sands.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	If successful, C&R theoretically could result in a minor reduction on oil on surface. However due to rapid spreading, health and safety risks it is considered that there is no reasonable chance of significant volumes of oil recovery. Therefore, there would be no or insignificant alteration in the volume of surface and/or entrained oil reaching intertidal zones including BHHP habitats.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	
Sandy Beach	No or insignificant alteration of impact	0	
Rocky Shoreline	No or insignificant alteration of impact	0	
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	No or insignificant alteration of impact	0	
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting fully submerged benthic primary producer habitat.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	If successful, C&R theoretically could result in a minor reduction in localised surface oil. However due to rapid spreading, health and safety risks it is considered that there is no reasonable chance of significant volumes of oil recovery. Therefore, there would be no or insignificant alteration of the volume of future entrained oil in the upper water column.
Water surface	No or insignificant alteration of impact	0	If successful, C&R theoretically could result in a minor reduction in localised surface oil. However due to rapid spreading, health and safety risks it is considered that there is no reasonable chance of significant volumes of oil recovery. Therefore, there would be no or insignificant alteration of impact.
Air	No or insignificant alteration of impact	0	Due to the rapid evaporation of diesel and low expected recovery rates of surface oil, C&R activities would not result in any significant change to local atmospheric VOC concentrations.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Commercial demersal fisheries are unlikely to be exposed to surface or shallow entrained diesel. Therefore surface C&R will have no or insignificant alternation of impact to demersal fisheries.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	If successful, C&R theoretically could result in a minor reduction in localised surface oil. However due to rapid spreading, health and safety risks it is considered that there is no reasonable chance of significant volumes of oil recovery. Therefore, there would be no or insignificant alteration of the volume of future entrained oil in the upper water column, including on shallow commercial and recreational fisheries.
Recreational fisheries	No or insignificant alteration of impact	0	
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	If successful, C&R theoretically could result in a minor reduction in localised surface oil. However due to rapid spreading, health and safety risks it is considered that there is no reasonable chance of significant volumes of oil recovery. Therefore, there would be no or insignificant alteration of the volume of future entrained oil in the upper water column, or surface oil, impacting an offshore facility.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	If successful, C&R theoretically could result in a minor reduction in localised surface oil. However due to rapid spreading, health and safety risks it is considered that there is no reasonable chance of significant volumes of oil recovery. Therefore, there would be no or insignificant alteration of the volume of surface and future entrained oil in the upper water column which may transit from Commonwealth waters, to reach Aboriginal heritage related sites in State/Territory waters.
Traditional Indonesian fishing	No or insignificant alteration of impact	0	If successful, C&R theoretically could result in a minor reduction in localised surface oil. However due to rapid spreading, health and safety risks it is considered that there is no reasonable chance of significant volumes of oil recovery. Therefore, there would be no or insignificant alteration of the volume of future entrained oil in the upper water column, including on shallow traditional indonesian fishing sites.

Protect of Sensitive Resources

Overall statement of likelihood of success of Protect of Sensitive Resources (Protect and Deflect / P&D):

Aim: This strategy aims to use physical barriers to exclude or restrict the spill contacting specific sensitive receptors or to deflect the spill from these locations; typically onto less sensitive areas.

Type of slick: Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered diesel which could accumulate over time. Weathered oil would be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than fresh oil (Woodside 2014).

Likely success/effectiveness against slick: Booms could be used to protect and deflect surface spills away from sensitive habitats, but they have limited effect against thin Group II oil films and no effect against subsurface entrained plumes (ITOPF 2011). Generally oil needs to be >100 g/m^2 (>0.1mm, which equates to Bonn Code 4/5) to feasibly corral oil with a boom (O'Brien 2002), as would be required for a P&D response. However diesel on the ocean surface from a vessel collision is unlikely to have slicks >100 g/m^2. Even in a scenario where the best equipment is available, shoreline protect and deflect activities at Browse Island or other exposed remote shoreline locations, would be technically challenging due to the general exposure to unfavourable sea conditions, large tidal range and shallow coral reefs. Generally protect and deflect is limited to sheltered waters, not exposed reef/beach environments. Only under exceptionally calm sea-states and appropriate tides would it be safe to conduct vessel activities to carry-out an effective protect and deflect operation at remote shorelines. MetOcean conditions required for this technique to be successful include <1 m sea-state and low surface currents - but these are frequently exceeded at remote offshore locations in the Browse Basin region. In addition, given the size of the offshore island shorelines (e.g. Browse Island, one of the smallest offshore islands, has an intertidal zone 3km in diameter, 7km in circumference), a substantial number of booms would be needed to be deployed to protect the shorelines, or deflect oil into a collection point on a beach. Anchoring of booms would most likely result in additional damage to the subtidal and intertidal environment (coral reef) surrounding most offshore islands, due to anchor chain drag. Booms themselves would also drag around on the coral intertidal reef during periods of lower tides, potentially resulting in significant physical damage to the benthos of the reef platform and also result in damage to booms. Booms could potentially be held in place by vessels however due to widths of shorelines requiring protection this would most likely require an unfeasibly large number of vessels, and at low tide this isn't practicable in intertidal zones. Most offshore island shorelines would be expected to 'self clean' any accumulated Group II oil due to the lack of adhesiveness, the coarse substrate, the high wave energy and high tidal regime (Fingas 2012), further reducing the impact mitigation potential of protect and deflect at these locations. As a result of the above mentioned factors, protect and deflect would be unlikely to result in any significant deflection or recovery of Group II diesel at remote intertidal/shoreline habitats.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and will have insignificant impact on entrained oil affecting subtidal benthic primary producer habitat.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and has insignificant impact on entrained oil affecting deep sea features.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and has insignificant impact on entrained oil affecting deep sea unconsolidated muds and sands.
Intertidal seabed			
Intertidal Coral Reef	Moderate additional impact	-2	P&D may result in a minor reduction of thin slicks of weathered diesel reaching intertidal receptors. However, anchoring extensive boom arrays would most likely result in physical damage to subtidal and intertidal coral reefs.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	P&D may result in a minor reduction of thin slicks of weathered diesel reaching intertidal receptors. However, due to the extensive scale of mangrove communities along the mainland and islands of the Kimberley and NT coastline, the ability to successfully achieve a benefit from P&D is extremely limited. Anchors/anchor chains also have the potential to damage mangrove aerial root structures and disturb other fragile low-energy shorelines.
Sandy Beach	Minor mitigation of impact	1	P&D may result in a minor reduction of thin slicks of weathered diesel reaching intertidal receptors. A correctly executed shoreline clean-up may result in a positive outcome compared to natural weathering.
Rocky Shoreline	Minor mitigation of impact	1	P&D may result in a minor reduction of thin slicks of weathered diesel reaching intertidal receptors. A correctly executed clean-up on a rocky shoreline may result in a positive outcome compared to natural weathering.
Macro-Algae and Seagrass	Minor mitigation of impact	1	P&D may result in a minor reduction of thin slicks of weathered diesel reaching intertidal receptors. However, anchoring extensive boom arrays would most likely result in physical damage to subtidal and intertidal coral reefs.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	P&D may result in a minor reduction of thin slicks of weathered diesel reaching intertidal receptors. A correctly executed clean-up on a sandy beach or rocky shoreline may result in a positive outcome, including protected species such as marine avifauna and turtles who utilise these habitats.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	P&D does not reduce the amount of entrained oil affecting the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	P&D does not reduce the amount of entrained oil affecting the upper water column.
Water surface	No or insignificant alteration of impact	0	P&D would only occur near shorelines and would not result in any significant reduction to the volume of oil on the water surface.
Air	No or insignificant alteration of impact	0	P&D would only occur at shorelines remote form the spill release location. The weathered slick will not have any significant volatile components remaining, and therefore P&D would have no effect on local atmospheric conditions.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in entrained oil, resulting in no change to oil exposure to commercial demersal fisheries.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to shallow commercial fisheries including aquaculture sites.
Recreational fisheries	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to fish communities, thus no change to recreational fishing.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Offshore facilites are located geographycially a long distance from sensitive shorline habitats, where this response strategy would be undertaken. P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to offshore facilities.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface and entrained oil, resulting in no change to impacts on Aboriginal heritage.
Traditional Indonesian fishing	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface and entrained oil, resulting in no change to impacts on Indonesian traditional fishing areas.

Shoreline Clean-Up

Overall statement of likelihood of success of Shoreline Clean-Up:

Aim: Using various physical means to clean up oil from affected shorelines to reduce impacts on sensitive receptors or to avoid any reintroduction of the hydrocarbon to the marine environment. It is often viewed as a three step process, with the first phase involving bulk collection of oil floating against the shoreline or stranded on it; phase two involving in-situ treatment of shoreline substrate and phase three involving removal of any remaining residues (final polish) (IPIECA 2015).

Type of slick: Diesel spilled from a vessel collision in the Browse Basin is expected to have undergone several physical and biological weathering processes, such as photo oxidation and biodegradation by the time it strands on a shoreline. Weathered diesel reaching a remote shoreline will be in the form of thin floating slicks which could accumulate over time. Impacts to ecological receptors from exposure to weathered oil (waxy flakes and residues) are far less than those associated with exposure to fresh oils, which have higher levels of toxicity (Milton et al, 2003; Hoff & Michel 2014; Woodside 2014). Group II oils are relatively non-adhesive and will not form a thick adhesive barrier on a shoreline (Fingas 2012).

Likely success/effectiveness against slick: Shoreline clean-up has been consistently found to not enhance ecological recovery of oiled coastlines (Sell et al 1995) but it may protect other resources in the area, such as birds, marine mammals or subtidal habitats including coral reefs or fish farms (CSIRO 2016). Choosing a particular clean-up technique is dependent on factors such as shoreline type, exposure, sensitivity, amount of oil, persistence of oil, toxicity of oil and rate of natural oil removal (IPIECA 2015). Mechanical cleaning is generally not an appropriate technique for offshore/remote shorelines, and manual techniques involving rakes and shovels would likely be required. The clean-up of Group II spills from a beach or shoreline is likely to be difficult, generating high volumes of waste in comparison to the oil recovered. Browse Island and other similar offshore shorelines would be expected to naturally 'self-clean' any accumulated Group II oils, due to factors such as the lack of adhesiveness of these oil types, the coarse substrate present and the high wave energy and high tidal regime (Fingas 2012). Typically, inaccessible rocky coves are highly exposed and are best left to naturally clean (IPIECA 2015). ITOPF (2011) also note that for a number of sensitive shoreline types, such as mangroves, natural cleaning is the preferred option in order to minimise the damage caused from clean-up activities. Thus shoreline clean-up would be most effective in areas which are expected to receive large amounts of shoreline oil; where chosen activities don't physically break/damage sensitive habitat such as coral or mangroves; and in areas which are not expected to self clean.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil in benthic primary producer habitat within subtidal areas.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil affecting filter feeding communities within subtidal areas.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil affecting deep-sea unconsolidated muds and sands in subtidal areas.
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	Shoreline clean-up on an intertidal coral reef would result in physical damage/breaking of coral structures, therefore a net damage to the eco-system.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	Shoreline clean-up within mangrove/low energy ecosystems is likely to result in more physical damage/breaking of mangrove root structures than benefit from any oil removed.
Sandy Beach	Minor mitigation of impact	1	Shoreline clean-up of sandy beaches is a well understood, well documented spill response technique, which can reliably remove thick oil from the eco-system. This is beneficial for species such as turtles who nest on sandy beaches. However, in the case of a condensate spill, the likely oil accumulating on a shoreline remote from the release location is likely to be very thin, and possibly not recoverable. Natural weathering on high energy beaches may be just as effective as attempting to clean-up very thin, non-adhesive slicks.
Rocky Shoreline	Minor mitigation of impact	1	Shoreline clean-up of rocky shorelines is a well understood, well documented spill response technique, which has the ability to remove some oil from the eco-system. However, certain techniques like steam cleaning and high pressure blasting are known to cause more harm than allowing the oil to naturally weather. Therefore, this technique would likely be successful, provided the correct clean-up techniques are chosen.
Macro-Algae and Seagrass	Minor additional impact	-1	Shoreline clean-up within intertidal macro-algae/seagrass ecosystems would likely result in more physical disturbance to plant/root structures than benefit from any oil removed.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	If it is deemed that the amount of hydrocarbons expected to impact shorelines is large enough that a shoreline clean up will have positive impacts, then the removal of oil from the intertidal zones would likely result in reduction in harm to the benthic primary producers and associated food sources utilised by foraging protected fauna such as seabirds. Also, removal of oil reaching a turtle nesting beach would be of benefit to turtle nesting success. However, due to the type (generally non-toxic and non-adhesive weathered oil), shoreline clean-up of weathered diesel may only have limited positive effect compared to natural weathering. Caution is required, as additional physical damage can occur in sensitive intertidal environments, and the general presence of responders can result in additional disturbance to natural wildlife behaviours and processes, especially seabirds and turtle nesting etc.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on entrained oil in the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on entrained oil in the upper water column.
Water surface	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on thin surface slicks on the water surface.
Air	No or insignificant alteration of impact	0	As oil will have significantly weathered by the time it reaches a shoreline, clean-up activities will result in no net change to impacts to air quality.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Shoreline clean-up not result in any change to impacts to offshore faciltiies.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	There would be no reduction in entrained oil, resulting in no significant change to fish communities, and thus commercial demersal fisheries.
Shallow commercial fisheries (including aquaculture)	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Recreational fisheries	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	Minor mitigation of impact	1	Shoreline clean-up may reduce oil damage to Aboriginal heritage sites along the Kimberley / NT coastline, however care would be required to ensure important sites are not damaged during the clean-up process.
Traditional Indonesian fishing	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.

Surface Dispersants

Overall statement of likelihood of success of Surface Dispersants:

Aim: To remove oil from the sea's surface via dispersant spraying from vessels and aircraft, thus reducing the amount of oil reaching birds, mammals and other organisms - as well as coastal habitats, socioeconomic features and shorelines (IPIECA 2015).

Type of slick: Surface oil is in the form of Group II floating slicks which have a low viscosity and rapidly spread into a thin sheen. They will be approximately 50 g/m2 (Bonn code 3/4) for <2km from the spill location, 10 g/m^2 up to approximately 160 km from the spill site and approximately 1 g/m^2 up to approximately 500 km from the spill site (RPS 2021a, RPS 2021b).

Likely success/effectiveness against slick: The National Research Council (2005) notes that the window to use dispersants is early, typically within hours to 2 days of a spill, then after that, weathering makes oil more difficult to disperse (due to increased viscosity). Rapid dispersion of dispersant-treated oil begins at a wind speed of approximately 7 knots with wave heights of 0.2 to 0.3 metres (IPIECA 2015). Conditions where wave energy is too low, oil droplets may resurface after being applied with dispersant due to oil not being effectively dispersed into the water column. Dispersant becomes challenging in high winds and rough seas, where floating oil will be over-washed or temporarily submerged (IPIECA 2015). Whilst dispersants reduce the amount of oil on the surface that can affect wildlife, they also increase the exposure of dispersed oil in the upper water column to other wildlife. It is expected that dispersant will not significantly change the proportion of surface oil which would become entrained as the sea-state changes. Therefore, given surface diesel slicks will rapidly entrain with increasing wind-speed, dispersant will have limited effect when compared with natural entrainment processes.

Generally oil slicks needs to be >100 g/m^2 (>0.1mm, which equates to Bonn code 4/5) to feasibly achieve a successfully dispersant operation. However diesel from a vessel collision on the ocean surface is unlikely to have slicks >100 g/m^2. Where there are any significant diesel slick, flammable/toxic vapours will also be present, and will likely exceed safe exposure thresholds, further reducing response efficiency (as vessels will not be permitted to operate in areas where explosive limits or VOC exposure thresholds are exceeded). Due to the very thin surface slicks, very low rates of successful dispersal would be expected. Therefore, surface dispersant application on a diesel vessel slick would not be an effective response strategy.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to shallow water BPPH. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Chemical dispersant would result in an insignificant increase in any additional oil reaching deep water locations, regardless of chemical dispersant application on the surface.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	Dispersant is generally considered ineffective at significantly increasing entrainment of thin sheens of marine diesel, compared to natural rates of entrainment. A significant volume of dispersant would need to be applied to result in any change, therefore this would result in negative impacts, due to additional chemicals on the surface and in the shallow water column, which could negatively impact on sensitive shallow/intertidal receptors such as corals, seagrass etc, and the biota who depend on them, including invertebrates, and mega-fauna who forage in these zones.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	
Sandy Beach	Minor additional impact	-1	
Rocky Shoreline	Minor additional impact	-1	
Macro-Algae and Seagrass	Minor additional impact	-1	
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor additional impact	-1	
Water column			
Lower water column (below photoic zone)	No or insignificant alteration of impact	0	No oil reaching deep water locations, regardless of dispersant application on surface.
Upper water column (in photic zone)	Minor additional impact	-1	Dispersed oil can cause marine organisms inhabiting the upper water column to be briefly exposed to dispersed oil which can potentially have toxic effects. Dispersant is generally considered ineffective at significantly increasing entrainment of thin sheens of marine diesel, compared to natural rates of entrainment. A significant volume of dispersant would need to be applied to result in any change, therefore this would result in negate impacts, due to additional chemicals on the surface and in the shallow water column.
Water surface	Minor additional impact	-1	
Air	No or insignificant alteration of impact	0	A very slight reduction in VOCs in local atmosphere could occur as a result of dispersant application and additional entrainment. However additional chemical dispersant mist in the local atmosphere would likely offset any reduction in VOCs.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	No oil reaching deep water locations, including demersal fish habitat, regardless of chemical dispersant application on surface.
Shallow commercial fisheries (including aquaculture)	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to shallow commercial fisheries.
Recreational fisheries	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to recreational fisheries.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor additional impact	-1	Surface chemical dispersant applciation may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing offshore facilities with shallow seawater intakes to increased entrained hydrocarbons, for the duration of surface chemical dispersant use. Exposed facilities may be required to conduct additional monitoring/maintenance of their internal seawater systems.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	As any dispersant application would occur within offshore waters, and as there would likely be significant naturally entrained of a diesel spill due to natural wind effects, surface dispersant application would result in an insignificant change in dispersed/entrained oil reaching traditional Aboriginal areas of the Kimberley and NT coastline.
Traditional Indonesian fishing	Minor additional impact	-1	Chemical dispersant and additional entrained oil could result in negative impacts to shallow water BPPH which support Indonesian traditional fishing target species. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH.

Pre-Contact Wildlife Response (Hazing and Translocation)

Overall statement of likelihood of success of Pre-contact OWR (hazing and relocation/displacement):

Aim: Hazing involves discouraging animals from entering oiled areas by encouraging them to move into low-risk unoiled areas, in an attempt to prevent them from becoming oiled (IPIECA 2017). Hazing techniques include vessels generating underwater noise and motion, vessel air horns making above-water noise and fire hoses directing streams in front of fauna. Translocation/displacement involves removing wildlife who are at risk of becoming oiled from the spill environment in an attempt to prevent them from becoming oiled (IPIECA 2017). This includes holding animals in captivity until the risk of oiling is over, or relocating them to another area not affected by the oil spill (IPIECA 2017).

Type of slick: Surface oil is in the form of Group II floating slicks which have a low viscosity and rapidly spread into a thin sheen. They will be approximately 50 g/m2 (Bonn code 3/4) for <2km from the spill location, 10 g/m^2 up to approximately 160 km from the spill site and approximately 1 g/m^2 up to approximately 500 km from the spill site (RPS 2021a, RPS 2021b). Group II oils are relatively non-adhesive, and oil reaching shorelines is likely to have undergone weathering and will be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than their unweathered counterparts (Milton et al, 2003; Hoff & Michel 2014; Woodside 2014).

Likely success/effectiveness against slick: Wildlife hazing in the open ocean is inherently unlikely to be effective due to a number of limitations;

1) effectiveness depends upon the deployment of numerous ocean-going vessels (as opposed to smaller vessels which can be used near to the shore);
2) against a spreading plume (i.e. away from the immediate source of the spill), the technique becomes entirely impracticable;
3) there are significant safety issues associated with a spill of diesel and vessel masters will not approach the source of the spill, or fresh areas of slick, while the spill is still ongoing; and
4) without the constraints of a shoreline or other geographical feature, the technique may cause wildlife to move into other areas of the spill area instead of away from it.

Wildlife hazing is most suitable when used near sensitive shoreline habitats against persistent oily slicks, such as IFO, HFO or crude oil spills - but in the case of a Group II vessel collision, oil slicks are thin and not considered particularly adhesive, therefore reducing the likelihood and severity of impacts on wildlife. Additionally, hazing isn't considered an effective measure against volatile spills which rapidly evaporate.

In regard to wildlife translocation, IPIECA (2014) advise that the difficulty of capturing wildlife safely and maintaining their health during relocation should not be underestimated, and that working with live or dead animals has health and safety issues including potential injuries (bites, scratches) or zoonotic diseases. Risks to wildlife are high during pre-emptive capture and the risks of oiling need to be weighed against the risk of injury, death etc. (IPIECA 2014). The translocation of turtles from beaches and islands would likely require the capture of large numbers of hatchlings, followed by translocation to a location far from the slick (to prevent surface oil impacts on released hatchlings). The prolonged retention of hatchlings has been demonstrated to be detrimental to hatchling swimming speed and survival, even in short periods (6 hours) of retention (Pilcher and Enderby 2001). Attempting to capture large numbers (or an entire flock) of healthy seabirds would be very challenging, if not impossible (DPaW 2014), especially at a remote shoreline location (such as Browse or Cartier Island). There is no practicable method to capture healthy seabirds at sea (DPaW 2014). Potential harm to healthy seabirds could occur during the capture process. Any seabirds released would likely fly back to the shoreline from which they originally were captured. Therefore, long term veterinary care (feeding etc.) would be required for any successfully captured birds, until spill weathering or remediation has occurred and it was safe to release the animals. An evaluation would need to be undertaken, to ensure the released animals do not pose a disease risk (human/zoonotic diseases), to the wild population into which they are released.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Sandy Beach	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Rocky Shoreline	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	Wildlife hazing of flocks of seabirds may temporarily prevent oiling of individuals or small proportions of a local/regional populations, however it is not likely effective across a broad geographical area. Even conducting wildlife hazing in the nearshore environment at an isolated location such as Browse Island would be of logistically challenging and potentially not result in any significant impact mitigation. Hazing of seabirds to prevent them landing on an oiled shoreline may temporarily prevent impacts, whilst shoreline clean-up is occurring. Capture and translocation of turtle hatchlings away from the oiled shoreline, and release in the open ocean is potentially feasible. Therefore, undertaking pre-contact oiled wildlife response at a shoreline may reduce the number of protected species of a local population from being oiled.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Water surface	No or insignificant alteration of impact	0	Wildlife hazing and/or translocation of seabirds or other megafauna, such as cetaceans and turtles in the open ocean, using vessel presence, vessel noise or at sea capture is highly unlikely to be successful. It may be possible to temporarily (minutes / hours), prevent a few individuals of a protected species from entering a small geographic area affected by a slick. However, over the longer term duration and geographic area of a well-blowout scenario, there would be no alteration to the level of oiling of wildlife populations using this strategy in the open ocean.
Air	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Recreational fisheries	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Traditional Indonesian fishing	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.

Post Contact Oiled Wildlife Response

Overall statement of likelihood of success of Post-contact OWR:

Aim: Post-contact wildlife response involves capturing oiled wildlife - and if necessary, cleaning, rehabilitating and releasing them.

Type of slick: Surface oil is in the form of Group II floating slicks which have a low viscosity and rapidly spread into a thin sheen. They will be approximately 50 g/m2 (Bonn code 3/4) for <2km from the spill location, 10 g/m^2 up to approximately 160 km from the spill site and approximately 1 g/m^2 up to approximately 500 km from the spill site (RPS 2021a, RPS 2021b). Group II oils are relatively non-adhesive, and oil reaching shorelines is likely to have undergone weathering and will be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than fresh oil (Milton et al, 2003; Hoff and Michel 2014; Woodside 2014). Note that Group II hydrocarbons are relatively non-adhesive compared to crude oils, and are generally not considered an oil product that would 'coat' the feathers of birds, requiring a full wildlife cleaning response on a shoreline.

Likely success/effectiveness against slick: Capture, relocation, assessment, cleaning and rehabilitation of oiled wildlife has the ability to increase the survival of individuals. ITOPF (2011) note that there are many cases where oiled turtles have been cleaned successfully and returned to the water. Any seabirds captured, cleaned and released would likely fly back to the shoreline from which they originally were captured. Once oiled, it is generally agreed that birds have a very low survival rate, even when rescue and cleaning is attempted (Bourne et al. 1967; Holmes and Cronshaw 1977; Croxall 1977; Ohlendorf et al. 1978; Chapman, 1981; Ford et al., 1982; Samuels and Lanfear, 1982; Varoujean et al., 1983; Ford, 1985; Evans and Nettleship 1985; Fry 1987; Seip et al. 1991; Anderson et al. 2000). French-McCay (2009) produced mortality estimates of 99% for surface swimmers, 35% for aerial divers and raptors, and 5% for aerial seabirds. Samuels and Lanfear (1982) estimated that 95% of oiled seabirds die. ITOPF (2011) note that penguins and pelicans are often the exception as they are generally more resilient than many other species, however they are not present in the Browse Basin. IPIECA (2014) advise working with live or dead animals has health and safety issues including potential injuries (bites, scratches) or zoonotic diseases. An evaluation would need to be undertaken, to ensure any released animals do not pose a disease risk (human/zoonotic diseases), to the wild population into which they are released.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Sandy Beach	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Rocky Shoreline	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	Post-contact OWR has the ability to increase the likelihood of survival of oil-affected EPBC species (individuals, or small proportion of a local population) in the intertidal/shoreline habitats. However, the seabird species of the Browse Basin are generally not expected to survive the capture, cleaning and rehabilitation process. Capture, cleaning and release of marine turtles would have a greater likelihood of success.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Water surface	Minor mitigation of impact	1	It is possible that some individuals of protected species, which have been oiled and are unable to fly, could be captured in the open ocean and relocated to an oiled wildlife treatment facility. Therefore, whilst there is a very low probability of survival, under the right circumstances a positive environmental outcome, for a limited number of individuals of a protected species could be achieved.
Air	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Recreational fisheries	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Traditional Indonesian fishing	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.

Controlled In-Situ Burning

Overall statement of likelihood of success of Controlled In-Situ Burning (ISB):

Aim: In-site burning rapidly removes the volume of spilled oil's hydrocarbon vapours in place, via combustion or burning (IPIECA 2016). This technique reduces the need to collect, store, transport and dispose recovered oil, plus it can shorten the overall response time (IPIECA 2016).

Type of slick: Surface oil is in the form of Group II floating slicks which have a low viscosity and rapidly spread into a thin sheen. They will be approximately 50 g/m2 (Bonn code 3/4) for <2km from the spill location, 10 g/m^2 up to approximately 160 km from the spill site and approximately 1 g/m^2 up to approximately 500 km from the spill site (RPS 2021a, RPS 2021b).

Likely success/effectiveness against slick: ISB requires wave heights typically below 1 m and wind speeds below 10 knots (IPIECA 2016) which are frequently exceeded at remote offshore locations in the Browse Basin region. Overseas experience shows that burns can be conducted safely, but the most discernible disadvantage is the resulting dark smoke plumes caused by the combustion of oil (IPIECA 2016). Carbon dioxide, soot (PM 2.5), water, polyaromatic hydrocarbons, volatile organic compounds, carbonyls, carbon monoxide, sulphur dioxide and potentially other gases can result from an in-situ burn, which has the potential to affect human and animal health (IPIECA 2016). IPIECA (2016) note that tests and information from previous burns indicate that ISB has little effect on water quality. Burn residue (i.e. burned oil depleted of volatiles and precipitated soot) rarely sinks and smothers benthic species (IPIECA 2016). Plus it is unlikely that Group II burn residue will cause smothering as this generally only occurs for heavier crudes (IPIECA 2016). IPIECA (2016) further note that burn residue is less toxic to aquatic biota than weathered oil.

To implement an effective in-situ burn response, a minimum surface hydrocarbon thickness of 2-5 mm (2000 - 5000 g/m^2) is required to be present. In the case of a vessel collision, the surface slick is not expected to meet the required thickness (i.e. only 10 g/m^2 or 0.1 mm expected thickness in the immediate area of the release). Booms would be required to corral the spill, in an attempt to generate additional oil thickness, but this in turn is expected to exceed the VOC exposure thresholds for the workforce, and also may result in concentrations exceeding the lower explosive limit. Given this, and the lack of suitable booms available for in-situ burns in Australia, implementation of this response in an open ocean, high current environment is not considered to be safe, effective or feasible, especially against the thin sheen and hazardous atmospheric conditions associated with a large fresh diesel spill.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)			
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)			
Deep-sea unconsolidated muds and sands			
Intertidal seabed			
Intertidal Coral Reef			
Mangrove/Mudflats/Samphires			
Sandy Beach			
Rocky Shoreline			
Macro-Algae and Seagrass			
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)			
Water column			
Lower water column (below photic zone)			
Upper water column (in photic zone)			
Water surface			
Air			
Socio-economic			
Commercial demersal fisheries			
Shallow commercial fisheries (including aquaculture)			
Recreational fisheries			
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)			
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)			
Traditional Indonesian fishing			

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X060-AH-LIS-60033 - Spill Impact Mitigation Assessment - Instantaneous IFO/HFO Surface Release

Revision	1
Date	31-Aug-21

Location	Browse Region including adjacent WA/NT shorelines	Spill Scenario	Vessel Collision 776m3 IFO/HFO Spill

	SIMA Stage 2: Predict Outcomes		SIMA Stage 3: Balance Trade-Offs - Impact Modification Factors													
	Potential Relative Impact		Prediction of the effectiveness and impact modification potential of the response options													
Resource Compartment (including values dependent on the resource compartment)	No Intervention (natural weathering)		At Sea Contain and Recover		Protect of Sensitive Resources		Shoreline Clean-up		Surface Dispersant		Pre-Contact Oiled Wildlife Response (Hazing & Translocation)		Post Contact Oiled Wildlife Response		Controlled In-situ Burning	Survillance, Monitoring and Visualisation (SMV)
		A	B1	A x B1	B2	A x B2	B3	A x B3	B4	A x B4	B5	A x B5	B6	A x B6		
Subtidal Benthic Communities															Controlled In-Situ Burning is not considered to be safe, effective or feasible.	SMV is implemented under all oil spill scenarios
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging within this habitat)	None / Insignificant	1	1	1	0	0	0	0	-1	-1	0	0	0	0		
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Deep-sea unconsolidated muds and sands	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Intertidal seabed																
Intertidal Coral Reef	Moderate	3	1	3	-1	-3	-1	-3	-1	-3	0	0	0	0		
Mangrove/Mudflats/Samphires	Minor	2	1	2	2	4	-1	-2	1	2	0	0	0	0		
Sandy Beach	Minor	2	1	2	1	2	2	4	1	2	0	0	0	0		
Rocky Shoreline	Minor	2	1	2	1	2	1	2	1	2	0	0	0	0		
Macro-Algae and Seagrass	Moderate	3	1	3	-1	-3	-1	-3	-1	-3	0	0	0	0		
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Significant	4	1	4	2	8	2	8	2	8	1	4	1	4		
Water column																
Lower water column (below photic zone)	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Upper water column (in photic zone, including plankton and EPBC foraging in the photic zone)	Minor	2	1	2	0	0	0	0	-1	-2	0	0	0	0		
Water surface, including foraging areas for EPBC listed species	Moderate	3	1	3	0	0	0	0	2	6	0	0	1	3		
Air	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0		
Socio-economic																
Commercial demersal fisheries	Moderate	3	0	0	0	0	1	3	0	0	0	0	0	0		
Shallow commercial fisheries (including aquaculture)	Moderate	3	1	3	0	0	1	3	-1	-3	0	0	0	0		
Recreational fisheries	Moderate	3	1	3	0	0	1	3	-1	-3	0	0	0	0		
Offshore Oil and Gas Exploration and Production Facilties (Platforms, Drilling Rigs etc)	None / Insignificant	1	1	1	0	0	0	0	-1	-1	0	0	0	0		
Cultural heritage																
Aboriginal heritage (cultural practices, sites and fishing / foraging)	None / Insignificant	1	0	0	0	0	1	1	0	0	0	0	0	0		
Indonesian traditional fishing	None / Insignificant	1	1	1	0	0	1	1	-1	-1	0	0	0	0		
		Total Impact Mitigation Score		30		10		17		3		4		7	-	-
		Carried to Field Capability Evaluation yes/no		Yes		Yes		Yes		Yes		Yes		Yes	No	Yes

Resource Compartment (including values dependent on the resource compartment)	No Intervention (natural weathering)		Justification for Potential Relative Impact Score
		A	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging within this habitat)	None / Insignificant	1	Subtidal benthic primary producer habitat (BPPH) are unlikley to be exposed to entrained/dissolved IFO/HFO above impact thresholds from a vessel collision in the Browse Basin. HFO will result in insignficant entraied/disoolved hdyrocarboson. IFO surface spill may result in exceedances of the 100ppb entrained oil threshold for up to 5km, and generally only in the top 10m of the water column. Therefore, BPPH in the offshore Browse Basin are not expected to be impacted. The consequence to benthic primary producer habitat is considered to be Insignificant.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	None / Insignificant	1	No impact from surface spill of IFO/HFO below 10m (RPS APASA 2014).
Deep-sea unconsolidated muds and sands	None / Insignificant	1	No impact from surface spill of IFO/HFO below 10m (RPS APASA 2014).
Intertidal seabed			
Intertidal Coral Reef	Moderate	3	Intertidal coral reefs could be impacted by surface fresh, weathered/emulsified, but very limited (if any) entrained and dissolved hydrcarbons from an IFO/HFO surface spill in the Browse Basin. The effect of IFO/HFO on intertidal coral is likely to result in significant smothering as IFO/HFO is expected to remain as a persistent, viscous surface spill when it arrives in intertidal coral areas. Physical oiling of coral tissue can cause a decline in metabolic rate and may cause varying degrees of tissue decomposition which can lead to death (Negri & Heyward 2000). The, toxicity of weathered/emulsified IFO/HFO is less than fresh oil. The effect of any residual toxic fractions of the oil on intertidal coral include partial mortality of colonies, reduced growth rates, bleaching, reduced photosynthesis, interruption of chemical communication necessary for mass spawning, premature explosion of larvae, decreased growth rates, decreased lipid content, decreased survival of larvae, decreased gonadal development, negative impacts to coral settlement, increased susceptibility to algae colonisation, epidemic diseases, localised tissue rupture, reduced reef resilience and mortality (Hayes et al 1992; Peters et al 1997; Negri & Heyward 2000; Shigenaka 2001; CSIRO 2016). Coral reefs are found in isolated locations within the Browse Basin and are considered to be significant benthic primary producers that play a key role in the ecosystem and have an iconic status in the environment (WA DoT 2018). They are considered of high importance to EPBC species that aggregate, nest, roost and forage in the area, hence isolated populations could potentially be exposed in the event of a spill. As spills disperse, intertidal communities are expected to recover (Dean et al. 1998), though the rate of recovery of coral reefs depends on the level or intensity of the disturbance, with recovery rates ranging from 1 or 2 years, to decades (Fucik et al. 1984, French McCay 2009). Impact on the receptor is considered to be Moderate.
Mangrove/Mudflats/Samphires	Minor	2	Mangrove, mudflats and samphire communities, which are remote from Permit areas, may be exposed weathered surface slicks, but are unlikely to be exposed to entrained/dissolved hydrocarbons above impact thresholds from a IFO/HFO spill resulting from a vessel collision in the Browse Basin. The potential effects of surface oiling include defoliation and mortality of mangroves (Burns et al. 1993; Duke et al. 2000). Oil exposure is only likely to occur at isolated locations amongst a very large and generally contiguous populations of mangrove communities. The recovery of mangroves from shoreline oil accumulation can be a slow process, due to the long-term persistence of oil trapped in anoxic sediments and subsequent release into the water column (Burns et al. 1993). Any impacts to benthic habitats are expected to be localised and of short to medium term. The potential consequence is considered to be Minor.
Sandy Beach	Minor	2	Sandy beaches may be exposed to fresh and weathered/emulsified IFO/HFO above impact thresholds in the event of a vessel collision in the Browse Basin. The effect of gradual accumulation of oil on the receptor could lead to harm including the increased prevalence of tumours in species (CSIRO 2016). Sandy beaches are the dominant shoreline habitat on offshore islands in the Browse Basin and are considered significant habitat for turtles and seabird nesting. Organisms such as polychaete worms, bivalves and crustaceans generally inhabit sandy beaches but the mobile nature of the sands generally limits diversity. These species provide a valuable food source for resident and migratory sea and shorebirds (DEC/MPRA 2005). Law et al (2011) note that when grain size is between 2 and 64 mm, beaches are not considered especially sensitive to oil spills as they are regularly cleaned by wave action and oil is generally not retained. Offshore island beaches of the Browse Basin are generally coarse grained, due to high wave energy. WA DoT (2018) assessed Kimberley sandy beaches and concluded that they are moderately ecologically sensitive and are moderately difficult to rehabilitate from an oil spill. The potential consequence is considered to be Minor.
Rocky Shoreline	Minor	2	Rocky shorelines may be exposed to to fresh and weathered/emulsified IFO/HFO above impact thresholds in the event of a vessel collision in the Browse Basin. This receptor is typically characterised as being a high wind and wave energy environment (CSIRO 2016). IFO/HFO from a spill has the potential to coat the substrate or become stranded by receding tides – but incoming tides also have the potential to remove deposited oil (Law et al 2011). CSIRO (2016) note that rocky shorelines are not considered sensitive environments, and IPIECA (2017) state that rocky shorelines generally have a diverse and productive intertidal community which are considered resilient to oil spills and short-term oil persistence. WA DoT (2018) note that rocky shorelines are the least susceptible of shoreline types to long term impacts from a spill. As such, this receptor is not expected to have issues relating to recovery from an oil spill. The potential consequence for rocky shorelines is considered to be Minor.
Macro-Algae and Seagrass	Moderate	3	Macroalgae and seagrass may be exposed to significant concentrations of surface fresh and/or weathered/entrained IFO/HFO, however entrained and dissolved oil would be below impact thresholds from a vessel collision in the Browse Basin. WA DoT (2018) note that dissolved oil causes more impacts to algae than floating oil, as it results in cellular level poisoning. The effect of subjecting seagrass and macroalgae to lethal or sublethal toxic effects of oil can result in mortality, reduced growth rates and impacts to seagrass flowering. Several studies have indicated rapid recovery rates may occur even in cases of heavy oil contamination (Connell et al, 1981; Burns et al. 1993; Dean et al. 1998; Runcie & Riddle 2006). Taylor and Rasheed (2011) reported that seagrass meadows were not significantly affected by an oil spill when compared to a non-impacted reference seagrass meadow. Macroalgae support diverse small invertebrates that are the principal food source for a number of inshore fish (WA DoT 2018). Seagrasses provide energy and nutrients for detrital grazing food webs (WA DoT 2018), act as a refuge for fish and invertebrates, and provide a food source for EPBC species such as dugongs and green turtles (DEC 2007). The potential consequence is considered to be Moderate.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Significant	4	Intertidal habitat may be exposed to significant concentrations of surface fresh and/or weathered/entrained IFO/HFO, however entrained and dissolved oil would be below impact thresholds from a vessel collision in the Browse Basin. The effect of IFO/HFO on this receptor can result in mortality or harm to benthic primary producers and organisms such as EPBC species that rely on these species for food, or rely on the habitat for nesting and roosting. IPIECA (2014) note that dehydration, gastrointestinal problems and anaemia are commonly found in oiled animals, causing potential long-term effects on reproductive success. They further note that the toxic effects of ingested oil generally impacts the liver, whilst volatile fumes damage lungs resulting in debilitating effects (IPIECA 2014). Oiled aquatic EPBC fauna can further suffer hypothermia, irritations, burns, respiratory problems and loss of waterproofing, leading to them moving onto land (i.e. away from their food source) where they have further difficulty thermoregulating and feeding (IPIECA 2017). Specifically, marine reptiles, including turtles and crocodiles can be exposed to hydrocarbons externally in intertidal areas through direct contact; or internally, by ingesting oil, consuming prey containing oil, or inhaling volatile compounds (Milton et al. 2003). Turtle hatchlings may be particularly vulnerable to toxicity and smothering, as they emerge from nests and make their way over the intertidal area to the water (AMSA 2015; Milton et al. 2003). Birds coated in hydrocarbons can suffer damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs (AMSA 2015; WA DoT 2018). Toxic effects may also result where the product is ingested, either through birds' attempts to preen their feathers (Jenssen 1994; Matcott et al. 2019) or ingested as weathered waxy flakes/residues present on shorelines. There is the potential for short to medium term impacts; however, the overall population viability for any protected species would not be threatened from a vessel collision spill. The cumulative potential consequence is considered to be Significant.

Water column			
Lower water column (below photic zone)	None / Insignificant	1	No impact from surface spill of IFO/HFO below 10m (RPS 2014).
Upper water column (in photic zone, including plankton and EPBC foraging in the photic zone)	Minor	2	The upper water column may be exposed to entrained and dissolved hydrocabons above impact thresholds from a vessel collision in the Browse Basin. HFO will result in no exposure above imact thresholds for entrained/disoolved hydrocarbons, however an IFO spill may result in exceedances of the 100ppb entrained oil threshold for up to 5km in the top 10m of the water column (RPS 2014). The effect of entrained and dissolved oil on this receptor include chronic impacts to juvenile fish, larvae and planktonic organisms due to their sensitivity during these life stages, with the worst impacts predicted to occur in smaller species (WA DoT 2018). Whale sharks are filter feeders and are expected to be highly vulnerable to entrained hydrocarbons (Campagna et al 2011) with potential effects including damage to the liver and lining of the stomach and intestines, as well as toxic effects on embryos (Lee 2011). Marine mammals, marine reptiles and marine avifauna could also be impacted through entrained and dissolved hydrocarbon exposure, primarily through ingestion during foraging activities (AMSA 1998). The upper water column is considered to be very important habitat for EPBC species as a large number of BIAs for marine fauna are present in the Browse Basin. It is expected that the upper water column will recover quickly as a vessel collision spill is unlikely to cause significant or cumulative impacts. Impacts to the upper water column from an IFO/HFO spill will be short-term and highly localised. Therefore, the consequence to the upper water column is considered to be Minor.
Water surface, including foraging areas for EPBC listed species	Moderate	3	The water surface will be exposed to fresh and weathered/emulsified IFO/HFO above impact thresholds from a vessel collision in the Browse Basin. Fresh and weathered oil can impact marine mammals surfacing, as they are vulnerable to oil exposure. Blue whales and humpback whales (baleen whales), that filter-feed near the surface, could potentially ingest oil. Oil may also foul the fibres of baleen whales impairing food gathering efficiency or fouling prey with hydrocarbons (AMSA 2015). Turtles can be exposed to hydrocarbons if they surface within the spill, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (Milton et al. 2003). Floating oil is considered to impact reptiles more than entrained/dissolved oil because reptiles hold their breath underwater and are unlikely to directly ingest dissolved oil (WA DoT 2018). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large, pre dive inhalations, make them vulnerable to spilled oil (AMSA 2015). Hatchlings spend more time on the surface than older turtles, thus increasing the potential for contact with oil slicks (Milton et al. 2003). Aquatic migratory birds are among the most vulnerable and visible species to be affected by surface oil, with oil impacts frequently leading to long-term physiological changes potentially resulting in lower reproductive rates or survival rates (Fingas 2012). The probability of lethal effects is dependent on factors such as timing, location, oceanographic and weather patterns, and the movements of species that forage, feed, nest and inhabit that area (IPIECA 2014), the amount of time spent on the water surface as well as any oil avoidance behaviour (French-McCay 2009). Direct contact with surface hydrocarbons may break down the ability of plumage to maintain body heat, resulting in direct and indirect impacts such as hypothermia, dehydration, drowning and starvation (AMSA 2015; Matcott et al, 2019; Jenssen 1994; IPIECA 2014; ITOPF 2011). Birds resting at the sea surface or surface plunging can be impacted by oil resulting in damage to external tissues, including skin and eyes, and internal tissue irritation in lungs and stomachs (Clark 1984; WA DoT 2018). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (Jenssen 1994; Matcott et al. 2019). The water surface is considered an important receptor where EPBC listed species forage. It is expected to recover from oil impacts with time, and there is potential that there could be cumulative impacts through bioaccumulation up the food chain from a surface spill of IFO/HFO. The consequence is considered to be Moderate.
Air	None / Insignificant	1	Air may be exposed to fresh surface IFO/HFO above impact thresholds from a vessel collision in the Browse Basin. IFO has low concentrations of aromatic hydrocarbons, and HFO has very low concentrations of aromatic hydrocarbons (RPS 2014). Although species such as cetaceans and marine reptiles could also be affected by harmful vapours during pre-dive inhalations (Milton et al. 2003), the risk of exposure is only present in the first few hours after the spill. Therefore, there is a low likelihood that local concentrations of atmospheric volatiles would exceed levels that would have the potential to cause harmful impacts to air breathing marine fauna. The receptor is not considered to be sensitive, thus is expected to recover in a very short period of time, as the evaporated hydrocarbons are rapidly dispersed by the wind, and evaporation from IFO/HFO will very rapidly reduce with time as oil weathers and emulsifies. Only a very localised area, immediately above the freshest parts of the oil slick, in the very initial states of the spill, would be impacted by evaporating hydrocarbons. The potential therefore consequence is considered to be Insignificant.
Socio-economic			
Commercial demersal fisheries	Moderate	3	Commercial demersal fisheries may be exposed to surface, weathered, entrained and limited dissolved IFO/HFO above impact thresholds from a vessel collision in the Browse Basin. Very limited entrained/dissolved hydrocarbons are expected, and none deeper than 10 metres (RPS 2014). The effect of shallow entrained/dissolved on this receptor includes the ability to cause economic loss (through indirect loss of stock and perceived tainting of stock by oil) (WA DoT 2018), impede access to fishing areas from the implementation of an exclusion zone during a spill response; impact seafood quality and employment; plus negatively impact lines and nets (ITOPF 2011). The economic impact from an oil spill is dependent on the species being cultured, as species have different recovery rates. WA DoT (2018) note that dissolved oil will impact finfish, taking 6-8 years for fisheries to recover (due to the time it takes for hatchlings to reach maturity) (WA DoT 2018), however due to limited dissolved components during an IFO/HFO spill, these impacts are unlikely. This receptor is considered to be important, however a vessel collision spill is unlikely to cause significant impacts to demersal fisheries due to the shallow, localised and very limited entrained oil affected area. The real and perceived consequence is considered to be Moderate.
Shallow commercial fisheries (including aquaculture)	Moderate	3	Shallow commercial fisheries (including aquaculture) may be exposed to surface, weathered, entrained and limited dissolved IFO/HFO above impact thresholds from a vessel collision in the Browse Basin. Very limited entrained/dissolved hydrocarbons are expected, and none deeper than 10 metres (RPS 2014). The effect of IFO/HFO spills on this receptor includes the ability to cause economic loss (through indirect loss of stock and perceived tainting of stock by oil) (WA DoT 2018), impede access to fishing areas from the implementation of an exclusion zone during a spill response; impact seafood quality and employment; plus negatively impact lines and nets (ITOPF 2011). The economic impact from an oil spill is dependent on the stock being cultured, as species have different recovery rates. DoT (2018) note that dissolved oil will have the greatest impact, with oyster farms potentially taking 3-4 years to recover from a spill (DoF 2013), whilst finfish farms could take 6-8 years to recover due to the time it takes for hatchlings to reach maturity. WA DoT (2018) note that the pearling industry relies almost exclusively on sourcing pearl oysters from Eighty Mile Beach (south of Broome) and an area off the Lacepede Islands. There is also other aquaculture in the region including trochus and barramundi (Fletcher et al 2017). WA DoT (2018) note that some wild stocks aquaculture species such as mussels are impacted more by dissolved oil than floating oil due to being filter feeders. however due to limited dissolved components during an IFO/HFO spill, these impacts are unlikely. This receptor is considered to be important however a vessel collision spill in the Browse Basin unlikely to cause any significant impacts to shallow commercial fisheries (including aquaculture) due to the limited and localised surface and very limited shallow entrained oil and remoteness of the shallow commercial fishing areas and aquaculture to potential release locations. Therefore, the real and perceived consequence is considered to be Moderate.
Recreational fisheries	Moderate	3	Recreational fisheries may be exposed to surface, weathered, entrained and limited dissolved IFO/HFO above impact thresholds from a vessel collision in the Browse Basin. Very limited entrained/dissolved hydrocarbons are expected, and none deeper than 10 metres (RPS 2014). The effects of IFO/HFO on this receptor includes negatively impacting nets and lines (ITOPF 2011), impeding access to fishing areas from the implementation of an exclusion zone during a spill response and impacting seafood quality and quantity. Recreational fishing is generally concentrated around readily accessible coastal settlements along the Kimberley and NT coastlines (such as Broome, Wyndham and Darwin) and there is little recreational fishing around the offshore Browse Basin due to the distance from land, lack of features of interest and deep waters. Offshore islands, coral reef systems and continental shelf waters of the Browse Basin however are increasingly being targeted by fishing based charter vessels (Fletcher and Santoro 2014) with extended fishing charters operating during certain times of the year. This receptor is considered to be important, however a vessel collision spill is unlikely to cause significant impacts to recreational fisheries due to the limited and localised surface and very limited shallow entrained oil affected area and very limited recreational fishing in the offshore Browse Basin. The real and perceived consequence is considered to be Moderate.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	None / Insignificant	1	Floating oil is unlikley to pose any significant hazard to offshore oil and gas exploration and production facilities, other than potentially requiring cleaning from a hull at the end of a spill response. Some offshore production assets have shallow seawater intakes (hull mounted, or within <10m of ocean surface). Other facilities only have deep (>50m water depth) seawater intakes. Depending on the depth of the seawater intakes, entrained/dispersed oil may be drawn into the intakes. Experience has shown that spill response and source control vessels/facilities assocaited with a large number of significant oil spills (including the 2010 Macondo/Gulf of Mexico oil spill), were exposed to significant entrained (including dispersed) oil, yet did not suffer from significant mechanical/operational issues assocaited with drawing entrained/dispersed oil in their internal seawater systems. Stakeholder consultation with Wild-Well, OSRL and AMOSC in 2021 has concluded that the exposure of offshore vessels/facilities to entrained/dispersed oil is unlikely to result in any signficant risk to the facility. The only recommendation was for vessels/facilities to monitor, and if necessary, to conduct additional maintenance on internal seawater systems (e.g. monitor/clean the reverse-osmosis filters for potable water generation and heat-exchanger plates on cooling water systems)., potentially resulting in the need for more frequent inspection/maintenance of desalination systems (reverse osmosis filters) and cooling water systems (heat exchanger plates). IFO/HFO spills do not rapidly entrain or dissolve into the water column. Therefore, any impact to offshore facilities from IFO/HFO floating oil is likely to be Insignificant.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	None / Insignificant	1	Aboriginal heritage including special places, cultural landscapes, practices and fishing/foraging along the Kimberley and NT coastline are highly unlikely to be impacted by surface and weathered IFO/HFO above impact thresholds from a vessel collision in the Browse Basin. The effect of surface weathered IFO/HFO on this receptor includes physically degrading a site, disrupting the harvesting of fish, and area closures could displace Aboriginal people and have implications on cultural identity, health and wellbeing. The receptor is important however is very remote from any potential vessel collision location and the recovery is expected to be short to medium term. Therefore, consequence is considered to be Insignificant.
Indonesian traditional fishing	None / Insignificant	1	Indonesian traditional fishing areas may be exposed to surface, weathered, entrained and limited dissolved IFO/HFO above impact thresholds from a vessel collision in the Browse Basin. Very limited entrained/dissolved hydrocarbons are expected, and none deeper than 10 metres (RPS 2014).. Indonesian traditional fishing occurs within the MoU box which covers Scott Reef and surrounds, Seringapatam Reef, Browse Island, Ashmore Reef, Cartier Island and various banks and shoals. The effect of IFO/HFO on these receptor could include reduction and contamination of target species such as sea cucumbers (bêche-de-mer), trochus (top shell snail), reef fish. Exclusion zones during the spill response may also affect access to fishing locations, even if the target species are not affected by the spill. This receptor is considered to be important however a vessel collision spill is unlikely to cause significant impacts to Indonesian traditional fishing due to the limited and localised surface and very limited shallow entrained oil affected area. The real and perceived consequence is considered to be Insignificant.

At Sea Containment and Recovery

Overall statement of likelihood of success of At Sea Contain and Recovery (C&R):

Aim: This strategy aims to collect oil from the ocean surface using booms and skimmers, generally at or near the release location, where oil concentrations are highest. Floating booms are used to corral and concentrate spilled floating oil into a surface thickness that will allow for mechanical removal (i.e. pumping oil into temporary storage) by devices such as skimmers (IPIECA 2015).

Type of slick: Surface oil is in the form of Group IV (IFO/HFO) floating slicks which have a high viscosity and will not rapidly spread into sheens. Surface oil concentrations will be approximately 25 g/m2 at 300 km, 10 g/m^2 (~0.01mm, which equates to Bonn code 1/2) up to approximately 500 km and down to below 1 g/m^2 up to approximately 1200 km from the spill site (RPS 2014, RPS 2021). With increasing wind conditions, IFO and HFO will rapdily increase in viscocity and emulsify. Due to the high viscocity of IFO-180, entrained oil concentrations may exceed 100ppb for up to 5km, and may exceed 10 ppb for up to 50km from an IFO spill location (RPS 2014). Due to the very high viscocity of HFO 380, no entrainment is expected (RPS 2014). IFO-180 has low concentrations of soluble aromatic hydrocarbons, and this component will tend to evaporate from the slicks. Hence, low concentrations (<6ppb) are forecast in the water upper water column (RPS 2014), with no dissolved factions expected in the lower water column or near deep seabed. As HFO has even lower concentrations of soluble aromatic hydrocarbons than IFO, no dissolved fractions in the water column are expected (RPS 2014, RPS 2021).

Likely success/effectiveness against slick: O'Brien (2002) notes that spreading of oil is the main obstacle to a successful at sea contain and recovery response. IFO/HFO oil do not spread rapidly, and as such, booming and recovery with skimmers is considered a viable response option. Generally oil needs to be >100 g/m^2 (>0.1mm, which equates to Bonn code 4/5) to feasibly corral oil with a boom and achieve any significant level of oil recovery with skimmers (O'Brien 2002), as booms have limited effect against thin oil films and no effect against a subsurface plume (ITOPF 2011). In the context of the Browse Basin, even with high sea surface and air temperatures in all seasons, the spreading of any IFO/HFO spill is not expected to be rapid. IFO/HFO spilled from a vessel collision would therefore remain at a thickness of >100g/m^2 for a reasonable period of time, making C&R a practical option (IPIECA 2017). Where there is any significant IFO/HFO slick, flammable/toxic vapours are not likely to be present, (except possibly in the first few hours), and therefore explosive limits or VOC exposure thresholds are not expected to be exceeded. Due to the thick surface slicks, moderate rates of recovery would be expected, provided the right weather conditions. IPIECA (2015) state that efficiency of contain and recover operations (for any oil type) can vary widely due to operational, environmental and logistical constraints, but usually it is limited to recovering approximately only 5-20% of the initial spilled volume. Contain and recovery is therefore considered a feasible response strategy for a Group IV (IFO/HFO) spill.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	Minor mitigation of impact	1	C&R may result in a minor (5-20%) reduction in localised surface oil which may have a minor positive outcome in reducing future entrained oil in the upper water column including submerged BBPH.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting deep sea features.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting deep sea unconsolidated muds and sands.
Intertidal seabed			
Intertidal Coral Reef	Minor mitigation of impact	1	C&R may result in a minor may result in a minor (5-20%) reduction on oil on surface, resulting in minor reduction in surface and entrained oil reaching intertidal zones.
Mangrove/Mudflats/Samphires	Minor mitigation of impact	1	
Sandy Beach	Minor mitigation of impact	1	
Rocky Shoreline	Minor mitigation of impact	1	
Macro-Algae and Seagrass	Minor mitigation of impact	1	
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting the lower water column.
Upper water column (in photic zone)	Minor mitigation of impact	1	C&R may result in a minor (5-20%) reduction in localised surface oil, which may have a minor positive outcome in reducing future entrained oil in the upper water column.
Water surface	Minor mitigation of impact	1	C&R may result in a minor (5-20%) reduction in localised surface oil.
Air	No or insignificant alteration of impact	0	Due to the very low aromatic hydrocarbon content of IFO/HFO, evaporation is expected to be low. Therefore, C&R activities would not result in any significant change to local atmospheric VOC concentrations.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	C&R may result in a minor (5-20%) reduction in localised surface oil which may have a minor positive outcome on entrained oil in the upper watercolum, however would resulting in no change to oil exposure to demersal fish communities.
Shallow commercial fisheries (including aquaculture)	Minor mitigation of impact	1	C&R may result in a minor reduction in localised surface oil which may have a minor positive outcome in reducing future entrained oil in the upper water column including shallow commercial and recreational fisheries.
Recreational fisheries	Minor mitigation of impact	1	
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor mitigation of impact	1	Due to the insignificant impact of floating IFO/HFO on an offshore facility, C&R will not result in a significant reduction to an already minor effect of floating oil against a facility hull. It may result in slightly reduced post spill cleaning, if significant volumes of oil are prevented from contacting the facility. However over time, natural weathering and UV exposure will result in gradual degradation of any IFO/HFO stuck to facilty at the waterline.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	C&R may result in a minor reduction in localised surface oil which may have a minor positive outcome in reducing future entrained oil in the upper water column. However, due to distance to aboriginal cultural heritage receptors, the impact mitigation potential is considered to be insignificant.
Traditional Indonesian fishing	Minor mitigation of impact	1	C&R may result in a minor reduction in localised surface oil which may have a minor positive outcome in reducing future surface oil and entrained oil in the upper water column reaching shallow traditional fishing habitats.

Protect of Sensitive Resources

Overall statement of likelihood of success of Protect of Sensitive Resources (Protect and Deflect / P&D):

Aim: This strategy aims to use physical barriers to exclude or restrict the spill contacting specific sensitive receptors or to deflect the spill from these locations; typically onto less sensitive areas.

Type of slick: Surface oil is in the form of Group IV (IFO/HFO) floating slicks which have a high viscosity and will not rapidly spread into sheens. Surface oil concentrations will be approximately 25 g/m2 at 300 km, 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) up to approximately 500 km and down to below 1 g/m2 up to approximately 1200 km from the spill site (RPS 2014, RPS 2021). With increasing wind conditions, IFO and HFO will rapdily increase in viscocity and emulsify. Due to the high viscocity of IFO-180, entrained oil concentrations may exceed 100ppb for up to 5km, and may exceed 10 ppb for up to 50km from an IFO spill location (RPS 2014). Due to the very high viscocity of HFO 380, no entrainment is expected (RPS 2014). IFO-180 has low concentrations of soluble aromatic hydrocarbons, and this component will tend to evaporate from the slicks. Hence, low concentrations (<6ppb) are forecast in the water upper water column (RPS 2014), with no dissolved factions expected in the lower water column or near deep seabed. As HFO has even lower concentrations of soluble aromatic hydrocarbons than IFO, no dissolved fractions in the water column are expected (RPS 2014, RPS 2021).

Likely success/effectiveness against slick: Booms could be used to protect and deflect surface spills away from sensitive habitats. Generally oil needs to be >100 g/m^2 (>0.1mm, which equates to Bonn Code 4/5) to feasibly corral oil with a boom (O'Brien 2002), as would be required for a P&D response. IFO/HFO slicks and emulsions on the ocean surface from a vessel collision may reach intertidal shorelines at >100 g/m^2. Even in a scenario where the best equipment is available, shoreline protect and deflect activities at Browse Island or other exposed remote shoreline locations, would be technically challenging due to the general exposure to unfavourable sea conditions, large tidal range and shallow coral reefs. Generally protect and deflect is limited to sheltered waters, not exposed reef/beach environments. Only under exceptionally calm sea-states and appropriate tides would it be safe to conduct vessel activities to carry-out an effective protect and deflect operation at remote shorelines. MetOcean conditions required for this technique to be successful include <1 m sea-state and low surface currents - but these are frequently exceeded at remote offshore locations in the Browse Basin region. In addition, given the size of the offshore island shorelines (e.g. Browse Island, one of the smallest offshore islands, has an intertidal zone 3km in diameter, 7km in circumference), a substantial number of booms would be needed to be deployed to protect the shorelines, or deflect oil into a collection point on a beach. Anchoring of booms would most likely result in additional damage to the subtidal and intertidal environment (coral reef) surrounding most offshore islands, due to anchor chain drag. Booms themselves would also drag around on the coral intertidal reef during periods of lower tides, potentially resulting in significant physical damage to the benthos of the reef platform and also result in damage to booms. Booms could potentially be held in place by vessels however due to widths of shorelines requiring protection this would most likely require an unfeasibly large number of vessels, and at low tide this isn't practicable in intertidal zones. Most offshore island shorelines would be expected to have some ability to 'self clean' accumulated IFO/HFO slicks, due to the coarse substrate, the high wave energy and high tidal regime (Fingas 2012), further reducing the impact mitigation potential of protect and deflect at these locations. As a result of the above mentioned factors, protect and deflect may result in some deflection or recovery of Group IFO/HFO slicks at remote intertidal/shoreline habitats.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and will have insignificant impact on entrained oil affecting subtidal benthic primary producer habitat.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and has insignificant impact on entrained oil affecting deep sea features.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and has insignificant impact on entrained oil affecting deep sea unconsolidated muds and sands.
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	P&D may result in a minor reduction of slicks of weathered/emulsified IFO/HFO reaching intertidal receptors. However, anchoring extensive boom arrays would most likely result in physical damage to subtidal and intertidal coral reefs.
Mangrove/Mudflats/Samphires	Moderate mitigation of impact	2	P&D is a proven method of preventing or reducting the impact of floating slicks from reaching intertidal receptors, particularly if a creek-mouth can be boomed to protect a wetland/mangrove community upstream of the creek-mouth. Due to the extensive scale of mangrove communities along the mainland and islands of the Kimberley and NT coastline, only small areas of mangroves could be protected, not the entire habitat. However, if the most important habitats are protected, a significant positive impact mitigation potential can be achieved. Anchors/anchor chains also have the potential to damage mangrove aerial root structures and disturb other fragile low-energy shorelines, therefore care would be required to prevent additional impacts.
Sandy Beach	Minor mitigation of impact	1	P&D may result in a minor reduction of slicks of weathered/emulsified IFO/HFO reaching intertidal receptors. A correctly executed P&D activity may result in a positive outcome compared to natural weathering.
Rocky Shoreline	Minor mitigation of impact	1	P&D may result in a minor reduction of slicks of weathered/emulsified IFO/HFO reaching intertidal receptors. A correctly executed P&D activity may result in a positive outcome compared to natural weathering.
Macro-Algae and Seagrass	Minor additional impact	-1	P&D may result in a minor reduction of slicks of weathered/emulsified IFO/HFO reaching intertidal receptors. However, anchoring extensive boom arrays would most likely result in physical damage to subtidal and intertidal seagrass and macro-algaie.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Moderate mitigation of impact	2	P&D can achieve a reduction of slicks of weathered/emulsified IFO/HFO reaching intertidal receptors. A correctly executed P&D activity may result in a positive outcome compared to natural weathering, including potential reduction of impact on protected species such as marine avifauna and turtles who utilise these habitats. This is espeically the case for receptors where a creek-mouth can be easily boomed to protect a large area of important habitat further upstream.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	P&D does not reduce the amount of entrained oil affecting the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	P&D does not reduce the amount of entrained oil affecting the upper water column.
Water surface	No or insignificant alteration of impact	0	P&D would only occur near shorelines and would not result in any significant reduction to the volume of oil on the water surface.
Air	No or insignificant alteration of impact	0	P&D would only occur at shorelines remote form the spill release location. The weathered slick will not have any significant volatile components remaining, and therefore P&D would have no effect on local atmospheric conditions.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in entrained oil, resulting in no change to oil exposure to commercial demersal fisheries.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to shallow commercial fisheries including aquaculture sites.
Recreational fisheries	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to fish communities, thus no change to recreational fishing.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor mitigation of impact	1	Due to the insignificant impact of floating IFO/HFO on an offshore facility, P&D will not result in a significant reduction to an already minor effect of floating oil against a facility hull. It may result in slightly reduced post spill cleaning, if significant volumes of oil are prevented from contacting the facility. However over time, natural weathering and UV exposure will result in gradual degradation of any IFO/HFO stuck to facilty at the waterline.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface and entrained oil, resulting in no change to impacts on Aboriginal heritage.
Traditional Indonesian fishing	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface and entrained oil, resulting in no change to impacts on Indonesian traditional fishing areas.

Shoreline Clean-Up

Overall statement of likelihood of success of Shoreline Clean-Up:

Aim: Using various physical means to clean up oil from affected shorelines to reduce impacts on sensitive receptors or to avoid any reintroduction of the hydrocarbon to the marine environment. It is often viewed as a three step process, with the first phase involving bulk collection of oil floating against the shoreline or stranded on it; phase two involving in-situ treatment of shoreline substrate and phase three involving removal of any remaining residues (final polish) (IPIECA 2015).

Type of slick: Surface oil is in the form of Group IV floating slicks which have a high viscosity and will not rapidly spread into sheens. Surface oil concentrations will be approximately 25 g/m2 at 300 km, 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) up to approximately 500 km and down to below 1 g/m2 up to approximately 1200 km from the spill site (RPS 2014, RPS 2021). With increasing wind conditions, IFO and HFO will rapdily increase in viscocity and emulsify. Due to the high viscocity of IFO-180, entrained oil concentrations may exceed 100ppb for up to 5km, and may exceed 10 ppb for up to 50km from an IFO spill location (RPS 2014). Modelling of a vessel collision in Permit Areas in the Browse Basin indicate that shoreline contact could occur in 1 day, with total volumes of oil ashore up to approx 300 m3.

Likely success/effectiveness against slick: Shoreline clean-up has been consistently found to not enhance ecological recovery of oiled coastlines (Sell et al 1995) but it may protect other resources in the area, such as birds, marine mammals or subtidal habitats including coral reefs or fish farms (CSIRO 2016). Choosing a particular clean-up technique is dependent on factors such as shoreline type, exposure, sensitivity, amount of oil, persistence of oil, toxicity of oil and rate of natural oil removal (IPIECA 2015). Mechanical cleaning is generally not an appropriate technique for offshore/remote shorelines, and manual techniques involving rakes and shovels would likely be required. The clean-up of IFO/HFO spills from a beach or shoreline is likely to be difficult, generating high volumes of waste in comparison to the oil recovered. Browse Island and other similar offshore shorelines would be expected to have some ability to naturally 'self-clean', due to the coarse substrate present and the high wave energy and high tidal regime (Fingas 2012), however due to the adhesivness and persistence of IFO/HFO slicks, a shoreline clean-up to assist with natural weathering may be warranted. Typically, inaccessible rocky coves are highly exposed and are best left to naturally clean (IPIECA 2015). ITOPF (2011) also note that for a number of sensitive shoreline types, such as mangroves, natural cleaning is the preferred option in order to minimise the damage caused from clean-up activities. Thus shoreline clean-up would be most effective in areas which are expected to receive large amounts of shoreline oil; where chosen activities don't physically break/damage sensitive habitat such as coral or mangroves; and in areas which are not expected to readily self clean a persistent slick.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil in benthic primary producer habitat within subtidal areas.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil affecting filter feeding communities within subtidal areas.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil affecting deep-sea unconsolidated muds and sands in subtidal areas.
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	Shoreline clean-up on an intertidal coral reef would result in physical damage/breaking of coral structures, therefore a net damage to the eco-system.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	Shoreline clean-up within mangrove/low energy ecosystems is likely to result in more physical damage/breaking of mangrove root structures than benefit from any oil removed.
Sandy Beach	Moderate mitigation of impact	2	Shoreline clean-up of sandy beaches is a well understood, well documented spill response technique, which can reliably remove thick oil from the eco-system. This is beneficial for species such as turtles who nest on sandy beaches. Natural weathering on high energy beaches may be effective, however shoreline clean-up may significantly assist the natural weathering processes.
Rocky Shoreline	Minor mitigation of impact	1	Shoreline clean-up of rocky shorelines is a well understood, well documented spill response technique, which has the ability to remove some oil from the eco-system. However, certain techniques like steam cleaning and high pressure blasting are known to cause more harm than allowing the oil to naturally weather. Therefore, this technique would likely be successful, provided the correct clean-up techniques are chosen.
Macro-Algae and Seagrass	Minor additional impact	-1	Shoreline clean-up within intertidal macro-algae/seagrass ecosystems would likely result in more physical disturbance to plant/root structures than benefit from any oil removed.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Moderate mitigation of impact	2	If it is deemed that the amount of hydrocarbons expected to impact shorelines is large enough that a shoreline clean up will have positive impacts, then the removal of persistent oil from the intertidal zones would likely result in reduction in harm to the benthic primary producers and associated food sources utilised by foraging protected fauna such as seabirds. Also, removal of persistent oil reaching a turtle nesting beach would be of benefit to turtle nesting success. Caution is required, as additional physical damage can occur in sensitive intertidal environments, and the general presence of responders can result in additional disturbance to natural wildlife behaviours and processes, especially seabirds and turtle nesting etc.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on entrained oil in the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on entrained oil in the upper water column.
Water surface	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on thin surface slicks on the water surface.
Air	No or insignificant alteration of impact	0	As oil will have significantly weathered by the time it reaches a shoreline, clean-up activities will result in no net change to impacts to air quality.
Socio-economic			
Commercial demersal fisheries	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Shallow commercial fisheries (including aquaculture)	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Recreational fisheries	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Shoeline clean-up results in no change to impacts of IFO/HFO on a floating facility.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	Minor mitigation of impact	1	Shoreline clean-up may reduce oil damage to Aboriginal heritage sites along the Kimberley / NT coastline, however care would be required to ensure important sites are not damaged during the clean-up process.
Traditional Indonesian fishing	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.

Surface Dispersants

Overall statement of likelihood of success of Surface Dispersants:

Aim: To remove oil from the sea's surface via dispersant spraying from vessels and aircraft, thus reducing the amount of oil reaching birds, mammals and other organisms - as well as coastal habitats, socioeconomic features and shorelines (IPIECA 2015c).

Type of slick: Surface oil is in the form of Group IV (IFO/HFO) floating slicks which have a high viscosity and will not rapidly spread into sheens. Surface oil concentrations will be approximately 25 g/m2 at 300 km, 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) up to approximately 500 km and down to below 1 g/m2 up to approximately 1200 km from the spill site (RPS 2014, RPS 2021). With increasing wind conditions, IFO and HFO will rapdily increase in viscocity and emulsify. Due to the high viscocity of IFO-180, entrained oil concentrations may exceed 100ppb for up to 5km, and may exceed 10 ppb for up to 50km from an IFO spill location (RPS 2014). Due to the very high viscocity of HFO 380, no entrainment is expected (RPS 2014). IFO-180 has low concentrations of soluble aromatic hydrocarbons, and this component will tend to evaporate from the slicks. Hence, low concentrations (<6ppb) are forecast in the water upper water column (RPS 2014), with no dissolved factions expected in the lower water column or near deep seabed. As HFO has even lower concentrations of soluble aromatic hydrocarbons than IFO, no dissolved fractions in the water column are expected (RPS 2014, RPS 2021).

Likely success/effectiveness against slick: The National Research Council (2005) notes that the window to use dispersants is early, typically within hours to 2 days of a spill, then after that, weathering makes oil more difficult to disperse (due to increased viscosity). Rapid dispersion of dispersant-treated oil begins at a wind speed of approximately 7 knots with wave heights of 0.2 to 0.3 metres (IPIECA 2015c). Conditions where wave energy is too low, oil droplets may resurface after being applied with dispersant due to oil not being effectively dispersed into the water column. Dispersant becomes challenging in high winds and rough seas, where floating oil will be over-washed or temporarily submerged (IPIECA 2015c). Whilst dispersants reduce the amount of oil on the surface that can affect wildlife, they also increase the exposure of dispersed oil in the upper water column to other wildlife.

Generally oil slicks needs to be >100 g/m^2 (>0.1mm, which equates to Bonn code 4/5) to feasibly achieve a successfully dispersant operation (IPIECA 2015c). In the context of the Browse Basin, even with high sea surface and air temperatures in all seasons, the spreading of any IFO/HFO spill is not expected to be rapid. IFO/HFO spilled from a vessel collision would therefore remain at a thickness of >100g/m2 for a reasonable period of time, making surface dispersant application a practical option. Where there is any significant IFO/HFO slick, flammable/toxic vapours are not likely to be present, (except possibly in the first few hours), and therefore explosive limits or VOC exposure thresholds are not expected to be exceeded. Therefore, surface dispersant application on a IFO/HFO slick is potentailly a feasible response strategy. Dispersed oils typically remain within the top 30m of the water column (AMSA 2010), limiting their impact to deep water receptors. Modelling (RPS APASA 2014b) incicates that if dispersant is applied too close to a submerged receptor, dispersed hydrocarbon concentrations are likely to exceed impact thresholds, however with increasing distance, and/or time for dispersed oil to reach a receptor, a significant decrease in the recieved oil concentration is observed. Approximately 20km was the safe threshold determined for surface dispersant application, based on modelling (RPS APASA 2014b).

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	Minor additional impact	-1	Surface dispersant and additional entrained oil would result in negative impacts to shallow water BPPH, in the top 30m of the water column. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH to enable sufficient dilution of the dispersed oil.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Surface dispersant would result in an insignificant increase in any additional oil reaching deep water locations, regardless of chemical dispersant application on the surface.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	Surface dispersant and additional entrained oil would result in negative impacts to shallow water corals, in the top 30m of the water column. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH to enable sufficient dilution of the dispersed oil.
Mangrove/Mudflats/Samphires	Minor mitigation of impact	1	Surface dispersant would result in a reduction in the 'stickiness' of oil, resulting in less smothering of mangroves, samphires and other intertidal vegetation. As mangroves are more susceptible to smothering than toxic effects of dissolved oil, surface dispersant would result in a positive outcome for these community types.
Sandy Beach	Minor mitigation of impact	1	Surface dispersant would result in an increase in entrainment resulting in less oil arriving on a shoreline. Also, dispersant would result in a reduction in the 'stickiness' of oil, resulting in potentailly less oil sticking to a shoreline, however it may also make the shoreline clean-up task more difficult, potentially resulting in secondary impacts due to disturbance to the shoreline during the clean-up (especially lower energy beaches).
Rocky Shoreline	Minor mitigation of impact	1	Surface dispersant would result in an increase in entrainment resulting in less oil arriving on a rocky shoreline. Also, dispersant would result in a reduction in the 'stickiness' of oil, resulting in potentailly less oil sticking to a rocky shoreline.
Macro-Algae and Seagrass	Minor additional impact	-1	Surface dispersant and additional entrained oil would result in negative impacts to shallow water seagrass and macro-algae, in the top 30m of the water column. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH to enable sufficient dilution of the dispersed oil.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Moderate mitigation of impact	2	Surface dispersant may have a combination of positive and negative effects to intertidal seabed habitats. However, as a key factor associated with dispersant use on persistent IFO/HFO slicks is making the oil less 'sticky' it would result in less smothering of wildlife using that shoreline.
Water column			
Lower water column (below photoic zone)	No or insignificant alteration of impact	0	Surface dispersant would result in an insignificant increase in any additional oil reaching deep water locations, regardless of chemical dispersant application on the surface.
Upper water column (in photic zone)	Minor additional impact	-1	Surface dispersant may cause marine organisms inhabiting the upper water column to be exposed to dispersed oil which can potentially have toxic effects.
Water surface	Moderate mitigation of impact	2	Surface dispersant could reduce the exposure of fauna on the ocean surface to thick, persistent IFO/HFO slicks. The dispersant would make the oil less 'sticky' and therefore, result in less smothering of wildlife on the ocean surface, especially for EBPC species such as avifauna and turtles, when in the vicinity of fresh/thick slicks.
Air	No or insignificant alteration of impact	0	A very slight reduction in VOCs in local atmosphere could occur as a result of dispersant application and additional entrainment. However additional chemical dispersant mist in the local atmosphere would likely offset any reduction in VOCs.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Surface dispersant would result in an insignificant increase in any additional oil reaching deep water locations, regardless of chemical dispersant application on the surface.
Shallow commercial fisheries (including aquaculture)	Minor additional impact	-1	Surface dispersant may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing shallow commerical fisheries to increased entrained hydrocarbons.
Recreational fisheries	Minor additional impact	-1	Surface dispersant may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing shallow recreational fisheries to increased entrained hydrocarbons.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor additional impact	-1	Experience has shown that source control vessels/facilities assocaited with a large number of significant oil spills (including the 2010 Macondo/Gulf of Mexico oil spill), were exposed to significant entrained (including dispersed) oil, yet did not suffer from significant mechanical/operational issues assocaited with drawing entrained/dispersed oil in their internal seawater systems. Stakeholder consultation with Wild-Well, OSRL and AMOSC in 2021 has concluded that the exposure of offshore vessels/facilities to entrained/dispersed oil is unlikely to result in any signficant risk to the facility. The only recommendation was for vessels/facilities to monitor, and if necessary, to conduct additional maintenance on internal seawater systems (e.g. monitor/clean the reverse-osmosis filters for potable water generation and heat-exchanger plates on cooling water systems). Therefore, dispersing IFO/HFO in close proximity to a vessel/facility with shallow seawater intakes may require some additional maintenance/cleaning of key components of these systems.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	As any surface dispersant application would occur within offshore waters, surface dispersant application would result in an insignificant change in dispersed/entrained oil reaching traditional Aboriginal areas of the Kimberley and NT coastline.
Traditional Indonesian fishing	Minor additional impact	-1	Surface dispersant may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing shallow traditional Indonesian fisheries to increased entrained hydrocarbons.

Pre-Contact Oiled Wildlife Response (Hazing and Translocation)

Overall statement of likelihood of success of Pre-contact OWR (hazing and relocation/displacement):

Aim: Hazing involves discouraging animals from entering oiled areas by encouraging them to move into low-risk unoiled areas, in an attempt to prevent them from becoming oiled (IPIECA 2017). Hazing techniques include vessels generating underwater noise and motion, vessel air horns making above-water noise and fire hoses directing streams in front of fauna. Translocation/displacement involves removing wildlife who are at risk of becoming oiled from the spill environment in an attempt to prevent them from becoming oiled (IPIECA 2017). This includes holding animals in captivity until the risk of oiling is over, or relocating them to another area not affected by the oil spill (IPIECA 2017).

Type of slick: Surface oil is in the form of Group IV floating slicks which have a high viscosity and will not rapidly spread into sheens. Surface oil concentrations will be approximately 25 g/m2 at 300 km, 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) up to approximately 500 km and down to below 1 g/m2 up to approximately 1200 km from the spill site (RPS 2014, RPS 2021). With increasing wind conditions, IFO and HFO will rapdily increase in viscocity and emulsify. Due to the high viscocity of IFO-180, entrained oil concentrations may exceed 100ppb for up to 5km, and may exceed 10 ppb for up to 50km from an IFO spill location (RPS 2014). Modelling of a vessel collision in Permit Areas in the Browse Basin indicate that shoreline contact could occur in 1 day, with total volumes of oil ashore up to approx 300 m3.

Likely success/effectiveness against slick: Wildlife hazing in the open ocean is inherently unlikely to be effective due to a number of limitations;

1) effectiveness depends upon the deployment of numerous ocean-going vessels (as opposed to smaller vessels which can be used near to the shore);
2) against a spreading plume (i.e. away from the immediate source of the spill), the technique becomes entirely impracticable;
3) there are some potential safety issues associated with an spill, incluing IFO/HFO and vessel masters will not approach the source of the spill, or fresh areas of slick, while the spill is still ongoing; and
4) without the constraints of a shoreline or other geographical feature, the technique may cause wildlife to move into other areas of the spill area instead of away from it.

Wildlife hazing is most suitable when used near sensitive shoreline habitats against persistent oily slicks, such as IFO, HFO or crude oil spills. In regard to wildlife translocation, IPIECA (2014) advise that the difficulty of capturing wildlife safely and maintaining their health during relocation should not be underestimated, and that working with live or dead animals has health and safety issues including potential injuries (bites, scratches) or zoonotic diseases. Risks to wildlife are high during pre-emptive capture and the risks of oiling need to be weighed against the risk of injury, death etc. (IPIECA 2014). The translocation of turtles from beaches and islands would likely require the capture of large numbers of hatchlings, followed by translocation to a location far from the slick (to prevent surface oil impacts on released hatchlings). The prolonged retention of hatchlings has been demonstrated to be detrimental to hatchling swimming speed and survival, even in short periods (6 hours) of retention (Pilcher and Enderby 2001). Attempting to capture large numbers (or an entire flock) of healthy seabirds would be very challenging, if not impossible (DPaW 2014), especially at a remote shoreline location (such as Browse or Cartier Island). There is no practicable method to capture healthy seabirds at sea (DPaW 2014). Potential harm to healthy seabirds could occur during the capture process. Any seabirds released would likely fly back to the shoreline from which they originally were captured. Therefore, long term veterinary care (feeding etc.) would be required for any successfully captured birds, until spill weathering or remediation has occurred and it was safe to release the animals. An evaluation would need to be undertaken, to ensure the released animals do not pose a disease risk (human/zoonotic diseases), to the wild population into which they are released.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Sandy Beach	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Rocky Shoreline	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	Wildlife hazing of flocks of seabirds may temporarily prevent oiling of individuals or small proportions of a local/regional populations, however it is not likely effective across a broad geographical area. Even conducting wildlife hazing in the nearshore environment at an isolated location such as Browse Island would be of logistically challenging and potentially not result in any significant impact mitigation. Hazing of seabirds to prevent them landing on an oiled shoreline may temporarily prevent impacts, whilst shoreline clean-up is occurring. Capture and translocation of turtle hatchlings away from the oiled shoreline, and release in the open ocean is potentially feasible. Therefore, undertaking pre-contact oiled wildlife response at a shoreline may reduce the number of protected species of a local population from being oiled.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Water surface	No or insignificant alteration of impact	0	Wildlife hazing and/or translocation of seabirds or other megafauna, such as cetaceans and turtles in the open ocean, using vessel presence, vessel noise or at sea capture is highly unlikely to be successful. It may be possible to temporarily (minutes / hours), prevent a few individuals of a protected species from entering a small geographic area affected by a slick. However, over the longer term, there would be no alteration to the level of oiling of wildlife populations using this strategy in the open ocean.
Air	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Recreational fisheries	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Traditional Indonesian fishing	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.

Post Contact Oiled Wildlife Response

Overall statement of likelihood of success of Post-contact OWR:

Aim: Post-contact wildlife response involves capturing oiled wildlife - and if necessary, cleaning, rehabilitating and releasing them.

Type of slick: Surface oil is in the form of Group IV floating slicks which have a high viscosity and will not rapidly spread into sheens. Surface oil concentrations will be approximately 25 g/m2 at 300 km, 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) up to approximately 500 km and down to below 1 g/m2 up to approximately 1200 km from the spill site (RPS 2014, RPS 2021). With increasing wind conditions, IFO and HFO will rapdily increase in viscocity and emulsify. Due to the high viscocity of IFO-180, entrained oil concentrations may exceed 100ppb for up to 5km, and may exceed 10 ppb for up to 50km from an IFO spill location (RPS 2014). Modelling of a vessel collision in Permit Areas in the Browse Basin indicate that shoreline contact could occur in 1 day, with total volumes of oil ashore up to approx 300 m3.

Likely success/effectiveness against slick: Capture, relocation, assessment, cleaning and rehabilitation of oiled wildlife has the ability to increase the survival of individuals. ITOPF (2011) note that there are many cases where oiled turtles have been cleaned successfully and returned to the water. Any seabirds captured, cleaned and released would likely fly back to the shoreline from which they originally were captured. Once oiled, it is generally agreed that birds have a very low survival rate, even when rescue and cleaning is attempted (Bourne et al. 1967; Holmes and Cronshaw 1977; Croxall 1977; Ohlendorf et al. 1978; Chapman, 1981; Ford et al., 1982; Samuels and Lanfear, 1982; Varoujean et al., 1983; Ford, 1985; Evans and Nettleship 1985; Fry 1987; Seip et al. 1991; Anderson et al. 2000). French-McCay (2009) produced mortality estimates of 99% for surface swimmers, 35% for aerial divers and raptors, and 5% for aerial seabirds. Samuels and Lanfear (1982) estimated that 95% of oiled seabirds die. ITOPF (2011) note that penguins and pelicans are often the exception as they are generally more resilient than many other species, however they are not present in the Browse Basin. IPIECA (2014) advise working with live or dead animals has health and safety issues including potential injuries (bites, scratches) or zoonotic diseases. An evaluation would need to be undertaken, to ensure any released animals do not pose a disease risk (human/zoonotic diseases), to the wild population into which they are released.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Sandy Beach	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Rocky Shoreline	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	Post-contact OWR has the ability to increase the likelihood of survival of oil-affected EPBC species (individuals, or small proportion of a local population) in the intertidal/shoreline habitats. However, the seabird species of the Browse Basin are generally not expected to survive the capture, cleaning and rehabilitation process. Capture, cleaning and release of marine turtles would have a greater likelihood of success.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Water surface	Minor mitigation of impact	1	It is possible that some individuals of protected species, which have been oiled and are unable to fly, could be captured in the open ocean and relocated to an oiled wildlife treatment facility. Therefore, whilst there is a very low probability of survival, under the right circumstances a positive environmental outcome, for a limited number of individuals of a protected species could be achieved.
Air	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Recreational fisheries	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Traditional Indonesian fishing	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.

Controlled In-Situ Burning

Overall statement of likelihood of success of Controlled In-situ Burning (ISB):

Aim: In-site burning rapidly removes the volume of spilled oil's hydrocarbon vapours in place, via combustion or burning (IPIECA 2016). This technique reduces the need to collect, store, transport and dispose recovered oil, plus it can shorten the overall response time (IPIECA 2016).

Type of slick: Surface oil is in the form of Group IV floating slicks which have a high viscosity and will not rapidly spread into sheens. Surface oil concentrations will be approximately 25 g/m2 at 300 km, 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) up to approximately 500 km and down to below 1 g/m2 up to approximately 1200 km from the spill site (RPS 2014, RPS 2021). With increasing wind conditions, IFO and HFO will rapdily increase in viscocity and emulsify (RPS 2014).

Likely success/effectiveness against slick: ISB requires wave heights typically below 1 m and wind speeds below 10 knots (IPIECA 2016) which are frequently exceeded during certain seasons in the Timor Sea region. Overseas experience shows that burns can be conducted safely, but the most discernible disadvantage is the resulting dark smoke plumes caused by the combustion of oil (IPIECA 2016). Carbon dioxide, soot (PM 2.5), water, polyaromatic hydrocarbons, volatile organic compounds, carbonyls, carbon monoxide, sulphur dioxide and potentially other gases can result from an in-situ burn, which has the potential to affect human and animal health (IPIECA 2016). IPIECA (2016) note that tests and information from previous burns indicate that ISB has little effect on water quality. Burn residue (i.e. burned oil depleted of volatiles and precipitated soot) rarely sinks and smothers benthic species (IPIECA 2016). IPIECA (2016) further note that burn residue is less toxic to aquatic biota than weathered oil.

To implement an effective in-situ burn response, a minimum surface hydrocarbon thickness of 2-5 mm (2000 - 5000 g/m^2) is required to be present. Booms would be required to corral the spill, in an attempt to generate additional oil thickness. But this in turn may result in an exceedance of the VOC exposure thresholds for the workforce, and also may result in concentrations exceeding the lower explosive limit (however this is quite unlikley for IFO/HFO). Given this, and the lack of suitable booms available for in-situ burns in Australia, implementation of this response in an open ocean, high current environment is not considered to be safe, effective or feasible against a short-duration release IFO/HFO spill.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)			
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)			
Deep-sea unconsolidated muds and sands			
Intertidal seabed			
Intertidal Coral Reef			
Mangrove/Mudflats/Samphires			
Sandy Beach			
Rocky Shoreline			
Macro-Algae and Seagrass			
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)			
Water column			
Lower water column (below photic zone)			
Upper water column (in photic zone)			
Water surface			
Air			
Socio-economic			
Commercial demersal fisheries			
Shallow commercial fisheries (including aquaculture)			
Recreational fisheries			
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)			
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)			
Traditional Indonesian fishing			

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X060-AH-LIS-60034 Spill Impact Mitigation Assessment - Long duration Subsea Condensate Release / Well Blowout	
Revision	2
Date	29-Nov-21

Location	Browse Region including adjacent WA/NT shorelines	Spill Scenario	Well blowout or other subsea release Condensate Spill

	SIMA Stage 2: Predict Outcomes Potential Relative Impact		SIMA Stage 3: Balance Trade-Offs - Impact Modification Factors Prediction of the effectiveness and impact modification potential of the response options															
Resource Compartment (including values dependent on the resource compartment)	No Intervention (natural weathering)		At Sea Contain and Recover		Protect of Sensitive Resources		Shoreline Clean-up		Sub-Surface Dispersant Injection		Surface Dispersant		Pre-Contact Oiled Wildlife Response (Hazing & Translocation)		Post Contact Wildlife Response		Controlled In-situ Burning	Survillance, Monitoring and Visualisation (SMV)
		A	B1	A x B1	B2	A x B2	B3	A x B3	B4	A x B4	B4	A x B4	B5	A x B5	B7	A x B7		
Subtidal Benthic Communities																		
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging within this habitat)	Significant	4	0	0	0	0	0	0	0	0	-1	-4	0	0	0	0		
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Deep-sea unconsolidated muds and sands	None / Insignificant	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Intertidal seabed																		
Intertidal Coral Reef	Moderate	3	0	0	-2	-6	-1	-3	0	0	-1	-3	0	0	0	0		
Mangrove/Mudflats/Samphires	Moderate	3	0	0	-1	-3	-1	-3	0	0	-1	-3	0	0	0	0		
Sandy Beach	Minor	2	0	0	0	0	1	2	1	2	-1	-2	0	0	0	0		
Rocky Shoreline	Minor	2	0	0	0	0	1	2	1	2	-1	-2	0	0	0	0		
Macro-Algae and Seagrass	Moderate	3	0	0	-1	-3	-1	-3	0	0	-1	-3	0	0	0	0		
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Significant	4	0	0	-1	-4	1	4	0	0	-1	-4	1	4	1	4		
Water column																	Controlled In-Situ Burning is not considered to be safe, effective or feasible.	SMV is implemented under all oil spill scenarios
Lower water column (below photic zone)	Moderate	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Upper water column (in photic zone, including plankton and EPBC foraging in the photic zone)	Significant	4	0	0	0	0	0	0	0	0	-1	-4	0	0	0	0		
Water surface, including foraging areas for EPBC listed species.	Moderate	3	0	0	0	0	0	0	3	9	-1	-3	0	0	1	3		
Air	Minor	2	0	0	0	0	0	0	3	6	0	0	0	0	0	0		
Socio-economic																		
Commercial demersal fisheries	Significant	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Shallow commercial fisheries (including aquaculture)	Significant	4	0	0	0	0	1	4	0	0	-1	-4	0	0	0	0		
Recreational fisheries	Minor	2	0	0	0	0	1	2	0	0	-1	-2	0	0	0	0		
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Cultural heritage																		
Aboriginal heritage (cultural practices, sites and fishing / foraging)	Minor	2	0	0	0	0	1	2	0	0	0	0	0	0	0	0		
Indonesian traditional fishing	Significant	4	0	0	0	0	1	4	0	0	-1	-4	0	0	0	0		
		Total Impact Mitigation Score		0		-16		11		19		-38		4		7	-	-
		Carried to Field Capability Evaluation yes/no		No		No		Yes		Yes		Np		No		Yes	No	Yes

Resource Compartment (including values dependent on the resource compartment)	No Intervention (natural weathering)		Justification for Potential Relative Impact Score
		A	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging within this habitat)	Significant	4	Subtidal benthic primary producer habitat (BPPH) may be exposed to entrained and dissolved condensate above impact thresholds from a well-blowout in the Browse Basin. The effect of the toxic fractions of entrained/dissolved oil on intertidal coral includes partial mortality of colonies, reduced growth rates, bleaching, reduced photosynthesis, interruption of chemical communication necessary for mass spawning, premature explosion of larvae, decreased growth rates, decreased lipid content, decreased survival of larvae, decreased gonadal development, negative impacts to coral settlement, increased susceptibility to algae colonisation, epidemic diseases, localised tissue rupture, reduced reef resilience and mortality (Hayes et al 1992; Peters et al 1997; Negri & Heyward 2000; Shigenaka 2001; CSIRO 2016). WA DoT (2018) note that coral is sensitive to dissolved hydrocarbons as it causes toxicity at a cellular level. Corals accumulate oil from the water column (Pie et al 2015) making it biologically available to EPBC species foraging in this habitat. Seagrass and macroalgae may be subject to lethal or sublethal toxic effects, including mortality, reduced growth rates and impacts to seagrass flowering. BPPH is collectively considered to be an important resource as it supports a high biomass of fish, cetaceans and seabirds, including foraging EPBC species (DEWHA 2008). Several studies have indicated rapid recovery rates for seagrass and macroalgae may occur even in cases of heavy oil contamination (Connell et al, 1981; Burns et al. 1993; Dean et al. 1998; Runcie & Riddle 2006), but coral is sensitive to oil (and dispersants), making recovery from spills potentially slow (Guzman et al 1994). The consequence to benthic primary producer habitat is considered to be Significant.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	None / Insignificant	1	Deep water filter feeding communities (below photoic zone / 50m water depth), deep water EPBC species and KEFs are highly unlikley to be exposed to entrained and dissolved condensate, above impact thresholds (RPS 2019a) from a well-blowout in the Browse Basin. Note, below 100m, exposure above thresholds is not predicted to occur (RPS 2019a). If exposed above impact thresholds, hydrocarbons may cause chemical toxicity (i.e. lethal or sub-lethal effects, or impairing cellular functions) and ecological changes (i.e. losing key organisms then opportunistic species take over). Benthic marine invertebrates can take up oil via diffusion from dissolved oil, ingesting of contaminated food items and contact with contaminated sediment. Entrained/dissolved oil (including dispersed oil) affects the health of filter feeding communities, leading to potential accumulation (Law et al 2011) which makes them a poorer food source for higher trophic level organisms including deep water EPBC foraging species. The toxic fractions of oil can be detrimental to marine invertebrates as they are susceptible to its narcotic impacts due to their high surface to volume ratio, often resulting in outright mortality, as well as decreases in reproduction rates (Hook et al 2014), oxidative damage to macromolecules, altered lipid ratios, deleterious effects on embryo development (Lee et al 2004) and changes to community structure (CSIRO 2016). Filter feeding communities are commonly, but sparsely distributed, throughout the region and WA DoT (2018) note that they play an important role in purifying water and creating habitat. As entrained/dissolved hydrocarbons from a well blowout are expected to remain in the top 50m of the water column, the impact of an oil spill is not expected to cause any significant impact at a local or regional scale. As such, the consequence to deep sea features is considered to be Insignficant.
Deep-sea unconsolidated muds and sands	None / Insignificant	1	Species that inhabit or rely on deep-sea unconsolidated muds and sands are highly unlikley to be exposed to entrained and dissolved condensate above impact thresholds (RPS 2019a) from a well-blowout in the Browse Basin. Note, below 100m, exposure above thresholds is not predicted to occur (RPS 2019a). CSIRO (2016) notes that benthic marine invertebrates can take up oil via diffusion from dissolved oil, ingesting contaminated food and contact with contaminated sediment. Small invertebrates (micro and meiofauna) are considered very susceptible to the narcotic impact of oil due to their high surface to volume ratio, often resulting in outright mortality, as well as decreases in reproduction rates (Hook et al 2014). Further deleterious effects to invertebrate embryo development result from exposure to sediments affected by entrained and dissolved oil (Lee et al 2004). Montagna et al (2013) state that after the Deepwater Horizon blowout, biodiversity loss resulted in the deep-sea sediments surrounding the wellhead (i.e. severe losses occurring within 3 km and losses due to elevated TPHs and PAHs up to 17 km away from the wellhead). However, as modelling (RPS 2019a) of gas/condensate well blowouts in the Browse Basin are not expected to result in exposures above impact thresholds deeper than 50m, these types of impacts are not anticiptaed. Communities in the Browse Basin region are considered low in diversity and abundance, and generally common throughout the area. Large sand waves and local strong seabed currents exist in the area and are likely to move seasonally causing substrate instability that limits development of infaunal communities. Therefore, exposure to hydrocarbons above impact thresholds from a well blowout is not expected to occur at a local or regional scale. If any impacts occur, the area is expected to recover, though recovery times in the deep sea are generally slow due to the low levels of recruitment and slow growth of biota (Montagna et al 2013). The potential consequence is considered to be Insignificant.
Intertidal seabed			
Intertidal Coral Reef	Moderate	3	Intertidal coral reefs could be impacted by surface fresh, weathered, entrained and dissolved condensate from a well blow-out in the Browse Basin. The effect of condensate on intertidal coral is unlikely to result in significant smothering as condensate is expected to be weathered and in the form of wax flakes/residues when it arrives in intertidal coral areas. In this form, toxicity is less than fresh condensate (Woodside 2014). The effect of the toxic fractions of entrained/dissolved oil on intertidal coral include partial mortality of colonies, reduced growth rates, bleaching, reduced photosynthesis, interruption of chemical communication necessary for mass spawning, premature explosion of larvae, decreased growth rates, decreased lipid content, decreased survival of larvae, decreased gonadal development, negative impacts to coral settlement, increased susceptibility to algae colonisation, epidemic diseases, localised tissue rupture, reduced reef resilience and mortality (Hayes et al 1992; Peters et al 1997; Negri & Heyward 2000; Shigenaka 2001; CSIRO 2016). WA DoT (2018) note that coral is sensitive to dissolved hydrocarbons as it causes toxicity at a cellular level. Coral reefs are found close to the permit area in isolated locations and are considered to be significant benthic primary producers that play a key role in the ecosystem and have an iconic status in the environment (WA DoT 2018). They are considered of high importance to EPBC species that aggregate, nest, roost and forage in the area, hence isolated populations could potentially be exposed in the event of a spill. As spills disperse, intertidal communities are expected to recover (Dean et al. 1998), though the rate of recovery of coral reefs depends on the level or intensity of the disturbance, with recovery rates ranging from 1 or 2 years, to decades (Fucik et al. 1984, French McCay 2009). Impact on the receptor is considered to be Moderate.
Mangrove/Mudflats/Samphires	Moderate	3	Mangrove, mudflats and samphire communities may be exposed to entrained/dissolved condensate above impact thresholds from a well-blowout in the Browse Basin. Given that mangroves are remote from permit areas, fresh or weathered condensate is unlikely to reach this receptor. The potential effects of entrained and dissolved oil include defoliation and mortality of mangroves (Burns et al. 1993; Duke et al. 2000). Entrained and dissolved oil exposure is only likely to occur at isolated locations amongst a very large and generally contiguous population. The recovery of mangroves from shoreline oil accumulation can be a slow process, due to the long-term persistence of oil trapped in anoxic sediments and subsequent release into the water column (Burns et al. 1993). Any impacts to benthic habitats are expected to be localised and of short to medium term with a Moderate consequence.
Sandy Beach	Minor	2	Sandy beaches may be exposed to weathered waxy flakes and residues above impact thresholds in the event of a well-blowout in the Browse Basin. The effect of gradual accumulation of oil on the receptor could lead to harm including the increased prevalence of tumours in species (CSIRO 2016). Sandy beaches are the dominant shoreline habitat on offshore islands in the Browse Basin and are considered significant habitat for turtles and seabird nesting. Organisms such as polychaete worms, bivalves and crustaceans generally inhabit sandy beaches but the mobile nature of the sands generally limits diversity. These species provide a valuable food source for resident and migratory sea and shorebirds (DEC/MPRA 2005). Law et al (2011) note that when grain size is between 2 and 64 mm, beaches are not considered especially sensitive to oil spills as they are regularly cleaned by wave action and oil is generally not retained. Offshore island beaches of the Browse Basin are generally coarse grained, due to high wave energy. WA DoT (2018) assessed Kimberley sandy beaches and concluded that they are moderately ecologically sensitive and are moderately difficult to rehabilitate from an oil spill. The potential consequence is considered to be Minor.
Rocky Shoreline	Minor	2	Rocky shorelines may be exposed to weathered, entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. This receptor is typically characterised as being a high wind and wave energy environment (CSIRO 2016). Condensate from a spill has the potential to coat the substrate or become stranded by receding tides – but incoming tides also have the potential to remove deposited condensate (Law et al 2011). CSIRO (2016) note that rocky shorelines are not considered sensitive environments, and IPIECA (2017) state that rocky shorelines generally have a diverse and productive intertidal community which are considered resilient to oil spills and short-term oil persistence. WA DoT (2018) note that rocky shorelines are the least susceptible of shoreline types to long term impacts from a spill of both floating and dissolved oil. As such, this receptor is not expected to have issues relating to recovery from an oil spill. The potential consequence for rocky shorelines is considered to be Minor.
Macro-Algae and Seagrass	Moderate	3	Macroalgae and seagrass may be exposed to entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. This receptor is unlikely to come into contact with significant amounts of fresh floating surface hydrocarbons, but could potentially be exposed to weathered waxy flakes and residues. WA DoT (2018) note that dissolved oil causes more impacts to algae than floating oil, as it results in cellular level poisoning. The effect of subjecting seagrass and macroalgae to lethal or sublethal toxic effects of condensate can result in mortality, reduced growth rates and impacts to seagrass flowering. Several studies have indicated rapid recovery rates may occur even in cases of heavy oil contamination (Connell et al, 1981; Burns et al. 1993; Dean et al. 1998; Runcie & Riddle 2006). Taylor and Rasheed (2011) reported that seagrass meadows were not significantly affected by an oil spill when compared to a non-impacted reference seagrass meadow. Macroalgae support diverse small invertebrates that are the principal food source for a number of inshore fish (WA DoT 2018). Seagrasses provide energy and nutrients for detrital grazing food webs (WA DoT 2018), act as a refuge for fish and invertebrates, and provide a food source for EPBC species such as dugongs and green turtles (DEC 2007). The potential consequence is considered to be Moderate.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Significant	4	Intertidal habitat may be exposed to weathered, entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. The effect of condensate on this receptor can result in mortality or harm to benthic primary producers and organisms such as EPBC species that rely on these species for food, or rely on the habitat for nesting and roosting. IPIECA (2014) note that dehydration, gastrointestinal problems and anaemia are commonly found in oiled animals, causing potential long-term effects on reproductive success. They further note that the toxic effects of ingested oil generally impacts the liver, whilst volatile fumes damage lungs resulting in debilitating effects (IPIECA 2014). Oiled aquatic EPBC fauna can further suffer hypothermia, irritations, burns, respiratory problems and loss of waterproofing, leading to them moving onto land (i.e. away from their food source) where they have further difficulty thermoregulating and feeding (IPIECA 2017). Specifically, marine reptiles, including turtles and crocodiles can be exposed to hydrocarbons externally in intertidal areas through direct contact; or internally, by ingesting oil, consuming prey containing oil, or inhaling volatile compounds (Milton et al. 2003). Turtle hatchlings may be particularly vulnerable to toxicity and smothering, as they emerge from nests and make their way over the intertidal area to the water (AMSA 2015; Milton et al. 2003). Birds coated in hydrocarbons can suffer damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs (AMSA 2015; WA DoT 2018). Toxic effects may also result where the product is ingested, either through birds' attempts to preen their feathers (Jenssen 1994; Matcott et al. 2019) or ingested as weathered waxy flakes/residues present on shorelines. There is the potential for short to medium term impacts; however, it is not expected that the overall population viability for any protected species would be threatened from a well blowout spill. The cumulative potential consequence is considered to be Significant.

Water column			
Lower water column (below photic zone)	Moderate	3	The lower water column may be exposed to entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. Note, below 100m, exposure above threshols is not predicted to occur (RPS 2019a). EPBC species that use this habitat could be negatively impacted by entrained and dissolved oil including impacts to juvenile fish, larvae and planktonic organisms due to their sensitivity during these life stages, with the worst impacts predicted to occur in smaller species (WA DoT 2018). In the Gulf of Mexico, Murawski et al (2014) found that spilled oiled resulted in an increased incidence of skin lesions in fish attributed to PAH. The lower water column has a high level of species diversity and endemism for demersal fish communities in the Browse Basin region, as cold nutrient-rich deep ocean current upwellings are found in canyon areas and attract fish aggregations, which in turn attract larger predatory fish, sharks, toothed whales and dolphins (DEWHA 2008). There is potential for short–to-medium term impacts on the environment from entrained and dissolved condensate, but it is not expected that the overall population viability for any protected species would be threatened. The potential consequence is considered to be Moderate.
Upper water column (in photic zone, including plankton and EPBC foraging in the photic zone)	Significant	4	The upper water column may be exposed to entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. The effect of entrained and dissolved oil on this receptor include chronic impacts to juvenile fish, larvae and planktonic organisms due to their sensitivity during these life stages, with the worst impacts predicted to occur in smaller species (WA DoT 2018). Whale sharks are filter feeders and are expected to be highly vulnerable to entrained hydrocarbons (Campagna et al 2011) with potential effects including damage to the liver and lining of the stomach and intestines, as well as toxic effects on embryos (Lee 2011). Marine mammals, marine reptiles and marine avifauna could also be impacted through entrained and dissolved hydrocarbon exposure, primarily through ingestion during foraging activities (AMSA 1998). The upper water column is considered to be very important habitat for EPBC species as a large number of BIAs for marine fauna are present in the Browse Basin. Whilst it is expected that the upper water column will recover with time, it is likely that there will be cumulative impacts such as bioaccumulation up the food chain. The consequence is considered to be Significant.
Water surface, including foraging areas for EPBC listed species.	Moderate	3	The water surface may be exposed to fresh and weathered surface condensate above impact thresholds from a well blowout in the Browse Basin. Fresh condensate and weathered waxy flakes/residues can impact marine mammals surfacing, as they are vulnerable to oil exposure. Blue whales and humpback whales (baleen whales), that filter-feed near the surface, could potentially ingest condensate. Spilled hydrocarbons may also foul the fibres of baleen whales impairing food gathering efficiency or fouling prey with hydrocarbons (AMSA 2015). Turtles can be exposed to hydrocarbons if they surface within the spill, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (Milton et al. 2003). Floating oil is considered to impact reptiles more than entrained/dissolved oil because reptiles hold their breath underwater and are unlikely to directly ingest dissolved oil (WA DoT 2018). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large, pre dive inhalations, make them vulnerable to spilled oil (AMSA 2015). Hatchlings spend more time on the surface than older turtles, thus increasing the potential for contact with oil slicks (Milton et al. 2003). Aquatic migratory birds are among the most vulnerable and visible species to be affected by surface oil, with oil impacts frequently leading to long-term physiological changes potentially resulting in lower reproductive rates or survival rates (Fingas 2012). The probability of lethal effects is dependent on factors such as timing, location, oceanographic and weather patterns, and the movements of species that forage, feed, nest and inhabit that area (IPIECA 2014), the amount of time spent on the water surface as well as any oil avoidance behaviour (French-McCay 2009). Direct contact with surface hydrocarbons may break down the ability of plumage to maintain body heat, resulting in direct and indirect impacts such as hypothermia, dehydration, drowning and starvation (AMSA 2015; Matcott et al, 2019; Jenssen 1994; IPIECA 2014; ITOPF 2011). Birds resting at the sea surface or surface plunging can be impacted by oil resulting in damage to external tissues, including skin and eyes, and internal tissue irritation in lungs and stomachs (Clark 1984; WA DoT 2018). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (Jenssen 1994; Matcott et al. 2019). The water surface is considered an important receptor where EPBC listed species forage. It is expected to recover from oil impacts with time, though there may be cumulative impacts through bioaccumulation up the food chain. The consequence is considered to be Moderate.
Air	Minor	2	Air may be exposed to fresh surface condensate above impact thresholds from a well blowout in the Browse Basin. RPS (2018 and 2019b) note that the ongoing nature of a condensate spill combined with the high potential for gas and oil to volatize from the water surface may lead to high local concentrations of atmospheric volatiles that have the potential to cause harmful impacts to species such as cetaceans if inhaled. Turtles could also be affected by harmful vapours during pre-dive inhalations (Milton et al. 2003). The receptor is not considered to be sensitive, thus is expected to recover in a very short period of time, as the evaporated hydrocarbons are rapidly dispersed by the wind, and evaporation rapidly reduce with time as oil weathers and entrains. Only a very localised area, immediately above the freshest parts of the oil slick would be impacted by evaporating hydrocarbons. The potential consequence is considered to be Minor.
Socio-economic			
Commercial demersal fisheries	Significant	4	Commercial demersal fisheries may be exposed to surface, weathered, entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. Note, below 100m, exposure above thresholds is not predicted to occur (RPS 2019a). The effect of condensate on this receptor includes the ability to cause economic loss (through indirect loss of stock and perceived tainting of stock by oil) (WA DoT 2018), impede access to fishing areas from the implementation of an exclusion zone during a spill response; impact seafood quality and employment; plus negatively impact lines and nets (ITOPF 2011). The economic impact from an oil spill is dependent on the stock being cultured, as species have different recovery rates. WA DoT (2018) note that dissolved oil will impact finfish, taking 6-8 years for fisheries to recover (due to the time it takes for hatchlings to reach maturity) (WA DoT 2018). This receptor is considered to be important, and effects from a well blowout can vary depending on factors such as seasonal timing and natural fluctuations in species levels. Impacts to commercial demersal fisheries, shallower than 100m, are expected to be short to medium term. The real and perceived consequence is considered to be Significant.
Shallow commercial fisheries (including aquaculture)	Significant	4	Shallow commercial fisheries (including aquaculture) may be exposed to surface, weathered, entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. The effect of condensate on this receptor includes the ability to cause economic loss (through indirect loss of stock and perceived tainting of stock by oil) (WA DoT 2018), impede access to fishing areas from the implementation of an exclusion zone during a spill response; impact seafood quality and employment; plus negatively impact lines and nets (ITOPF 2011). The economic impact from an oil spill is dependent on the stock being cultured, as species have different recovery rates. DoT (2018) note that dissolved oil will have the greatest impact with oyster farms potentially taking 3-4 years to recover from a spill (DoF 2013), whilst finfish farms could take 6-8 years to recover due to the time it takes for hatchlings to reach maturity. WA DoT (2018) note that the pearling industry relies almost exclusively on sourcing pearl oysters from Eighty Mile Beach (south of Broome) and an area off the Lacepede Islands. There is also other aquaculture in the region including trochus and barramundi (Fletcher et al 2017). WA DoT (2018) note that some wild stocks aquaculture species such as mussels are impacted more by dissolved oil than floating oil due to being filter feeders. This receptor is considered to be important, and effects from a well blowout can vary depending on factors such as seasonal timing and natural fluctuations in species levels. Impacts to shallow commercial fisheries (including aquaculture) are expected to be short to medium term. The real and perceived consequence is considered to be Significant.
Recreational fisheries	Minor	2	Recreational fisheries may be exposed to surface, weathered, entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. Note, below 100m, exposure above thresholds is not predicted to occur (RPS 2019a).The effect of condensate on this receptor includes negatively impacting nets and lines (ITOPF 2011), impeding access to fishing areas from the implementation of an exclusion zone during a spill response and impacting seafood quality and quantity. Recreational fishing is generally concentrated around readily accessible coastal settlements along the Kimberley and NT coastlines (such as Broome, Wyndham and Darwin) and there is little recreational fishing around the offshore Browse Basin due to the distance from land, lack of features of interest and deep waters. Offshore islands, coral reef systems and continental shelf waters of the Browse Basin however are increasingly being targeted by fishing based charter vessels (Fletcher and Santoro 2014) with extended fishing charters operating during certain times of the year. This receptor is considered to be important, and effects from a well blowout can vary depending on factors such as seasonal timing and natural fluctuations in species levels. Impacts to shallow recreational fisheries, shallower than 100m, are expected to be short to medium term. The real and perceived consequence is considered to be Minor.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	Minor	2	Floating condensate (which is not an adhesive oil and will rapidly evaporative) is unlikley to adhere to an offshore facility/vessel or require any post-spill cleaning. Some offshore production assets have shallow seawater intakes (hull mounted, or within <10m of ocean surface). Other facilities only have deep (>50m water depth) seawater intakes. Depending on the depth of the seawater intakes, entrained/dispersed condensate may be drawn into the intakes. Experience has shown that spill response and source control vessels/facilities assocaited with a large number of significant oil spills (including the 2010 Macondo/Gulf of Mexico oil spill), were exposed to significant entrained (including dispersed) oil, yet did not suffer from significant mechanical/operational issues assocaited with drawing entrained/dispersed oil in their internal seawater systems. Stakeholder consultation with Wild-Well, OSRL and AMOSC in 2021 has concluded that the exposure of offshore vessels/facilities to entrained/dispersed oil is unlikely to result in any signficant risk to the facility. The only recommendation was for vessels/facilities to monitor, and if necessary, to conduct additional maintenance on internal seawater systems (e.g. monitor/clean the reverse-osmosis filters for potable water generation and heat-exchanger plates on cooling water systems), potentially resulting in the need for more frequent inspection/maintenance of desalination systems (reverse osmosis filters) and cooling water systems (heat exchanger plates). Given there will be entrained condensate in the shallow wter column from a subsea release, the consequence is considered to be Minor.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	Minor	2	Aboriginal heritage including special places, cultural landscapes, practices and fishing/foraging along the Kimberley and NT coastline may be impacted by surface and weathered condensate above impact thresholds from a well blowout in the Browse Basin. The effect of surface condensate on this receptor includes physically degrading a site, disrupting the harvesting of fish, and area closures could displace Aboriginal people and have implications on cultural identity, health and wellbeing. The receptor is important and the potential for recovery is expected to be short to medium term and the receptor is generally remote from any potential well blow-out location. The consequence is considered to be Minor.
Indonesian traditional fishing	Significant	4	Indonesian traditional fishing may be impacted by weathered, entrained and dissolved condensate above impact thresholds from a well blowout in the Browse Basin. Indonesian traditional fishing occurs within the MoU box which covers Scott Reef and surrounds, Seringapatam Reef, Browse Island, Ashmore Reef, Cartier Island and various banks and shoals. The effect of condensate on these receptor could include reduction and contamination of target species such as sea cucumbers (bêche-de-mer), trochus (top shell snail), reef fish and sharks. Exclusion zones during the spill response may also affect access to fishing locations, even if the target species are not affected by the condensate. This receptor is considered to be important, and effects from a well blowout can vary depending on factors such as seasonal timing and natural fluctuations in species levels. Impacts are expected to be short to medium term. The real and perceived consequence is considered to be Significant.

At Sea Containment and Recovery

Overall statement of likelihood of success of At Sea Contain and Recovery (C&R):

Aim: This strategy aims to collect oil from the ocean surface using booms and skimmers, generally at or near the release location, where oil concentrations are highest. Floating booms are used to corral and concentrate spilled floating oil into a surface thickness that will allow for mechanical removal (i.e. skimming and pumping oil into temporary storage) (IPIECA 2015).

Type of slick: Surface oil is in the form of Group I floating slicks which have a low viscosity and rapidly spread into a thin sheen. Surface oil concentrations will be up to approximately 10 g/m^2 (~0.01mm, which equates to Bonn code 1/2) for up to approximately 250 kilometres from the spill site and weathered oil concentrations reduce down to below 1 g/m^2 up to approximately 1000 km from the spill site (RPS 2021).

Likely success/effectiveness against slick: O'Brien (2002) notes that spreading of oil is the main obstacle to a successful at sea contain and recovery response, with this type of oil tending to spread so thinly and quickly that skimmers are unable to efficiently skim and recover meaningful quantities. Generally oil needs to be >100 g/m^2 (>0.1mm, which equates to Bonn code 4/5) to feasibly corral oil with a boom and achieve any significant level of oil recovery with skimmers (O'Brien 2002), as booms have limited effect against thin oil films and no effect against a subsurface plume (ITOPF 2011). Condensate spills from a well blowout would be unlikely to surface at >100g/m^2, and would rapidly evaporate and spread upon surfacing, resulting in very thin surface slicks making this technique inefficient and impractical (IPIECA 2017). Where there is any significant condensate slick, flammable/toxic vapours will also be present, and will likely exceed safe exposure thresholds, further reducing response efficiency (as vessels will not be permitted to operate in areas where explosive limits or VOC exposure thresholds are exceeded). Due to the very thin surface slicks, very low rates of recovery would be expected. Note that IPIECA (2015) state that efficiency of contain and recover operations (for any oil type) can vary widely due to operational, environmental and logistical constraints, but usually it is limited to recovering approximately only 5-20% of the initial spilled volume. Contain and recovery is therefore unlikely to be an effective response strategy, with limited chance of any significant surface slick recovery from a Group I spill.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting fully submerged benthic primary producer habitat.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting deep sea features.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting deep sea unconsolidated muds and sands.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction of surface/floating oil and no effect on entrained oil at the spill location, thus resulting in no change to the amount of oil reaching the intertidal/shoreline zones.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	
Sandy Beach	No or insignificant alteration of impact	0	
Rocky Shoreline	No or insignificant alteration of impact	0	
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	No or insignificant alteration of impact	0	
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	C&R occurs on the surface and has no impact on entrained oil affecting the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	C&R occurs on the surface and would result in an insignificant reduction in condensate on the surface which could potentially become entrained in the future. Therefore C&R would result in no reduction in the volume of entrained oil affecting the upper water column.
Water surface	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction of surface/floating oil on the water surface due to inability of booms and skimmers to revcovery very thin slicks.
Air	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction of oil on surface, and therefore no significant change to the evaporation of oil into the local atmosphere. VOC concentrations at locations where fresh oil slicks are present would likely be above safe exposure levels. Collection of condensate on vessels would likely result in further increase in exposure of workers to high concentrations of VOCs, above safe exposure levels.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to demersal fish communities.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to shallow commercial fisheries including aquaculture.
Recreational fisheries	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to recreational fishing areas.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to offshore facilities.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to Aboriginal cultural heritage receptors.
Indonesian traditional fishing	No or insignificant alteration of impact	0	C&R would result in an insignificant reduction in oil on surface, and no impact on entrained oil, resulting in no change to oil exposure to traditional fishing areas.

Protection of Sensitive Resource

Overall statement of likelihood of success of Protect of Sensitive Resources (Protect and Deflect / P&D):

Aim: This strategy aims to use physical barriers to exclude or restrict the spill contacting specific sensitive receptors or to deflect the spill from these locations; typically onto less sensitive areas.

Type of slick: Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered condensate which could accumulate over time. Weathered oil would be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than fresh oil (Woodside 2014).

Likely success/effectiveness against slick: Booms could be used to protect and deflect surface spills away from sensitive habitats, but they have limited effect against thin Group I oil films and no effect against subsurface entrained plumes (ITOPF 2011). Generally oil needs to be >100 g/m2 (>0.1mm, which equates to Bonn Code 4/5) to feasibly corral oil with a boom (O'Brien 2002), as would be required for an oat sea containment and recovery response. However, P&D could feasibly work on lower concentraion slicks, to prevent oil accumulating on a shoreline receptor. Condensate arriving on the ocean surface from a well-blowout is generally not predicted to appear in slicks >100 g/m^2, and would generally be <10 g/m^2. Even in a scenario where the best equipment is available, shoreline P&D activities at Browse Island or other exposed remote shoreline locations, would be technically challenging due to the general exposure to unfavourable sea conditions, large tidal range and shallow coral reefs. Generally P&D is limited to sheltered waters, not exposed reef/beach environments. Only under exceptionally calm sea-states and appropriate tides would it be safe to conduct vessel activities to carry-out an effective P&D operations at remote shorelines. MetOcean conditions required for this technique to be successful include <1 m sea-state and low surface currents - but these are frequently exceeded at remote offshore locations in the Browse/Bonaparte Basin region. In addition, given the size of the offshore island shorelines (e.g. Browse Island, one of the smallest offshore islands, has an intertidal zone 3km in diameter, 7km in circumference), a substantial number of booms would be needed to be deployed to protect offshore island shorelines, or deflect oil into a collection point on a beach. Anchoring of booms would most likely result in additional damage to the subtidal and intertidal environment (coral reef) surrounding most offshore and outer Kimberley/NT islands, due to anchor chain drag. Booms themselves would also drag around on the coral intertidal reef during periods of lower tides, potentially resulting in significant physical damage to the benthos of the reef platform and also result in damage to booms. Booms could potentially be held in place by vessels however due to widths of shorelines requiring protection this would most likely require an unfeasibly large number of vessels, and at low tide this isn't practicable in intertidal zones. . Most offshore island shorelines would be expected to 'self clean' any accumulated Group I oil due to the lack of adhesiveness, the coarse substrate, the high wave energy and high tidal regime (Fingas 2012), further reducing the impact mitigation potential of P&D at these locations. There would also be potential for significant damage to mangrove root-systems, if conducting P&D in mangrove environments. Any accumulated weathered condensate on rocky shorelines and sandy beaches will likely rapidly natural weather/degrade, due to generally high/very high temperatures and UV exposure in the region. As a result of the above mentioned factors, P&D would be unlikely to result in any significant deflection or recovery of Group I condensate, or tangible enviornmental benefit, at remote intertidal/shoreline habitats.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and will have insignificant impact on entrained oil affecting subtidal benthic primary producer habitat.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and has insignificant impact on entrained oil affecting deep sea features.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	P&D occurs on the surface at a shoreline location and has insignificant impact on entrained oil affecting deep sea unconsolidated muds and sands.
Intertidal seabed			
Intertidal Coral Reef	Moderate additional impact	-2	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline. Anchoring extensive boom arrays would most likely result in physical damage to subtidal and intertidal coral reefs.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	Prevention of oil entering mangroves/samphires would be of benefit, however due to the thin surface slick, the extensive scale of mangrove communities along the mainland and islands of the Kimberley and NT coastline, the ability to successfully achieve a benefit from P&D is extremely limited. Anchors/anchor chains also have the potential to damage mangrove aerial root structures and disturb other fragile low-energy shorelines.
Sandy Beach	No or insignificant alteration of impact	0	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline
Rocky Shoreline	No or insignificant alteration of impact	0	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline
Macro-Algae and Seagrass	Minor additional impact	-1	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline. Anchors/anchor chains would also most likely result in physical damage to seagrass / algal beds.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor additional impact	-1	Weathered condensate is generally non-adhesive and of low toxicity. P&D may divert some weathered condensate away from a receptor, however the weathered condensate would rapidly degrade due to heat and UV exposure in the Kimberley/NT coastline. Additional impacts could also occur to sensitive habitats such as coral reefs and fragile low energy environments such as mangroves and mudflats. Therefore, additional impacts could occur to habitats which support protected species.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	P&D does not reduce the amount of entrained oil affecting the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	P&D does not reduce the amount of entrained oil affecting the upper water column.
Water surface	No or insignificant alteration of impact	0	P&D would only occur near shorelines and would not result in any significant reduction to the volume of oil on the water surface.
Air	No or insignificant alteration of impact	0	P&D would only occur at shorelines remote form the spill release location. The weathered slick will not have any significant volatile components remaining, and therefore P&D would have no effect on local atmospheric conditions.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in entrained oil, resulting in no change to oil exposure to commercial demersal fisheries.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to shallow commercial fisheries including aquaculture sites.
Recreational fisheries	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to fish communities, thus no change to recreational fishing.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface or entrained oil, resulting in no change to oil exposure to offshore facilities.

Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface and entrained oil, resulting in no change to impacts on Aboriginal heritage.
Indonesian traditional fishing	No or insignificant alteration of impact	0	P&D would result in insignificant reduction in oil on surface and entrained oil, resulting in no change to impacts on Indonesian traditional fishing areas.

Shoreline Clean-Up

Overall statement of likelihood of success of Shoreline Clean-Up:

Aim: Using various physical means to clean up oil from affected shorelines to reduce impacts on sensitive receptors or to avoid any reintroduction of the hydrocarbon to the marine environment. It is often viewed as a three step process, with the first phase involving bulk collection of oil floating against the shoreline or stranded on it; phase two involving in-situ treatment of shoreline substrate and phase three involving removal of any remaining residues (final polish) (IPIECA 2015).

Type of slick: Surface oil reaching remote shorelines will be in the form of thin floating slicks of weathered oil which could accumulate over time. Given the time to reach shorelines, a condensate spill is expected to have undergone several physical and biological weathering processes, such as photo oxidation and biodegradation. Impacts to ecological receptors from exposure to weathered oil (waxy flakes and residues) are far less than those associated with exposure to fresh oils, which have higher levels of toxicity (Milton et al, 2003; Hoff & Michel 2014; Woodside 2014). Group I oils are relatively non-adhesive and will not form a thick adhesive barrier on a shoreline (Fingas 2012).

Likely success/effectiveness against slick: Shoreline clean-up has been consistently found to not enhance ecological recovery of oiled coastlines (Sell et al 1995) but it may protect other resources in the area, such as birds, marine mammals or subtidal habitats including coral reefs or fish farms (CSIRO 2016). Choosing a particular clean-up technique is dependent on factors such as shoreline type, exposure, sensitivity, amount of oil, persistence of oil, toxicity of oil and rate of natural oil removal (IPIECA 2015). Mechanical cleaning is generally not an appropriate technique for offshore/remote shorelines, and manual techniques involving rakes and shovels would likely be required. The clean-up of Group I spills from a beach or shoreline is likely to be difficult, generating high volumes of waste in comparison to the oil recovered. Browse Island and other similar offshore shorelines would be expected to naturally 'self-clean' any accumulated Group I oils, due to factors such as the lack of adhesiveness of these oil types, the coarse substrate present and the high wave energy and high tidal regime (Fingas 2012). Typically, inaccessible rocky coves are highly exposed and are best left to naturally clean (IPIECA 2015). ITOPF (2011) also note that for a number of sensitive shoreline types, such as mangroves, natural cleaning is the preferred option in order to minimise the damage caused from clean-up activities. Thus shoreline clean-up would be most effective in areas which are expected to receive large amounts of shoreline oil; where chosen activities don't physically break/damage sensitive habitat such as coral or mangroves; and in areas which are not expected to self clean. In addition, any accumulated weathered condensate on rocky shorelines and sandy beaches will likely rapidly natural weather/degrade, due to generally high/very high temperatures and UV exposure in the region.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil in benthic primary producer habitat within subtidal areas.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil affecting filter feeding communities within subtidal areas.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Shoreline clean-up will have no impact on entrained oil affecting deep-sea unconsolidated muds and sands in subtidal areas.
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	Shoreline clean-up on an intertidal coral reef would result in physical damage/breaking of coral structures, therefore a net damage to the coral eco-system.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	Shoreline clean-up within mangrove/low energy ecosystems is likely to result in more physical damage/breaking of mangrove root structures than benefit from any oil removed.
Sandy Beach	Minor mitigation of impact	1	Shoreline clean-up of sandy beaches is a well understood, well documented spill response technique, which can reliably remove thick oil from the eco-system. This is beneficial for species such as turtles who nest on sandy beaches. However, in the case of a condensate spill, the likely oil accumulating on a shoreline remote from the release location is likely to be very thin, and possibly not recoverable. Natual weathering on high energy beaches may be just as effective as attempting to clean-up very thin, non-adhesive slicks.
Rocky Shoreline	Minor mitigation of impact	1	Shoreline clean-up of rocky shorelines is a well understood, well documented spill response technique, which has the ability to remove some oil from the eco-system. However, certain techniques like steam cleaning and high pressure blasting are known to cause more harm than allowing the oil to naturally weather. Therefore, this technique would likely be successful, provided the correct clean-up techniques are chosen.
Macro-Algae and Seagrass	Minor additional impact	-1	Shoreline clean-up within intertidal macro-algae/seagrass ecosystems would likely result in more physical disturbance to plant/root structures than benefit from any oil removed.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	If it is deemed that the amount of hydrocarbons expected to impact shorelines is large enough that a shoreline clean up will have positive impacts, then the removal of oil from the intertidal zones would likley result in reduction in harm to the benthic primary producers and associated food sources utilised by foraging protected fauna such as seabirds. Also, removal of oil reaching a turtle nesting beach would be of benefit to turtle nesting success. However, due to the type (generally non-toxic and non-adhesive weathered oil), shoreline clean-up of weathered condensate may only have limited positive effect compared to natural weathering. Caution is required, as additional physical damage can occur in sensitive intertidal environments, and the general presence of responders can result in additional disturbance to natural wildlife behaviours and processes, espeically seabirds and turtle nesting etc.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on entrained oil in the lower water column.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on entrained oil in the upper water column.
Water surface	No or insignificant alteration of impact	0	Shoreline clean-up will have insignificant impact on thin surface slicks on the water surface.
Air	No or insignificant alteration of impact	0	As oil will have significantly weathered by the time it reaches a shoreline, clean-up activities will result in no net change to impacts to air quality.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	There would be no reduction in entrained oil, resulting in no significant change to fish communities, and thus commercial demersal fisheries.
Shallow commercial fisheries (including aquaculture)	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Recreational fisheries	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	There would be no reduction in entrained oil, resulting in no significant change to exposure to offshore faciltiies.

Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	Minor mitigation of impact	1	Shoreline clean-up may reduce oil damage to Aboriginal heritage sites along the Kimberley / NT coastline, however care would be required to ensure important sites are not damaged during the clean-up process.
Indonesian traditional fishing	Minor mitigation of impact	1	Reduction in oil remobilising from a shoreline into intertidal habitats may result in less harm to intertidal fish nurseries and foraging habitats. However damage to these ecosystems could occur, through physical damage associated with shoreline clean-up in sensitive intertidal environments.

Subsea Dispersant Injection

Overall statement of likelihood of success of Subsea Dispersant Injection:

Aim: Subsea dispersant injection (SSDI) involves using dispersant injection wands to inject dispersant into the oil/gas stream directly at the release location on the seabed. The dispersant will act to reduce the oil droplet sizes, resulting in an increase in oil entrainment in the water column. The reduction in oil droplet size will result in a reduction in oil arriving on the ocean surface, and therefore reducing the rates of evaporation, and subsequently reducing the local atmospheric concentration of Volitile Organic Carbon (VOC) around the release location (RPS 2019b).

Type of slick: Condensate (from a well-blowout) reaching the surface will form thin, patchy surface slicks within a few kilometers of the release location. Surface oil is in the form of Group I floating slicks which have a low viscosity and rapidly spread into a thin sheen. Surface oil concentrations will be up to approximately 10 g/m2 (~0.01mm, which equates to Bonn code 1/2) for up to approximately 250 kilometres from the spill site and weathered oil concentrations reduce down to below 1 g/m2 up to approximately 1000 km from the spill site (RPS 2021). Under very light wind conditions, weathering curves predict that up to 80% of the oil would evaporate. The remaining ~20% entraining in the top 3m of the water column, with a small fraction (<10%) undergoing biological degradation over time. With increasing wind conditions (>6 knots), a higher proportion of oil would become entrained, reducing the rates of evaporation and associated VOC exposure to the atmosphere (RPS 2019b).

Likely success/effectiveness against slick: Atmospheric modelling (RPS 2019b) of several worst-case well-blowout scenarios indicates that VOC concentrations would routinely be expected to exceed the 500 ppm VOC 15 minute short-term exposure threshold, resulting in the shut-down of any vessel activities near the well blowout location. This VOC risk would therefore potentially stop 'source control' activities, such as debris clearance or capping stack installation, potentially prolonging the duration of a well blowout and associated slicks and entrained oils. If SSDI were used during a well blow-out, for the time that SSDI was applied, modelling (RPS 2019b) indicates the rates of entrainment would increase and rates of evaporation would decrease. During light wind condtions, ~70% of the condensate would entrain in the shallow water colum (top 3m), with evaporation (and associated atmospheric VOC exposure) reducing to ~30%. Under increased wind conditions (>6 knots), evaporation becomes close to zero (RPS 2019b). Therefore SSDI will cause a reduction in atmospheric VOC concentration, enabling a safe debris clearance/capping stack installation. Any impacts associated with the use of SSDI to achieve a successful well-kill using a capping stack are offset by the significant reduction in the overall duration of the blow-out (and net reduction in entrained hydrocarbons) compared to a relief well-kill scenario.

The increase in entrainment from SSDI is similar to normal levels of entrainment expected to occur under higher wind conditions, and the effects of increased entrainment due to SSDI are partially offset due to a reduction in oil droplet size, resulting in a significant increase in biodegradation rates (up to 50%).

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	SSDI may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing BPPH to increased entrained hydrocarbons, for the duration of SSDI use. However, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs. Any impacts are also further offset due to the significant increase in biodegradation when SSDI is used.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	SSDI will not result in any increase in entrained hydrocarbons reaching deep water recetors.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	SSDI may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing intertidal coral reef to increased entrained hydrocarbons for the duration of SSDI use. However, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs. Any impacts are also further offset due to the significant increase in biodegradation when SSDI is used.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	SSDI would result in a reduction in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing mangroves, samphires etc to increased entrained hydrocarbons for the duration of SSDI use. However, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs. Any impacts are also further offset due to the significant increase in biodegradation when SSDI is used.
Sandy Beach	Minor mitigation of impact	1	SSDI would result in a reduction in increased entraimnet for the duraiton that SSDI was used, reducing oil load on beaches, for the duration which SSDI was used.
Rocky Shoreline	Minor mitigation of impact	1	SSDI would result in a reduction in increased entraimnet for the duraiton that SSDI was used, reducing oil load on rocky shorelines, for the duration which SSDI was used.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	SSDI may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing macro-algae and seagrass to increased entrained hydrocarbons, for the duration that SSDI is used. However, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs. Any impacts are also further offset due to the significant increase in biodegradation when SSDI is used.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	No or insignificant alteration of impact	0	SSDI may have a combination of positive and negative effects to intertidal seabed habitats. As a result, a 'no or insignificant alteration of impact' has been assigned for habitats important for protected species.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	SSDI will not result in any increase in entrained hydrocarbons reaching deep water recetors.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	SSDI may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing receptors to increased entrained hydrocarbons, for the duration that SSDI was used. However, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs. Any impacts are also further offset due to the significant increase in biodegradation when SSDI is used.
Water surface	Major mitigation of impact	3	SSDI would result in a very significant reduction in oil arriving on the surface, resulting in a significant reduction in exposure of wildlife using the ocean surface, for the days on which SSDI was used.
Air	Major mitigation of impact	3	SSDI would result in a very significant reduction in VOCs in the atmosphere, making it safer for air breathing animals, including marine fauna and humans conducting the source control activities, for the days on which SSDI was used.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	SSDI will not result in any increase in entrained hydrocarbons reaching deep water recetors.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	SSDI may result in increased entrained oil concentration in the shallow water column, therefore potentially exposing shallow commerical fisheries to increased entrained hydrocarbons, for the duration of SSDI use. However, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs. Any impacts are also further offset due to the significant increase in biodegradation when SSDI is used.
Recreational fisheries	No or insignificant alteration of impact	0	SSDI may result in increased entrained oil concentration in the shallow water column, therefore potentially exposing shallow recreational fisheries to increased entrained hydrocarbons, for the duration of SSDI use. However, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs. Any impacts are also further offset due to the significant increase in biodegradation when SSDI is used.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	SSDI may result in increased entrained oil concentration in the shallow water column, therefore potentially exposing offshore facilities with shallow seawater intakes to increased entrained hydrocarbons, for the duration of SSDI use. Exposed facilities may be required to conduct additional monitoring/maintenance of their internal seawater systems, however this would already likely be required, as exposure to elevated entrained condensate would already be occuring from any condensate well blowout.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	As any SSDI application would occur within offshore waters, and as there would be significant oil already entrained from any well-blowout event, SSDI application over a short period of the overall blow-out would result in an insignificant change in dispersed oil reaching traditional Aboriginal areas of the Kimberley and NT coastline. In addition, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs.
Indonesian traditional fishing	No or insignificant alteration of impact	0	SSDI may result in a minor increased in entrained oil concentration in the shallow water column, therefore potentially exposing shallow Indonesian traditional fisheries to increased entrained hydrocarbons, for the duration of SSDI use. However, any instantaneous increase in impact is likley offset by an overall reduction in the number of days which the well blowout occurs. Any impacts are also further offset due to the significant increase in biodegradation when SSDI is used.

Surface Dispersant

Overall statement of likelihood of success of Surface Dispersant:

Aim: To remove oil from the sea's surface via dispersant spraying from vessels and aircraft, thus reducing the amount of oil reaching birds, mammals and other organisms - as well as coastal habitats, socioeconomic features and shorelines (IPIECA 2015).

Type of slick: Surface oil is in the form of Group I floating slicks which have low viscosity and rapidly spread into a thin sheen. Surface oil concentrations will be approximately 10 g/m^2 for up to 250 kilometres from the spill site and weathered oil concentrations reduce down to below 1 g/m^2 approximately 1000 km from the spill site (RPS 2021).

Likely success/effectiveness against slick: The National Research Council (2010) notes that the window to use dispersants is early, typically within hours to 2 days of a spill, then after that, weathering makes oil more difficult to disperse (due to increased viscosity). Rapid dispersion of dispersant-treated oil begins at a wind speed of approximately 7 knots with wave heights of 0.2 to 0.3 metres (IPIECA 2015). Conditions where wave energy is too low, oil droplets may resurface after being applied with dispersant due to oil not being effectively dispersed into the water column. Dispersant becomes challenging in high winds and rough seas, where floating oil will be over-washed or temporarily submerged (IPIECA 2015). Whilst dispersants reduce the amount of oil on the surface that can affect wildlife, they also increase the exposure of dispersed oil in the upper water column to other wildlife. It is expected that dispersant will not significantly change the proportion of surface oil which would become entrained as the sea-state changes.

Generally oil slicks needs to be >100 g/m^2 (>0.1mm, which equates to Bonn code 4/5) to feasibly achieve a successfuly dispersant operation. However condensate arriving on the ocean surface from a well-blowout will never appear in slicks >100 g/m^2, and would generally be <10 g/m^2. Where there are any significant condensate slick, flammable/toxic vapours will also be present, and will likely exceed safe exposure thresholds, further reducing response efficiency (as vessels will not be permitted to operate in areas where explosive limits or VOC exposure thresholds are exceeded). Due to the very thin surface slicks, very low rates of succesful dispersal would be expected. During a well blow-out, significant volumes of oil/condensate would already be entrained, therefore surface dispersant application will result in further increases in entrained oil concentration. Therefore, surface dispersant application on a condensate slick would not be a safe or effective response strategy.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to shallow water BPPH. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Chemical dispersant would result in an insignificant increase in any additional oil reaching deep water locations, regardless of chemical dispersant application on the surface.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	
Intertidal seabed			
Intertidal Coral Reef	Minor additional impact	-1	Dispersant is generally considered ineffective at significantly increasing entrainment of thin sheens of condensate, compared to natural rates of entrainment. A significant volume of dispersant would need to be applied to result in any change, therefore this would result in negative impacts, due to additional chemicals on the surface and in the shallow water column, which could negatively impact on sensitive shallow/intertidal receptors such as corals, seagrass etc, and the biota who depend on them, including invertebrates, and mega-fauna who forage in these zones.
Mangrove/Mudflats/Samphires	Minor additional impact	-1	
Sandy Beach	Minor additional impact	-1	
Rocky Shoreline	Minor additional impact	-1	
Macro-Algae and Seagrass	Minor additional impact	-1	
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor additional impact	-1	
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	No oil reaching deep water locations, regardless of dispersant application on surface.
Upper water column (in photic zone)	Minor additional impact	-1	Dispersed oil can cause marine organisms inhabiting the upper water column to be briefly exposed to dispersed oil which can potentially have toxic effects. Dispersant is generally considered ineffective at significantly increasing entrainment of thin sheens of condensate, compared to natural rates of entrainment. A significant volume of dispersant would need to be applied to result in any change, therefore this would result in negate impacts, due to additional chemicals on the surface and in the shallow water column.
Water surface	Minor additional impact	-1	
Air	No or insignificant alteration of impact	0	A very slight reduction in VOCs at the point of application of surface disperant could occur, however it would not affect the broader local atmosphere of the area around the surfacing slick over time.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	No oil reaching deep water locations, including demersal fish habitat, regardless of chemical dispersant application on surface.
Shallow commercial fisheries (including aquaculture)	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in minor additional exposure of entrained condensate during a condensate well blowout, resuting in a minor increase in impacts to shallow commercial fisheries.
Recreational fisheries	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in minor additional exposure of entrained condensate during a condensate well blowout, resuting in a minor increase in impacts to recreational fisheries.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Due to the naturally high rates of entrainment of floating condensate, surface chemical dispersant application would be unlikely to result in any significant increase in the rates of entrainment, and therefore no change to risk to an offshore facility seawater intakes.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	As any dispersant application would occur within offshore waters, and as there would be significant oil entrained from any well-blowout event, surface dispersant application would result in an insignificant change in dispersed oil reaching traditional Aboriginal areas of the Kimberley and NT coastline.
Indonesian traditional fishing	Minor additional impact	-1	Chemical dispersant and additional entrained oil would result in negative impacts to shallow water BPPH which support indonesian traditional fishing target species. However, impacts would be minor, provided dispersant applied at a significant distance from the BPPH.

Pre-Contact Oiled Wildlife Response (Hazing and Translocation/Displacement)

Overall statement of likelihood of success of Pre-contact OWR (hazing and translocation):

Aim: Hazing involves discouraging animals from entering oiled areas by encouraging them to move into low-risk unoiled areas, in an attempt to prevent them from becoming oiled (IPIECA 2017). Hazing techniques include vessels generating underwater noise and motion, vessel air horns making above-water noise and fire hoses directing streams in front of fauna. Translocation/displacement involves removing wildlife who are at risk of becoming oiled from the spill environment in an attempt to prevent them from becoming oiled (IPIECA 2017). This includes holding animals in captivity until the risk of oiling is over, or relocating them to another area not affected by the oil spill (IPIECA 2017).

Type of slick: Floating oil is in the form of Group I slicks which have a low viscosity and rapidly spread into a thin sheen. Slicks will be approximately 10 g/m^2 up to approximately 250 kilometres from the spill site. Weathered oil concentrations reduce down to below 1 g/m^2 up to approximately 1000 km from the spill site (RPS 2021). Group I oils are relatively non-adhesive, and oil reaching shorelines is likely to have undergone weathering and will be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than their unweathered counterparts (Milton et al, 2003; Hoff & Michel 2014; Woodside 2014).

Likely success/effectiveness against slick: Wildlife hazing in the open ocean is inherently unlikely to be effective due to a number of limitations;

1) effectiveness depends upon the deployment of numerous ocean-going vessels (as opposed to smaller vessels which can be used near to the shore);
2) against a spreading plume (i.e. away from the immediate source of the spill), the technique becomes entirely impracticable;
3) there are significant safety issues associated with a spill of condensate and vessel masters will not approach the source of the spill, or fresh areas of slick, while the spill is still ongoing; and
4) without the constraints of a shoreline or other geographical feature, the technique may cause wildlife to move into other areas of the spill area instead of away from it.

Wildlife hazing is most suitable when used near sensitive shoreline habitats against persistent oily slicks, such as IFO, HFO or crude oil spills - but in the case of a subsea condensate well blowout, oil slicks are thin and not considered particularly adhesive, therefore reducing the likelihood and severity of impacts on wildlife. Additionally, hazing isn't considered an effective measure against volatile spills which rapidly evaporate.

In regard to wildlife translocation**,** IPIECA (2014) advise that the difficulty of capturing wildlife safely and maintaining their health during relocation should not be underestimated, and that working with live or dead animals has health and safety issues including potential injuries (bites, scratches) or zoonotic diseases. Risks to wildlife are high during pre-emptive capture and the risks of oiling need to be weighed against the risk of injury, death etc. (IPIECA 2014). The translocation of turtles from beaches and islands would likely require the capture of large numbers of hatchlings, followed by translocation to a location far from the slick (to prevent surface oil impacts on released hatchlings). The prolonged retention of hatchlings has been demonstrated to be detrimental to hatchling swimming speed and survival, even in short periods (6 hours) of retention (Pilcher and Enderby 2001). Attempting to capture large numbers (or an entire flock) of healthy seabirds would be very challenging, if not impossible (DPaW 2014), especially at a remote shoreline location (such as Browse or Cartier Island). There is no practicable method to capture healthy seabirds at sea (DPaW 2014). Potential harm to healthy seabirds could occur during the capture process. Any seabirds released would likely fly back to the shoreline from which they originally were captured. Therefore, long term veterinary care (feeding etc.) would be required for any successfully captured birds, until spill weathering or remediation has occurred and it was safe to release the animals. An evaluation would need to be undertaken, to ensure the released animals do not pose a disease risk (human/zoonotic diseases), to the wild population into which they are released.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Sandy Beach	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Rocky Shoreline	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	Wildlife hazing of flocks of seabirds may temporarily prevent oiling of individuals or small proportions of a local/regional populations, however it is not likely effective across a broad geographical area. Even conducting wildlife hazing in the nearshore environment at an isolated location such as Browse Island would be of logistically challenging and potentially not result in any significant impact mitigation. Hazing of seabirds to prevent them landing on an oiled shoreline may temporarily prevent impacts, whilst shoreline clean-up is occurring. Capture and translocation of turtle hatchlings away from the oiled shoreline, and release in the open ocean is potentially feasible. Therefore, undertaking pre-contact oiled wildlife response at a shoreline may reduce the number of protected species of a local population from being oiled.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Water surface	No or insignificant alteration of impact	0	Wildlife hazing and/or translocation of seabirds or other megafauna, such as cetaceans and turtles in the open ocean, using vessel presence, vessel noise or at sea capture is highly unlikely to be successful. It may be possible to temporarily (minutes / hours), prevent a few individuals of a protected species from entering a small geographic area affected by a slick. However, over the longer term duration and geographic area of a well-blowout scenario, there would be no alteration to the level of oiling of wildlife populations using this strategy in the open ocean.
Air	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Recreational fisheries	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.
Indonesian traditional fishing	No or insignificant alteration of impact	0	Not relevant for pre-contact oiled wildlife response.

Post Contact Oiled Wildlife Response

Overall statement of likelihood of success of Post-contact OWR:

Aim: Post-contact oiled wildlife response involves capturing oiled wildlife - and if necessary, cleaning, rehabilitating and releasing them.

Type of slick: Floating oil is in the form of Group I floating slicks which have a low viscosity and rapidly spread into a thin sheen. Slicks will be approximately 10 g/m^2 up to approximately 170 kilometres from the spill site. Weathered oil concentrations reduce down to below 1 g/m^2 up to approximately 1000 km from the spill site (RPS 2021). Group I oils are relatively non-adhesive, and oil reaching shorelines is likely to have undergone weathering and will be in the form of waxy flakes and residues which are generally considered to be of lower toxicity than fresh oil (Milton et al, 2003; Hoff & Michel 2014; Woodside 2014). Note that Group I hydrocarbons are relatively non-adhesive compared to crude oils, and are generally not considered an oil product that would 'coat' the feathers of birds, requiring a full wildlife cleaning response on a shoreline.

Likely success/effectiveness against slick: Capture, relocation, assessment, cleaning and rehabilitation of oiled wildlife has the ability to increase the survival of individuals. ITOPF (2011) note that there are many cases where oiled turtles have been cleaned successfully and returned to the water. Any seabirds captured, cleaned and released would likely fly back to the shoreline from which they originally were captured. Once oiled, it is generally agreed that birds have a very low survival rate, even when rescue and cleaning is attempted (Bourne et al. 1967; Holmes and Cronshaw 1977; Croxall 1977; Ohlendorf et al. 1978; Chapman, 1981; Ford et al., 1982; Samuels and Lanfear, 1982; Varoujean et al., 1983; Ford, 1985; Evans and Nettleship 1985; Fry 1987; Seip et al. 1991; Anderson et al. 2000). French-McCay (2009) produced mortality estimates of 99% for surface swimmers, 35% for aerial divers and raptors, and 5% for aerial seabirds. Samuels and Lanfear (1982) estimated that 95% of oiled seabirds die. ITOPF (2011) note that penguins and pelicans are often the exception as they are generally more resilient than many other species, however they are not present in the Browse Basin. IPIECA (2014) advise working with live or dead animals has health and safety issues including potential injuries (bites, scratches) or zoonotic diseases. An evaluation would need to be undertaken, to ensure any released animals do not pose a disease risk (human/zoonotic diseases), to the wild population into which they are released.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Deep-sea unconsolidated muds and sands	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Intertidal seabed			
Intertidal Coral Reef	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Mangrove/Mudflats/Samphires	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Sandy Beach	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Rocky Shoreline	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Macro-Algae and Seagrass	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)	Minor mitigation of impact	1	Post-contact OWR has the ability to increase the likelihood of survival of oil-affected EPBC species (individuals, or small proportion of a local population) in the intertidal/shoreline habitats. However, the seabird species of the Browse Basin are generally not expected to survive the capture, cleaning and rehabilitation process. Capture, cleaning and release of marine turtles would have a greater likelihood of success.
Water column			
Lower water column (below photic zone)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Upper water column (in photic zone)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Water surface	Minor mitigation of impact	1	It is possible that some individuals of protected species, which have been oiled and are unable to fly, could be captured in the open ocean and relocated to an oiled wildlife treatment facility. Therefore, whilst there is a very low probability of survival, under the right circumstances a positive environmental outcome, for a limited number of individuals of a protected species could be achieved.
Air	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Socio-economic			
Commercial demersal fisheries	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Shallow commercial fisheries (including aquaculture)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Recreational fisheries	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.
Indonesian traditional fishing	No or insignificant alteration of impact	0	Not relevant for post-contact oiled wildlife response.

Controlled In-situ Burning

Overall statement of likelihood of success of Controlled In-situ Burning (ISB):

Aim: In-situ burning rapidly removes the volume of spilled oil's hydrocarbon vapours in place, via combustion or burning (IPIECA 2016). This technique reduces the need to collect, store, transport and dispose recovered oil, plus it can shorten the overall response time (IPIECA 2016).

Type of slick: Floating oil is in the form of Group I floating slicks which have a low viscosity and rapidly spread into a thin sheen. Slicks will be approximately 10 g/m^2 up to approximately 250 kilometres from the spill site, reducing to weathered oil below 1 g/m^2 up to approximately 1000 km from the spill site (RPS 2021).

Likely success/effectiveness against slick: ISB requires wave heights typically below 1 m and wind speeds below 10 knots (IPIECA 2016) which are frequently exceeded at remote offshore locations in the Browse Basin region. Overseas experience shows that burns can be conducted safely, but the most discernible disadvantage is the resulting dark smoke plumes caused by the combustion of oil (IPIECA 2016). Carbon dioxide, soot (PM 2.5), water, polyaromatic hydrocarbons, volatile organic compounds, carbonyls, carbon monoxide, sulphur dioxide and potentially other gases can result from an in-situ burn, which has the potential to affect human and animal health (IPIECA 2016). IPIECA (2016) note that tests and information from previous burns indicate that ISB has little effect on water quality. Burn residue (i.e. burned oil depleted of volatiles and precipitated soot) rarely sinks and smothers benthic species (IPIECA 2016). Plus it is unlikely that Group I burn residue will cause smothering as this generally only occurs for heavier crudes (IPIECA 2016). IPIECA (2016) further note that burn residue is less toxic to aquatic biota than weathered oil.

To implement an effective in-situ burn response, a minimum surface hydrocarbon thickness of 2-5 mm (2000 - 5000 g/m^2) is required to be present. In the case of a well blowout, the surface slick is not expected to meet the required thickness (i.e. only 10 g/m^2 or 0.1 mm expected thickness in the immediate area of the release). Booms would be required to corral the spill, in an attempt to generate additional oil thickness, but this in turn is expected to exceed the VOC exposure thresholds for the workforce, and also may result in concentrations exceeding the lower explosive limit. Given this, and the lack of suitable booms available for in-situ burns in Australia, implementation of this response in an open ocean, high current environment is not considered to be safe, effective or feasible, especially against the thin sheen and hazardous atmospheric conditions associated with a condensate spill.

Resource Compartment (including values dependent on the resource compartment)	Impact Modification Score		Justification for Impact Modification Score
		B	
Subtidal Benthic Communities			
Benthic primary producer habitat (coral, seagrass, macro-algae and shallow water EPBC species foraging areas)			
Deep-sea features (filter feeding communities, deep water EPBC species foraging areas and Key Ecological Features)			
Deep-sea unconsolidated muds and sands			
Intertidal seabed			
Intertidal Coral Reef			
Mangrove/Mudflats/Samphires			
Sandy Beach			
Rocky Shoreline			
Macro-Algae and Seagrass			
Intertidal habitat which is important habitat for protected species (nesting / roosting / foraging)			
Water column			
Lower water column (below photic zone)			
Upper water column (in photic zone)			
Water surface			
Air			
Socio-economic			
Commercial demersal fisheries			
Shallow commercial fisheries (including aquaculture)			
Recreational fisheries			
Offshore Oil and Gas Exploration and Production Faciltiies (Platforms, Drilling Rigs etc)			
Cultural heritage			
Aboriginal heritage (cultural practices, sites and fishing / foraging)			
Indonesian traditional fishing			

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