Van Gogh Infill Installation EP Summary

TV-35-RE-10001.03

PROJECT / FACILITY	Van Gogh Infill	
REVIEW INTERVAL (MONTHS)	N/A	
SAFETY CRITICAL DOCUMENT	~~YES~~	NO

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ACRONYMS

Abbreviation	Description
°C	Degrees Celsius
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHO	Australian Hydrographic Office
ALARP	As Low as Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
APASA	Asia-Pacific Applied Sciences Association
BIAs	Biologically Important Areas
CFA	Commonwealth Fisheries Association
CVC	Cameron vertical Connector
DAWR	Department of Agriculture and Water Resources
DoD	Department of Defence
DoT	Department of Transport (WA)
DPaW	Department of Parks and Wildlife (WA)
EF&LS	Exmouth Freight & Logistics Services
EHFL	Electric Hydraulic Flying Lead
EMBA	Environment that May Be Affected
EP	Environment Plan
EPA	Environmental Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
EPO	Environmental Performance Objective
EPSs	Environmental Performance Standards
ESD	Emergency shutdown
GHG	Greenhouse gas
HSE	Health Safety Environment
IAPP	International Air Pollution Prevention
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMDG	International Maritime Dangerous Goods
IMS	Invasive Marine Species
IMT	Incident Management Team
IUCN	International Union for Conservation of Nature

Abbreviation	Description
JWM	Jetwave Marine
KEF	Key Ecological Feature
km	Kilometre
km^2	Square Kilometres
L	Litre
m	Metres
m^3	Cubic Metres
MARPOL	International Convention for the Prevention of Pollution from Ships
MGO	Marine Gas Oil
mm	Millimetres
MOC	Management of Change
NEBA	Net Environmental Benefit Analysis
NMSC	National Marine Safety Committee
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOx	Oxides of Nitrogen
NWMR	North West Marine Region
NWS	North West Shelf
ODS	Ozone Depleting Substance
OPEP	Oil Pollution Emergency Plan
OPGGS (E) R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSCP	Oil Spill Contingency Plan
OSRL	Oil Spill Response Limited
OWA	Oiled Wildlife Advisors
OWRP	Oiled Wildlife Response Plan
PAH	Polycyclic aromatic hydrocarbon
PLEM	Pipeline End Manifold
ppm	Parts Per Million
ROV	Remote Operated Vehicle
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plan
SOx	Oxides of Sulphur
VRASS	Vessel Risk Assessment
WA	Western Australia

Abbreviation	Description
WAFIC	Western Australian Fishing Industry Council
WAOWRP	WA Oiled Wildlife Response Plan
WDCS	Whale and Dolphin Conservation Society
WDTF	Western Deepwater Trawl Fishery
XT	Xmas Tree

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1. INTRODUCTION

Quadrant PVG Pty (Quadrant) is the registered operator of the Van Gogh field (within the WA-35-L production licence area), located approximately 45 km from the North West Cape and 110 km from the town of Onslow Western Australia.

Quadrant operates the Van Gogh, Coniston and Novara fields (Coniston and Novara fields are within the adjacent WA-55-L production licence) via a floating production, storage and offtake (FPSO) facility (Ningaloo Vision). To maintain production at the facility, additional wells, P11 and P12 will be drilled at Drill Centre 2 (DC2) (under the *Van Gogh, Coniston and Novara Drilling and Completions Environment Plan (EA-00-RI-10060)*) within the Van Gogh field. The infill installation activities needed to tie in the additional wells to the facility (**Figure 2-1**) form the scope of the *Van Gogh Infill Installation Environment Plan (TV-35-RE-100001.01)* (the EP).

Following completion of the activities under the EP, operation of the facility is covered under the NOPSEMA accepted *Ningaloo Vision Operations EP (Commonwealth Waters) (EA-66-RI-10003*).

1.1 Compliance

The overall purpose of the EP is to comply with statutory requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations); and to ensure that the activity is planned and conducted in line with Quadrant environmental policies and standards, including the corporate Environmental Policy. The EP was assessed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 9th April 2018. A revision to the EP was accepted on 17th December 2018 to allow for activities to occur in 2019. This EP summary has been prepared in accordance with the requirements of regulation 11 (4) of the OPGGS (E) Regulations.

1.2 Activity Durations and Timing

Activities will be conducted 24 hours per day, seven days per week. It is envisaged that the total duration of all activities covered by the EP will be approximately 7 days. However, with potential for weather and operational delays, this could extend the project duration (infill installation activities) to approximately 21 days. Activities may not be continuous during these timeframes, and the project vessel may depart and return on numerous occasions during this period.

The earliest date for commencement of the activity is Q4 2018 with all activity completed on, or before, 31st December 2019.

2. ACTIVITY LOCATION

Subsea facilities will be installed and located in production licence WA-35-L. Within the production licence, activities will be conducted within a defined 'operational area', which is a 500 m radius of DC2, as defined in **Table 2-1** and **Figure 2-2**. The 'operational area' defines the boundary within which activities associated with infill installation described in this EP will occur. The water depth within the operational area is approximately 380 m.

Table 2-1: Coordinates of DC2

Latitude	Longitude
20° 34' 55.304" S	114° 56' 03.018" E

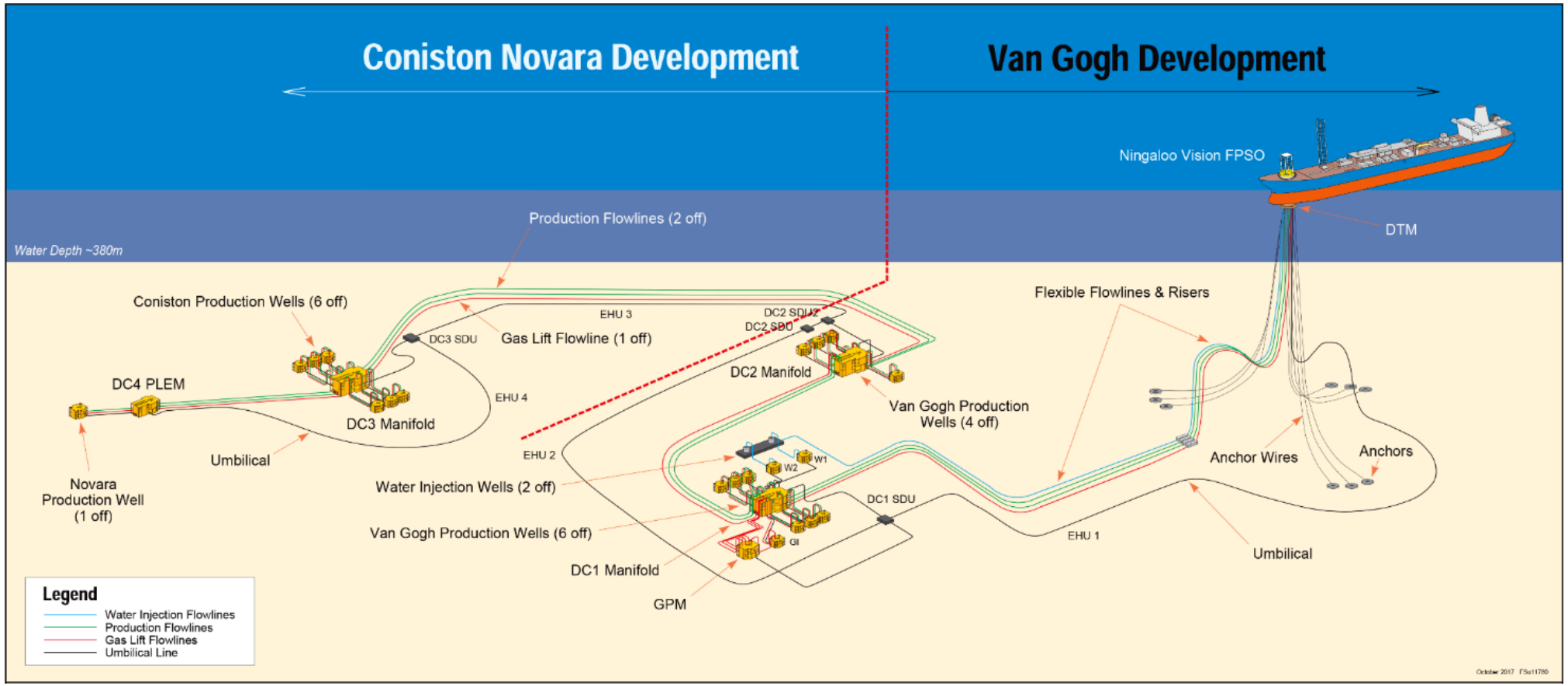

Figure 2-1: Existing Van Gogh / Coniston infrastructure

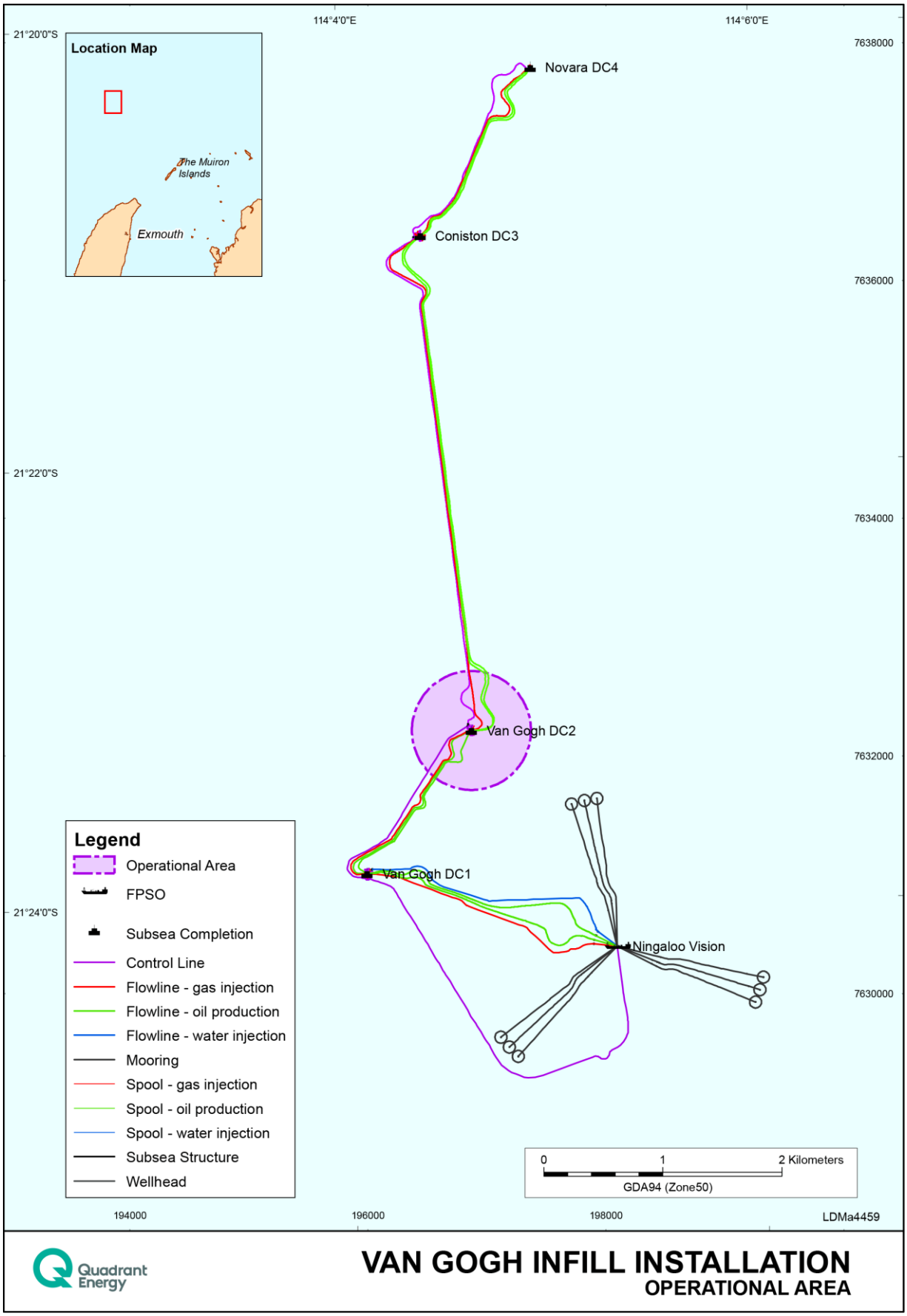

Figure 2-2: Location of the Van Gogh infill installation operational area

3. DESCRIPTION OF THE ACTIVITY

3.1 Overview

Quadrant proposes to conduct infill installation activities on the P11 and P12 wells drilled at DC2 within the Van Gogh field. These activities include:

- Connecting the DC2 manifold and the P11 and P12 Christmas trees (XTs) via the respective rigid tie-in spool;
- Connecting the gas lift jumpers (GLJ) and the Electro-Hydraulic Flying Lead (EHFL) from the P11 and P12 XTs to the manifold;
- Testing; and
- Commissioning.

A manned installation support vessel (ISV) will be used to carry out the activity. The ISV will be a dynamic positioning (DP) Class 2 or 3 vessel with a heavy lift built-in crane and two (2) work class ROVs (WROV). Support vessels are not planned for use during the activity. The exact ISV is yet to be confirmed.

No anchoring will be required during the activity.

ISV refuelling at sea will not occur during the activity. Helicopters may be used to transfer crew and equipment, and assist in Health Safety Environment (HSE) or operational emergencies, as required.

3.2 Installation Activities

3.2.1 Spools, Flying Lead and Gas Lift Jumper Installation

The activity will involve the installation of two rigid spools to connect the manifold to the P11 and P12 XTs. The ISV will transport the two 6" x 25 m rigid spools (prefabricated and tested), jumpers and Electro-Hydraulic Flying Lead (EHFL) to the operational area. The ISV and ROVs will then install the spools between the XTs and the DC2 manifold. Note that the rigid spools are installed between each well and the DC2 manifold i.e. they are not installed on the seabed.

The two EHFLs will be pre-installed on a deployment frame and then overboarded with the ISV's crane. The EHFLs will be installed between the P11 and the P12 XTs, along the seabed, using both WROVs.

The two 60m GLJ will be similarly pre-installed on a second deployment frame and overboarded. The deployment frames will be recovered at the end of the activity by the ISV crane assisted by the WROVs.

The DC2 manifold and the P11 and P12 XTs will be connected via the rigid tie-in spools. The P11 and P12 XTs will each operate with direct flowline, GLJ and EHFL connections to the manifold.

3.2.2 Metrology

Subsea metrology (measurements made between subsea equipment) will be undertaken in preparation for installation activities. Metrology will involve the use of an ROV and LBL (long baseline) acoustic transponders deployed to the seabed, aided by a crane and/or ROV. Ultra-short baseline (USBL) transponders positioned on vessel hulls near the sea surface will also be used for crane and ROV positioning.

3.2.3 Cement Bag Installation

Cement filled bags will be deployed on the GLJs and EHFLs after installation to ensure on-bottom stability. Six 1m x 1m cement bags will be installed on each GLJ and EHFL respectively (24 in total). All cement bags will be lowered to the seabed in a metal basket (2m x 2m) and the WROVs will fly each cement bag from the basket onto each GLJ and EHFL. The basket will be recovered after cement bag installation.

3.2.4 Pre-Commissioning

Leak testing will be completed between production wing valves on the P11 and P12 XTs and the isolation valves on the DC2 manifold. Pressure testing and electrical testing of the control system and the gas lift circuit will be effected from the ISV by specialist personnel on-board.

3.2.5 Cold Commissioning

Communication testing with the XTs, DC2 manifold and the Ningaloo Vision control room and function testing of the subsea hydraulically actuated valves will be conducted. The valves will be tested using the subsea control system with a WROV observing the operations.

3.2.6 Surveys

A pre-installation seabed survey will be executed to ensure the seabed is suitable for installation. A detailed biological seabed survey has already been completed for the Van Gogh Field; however, surveys prior to installation of subsea infrastructure will be conducted to check for debris and natural features (i.e. rocks or spans). If required, the WROV may use water jetting to remove marine growth and/or cuttings on the existing subsea infrastructure.

On completion of the installation of the spools, GLJs/EHFLs and pre-commissioning/cold-commissioning, an as-built survey will be conducted using a WROV.

3.3 Simultaneous Operations

The DC2 manifold will be producing via the existing P7, P8, P9 and P10 wells whilst installation of the two spools, GLJs and EHFLs is executed.

Following completion of the installation and cold-commissioning works, the P11 and P12 wells will be brought online sequentially. This will be covered under the *Ningaloo Vision Operations EP (Commonwealth Waters) (EA-66-RI-10003).*

4. DESCRIPTION OF ENVIRONMENT

4.1 Environment That May Be Affected (EMBA)

Stochastic hydrocarbon dispersion and fate modelling undertaken for the credible 'worst-case' hydrocarbon spill scenarios indicated that the largest spatial extent of potential impact to fauna and/or habitat would result from a vessel collision rupturing a fuel tank and releasing marine gas oil (MGO). However, the spill trajectory of the mixed crude subsea release, due to damaged subsea infrastructure, extended further north than the MGO spill and therefore has assisted in defining the EMBA.

The spill trajectory area for these two scenarios were therefore considered to represent the greatest extent of the EMBA and was used to identify the environmental values and sensitivities within the existing environment that may be at risk, including by searches of the EPBC Act Protected Matters Database.

The existing environment within the operational area and EMBA is summarised in the following sections.

4.2 Physical Environment and Habitat

4.2.1 Physical environment

The operational area is situated within Commonwealth waters of the North-west Marine Region which is further divided into eight provincial bioregions (DSEWPaC 2008). The EMBA overlaps five provincial bioregions:

- Northwest Province (overlaps operational area);
- Northwest Shelf Province;

- Central Western Transition;
- Central Western Shelf Transition; and
- Central Western Shelf Province.

4.2.2 Habitats

4.2.2.1 Operational Area

Quadrant commissioned Tri-Surv (Tri-Surv 2007) to undertake geophysical seabed mapping of the Van Gogh development area (24 km^2 covering both DC1 and DC2 drill centre/manifold locations). The survey showed the seabed in the study area to be comprised of silty clay with some fine sand and shell fragments of less than 1 mm dimensions, with a gentle sloping gradient in a west-northwest direction.

ROV surveys of the benthic habitat were also undertaken in the vicinity of the DC1 and DC2 drill centre/manifold locations, along the flowline route and at the FPSO turret mooring (Enesar 2007). The combined results from these surveys demonstrate that the seabed is comprised of soft sedimentary habitats only and does not contain any outcrops or deep-water reefs indicative of areas with high epibenthic diversity. The fauna observed was typically sparse, deep-sea soft sedimentary and demersal fauna, of the expected types of organisms to be found at these depths and location (Enesar 2007).

Infauna assemblages have been sampled at the Van Gogh development area (Enesar 2007). Infauna sampled in this area was found to be low in abundance but with high diversity; polychaetes comprised 68% of the diversity and crustacean 29% of the diversity (Enesar 2007). These studies concluded that the infauna abundance and community composition was typical of deep water benthic habitats of the NWS (Enesar 2007; Gardline Marine Services 2009).

4.2.2.2 EMBA

The presence of marine and coastal habitats within the EMBA is summarised in **Table 4-1**.

Table 4-1: Habitats within the EMBA listed according to presence within the operational area and IMCRA Provincial Bioregions of Australia

Category	Receptor	Operational Area Presence	EMBA Presence					Relevant Events that may impact on the receptors
			Northwest Province	Northwest Shelf Province	Central Western Transition	Central Western Shelf Transition	Central Western Shelf Province	
Benthic Habitats	Coral reefs			✓		✓	✓	<u>Unplanned</u> • Marine gas oil release from vessel collision • Crude release due to damaged subsea infrastructure
	Seagrass			✓		✓	✓	<u>Unplanned</u> • Marine gas oil release from vessel collision • Crude release due to damaged subsea infrastructure
	Macroalgae			✓		✓	✓	<u>Unplanned</u> • Marine gas oil release from vessel collision • Crude release due to damaged subsea infrastructure
	Non-coral benthic invertebrates	✓	✓	✓	✓	✓	✓	<u>Planned</u> • Seabed disturbance • Planned operational discharges <u>Unplanned</u> • Non-hydrocarbon release (surface) - solid • Marine gas oil release from vessel collision

Category	Receptor	Operational Area Presence	EMBA Presence					Relevant Events that may impact on the receptors
			Northwest Province	Northwest Shelf Province	Central Western Transition	Central Western Shelf Transition	Central Western Shelf Province	
								• Crude release due to damaged subsea infrastructure
Shoreline habitats	Mangroves			✓		✓	✓	<u>Unplanned</u> • Marine gas oil release from vessel collision • Crude release due to damaged subsea infrastructure
	Intertidal mud / sand flats			✓		✓	✓	
	Intertidal platforms			✓		✓	✓	
	Sandy beaches			✓		✓	✓	
	Rocky shorelines			✓		✓	✓	

4.3 Protected/ Significant Areas

Protected/significant areas identified in the EMBA are detailed in **Table 4-2** and Figure 4-1 to **Figure 4-2**. The management zones, associated with the Australian Marine Parks identified in the EMBA, and the relevant objectives are detailed in **Table 4-3**.

Table 4-2: Distance from operational area boundary to values and sensitivities within the EMBA

Value/Sensitivity	Distance from Operational Area (km)	EMBA Presence
Australian Marine Parks	31.5	Gascoyne Marine Park: - Habitat Protection Zone (IUCN IV) - Multiple Use Zone (IUCN VI)
	30	Ningaloo Marine Park: - Recreational Use Zone (IUCN II)
	394	Shark Bay Marine Park: - Multiple Use Zone (IUCN VI)
State Marine Parks and Marine Management Areas	35	Muiron Islands Marine Management Area
	37	Ningaloo Marine Park*
World & National Heritage Places	30	The Ningaloo Coast
Commonwealth Heritage Places	30	Ningaloo Marine Area – Commonwealth Waters
Key Ecological Features	Overlaps	Continental Slope Demersal Fish Communities
	8	Canyons Linking the Cuvier Abyssal Plain with the Cape Range Peninsula
	24	Ancient Coastline at 125 m Depth Contour
	30	Commonwealth Waters adjacent to Ningaloo Reef

*Ningaloo Marine Park is not within the EMBA but has been included based on the predicted potential shoreline accumulation modelling outputs.

Table 4-3: Management Zones for the Australian Marine Parks found within the EMBA and the associated objectives

Management Zones	Objective
Multiple Use (IUCN VI)	To provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species. *The zone allows for a range of sustainable uses, including commercial fishing and mining where they are authorised and consistent with park values. Mining operations are defined in the EPBC Act and include oil spill response.*
Habitat Protection (IUCN IV)	To provide for the conservation of ecosystems, habitats and native species in as natural a state as possible, while allowing activities that do not harm or cause destruction to seafloor habitats
Recreational Use (IUCN IV)	To provide for the conservation of ecosystems, habitats and native species in as natural a state as possible, while providing for recreational use.

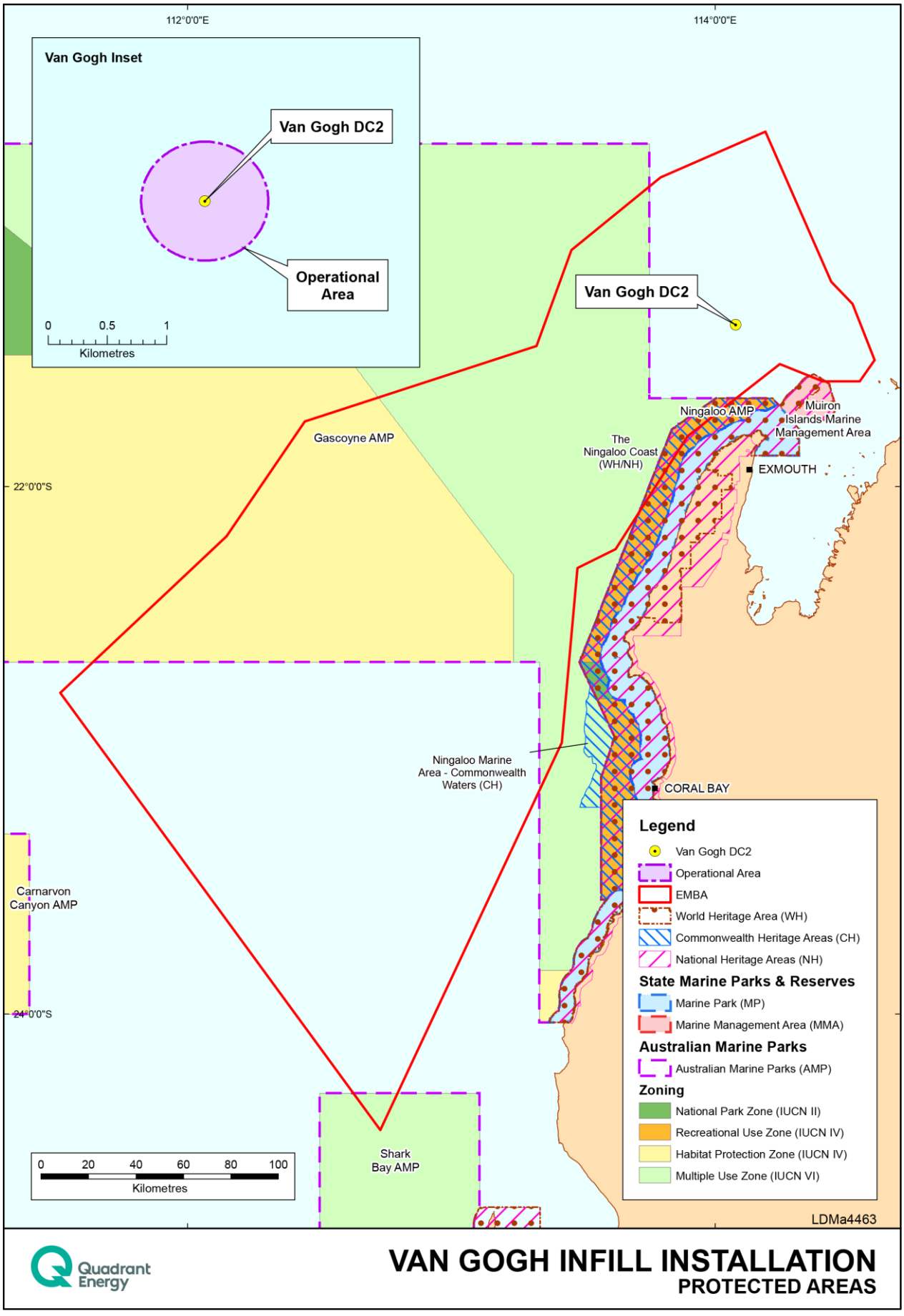

Figure 4-1: Protected areas within and near the EMBA

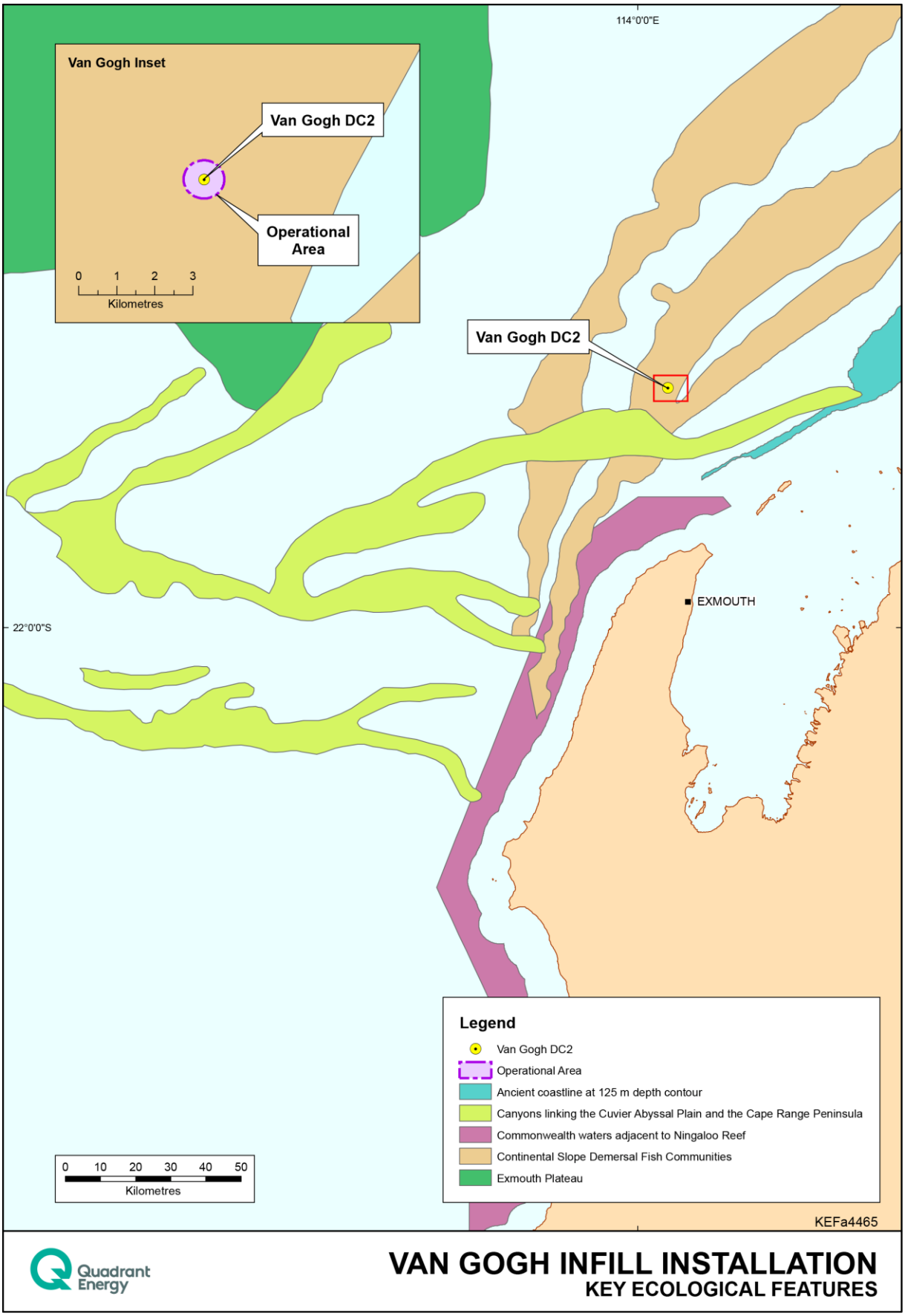

Figure 4-2: Key ecological features within and near the EMBA

4.4 Threatened and Migratory Marine Fauna

The most recent EPBC protected matters searches were conducted in October 2018 for the operational area and EMBA. The searches identified 26 `listed threatened' species of marine fauna within the operational area, and 48 `listed migratory' species (**Table 4-4**). The listed threatened marine fauna that may occur within the EMBA and their migratory characteristics are also given in **Table 4-4**. For each species identified, the nature of likely presence is provided, including any overlap with designated Biologically Important Areas (BIAs).

4.4.1 Marine Mammals

A search of the EPBC Act Protected Matters Database identified 31 cetacean species that may occur within the operational area and EMBA. Of these, 12 are listed as migratory and five are listed as threatened under the EPBC Act.

4.4.2 Fish and Sharks

A search of the EPBC Act Protected Matters Database identified five threatened fish species within the operational area and EMBA. Of these, four are listed also listed as migratory. The search also identified 37 listed marine fish (pipefish and seahorses). In addition, two conservation dependent species were identified as potentially occurring within the EMBA.

4.4.3 Marine Reptiles

A search of the EPBC Act Protected Matters Database identified five marine turtle species listed as threatened and migratory, and one seasnake listed as threatened, which may occur within the operational area and/or EMBA.

4.4.4 Marine Seabirds

A search of the EPBC Act Protected Matters Database identified 7 threatened marine bird species (five of which are also migratory) which have a recognised range that overlaps the operational area and/or EMBA.

Table 4-4: Threatened and migratory species and communities in the operational area and EMBA

Value/Sensitivity		EPBC Act Status CE= Critically Endangered E= Endangered V= Vulnerable M= Migratory CD= Conservation dependent	Operational Area Presence	Particular values or sensitivities within the Operational Area	EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**						
Protected Species and Communities: Fish, Sharks and Rays							
Dwarf sawfish	*Pristis clavata*	V, M			✓	Species or habitat known to occur	<u>Planned</u> Interaction with other marine users Light emissions Noise emissions Planned operational discharges Spill response operations <u>Unplanned</u> Marine fauna collision Non-hydrocarbon and chemicals release – liquid Non-hydrocarbon release (surface) - solid Minor hydrocarbon release Crude release due to damaged subsea infrastructure Marine gas oil release from vessel collision
Giant manta ray	*Manta birostris*	M	✓	Species or habitat likely to occur	✓	Species or habitat known to occur	
Great white shark	*Carcharodon carcharias*	V, M	✓	Species or habitat may occur	✓	Species or habitat known to occur	
Green sawfish	*Pristis zijsron*	V, M	✓	Species or habitat known to occur	✓	Species or habitat known to occur	
Grey nurse shark	*Carcharias taurus*	V	✓	Species or habitat may occur	✓	Species or habitat known to occur	
Longfin mako	*Isurus paucus*	M	✓	Species or habitat likely to occur	✓	Species or habitat likely to occur	
Narrow sawfish	*Anoxypristis cuspidata*	M	✓	Species or habitat may occur	✓	Species or habitat likely to occur	
Porbeagle	*Lamna nasus*	M			✓	Species or habitat may occur	
Reef manta ray	*Manta alfredi*	M	✓	Species or habitat may occur	✓	Species or habitat known to occur	

Value/Sensitivity		EPBC Act Status CE= Critically Endangered E= Endangered V= Vulnerable M= Migratory CD= Conservation dependent	Operational Area Presence	Particular values or sensitivities within the Operational Area	EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**						
Shortfin mako	*Isurus oxyrinchus*	M	✓	Species or habitat likely to occur	✓	Species or habitat likely to occur	
Whale shark	*Rhincodon typus*	V, M	✓	Foraging, feeding or related behaviour known to occur	✓	Foraging, feeding or related behaviour known to occur	
Scalloped hammerhead	*Sphyrna lewini*	CD	✓	Species or habitat may occur	✓	Species or habitat may occur	
Bluefin tuna	*Thunnus maccoyii*	CD	✓	Species or habitat may occur	✓	Species or habitat may occur	
Protected Species and Communities: Marine Mammals							
Antarctic minke whale	*Balaenoptera bonaerensis*	M			✓	Species or habitat likely to occur	<u>Planned</u> Interaction with other marine users Noise emissions Planned operational discharges Spill response operations <u>Unplanned</u> Marine gas oil release from vessel collision
Blue whale	*Balaenoptera musculus*	E, M	✓	Species or habitat likely to occur	✓	Migration route known to occur	
Bryde's whale	*Balaenoptera edeni*	M	✓	Species or habitat may occur	✓	Species or habitat likely to occur	
Dugong	*Dugong*	M			✓	Breeding known to occur within area	

Value/Sensitivity		EPBC Act Status CE= Critically Endangered E= Endangered V= Vulnerable M= Migratory CD= Conservation dependent	Operational Area Presence	Particular values or sensitivities within the Operational Area	EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**						
Fin whale	*Balaenoptera physalus*	V, M	✓	Species or habitat likely to occur	✓	Foraging, feeding or related behaviour likely to occur	Marine fauna collision Crude release due to damaged subsea infrastructure
Humpback whale	*Megaptera novaeangliae*	V, M	✓	Species or habitat known to occur	✓	Species or habitat known to occur	
Indo-pacific humpback dolphin	*Sousa chinensis*	M			✓	Species or habitat may occur	
Killer whale	*Orcinus orca*	M	✓	Species or habitat may occur	✓	Species or habitat may occur	
Sei whale	*Balaenoptera borealis*	V, M	✓	Species or habitat likely to occur	✓	Foraging, feeding or related behaviour likely to occur	
Southern right whale	*Eubalaena australis*	E, M			✓	Species or habitat likely to occur	
Sperm whale	*Physeter macrocephalus*	M			✓	Species or habitat may occur	
Spotted bottlenose dolphin	*Turdiops aduncus*	M	✓	Species or habitat may occur	✓	Species or habitat known to occur	

Value/Sensitivity		EPBC Act Status CE= Critically Endangered E= Endangered V= Vulnerable M= Migratory CD= Conservation dependent	Operational Area Presence	Particular values or sensitivities within the Operational Area	EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**						
Protected Species and Communities: Marine Reptiles							
Flatback turtle	*Natator depressus*	V, M	✓	Congregation or aggregation known to occur	✓	Congregation or aggregation known to occur	<u>Planned</u> Interaction with other marine users Light emissions Noise emissions Planned operational discharges Spill response operations <u>Unplanned</u> Marine fauna collision Marine gas oil release from vessel collision Crude release due to damaged subsea infrastructure
Green turtle	*Chelonia mydas*	V, M	✓	Species or species habitat known to occur	✓	Congregation or aggregation known to occur	
Leatherback turtle	*Dermochelys coriacea*	E, M	✓	Species or species habitat likely to occur	✓	Species or species habitat known to occur	
Hawksbill turtle	*Eretmochelys imbricata*	V, M	✓	Species or species habitat known to occur	✓	Congregation or aggregation known to occur	
Loggerhead turtle	*Caretta caretta*	E, M	✓	Species or species habitat known to occur	✓	Congregation or aggregation known to occur	
Short-nosed seasnake	*Aipysurus apraefrontalis*	CE			✓	Species or species habitat likely to occur within area	
Protected Species and Communities: Birds (Seabirds)							

Value/Sensitivity		EPBC Act Status CE= Critically Endangered E= Endangered V= Vulnerable M= Migratory CD= Conservation dependent	Operational Area Presence	Particular values or sensitivities within the Operational Area	EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**						
Australian fairy tern	*Sternula nereis*	V	✓	Foraging, feeding or related behaviour likely to occur	✓	Breeding known to occur	<u>Planned</u> Interaction with other marine users Light emissions Noise emissions Atmospheric emissions Planned operational discharges Spill response operations <u>Unplanned</u> Non-hydrocarbon release (surface) - solid Marine gas oil release from vessel collision Crude release due to damaged subsea infrastructure
Black-browed albatross	*Thalassarche melanophris*	V, M			✓	Species or habitat may occur	
Campbell albatross	*Thalassarche impavida*	V, M			✓	Species or habitat may occur	
Common noddy	*Anous stolidus*	M	✓	Species or habitat may occur	✓	Species or habitat may occur	
Flesh-footed shearwater	*Ardenna carneipes*	M			✓	Species or habitat likely to occur	
Fork-tailed swift	*Apus pacificus*	M			✓	Species or habitat likely to occur	
Lesser frigatebird	*Fregata ariel*	M	✓	Species or habitat may occur	✓	Species or habitat likely to occur	
Roseate tern	*Sterna dougallii*	M			✓	Breeding likely to occur	
Shy albatross	*Thalassarche cauta cauta*	V, M			✓	Species or habitat may occur	

Value/Sensitivity		EPBC Act Status CE= Critically Endangered E= Endangered V= Vulnerable M= Migratory CD= Conservation dependent	Operational Area Presence	Particular values or sensitivities within the Operational Area	EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**						
Soft-plumaged petrel	*Pterodroma mollis*	V			✓	Foraging, feeding or related behaviour likely to occur	
Southern giant-petrel	*Macronectes giganteus*	E, M	✓	Species or habitat may occur	✓	Species or habitat may occur	
Streaked shearwater	*Calonectris leucomelas*	M	✓	Species or habitat likely to occur	✓	Species or habitat likely to occur	
Wedge-tailed shearwater[1]	*Ardenna pacifica*	M					
White-capped albatross	*Thalassarche cauta steadi*	V, M			✓	Species or habitat may occur	
Protected Species and Communities: Birds (Shorebirds)							
Common sandpiper	*Actitis hypoleucos*	M	✓	Species or habitat may occur	✓	Species or habitat may occur	Planned Interaction with other marine users Light emissions
Curlew sandpiper	*Calidris ferruginea*	CE	✓	Species or habitat may occur	✓	Species or habitat may occur	

[1] Wedge-tailed shearwater not identified in **Appendix C**, however, BIA overlaps with Operational Area and EMBA

Value/Sensitivity		EPBC Act Status CE= Critically Endangered E= Endangered V= Vulnerable M= Migratory CD= Conservation dependent	Operational Area Presence	Particular values or sensitivities within the Operational Area	EMBA presence	Particular values or sensitivities within EMBA	Relevant Events
Common Name	**Scientific Name**						
Eastern curlew	*Numenius madagascariensis*	CE, M	✓	Species or habitat may occur	✓	Species or habitat may occur	Noise emissions Atmospheric emissions Planned operational discharges Spill response operations <u>Unplanned</u> Non-hydrocarbon release (surface) - solid Marine gas oil release from vessel collision Crude release due to damaged subsea infrastructure
Osprey	*Pandion haliaetus*	M	✓	Species or habitat may occur	✓	Species or habitat known to occur	
Pectoral sandpiper	*Calidris melanotos*	M	✓	Species or habitat may occur	✓	Species or habitat may occur	
Red knot	*Calidris canutus*	E, M	✓	Species or habitat may occur	✓	Species or habitat may occur	
Sharp-tailed sandpiper	*Calidris acuminate*	M	✓	Species or habitat may occur	✓	Species or habitat may occur	

4.5 Socio-Economic Receptors

Table 4-5 identifies the relevant State and Commonwealth fisheries that overlap the operational area and EMBA. Active fisheries were identified in consultation with the Department of Primary Industries and Regional Development (DPIRD).

Other socio-economic considerations such as shipping, recreational fishing, oil and gas industry, tourism and cultural heritage in relation to the operational area and EMBA are summarised in **Table 4-6**.

4.6 Windows of Sensitivity

Timing of peak activity for threatened species and other relevant, significant sensitivities is given in **Table 4-7.**

Table 4-5: State and Commonwealth fisheries within the EMBA

Fishery	Description	Operational Area Presence	Relevant events within the Operational Area	Relevant events within the EMBA
Commonwealth Fisheries				
North West Slope Trawl Fishery	A deepwater trawl fishery extending from 114° E to approximately 125° E off the WA coast between the 200 m isobaths and the outer limit of the Australian Fishing Zone (AFZ). Targets Australian scampi and prawns.	✓	<u>Planned</u> Interaction with other marine user However, fishery interaction unlikely to occur, since there has been no recent commercial fishing within the operational area	<u>Planned</u> Spill response operations <u>Unplanned</u> Marine gas oil release from vessel collision Crude release due to damaged subsea infrastructure
Western Tuna and Billfish Fishery	A longline and minor line fishery for striped marlin, broadbill swordfish, bigeye tuna and yellowfin tuna. The fishery extends westward from Cape York Peninsula (142°30' E) off Queensland to 34° S off the WA west coast. It also extends eastward from 34° S off the west coast of WA across the Great Australian Bight to 141° E at the South Australian–Victorian border.	✓		
Skipjack Tuna Fishery (Western)	Predominantly purse seine fishery skipjack tuna. The fishery covers the entire sea around Western Australia, out to the 200 nm. The fishery is not currently active with management arrangements under review.	✓ Management under review.		
Southern Bluefin Tuna Fishery	The fishery extends to the high seas for Australian flagged vessels and targets southern bluefin tuna. This fishery is incorporated into the Western Tuna and Billfish Fishery	✓	No current effort on NWS	
Western Deepwater Trawl Fishery	A deepwater trawl fishery (>200 m) historically dominated by finfish. The Western Deepwater Trawl Fishery (WDTF) operates in Western Australia between the western boundary of the Great Australian Bight Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery in the south (115°08'E) and the western boundary of the North West Slope Trawl Fishery in the north (114°E). Fishing zone does not overlap operational area.			
State Fisheries				
Marine Aquarium Fish Fishery	The Marine Aquarium Fish Fishery is primarily a dive based fishery targeting fish species which operates in Western Australia's State waters spanning the coastline from the	✓	These fisheries collect specimens by diving or wading which cannot	<u>Planned</u> Spill response operations

Fishery	Description	Operational Area Presence	Relevant events within the Operational Area	Relevant events within the EMBA
	Northern Territory border in the north to the South Australian border in the south		occur in the operational area due to the depth in excess of 350 m.	<u>Unplanned</u> Marine gas oil release from vessel collision Crude release due to damaged subsea infrastructure
Specimen Shell Managed Fishery	The Specimen Shell Managed Fishery targets shells primarily by diving or wading shallow waters and is permitted in Western Australian waters between the high water mark and the 200 m isobaths.	✓		
Sea Cucumber Fishery (formerly Beche-de-mer Fishery))	The Western Australian sea cucumber fishery is primarily based in the northern half of the State, from Exmouth Gulf to the Northern Territory border, however fishers do have access to all Western Australian waters. It is a hand-harvest fishery, with animals caught principally by diving, and a smaller amount by wading	✓		
Mackerel Managed Fishery (Area 2 and 3)	The fishery uses near-surface trolling lines from boats and extends from the West Coast Bioregion to the WA/NT border, with most effort and catches recorded north of Geraldton, especially from the Kimberley and Pilbara coasts. Catches are reported separately for three Areas: Area 1, 2 and 3.	✓	<u>Planned</u> Interaction with other marine users Spill response operations However, interaction with fishery is unlikely to occur since the fishery targets coastal waters around reefs, shoals and headlands.	
Developing Octopus Interim Managed Fishery	Fishery in development phase. Octopus are primarily caught in the Developing Octopus Interim Managed Fishery (largest fishery) are limited to the boundaries of the developmental fishery, which is an area bounded by the Kalbarri Cliffs (26°30'S) in the north and Esperance in the south.			Interaction with the fishery is unlikely to occur given the fishery south of Kalbarri
West Coast Deep Sea Crustacean Managed Fishery	Baited pots in waters >150 m for crystal (snow) crabs. Permitted in all waters lying north of latitude 34° 24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150m isobaths out to the extent of the Australian Fishing Zone	✓	<u>Planned</u> Interaction with other marine users Spill response operations	Interaction with the fishery is unlikely to occur given the fishery mostly operates in depths of 500-800 which is deeper than

Fishery	Description	Operational Area Presence	Relevant events within the Operational Area	Relevant events within the EMBA
			However, interaction with the fishery is unlikely to occur given the fishery mostly operates in depths of 500-800 which is deeper than the operational area (How and Nardi 2014).	the operational area (How and Nardi 2014).
West Coast Rock Lobster Managed Fishery	Baited pot fishery for western rock lobster fished all year round. The fishery is situated along the west coast of Australia between Latitudes 21°44´ to 34°24´ S. The fishery is managed in three zones: Zone A – Abrolhos Islands, north of latitude 30° S excluding the Abrolhos Islands (Zone B) and south of latitude 30° S (Zone C).			
Roe's Abalone Fishery	Dive fishery covering all WA waters. The Area 8 commercial fishery (north of Moore River) has been closed indefinitely for the 2011/12 season and beyond.			
Shark Bay Scallop Managed Fishery & Shark Bay Prawn Managed Fishery	The boundaries of the Shark Bay Prawn Managed Fishery and the Shark Bay Scallop Managed Fishery are located in and near the waters of Shark Bay. Generally, they are closed between November and April but depend on pre-season surveys and environmental conditions each year			<u>Planned</u> Spill response operations <u>Unplanned</u> Marine gas oil release from vessel collision Crude release due to damaged subsea infrastructure
Gascoyne Demersal Scalefish Managed Fishery	The Gascoyne Demersal Scalefish Managed Fishery operates in the waters of the Indian Ocean and Shark Bay between latitudes 23°07'30" S and 26°30'S. Vessels are not permitted to fish in inner Shark Bay. The fishery licensed vessels fish throughout the year with mechanised handlines.			
Pearl Oyster Managed	Dive fishery, operating in shallow coastal waters along the North-West Shelf.			

Fishery	Description	Operational Area Presence	Relevant events within the Operational Area	Relevant events within the EMBA
Fishery (Western Australia)	The fishery is separated into four zones.			
Pilbara Fish Trawl (Interim) Managed Fishery	The Pilbara Fish Trawl Interim Managed Fishery targets scalefish by trawling. The fishery is situated in the Pilbara region in the north west of Australia. It occupies the waters north of latitude 21°35'S and between longitudes 114°9'36" E and 120°E. The fishery is seaward of the 50 m isobaths and landward of the 200 m isobaths The fishery consists of two zones; Zone 1 in the south west of the Fishery (which is closed to trawling) and Zone 2 in the North, which consists of six management areas.			<u>Planned</u> Spill response operations <u>Unplanned</u> Marine gas oil release from vessel collision Crude release due to damaged subsea infrastructure
Pilbara Trap Managed Fishery & Pilbara Line Fishery	The Pilbara Trap Managed Fishery targets scalefish by fish trap and drop line. The fishery is permitted to operate within waters bounded by a line commencing at the intersection of 21°56´ S latitude and the high water mark on the western side of the North West Cape			

Table 4-6: Socio-economic receptors within the EMBA

Value/Sensitivity	Description	Operational Area Presence	Relevant events within the Operational Area	Relevant events within the EMBA
Shipping	The operational area is located 45 km north west of a Shipping Fairway designated by the Australian Maritime Safety Authority (AMSA). The shipping fairways are designed to keep shipping traffic away from offshore infrastructure and aims to reduce the risk of collision. Analysis of historical AUSREP shipping data indicates that commercial vessels do use the general area. Vessels most likely encountered include other vessels associated with Quadrant and other oil and gas operators. Shipping using NWS waters includes iron ore carriers, oil tankers and other vessels proceeding to or from the ports of Dampier, Port Walcott and Port Hedland; however, these are predominantly heading north from these ports. Large cargo vessels carrying freight bound or departing from Fremantle, transit along the WA coastline heading north and south in deeper waters.	✓	<u>Planned</u> Interaction with marine users Spill response operations	<u>Planned</u> Spill response operations <u>Unplanned</u> Marine gas oil release from vessel collision Crude release due to damaged subsea infrastructure
Recreational and charter boat fishing	Within the North-west Marine Region, recreational fishing is experiencing significant growth, with a distinct seasonal peak in winter when the local population increases significantly from tourists visiting the Exmouth/Onslow area and Dampier Archipelago (Fletcher and Santoro 2017). Increased recreational fishing has also been attributed to those involved in the construction or operation of developments within the region. Charter boat fishing is popular from the locations of Broome, Dampier, Point Samson, Exmouth, Coral Bay, Carnarvon and Denham. Within the operational area, there are no known natural seabed features that would aggregate fishes and which are typically targeted by recreational or charter boat fishers.			
Oil and gas infrastructure	The North West Shelf is an active area for petroleum exploration and developments. Other than the existing Quadrant facilities within the operational area, nearby activities of other operators within the EMBA include: • Vincent Development (Ngujima-Yin FPSO) in WA-28-L, approximately 4 km south of Ningaloo Vision FPSO; • Enfield Development (Nganhurra FPSO) in WA-28-L, approximately 12 km south west of Ningaloo Vision FPSO; and • Pyrenees Development (Pyrenees Venture FPSO) in in WA-42-L, approximately 15 km south of the Ningaloo Vision FPSO. • Macedon PLEM subsea completion and gas pipeline			

Value/Sensitivity	Description	Operational Area Presence	Relevant events within the Operational Area	Relevant events within the EMBA
Tourism	There are many sources of marine-based tourism within the environment that may be affected. Aquatic recreational activities such as boating, diving and fishing occur near the coast and islands off of the Pilbara and Ningaloo coasts. These activities are concentrated in the vicinity of the population centers such as Coral Bay, Exmouth, Dampier and Onslow. In the waters immediately surrounding the operational area, tourism activities are limited due to its distance from the coast.			
Cultural Heritage	No known sites of Cultural Heritage significance or National Heritage places on the basis of Maritime Heritage exist within the EMBA. Areas protected as National Heritage places on the basis of Indigenous Heritage within the EMBA are: • The Ningaloo Coast Shorelines within the vicinity of the EMBA (e.g. Exmouth) also have a long history of occupancy by Indigenous communities. In addition, the following historic shipwrecks (older than 75 years) are located within the EMBA: • Lady Ann (1982) • Gem (1893)			Events relevant to historic shipwrecks are: <u>Planned</u> Spill response operations <u>Unplanned</u> Hydrocarbon Release – vessel collision Hydrocarbon release – loss of well control Hydrocarbon release – damage to subsea infrastructure

Table 4-7: Environmental values and sensitivities within the EMBA – windows of sensitivity

Categories	Receptors (critical life cycle stages)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Physical environment and habitats	All shoreline habitats												
	Coral (spawning periods)												
	Macroalgae	growing				shedding fronds				growing			
	Other benthic habitats												
Marine Fauna (incl. threatened/ migratory species)	**Fish/ Sharks and fisheries species**												
	Whale sharks			Aggregations at Ningaloo Coast									
	Fisheries species spawning/aggregation times [1]												
	Baldchin groper												
	Blacktip shark												
	Crystal crab												
	Goldband snapper												
	King George whiting												
	Pink snapper												
	Rankin cod												
	Red Emperor												
	Spangled Emperor												
	Sandbar shark												
	Spanish mackerel												
	Marine Mammals												
	Dugong (breeding)	breeding								breeding			
	Humpback whale (migration)						northern			southern			

Categories	Receptors (critical life cycle stages)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	Blue whale (migration)					northern						southern	
	Marine Reptiles												
	Hawksbill turtle's resident adult and juveniles[2]	Widespread throughout NW Shelf waters, highest density of adults and juveniles over hard bottom habitat (coral reef, rocky reef, pipelines etc.)											
	Hawksbill turtle (mating aggregations[2])												
	Hawksbill turtle (nesting and internesting[2])												
	Hawksbill turtle (hatching[1])												
	Flatback turtles (resident adult and juveniles[2])	Widespread throughout NW Shelf waters, increased density over soft bottom habitat 10 – 60m deep, post hatchling age classes and juveniles spread across shelf waters											
	Flatback turtle (mating aggregations[2])												
	Flatback turtle (nesting and internesting[2])												
	Flatback turtle (hatching[2])												
	Flatback turtle (nesting[2])												
	Green turtles (resident adult and juveniles[2])	Widespread throughout the NW Shelf waters, highest density associated with seagrass beds and macro algae communities, high density juveniles in shallow waters off beaches, amongst mangroves and in creeks											
	Green turtle (mating aggregations[2])												
	Green turtle nesting and internesting[2])												
	Green turtle (hatching[2])												
	Loggerhead turtles (resident adult and juveniles[2])	Widespread throughout the NW Shelf waters, increased density associated with soft bottom habitat supporting their bivalve food source, juveniles associated with nearshore reef habitat											

Categories	Receptors (critical life cycle stages)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	Loggerhead turtle (mating aggregations[2])												
	Loggerhead turtle (nesting and internesting[2])												
	Loggerhead turtle (hatching[2])												
	Leatherback turtles												
	Seabirds												
	Terns, shearwaters, petrels (nesting)												
	Commercial Managed Fisheries												
	Oil and gas												
	Shipping												
	Tourism/ recreational												

KEY / NOTES		
	Peak activity, presence reliable and predictable	[1] Information provided from Department of Fisheries consultation
	Lower level of abundance/activity/presence	[2] Information provided by K. Pendoley
	Activity not occurring	
	Activity can occur throughout year	
	Proposed timing of activity	

5. STAKEHOLDER CONSULTATION

Quadrant understands retaining a broad licence to operate depends on the development and maintenance of positive and constructive relationships with a comprehensive set of stakeholders across the community, Government and business sectors.

Quadrant has established long-term and meaningful dialogue with those stakeholders who have demonstrated an interest in its present and planned future activities in Australia.

For the activities to be undertaken under the EP, a standardised approach was applied to identify key stakeholders for the activity, beginning with a review of the stakeholder database, and of the stakeholders consulted over other recent activities in the area. In particular, the operational area for the activity was used to identify relevant persons on an activity-by-activity basis, and will be used throughout the duration of the EP. The key stakeholders identified for the activity are based on the operational area and EMBA and are provided in **Table 5-1**.

5.1 Summary

Stakeholders (refer **Table 5-1**) were informed of activities covered by the EP via an activity specific consultation package distributed by email in January 2018. Quadrant's Exmouth Consultation Reference Group (CRG) were first consulted regarding the planned installation activity during a CRG meeting on November 8, 2017. Following this, Quadrant's wider stakeholder group were have been informed of the planned infill drilling and installation activity in via Quadrant's Quarterly Consultation Update since December 2017, most recently distributed on September 28, 2018.

Quadrant's Ningaloo Vision FPSO has produced from the Van Gogh, Coniston and Novara field since 2010, and therefore it is reasonable to expect that stakeholders are familiar with Quadrant's presence in the region. This includes consultation for the *Ningaloo Vision Operations EP* (TV-00-RI-003), *Coniston Novara Development EP* (phase one drilling) (EA-00-RI-208), *Coniston Novara Phase II Drilling EP* (EA-00-RI-268/1), the *Coniston Novara Construction and Installation EP* (EA-00-RI-232/1) and more recently the *Van Gogh, Coniston and Novara Drilling and Completions EP* (EA-00-RI-10060), a five year drilling EP which covers the 2018 infill drilling campaign.

All stakeholders listed in **Table 5-2** were engaged prior to EP submission as early as January 2018, and also received an update on timing for the Van Gogh Infill Installation activity via a Quarterly Consultation Update, distributed on 28 September 2018. No comment on the activity was received in response to this latest update.

Quadrant considers that consultation with stakeholders has been adequate for activities covered under this EP (further detailed in **Table 5-2**). No stakeholder has objected to the activity covered under this EP nor claimed that the environmental impacts or risks are unacceptable. Given the short duration, the nature of this activity and Quadrant's ongoing presence in the Exmouth community, Quadrant anticipates minimal interaction with mariners for this activity. Despite this Quadrant will provide relevant marine notices detailed in **Table 5-2**.

All correspondence with external stakeholders is recorded and Quadrant will remain available before, during and after the activity. Consultation material and feedback received will be provided to the appropriate internal Quadrant personnel when relevant.

Many stakeholders have stated that they will contact Quadrant by exception, that is, if upon receiving the stakeholder information package they feel the activity is of interest or concern to them, they will contact Quadrant.

Consultation, agreements or contracts that support Quadrant's oil spill response strategies and tactics have been put into place with agencies and organisations throughout the development of the OPEP so that roles and responsibilities are understood and accepted. These are outlined in **Table 5-3.**

Quadrant maintains a comprehensive stakeholder database with stakeholders identified through the following mechanisms:

- Regular review of all legislation applicable to petroleum and marine activities;
- Identification of marine user groups and interest groups active in the area (e.g., recreational and commercial fisheries, other oil and gas producers, merchant shipping, etc.);
- DPIRD fishing license holder database will be sourced annually;
- Active participation in industry bodies (e.g. APPEA and AMOSC); and
- Records from previous consultation activities in the area.

5.1.1 Exmouth Consultation Reference Group

The Exmouth CRG is Quadrant's main community stakeholder reference group, as much of Quadrant's exploration and production activity is centred on the remote town. The Exmouth CRG, as a joint-industry meeting with neighbouring oil and gas operators, is convened three times a year in Exmouth for a project briefing session covering all activities forecast by Quadrant for a 3-6 month period.

Members are provided with project-specific information briefings at these meetings, to facilitate the raising of comments or concerns directly with Quadrant via email, telephone conversation or at the meetings. Quadrant Energy's regular presence in Exmouth and attendance at community functions, such as the annual Whale Shark Festival, also supports communications with the wider community.

Quadrant's Exmouth CRG were first consulted regarding the planned installation activity during a CRG meeting on November 8, 2017. Meetings have since been held on March 8, August 2 and November 8, 2018.

All meetings from November 2017 to November 2018 have included current updates of Quadrant's activities in the region, including Van Gogh Infill Drilling and proposed Installation activities. Particularly on November 8, 2018, present stakeholders were informed of updates to installation activity timing.

Table 5-1: Summary of stakeholders consulted

Group	Stakeholder
Fishers and representative bodies	• A Raptis and Sons • Austral Fisheries • Australian Fisheries Management Authority (AFMA) • Australian Southern Bluefin Tuna Association (ASBTIA) • Commonwealth Fisheries Association (CFA) • Fat Marine • Marine Tourism WA • MG Kailis • Pearl Producers Association • Recfishwest • Shark Bay Seafoods • Western Australian Fishing Industry Council (WAFIC) • Westmore Seafoods
Marine conservation	• Department of Primary Industries and Regional Development (DPIRD) • Department of Biodiversity, Conservation and Attractions (DBCA)
Shipping safety and security	• Australian Maritime Safety Authority (AMSA) • Department of Defence (DoD) • Department of Transport (DoT)
Exmouth Community Reference Group (CRG)	• BHP • Cape Conservation Group • DBCA (Regional) • DoT (Regional) • Exmouth Chamber of Commerce and Industry • Exmouth District High School • Exmouth Game Fishing Club • Federal Member of Parliament • Gascoyne Development Commission • Member of the Legislative Assembly • North West Cape Exmouth Aboriginal Corporation • Ningaloo Station • Ningaloo Coast World Heritage Advisory Council • Shire of Exmouth • Toll Exmouth • Woodside Pty Ltd
Adjacent regulator	• Department of Mines, Industry Regulation and Safety (DMIRS)
Commonwealth Government departments	• Department of Agriculture and Water Resources – Biosecurity • Department of Agriculture and Water Resources – Fisheries • Director of National Parks

Table 5-2: Consultation summary for activity

STAKEHOLDER	ASSESSMENT OF CONSULTATION UNDERTAKEN
Fishers and representative bodies – fishers identified by Quadrant as possibly being active in the area, and their representative bodies.	
A Raptis and Sons	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's

STAKEHOLDER	ASSESSMENT OF CONSULTATION UNDERTAKEN
	Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Austral Fisheries	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's *Quarterly Consultation Update* documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Australian Fisheries Management Authority	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's *Quarterly Consultation Update* documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Australian Southern Bluefin Tuna Association (ASBTIA)	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's *Quarterly Consultation Update* documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Commonwealth Fishing Association	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Fat Marine	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's *Quarterly Consultation Update* documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. No response regarding the activity has been received to date. This stakeholder is historically concern with seismic activities and has raised no concern with drilling activities in the past. No action arising from this consultation for this EP.
Marine Tourism WA	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.. No comment has been received to date relating to this EP; previous interaction with stakeholder has reassured Quadrant that a response would only be received in the event of concern regarding the activity.

STAKEHOLDER	ASSESSMENT OF CONSULTATION UNDERTAKEN
MG Kailis	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's *Quarterly Consultation Update* documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.. No response regarding the activity has been received to date. No action arising from this consultation for this EP. MG Kailis were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Pearl Producers Association	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's *Quarterly Consultation Update* documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Recfishwest	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Shark Bay Seafoods	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's *Quarterly Consultation Update* documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Western Australian Fishing Industry Council	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 11, 2018, and receive all Quadrant's Quarterly Consultation Update documents. No response regarding the activity has been received to date including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.. Historically WAFIC have been concerned with seismic activities and issues arising from petroleum exclusion zones. Given exclusion zones around the project vessel will be temporary and short in nature, Quadrant anticipates no action arising from this consultation for this EP.
Westmore Seafoods	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's *Quarterly Consultation Update* documents. No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Exmouth Consultation Reference Group (CRG)	
Base Marine	Base Marine were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.

STAKEHOLDER	ASSESSMENT OF CONSULTATION UNDERTAKEN
BHP	BHP are a neighbouring operator to this activity and received consultation material by email on January 4, 2018. No further action required for this EP. Additionally a BHP representative is present at each CRG meeting. BHP were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Cape Conservation Group	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. A CCG representative was in attendance at CRG meetings from November 2017 to November 2018, and received a detailed briefing on the activity. No response regarding the activity has been received to date. No action arising from this consultation for this EP. The CCG were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
DBCA (Regional)	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. An Exmouth DBCA representative was in attendance at the November CRG meeting in Exmouth, and received a detailed briefing on the activity. A representative from DBCA was provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
DoT (Regional)	No response regarding the activity has been received to date. No action arising from this consultation for this EP. An Exmouth DoT representative was in attendance at the November CRG meeting in Exmouth, and received a detailed briefing on the activity. The Department were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Exmouth Bus Charter	EBC were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Exmouth Chamber of Commerce and Industry	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. The Exmouth CCI president was in attendance at the November CRG meeting in Exmouth, and received a detailed briefing on the activity. The President of the Exmouth CCI was provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.

STAKEHOLDER	ASSESSMENT OF CONSULTATION UNDERTAKEN
Exmouth District High School	The Exmouth DHS Principal was in attendance at the November CRG meeting in Exmouth, and received a detailed briefing on the activity and this stakeholders receives all Quadrant's Quarterly Consultation Update documents.
Exmouth Game Fishing Club	No response regarding the activity has been received to date. No action arising from this consultation for this EP. The Exmouth Game Fishing Club were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Federal Member of Parliament	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.
Gascoyne Development Commission	No response regarding the activity has been received to date. No action arising from this consultation for this EP. A GDC representative was in attendance at the November CRG meeting in Exmouth, and received a detailed briefing on the activity.
Member of the Legislative Assembly	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.
North West Cape Exmouth Aboriginal Corporation	No response regarding the activity has been received to date. No action arising from this consultation for this EP.
Ningaloo Station	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.
Ningaloo Coast World Heritage Advisory Council	No response regarding the activity has been received to date. No action arising from this consultation for this EP. The NCWHAC executor and representative was in attendance at the November CRG meeting in Exmouth, and received a detailed briefing on the activity. The Executor of the committee was provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Shire of Exmouth	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and responded querying supplying the vessel through Exmouth and potential increases to airport transfers. Quadrant has provided this information in response on January 11, 2018. Quadrant continues conversations with the Shire of Exmouth, outside of EP preparations, regarding the community's local economy. An Exmouth Shire staff member was in attendance at CRG meetings from November 2017 to November 2018, and received a detailed briefing on the activity. The Shire of Exmouth were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.

STAKEHOLDER	ASSESSMENT OF CONSULTATION UNDERTAKEN
Exmouth Freight and Logistics (Toll Exmouth)	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. A Toll Exmouth business owner was in attendance at the November CRG meeting in Exmouth, and received a detailed briefing on the activity. EFL were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Woodside Pty Ltd	Woodside are a neighbouring operator to this activity and received consultation material by email on January 4, 2018. Woodside have replied to consultation on 24/1/18 requesting further information regarding Quadrant's planned drilling activities in 2018, which were addressed as part of engagement for drilling activities. No comment has been received regarding installation activities. Additionally a Woodside representative is present at each CRG meeting. Quadrant will continue ongoing consultation with Woodside before, during and after planned 2018 activities at Van Gogh. No further action required for this EP. A representative from Woodside was provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Marine Conservation	
Fisheries – Department of Primary Industries and Regional Development (DPIRD)	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. A fisheries representative responded with thanks on January 5, 2018, acknowledging receipt of this email. Quadrant has followed up with Fisheries regarding drilling activities in the permit, and Fisheries confirmed via email on January 19, 2018, that historic advice for these permits, received on August 24, 2015, remains valid. Fisheries advice is incorporated into all Quadrant Energy EPs. In sections of the EP, Quadrant has included fishing activities (refer **Table 4-5**), pollution emergency plan advice (OPEP) and biosecurity (refer **Section 6.4.7**) accordingly. The Department were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Department of Biodiversity, Conservation and Attractions (DBCA)	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. No response regarding the activity has been received to date. No action arising from this consultation for this EP. The Department were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Shipping safety and security – stakeholders who provide information on shipping and vessel traffic, or may be involved in a response to an unplanned event.	

STAKEHOLDER	ASSESSMENT OF CONSULTATION UNDERTAKEN
Australian Maritime Safety Authority	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. AMSA provided shipping traffic plots via email on January 8, 2018, which indicates most vessel traffic encountered would be industry traffic as they centre around FPSO's. Quadrant has provided the AMSA traffic plot to the Quadrant logistics and supply team. Following advice from AMSA, Quadrant commits to relevant marine notices.
Department of Defence	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. The Department responded to consultation on January 24, 2018, advising of no concern with the activity and requesting notification prior to commencement to the Defence Airspace and AHO branch of the Department. The Department and AHO were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Department of Transport	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018, and receive all Quadrant's Quarterly Consultation Update documents\ including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation.. DoT responded to consultation with thanks on January 16, 2018, Quadrant commits to ongoing consultation with DoT on all Quadrant activities as per DoT's Industry Guidance Note. Quadrant provided the activity OPEP with additional consultation information as per DoT's Industry Guidance Note on January 25th 2018. DoT responded with thanks on February 5, 2018, acknowledging receipt of the OPEP. DoT provided comments on the OPEP which were subsequently included in Revision 0.1.
Adjacent Regulators	
State Department of Mines, Industry Regulation and Safety (DMIRS)	DMIRS were provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 4, 2018 and receive all Quadrant's Quarterly Consultation Update documents including one distributed on September 28, 2018, which included timing updates for Van Gogh Infill Installation. DMIRS responded via email on January 16, 2018, acknowledging the activity would occur in Commonwealth Waters under NOPSEMA's regulation. DMIRS requested no further information on this activity. DMIRS were provided a pre-start notification via email on November 13, 2018, with an anticipated commencement date, noting the Environment Plan will now be extended to allow the activity to occur within January, 2019.
Commonwealth Government Departments	
Department of Agriculture and Water Resources – Biosecurity	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 11, 2018, as requested in the Australian Government Guidance on Offshore Petroleum and Greenhouse Gas Activities Consultation. No response had been received at the time of submission,

STAKEHOLDER	ASSESSMENT OF CONSULTATION UNDERTAKEN
	and is not anticipated as Quadrant has consulted regularly with the State agency DPIRD.
Department of Agriculture and Water Resources – Fisheries	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 11, 2018, as requested in the Australian Government Guidance on Offshore Petroleum and Greenhouse Gas Activities Consultation. The Department responded with thanks on January 23, 2018, noting they have no comment on the activity. Quadrant will provide ongoing consultation as outlined in **Section 5.2**.
Director of National Parks	This stakeholder was provided the Van Gogh, Coniston and Novara drilling and installation consultation package on January 17, 2018, given the proximity to the Ningaloo Marine Park - and as requested in the Australian Government Guidance on Offshore Petroleum and Greenhouse Gas Activities Consultation. An email response was received on February 2, 2018, and the activity OPEP has been updated accordingly.

5.2 Ongoing Consultation

Consultation associated with the activities covered by the EP comprises three tiers, the Activity Consultation Package distributed prior to EP acceptance (sent on December 8, 2017), a notification prior to activity commencement when timing and other details are confirmed, and within Quadrant's Quarterly Consultation Updates (last issued September 2018, next planned for December 2018).

Stakeholder consultation will be ongoing and Quadrant will work with stakeholders to address any future concerns if they arise throughout the duration of the EP. Should any new stakeholders be identified, they will be added to the stakeholder database and included in all future correspondence as required, including specific activity notifications.

5.2.1 Stakeholder Notifications

Prior to mobilisation, Quadrant will provide a notification to relevant stakeholders. Stakeholders who receive this notification document will be based on Quadrant's stakeholder list at the time, which may include additional stakeholders to those listed in **Table 5-1** if they have been identified by Quadrant, or have specifically requested the information through consultation.

If the ISV departs and returns to the operational area after the initial notifications, relevant stakeholders will be notified as appropriate.

5.2.2 Quarterly Consultation Update

Activities covered under the EP will be included in Quadrant's Quarterly Consultation Updates until they can be listed as a 'completed activity', with updates scheduled for approximately June, September, December and March annually.

The Van Gogh installation activity was included in Quadrant's Quarterly Consultation Update distributed in December 2017, March 2018, June 2018 and September 2018. No comments regarding Van Gogh were received in response to this consultation.

5.3 **OPEP Consultation**

In preparing oil pollution emergency plans (OPEP), a number of parties are identified to provide spill response services and actions to support the implementation of the OPEP. These OPEP stakeholders are identified through evaluation of the activity and spill potential for all Quadrant OPEPs, including the *Van Gogh Infill Installation OPEP* (TV-35-RE-100001.02).

Consultation, agreements or contracts have been put into place with agencies and organisations throughout the development of Quadrant oil spill response strategies and tactics so that roles and responsibilities are understood and accepted as outlined in **Table 5-3.**

Table 5-3: OPEP consultation summary

Engaged with		Assessment of Consultation Undertaken
Function	**Stakeholder**	
Australian Marine Oil Spill Centre (AMOSC)		Historically AMOSC reviewed Oil Spill Contingency Plans (OSCPs) and OPEPs and are satisfied with the description of their support. AMOSC now request to only view OPEPs once they are accepted by the regulator and before the activity commences. Roles and responsibilities defined in the OPEP reflect the arrangements established under contract conditions as a Participating Member of AMOSC under the AMOSCPlan.
Australian Marine Safety Authority (AMSA)		Historically AMSA reviewed OPEPs and are satisfied with the description of their support. AMSA now request to only view OPEPs once they are accepted by the regulator and before the activity commences. Roles and responsibilities defined in the OPEP reflect the arrangements established within a Memorandum of Understanding (MOU) between AMSA and Quadrant. Quadrant continue to undertake an annual workshop with AMSA as required under Sections 22 and 24 of the Quadrant/AMSA MOU. This enables the open flow of information relevant to the oil spill response arrangements: *Ongoing consultation and cooperation* AMSA and the titleholder will nominate contact points for the ongoing management of this MOU. AMSA and the Titleholder agree to maintain a cooperative approach to preparing and responding to marine pollution incidents, including the open exchange of information and technical advice. AMSA will facilitate an annual workshop to provide an open forum to exchange information on best practice and review and update operational procedure.
Logistics provider	CH Robinson	CH Robinson provide a global freight forwarding service under contract conditions to Quadrant. All arrangements defined in the OPEP reflecting freight forwarding services reflect contracted services.
	Toll Logistics	Toll Logistics operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating Toll Logistics reflect contracted services.
Field support organisation	Exmouth Freight & Logistics Services (EF&LS)	EF&LS operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating EF&LS reflect contracted services.
Department of Environmental Regulation (DER) (Waste Management Branch)		The DER Waste Management Branch have reviewed and have had input in defining the Waste Management Plan contained in Quadrant OSCP/OPEPs. The waste management processes do not change between OPEPs, so the original consultation is sufficient for the OPEP.
Department of Biodiversity, Conservation and Attractions (DBCA)		DBCA were contributors to development of the WA Oiled Wildlife Response Plan (OWRP) defined in the OPEP. Descriptions of the Quadrant interface with the WAOWRP contained within the OPEP are

Engaged with		Assessment of Consultation Undertaken
Function	**Stakeholder**	
		consistent with the intent of DBCA (and AMOSC) for oiled wildlife response. No further consultation is required.
Department of Transport (Hazard Management Authority)		All roles and responsibilities defined within the OPEP for DoT reflect the arrangements for the Westplan MOP as further defined by the DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangements. Quadrant commits to ongoing consultation with DoT on all Quadrant activities as per DoT's Industry Guidance Note.
Subsea response service provider	Oceaneering	Oceaneering operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating Oceaneering reflect contracted services.
Oil Spill Response Limited (OSRL)		OSRL operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating OSRL reflect contracted services.
Vessel providers	Go Marine	Go Marine operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating Go Marine reflect contracted services.
	Jet Wave Marine (JWM)	JWM operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating JWM reflect contracted services.
	Bhagwan Marine	Bhagwan Marine operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating Bhagwan Marine reflect contracted services.
Aircraft providers		Aircraft providers operate under contract conditions with Quadrant. All arrangements defined in this OPEP nominating aircraft providers reflect contracted services.
Spill modelling provider	RPS APASA	APASA operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating APASA reflect contracted services.
Waste contractor	North West Alliance (NWA)	NWA operate under contract conditions with Quadrant. All arrangements defined in the OPEP nominating NWA reflect contracted services.

6. ENVIRONMENTAL HAZARDS AND CONTROLS

The impact and risk assessment approach is consistent with the requirements of AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines and ISO/IEC 31010 Risk management – Risk management techniques. The approach can be mapped to the requirements of the OPGGS (E) Regulations for an EP, as described by NOPSEMA (N4700-GN1074 Rev 1 2013). The key steps are illustrated in **Figure 6-1** below.

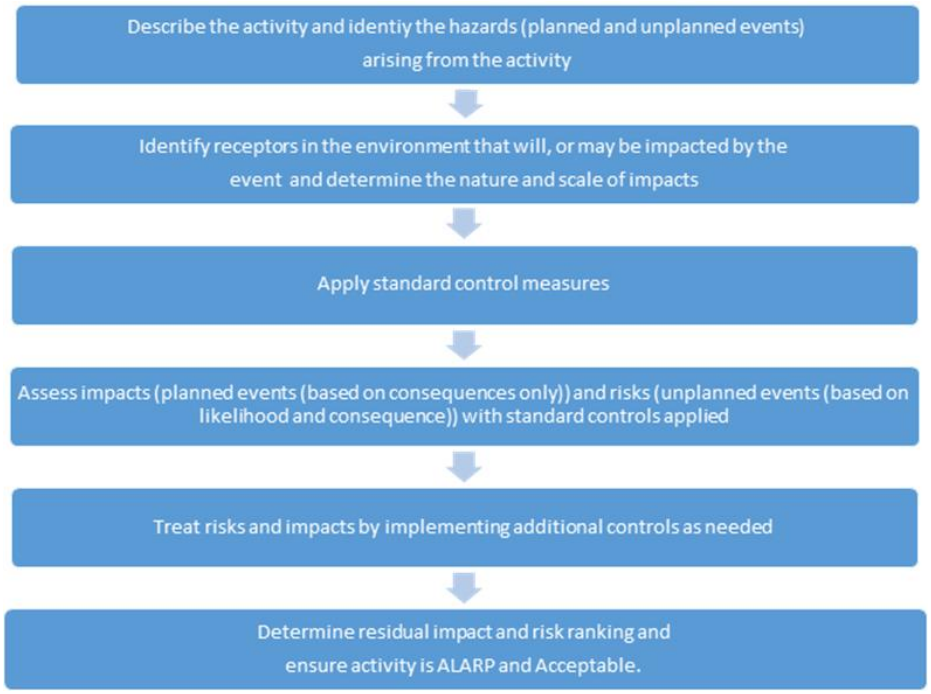

Figure 6-1: Environmental impact and risk assessment process

An assessment against the activity was undertaken and the environmental hazards or aspects were then identified. The risk assessment identified seven potential planned and unplanned events.

The extent of actual or potential impacts from each planned or unplanned event is assessed using the description of the activity and known information on impacts (published industry reports and scientific studies) and in some circumstances, where required, predictive information such as modelling (e.g. hydrocarbon spills). Impact mechanisms and thresholds for impacts where relevant are determined and described, using scientific literature and modelling where required. The consequence level of the impact is then determined for each planned and unplanned event based on the severity of the impact to relevant receptor.

This process determines a consequence level based on set criteria for each receptor category and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. The consequence definitions are outlined in **Table 6-1** below.

Table 6-1: Consequence level description

Consequence Level		Consequence Level Description
A	Negligible	No impact or negligible impact.
B	Minor	Detectable but insignificant change to local population, industry or ecosystem factors. Localised effect with rapid recovery.
C	Moderate	Significant impact to local population, industry or ecosystem factors. Medium term recovery.
D	Major	Major long-term effect on local population, industry or ecosystem factors. Slow recovery over decades.
E	Critical	Complete loss of local population, industry or ecosystem factors AND/ OR major wide-spread regional impacts with slow recovery.

For unplanned events, a risk ranking is also determined using an assessment of the likelihood (likelihood ranking) of the event as well as the consequence level of the potential impact should that event occur. A description of likelihood as per Quadrant's Risk Matrix as shown in **Table 6-2** below.

Table 6-2: Likelihood description

No.	Matrix	Description
5	Probable	1. Event has occurred frequently within the Company. 2. Between 1 and 10 incidents every 10 years (i.e. up to frequency 1/year).
4	Likely	1. Event has occurred frequently within the Industry. 2. Between 1 and 10 incidents every 100 years (i.e. up to frequency 10^{-1}/year).
3	Unlikely	1. Event has occurred occasionally within the Company. 2. Between 1 and 10 incidents every 1000 years (i.e. up to frequency 10^{-2}/year).
2	Very Unlikely	1. Has occasionally occurred within the Industry. 2. Between 1 and 10 incidents every 10,000 years (i.e. up to frequency 10^{-3}/ year).
1	Rare	1. Could happen under exceptional circumstances only. 2. Between 1 and 10 incidents every 100,000 years (i.e. up to frequency 10^{-4}/ year).

Risk rankings (consequence x likelihood) are assigned in accordance with Quadrant Energy's Risk Matrix as shown in **Figure 6-2** below.

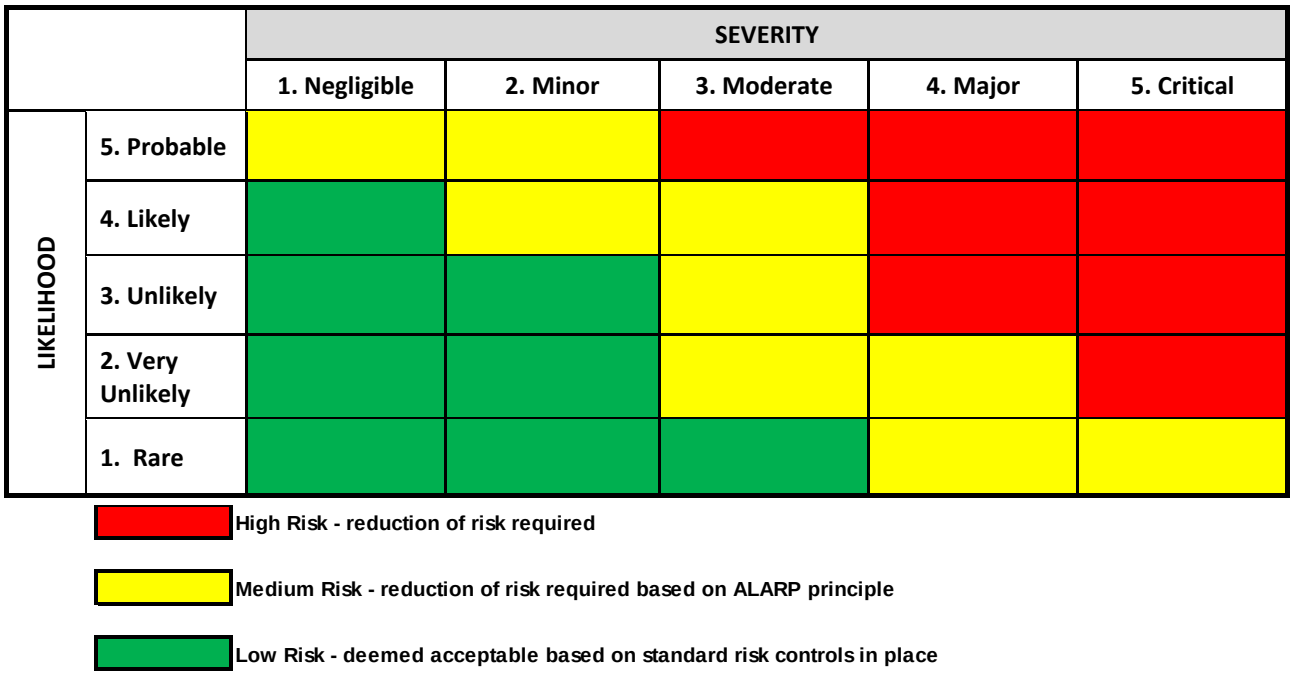

Figure 6-2: Quadrant Energy risk matrix

For each planned and unplanned event, a set of Environmental Performance Outcome(s) (EPO's), Environmental Performance Standards (EPS) and Measurement Criteria (MC) are identified. The definitions of the performance outcomes, standards and measurement criteria are consistent with the OPGGS (E) Regulations. For planned and unplanned events, an ALARP and Acceptability assessment is also undertaken.

6.1 ALARP Evaluation

The ALARP principle is that the residual impacts and risk shall be 'as low as reasonably practicable'. It has particular connotations as a route to reduce risks when considering law, regulation and standards.

For an impact or risk to be ALARP it must be possible to demonstrate that the cost involved in reducing the impact or risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the fact that infinite time, effort and money could be spent on the attempt of reducing a risk to zero. It should not be understood as simply a quantitative measure of benefit against detriment. It is more a best common practice of judgement of the balance of impact or risk and societal benefit.

For planned and unplanned events, an ALARP assessment is undertaken to demonstrate that the standard control measures adopted reduce the impact (consequence level) or risk to ALARP. This process relies on demonstrating that further potential control measures would require a disproportionate level of cost/effort in order to reduce the level of impact or risk. If this cannot be demonstrated, then further controls are adopted. The level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact or risk.

6.2 Acceptability Evaluation

Quadrant considers an impact or risk associated with the proposed activity to be acceptable if the following criteria are met:

- The consequence from a planned event is ranked as A or B; or a risk of impact from an unplanned event is ranked low to medium;
- An assessment has been completed to determine if further information/studies are required to support or validate the consequence assessment;
- Performance standards are consistent with legal and regulatory requirements;

- Performance standards are consistent with Quadrant Environmental Management Policy;
- Performance standards are consistent with industry standards and best practice guidance (e.g. National Biofouling Guidance for the Petroleum Industry);
- Performance standards are consistent with stakeholder expectations; and
- Performance standards have been demonstrated to reduce the impact or risk to ALARP

6.3 Environmental Risk Treatment Summary for Planned Events

6.3.1 Interaction with Other Marine Users

Event: Interactions with Other Marine Users	Interactions with other users of the sea through undertaking the activity. The ISV will be continually operating 24 hours a day, seven days a week for the duration of the activity, approximately 21 days. The presence of the ISV in the operational area could potentially inhibit marine user groups, tourism, commercial shipping, fishing and other oil and gas activities and the presence of the ISV could pose a collision risk and inconvenience to fishing practices during these operations.
Potential Receptors	Marine user groups, commercial fishers, tourism, shipping traffic and other oil and gas activities
Potential Impacts	Nine Commonwealth fisheries and state fisheries have zones that overlap the operational area. Potential impacts to commercial fisheries are a temporary loss of access to fishing grounds when the ISV is in the operational area, which could potentially result in reduced catches and income. An analysis of the historical fishing effort data, current fishery closures, depth range of activity, fishing methods and consultation feedback has revealed that there is a low potential for interaction with commercial fisheries. None of the Commonwealth or State fisheries identified (**Table 4-5**) are likely to be active in the operational area during the activity. Indigenous subsistence fishing and traditional hunting may occur in waters close to shorelines, outside of the operational area and therefore interactions with the ISV will not occur. Ongoing consultation with indigenous users has raised no concerns about the oil and gas activity occurring in offshore waters. Tourism activities are not expected to occur in the operational area, given the water depths and distance from shore. Activities such as snorkelling, diving, surfing and fishing activities may occur near the coast and islands off of the Pilbara and Ningaloo Coast, however, interaction with these activities and the ISV are unlikely to occur. As such, impacts to tourism are not expected. There are no recognised shipping routes in or near the operational area with the nearest designated shipping route located 45 km northwest. However, analysis of historical AUSREP shipping data indicates that commercial vessels do use the general area, most likely vessels in the oil and gas industry. Should commercial vessels need to deviate from planned routes to avoid the ISV, this may slightly increase transit times and fuel consumption. As the operational area is in open waters with no grounding or navigational hazards, it is not likely that any such deviation would increase the potential for vessel collision or grounding.
Impact Assessment	
Receptors	**Consequence**
Socio-Economic Receptors	A review of shipping data provided in consultation indicates that there will not be a significant disruption to commercial shipping due to the distance of the activity from the nearest shipping lane and lack of concerns raised through consultation. Vessels, including for oil and gas activities, could be required to divert around the operational area but this would be a temporary exclusion given the duration of the installation activity. Tourism activity is not expected to occur in the operational area and therefore,

	no impacts are expected. Commercial fishing is not expected to be active in the operational area. Marine users currently plan their activities in consideration of other petroleum activities and other marine users (fisheries and shipping) in the region.
Overall Consequence Ranking	A – Negligible
Management Control	**Effectiveness of Control**
Maritime notices	Ensure other marine users are aware of the presence of the ISV and are provided with information on timings of the activity including ISV arrival and departure, so that the maritime industry is aware of the petroleum activities (including how the site is left).
Stakeholder Consultation	
Exclusion zone	Exclusion zones around the ISV prevents other vessels from getting too close and causing damage to equipment of either party.
Navigation equipment and procedures	Reduces risk of environmental impact from vessel collisions due to ensuring safety requirements are fulfilled.

6.3.2 Seabed Disturbance

Event: Seabed Disturbance	Installation and movement of the subsea infrastructure will disturb the seabed and associated benthic habitat. During the installation of Van Gogh infrastructure, additional potential seabed disturbance (temporary) may also occur (but is not limited to) in the operational area due to: • Sedimentation as infrastructure is placed on the seabed; • WROV operations and WROV propeller wash; • Placement of WROV baskets, including with cement bags, on the seabed; • Placement of deployment frames on the seabed; • Marine growth and cuttings removal using the WROV; • Dropped objects (e.g. subsea infrastructure); and • Placement of survey and positioning beacons and support frames onto the seabed. Sedimentation and water quality impacts (i.e. increased turbidity) could be caused by the initial placement of solid structures, deployment/retrieval/movement of equipment and WROV operations. However, sediment loads are not expected to be significant. Each placement onto and lift from the seabed will cause a single brief disturbance resulting in a transient plume of sediment. <u>Installation of equipment</u> The proposed Van Gogh activities which have the potential to disturb the seabed are installation of the two EHFL, two GLJ. Temporary disturbance will occur due to the use of their deployment frames (6 m x 2.5 m x 3m) which will be retrieved following completion of deployment. <u>Stabilisation materials recovery and placement</u> Van Gogh installation activities include the laying of cement filled bags (1m x 1m cement bag) on the GLJs and EHFLs. Each GLJ and EHFL will have up to six cement bags installed (24 bags in total). The cement bags will be lowered to the seabed in a metal basket (2 m x 2 m). These activities may result in seabed disturbance due to movement and placement of materials on the seabed; however, the area of seabed affected will be small and localised and unlikely to extend beyond the area originally impacted during the laying of the GLJs and EHFLs.

	The overall footprint for disturbance for the Van Gogh infill installation activities is approximately 200 m^2.
Potential Receptors	Threatened / Migratory Fauna; Physical Environment/ Habitat; Socio-economic
Potential Impacts	Installation of the subsea infrastructure can cause the following impacts: • Direct physical disturbance of approximately 200 m^2 of benthic and seabed habitat from installation of infrastructure; • Indirect disturbance to benthic habitats and associated marine fauna by sedimentation; • Increased turbidity of the near-seabed water column; and • Introduction of artificial habitat for benthic fauna colonization.
Impact Assessment	
Receptor	**Consequence**
Threatened / Migratory Fauna	The areas of seabed that are expected to be impacted included soft sediments with little epifauna and would result in localised loss of widespread habitat. Disturbance to the seabed may have indirect impacts to protected fauna if the disturbance leads to a reduction on habitat quality or food availability. However, the area potentially impacted is not expected to be significant foraging habitat for protected fauna. No decrease in local population size, area of occupancy of species, loss or disruption of habitat critical or disruption to the breeding cycle of any of these protected matters is expected.
Physical Environment/ Habitat	The physical environment and habitat will be disturbed during the Van Gogh infill installation activities. However, the area potentially impacted has previously been disturbed, is small compared to the wider environment and in the majority of cases, the disturbed area is expected to recolonise. As such, long term disturbance and negative impacts to the wider ecosystem are not expected. The Continental Slope Demersal Fish Communities KEF is found within the operational area, however the area of the KEF disturbed is negligible compared to area available the demersal fish communities. There are no seabed features (e.g., reefs, canyons, shipwrecks) present within the operational area that would be expected to aggregate demersal fishes. Any localised disturbance to benthic habitat is not expected to have an impact to any fishes attracted to the subsea infrastructure although, localised and temporary avoidance or attraction could occur during installation activities.
Socio-Economic Receptors	Disturbance of the seabed is unlikely to impact socio-economic receptors such as shipping. Seabed disturbance may temporarily alter scampi habitat, however, the area impacted is insignificant compared to the available fishing area and trawling is unlikely to occur in the vicinity of subsea infrastructure due to snagging hazards on the subsea infrastructure and proximity to the FPSO. Therefore, impacts to commercial fisheries are not expected. No stakeholder concerns have been raised regarding this aspect.
Overall Consequence Ranking	A – Negligible
Management Control	**Effectiveness of Control**
Pre- and post-installation seabed surveys	To understand the seabed conditions and minimise any potential risks caused by subsea hazards (e.g. infrastructure) and inform final location of infrastructure (e.g. avoiding areas of hard substrate). This would also prevent damage to any sensitive features.
Recovery of	Prevents long term changes to the seabed by recovery of deployment equipment.

deployment frames and transponders	
Installation procedures	Ensures accurate positioning during installation and prevent multiple disturbances to the seabed due to incorrect placement, recovery and re-placement of infrastructure

6.3.3 Light Emissions

Event: Light Emissions	During the activity, safety and navigational lighting on the ISV will generate light emissions that may potentially affect marine fauna behaviour. Spot lighting may also be used on an as-needed basis e.g., in-sea ROV inspection, deployment and retrieval. Lighting will typically consist of bright white (i.e., metal halide, halogen, fluorescent) lights. Minimum lighting is required for safety and navigational purposes on board the ISV so it cannot be eliminated if the proposed activity is to proceed. Direct light spill on surface waters will be limited to the area directly adjacent to the ISV and would not directly spill outside of the operational area.
Potential Receptors	Threatened / Migratory Fauna – Fish, Marine Turtles and Seabirds
Potential Impacts	Continuous lighting in the same location for an extended period of time may result in alterations to normal marine fauna behaviour, as discussed below for each fauna group. The combination of colour, intensity, closeness, direction and persistence of a light source are key factors in determining the magnitude of environmental impact (EPA 2010). <u>Fish</u> The response of fish to light emissions varies according to species and habitat. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan *et al*. 2001), with traps drawing catches from up to 90 m away (Milicich *et al*. 1992). Lindquist *et al*. (2005) concluded from a study that artificial lighting associated with offshore oil and gas activities resulted in an increased abundance of clupeids (herring and sardines) and engraulids (anchovies); these species are known to be highly photopositive. Overall, a short-term localised increase in fish activity as a result of vessel lighting is expected to occur, however, with negligible impacts. <u>Marine turtles</u> Light pollution reaching turtle nesting beaches is widely considered detrimental owing to its ability to alter important nocturnal activities including choice of nesting sites and orientation/navigation to the sea by post-nesting females and hatchlings. Light pollution is also highlighted in the Recovery Plan for Marine Turtles in Australia as a factor requiring management for successful marine turtle nesting (Commonwealth of Australia 2017). The most significant risk posed to marine turtles from artificial lighting is the potential disorientation of hatchlings following their emergence from nests, although breeding adult turtles can also be disoriented (Rich and Longcore 2006, in EPA 2010). Once in the ocean, hatchlings are thought to remain close to the surface, orient by wave fronts and swim into deep offshore waters for several days to escape the more predator-filled shallow inshore waters. During this period, light spill from coastal port infrastructure and ships may 'entrap' hatchling swimming behaviour, reducing the success of their seaward dispersion and potentially increasing their exposure to predation via silhouetting (Salmon *et al*. 1992). It is possible that individual flatback, green, hawksbill and loggerhead turtles may be encountered in the operational area, particularly due to the operational area being in close proximity to their internesting BIAs and critical habitats for nesting. However, the potential impacts of light emissions to these turtle species from the activity is expected to be restricted to localised attraction and temporary disorientation but with no long term or residual impact due to the activity's short duration (approximately 21 days);

	and the unlikely presence of hatchlings due to the distance from the nearest shorelines (over 40 km). The WA Environmental Protection Authority (EPA) conservatively estimates there is only a light influence on marine turtles if the light source is within 1.5 km of the nesting beach (EPA 2010). Given the operational area is located over 40 km away from the nearest nesting beach, impacts to turtles from activity lighting are considered negligible. Seabirds Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Marquenie *et al*. 2008). The light sources associated with the ISVs may also provide enhanced capability for seabirds to forage at night. The ISV will not be in the operational area for a long period of time (approximately 21 days), and so will unlikely attract large numbers of seabirds. Other marine fauna There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding or breeding behaviours of cetaceans. Cetaceans predominantly utilise acoustic senses to monitor their environment rather than visual cues (Simmonds *et al*. 2004), therefore, impacts are thought to be unlikely.
Impact Assessment	
Receptors	**Consequence**
Threatened / Migratory Fauna	Continuous lighting in the same location for an extended period of time may result in alterations to normal marine fauna behaviour. Sensitive receptors that may be impacted include fish at surface, marine turtles and mammals, and seabirds. Given the operational area is located in close proximity to flatback, green, hawksbill and loggerhead turtle internesting habitats, individuals may occur in the operational area, although large numbers are not expected. The nearest coastline is located over 40 km from the operational area, therefore, turtle nesting and hatchlings are not expected to be impacted by light emissions from the activities. Cetaceans, adult turtles and marine mammals are not known to be significantly attracted to light sources at sea and therefore, disturbances to behaviour are unlikely to occur. Fish and birds have been shown to be attracted to artificial light sources, however, the low level of light emitted from the ISV is unlikely to lead to large scale changes in species abundance or distribution. Impacts to transient fish and seabirds will therefore, be limited to short-term behavioural effects with no decrease in local population size, area of occupancy of species or loss or disruption of habitat critical / disruption to the breeding cycle.
Overall Consequence Ranking	A – Negligible
Management Control	**Effectiveness of Control**
None - inherently ALARP	Evaluation of the potential impacts of light emissions determined that no control measures were required as the inherent consequence of light emissions is expected to be negligible.

6.3.4 Noise Emissions

Event: Noise Emissions	Noise generated by the ISV propagating through the water column, and from subsea positioning systems used during the activity may result in physiological or behavioural impacts to marine fauna, especially to cetacean species who use sound for navigation

	and communication. Helicopters will be used during the activity for crew change requirements and noise impacts generated from helicopter will also be assessed in this section.
Potential Receptors	Threatened / Migratory Fauna – Cetaceans, Marine Turtles and Fish
Potential Impacts	It is reasonable that fauna (cetaceans) may exhibit avoidance or attraction behaviour. The operational area overlaps with the humpback whale and pygmy blue whale migration route/BIA. Depending on the exact timing of the activity, individual humpback and pygmy blue whales may pass through the area and may exhibit avoidance behaviour however it is expected to be temporary (the duration of the activity). Similarly, other marine fauna associated with the operational area, such as pelagic fish and sharks (including whale sharks) may exhibit avoidance behaviour however it is expected to be temporary (the duration of the activity). Noise emitted by the ISV, ROVs or from subsea positioning systems during the activity will be short in duration and is likely to be reduced to background levels within kilometres to tens of kilometres. As such, any potential related marine fauna behavioural impacts are expected to be temporary and short ranged and is not expected to lead to long term changes in individual behaviour (e.g. migration) or lead to changes at the population level. Impacts to fish may result in indirect impacts to fisheries in the operational area. However, impacts to fisheries are considered negligible, given the short duration of the activity, the available area for commercial fishermen to catch plus, the area over which commercial species spawn. Noise levels are not expected to impact other socio-economic receptors (e.g. tourism) due to their low activity level within the vicinity of the operational area.
Impact Assessment	
Receptors	**Consequence**
Threatened / Migratory Fauna	Noise generated from ISV, subsea positioning systems and ROVs may result in physiological or behavioural impacts to marine fauna, especially to cetacean species who use sound for navigation and communication. Sensitive receptors that may be impacted include fish, marine turtles and mammals. Given that the activity will be a once off, for a very short duration, marine fauna potentially affected by acoustic noise are expected to exhibit avoidance and/or attraction behaviour to noise. Avoidance behaviour is likely to be localised within the area of the activity (due to small spatial extent of proposed activities) and temporary, i.e. for the duration of the activity only. Acoustic disturbances to marine fauna due to subsea positioning equipment are expected to be minimal as the sound levels generated are at a very high frequency and decay rapidly with distance travelled from the source and will only occur for short periods throughout the activity duration. Given the low level of noise expected from the ISV, ROVS and subsea positioning systems, and the short and temporary duration of noise emissions, significant impact to threatened or migratory species are not expected. Some behavioural response may be expected from the noise levels emitted, but not at levels that could cause mortality or injury to marine fauna, or significant changes to migration and foraging behaviour.
Socio-Economic	Noise levels are not expected to impact on socio-economic receptors due to their low activity level within the vicinity of the operational area. Noise emissions may result in temporary avoidance of commercially important species however it is expected to be temporary and only for the duration of the activity. Therefore, impacts to commercial fisheries is expected to be negligible.
Overall Consequence Ranking	A – Negligible

Management Control	Effectiveness of Control
Procedure for interacting with marine fauna	Reduces risk of physical and behavioural impacts to marine fauna from vessels and helicopters.

6.3.5 Planned Operational Discharges

Event: Planned Discharges	In order to operate the ISV and undertake the infill installation activities, a number of planned routine discharges to the marine environment will be required, as outlined below. Sewage The volume of sewage is directly proportional to the number of persons on-board the ISV. Up to 30 -40 L of sewage/greywater will be generated per person per day. Treated sewage will be disposed in accordance with MARPOL Annex IV. Food waste Putrescible waste will consist of approximately 1 L of food waste per person per day. The ISV will not discharge food waste in the operational area. Brine Brine generated from the water supply systems on-board the ISV will be discharged to the ocean at a salinity of approximately 10% higher than seawater. The volume of the discharge is dependent on the requirement for fresh (or potable) water and would vary between vessels and the number of people on-board. Cooling water Seawater is used as a heat exchange medium for the cooling of machinery engines. Seawater is drawn from the ocean and flows counter-current through closed-circuit heat exchangers, transferring heat from the ISV engines and machinery to the seawater. The seawater is then discharged to the ocean (i.e. it is a once-through system). Cooling water temperatures vary depending upon the ISV's engine work load and activity. Deck drainage Deck drainage from rainfall or wash-down operations would discharge to the marine environment. The deck drainage would contain particulate matter and residual chemicals such as cleaning chemicals, oil and grease. Assessment of the spillage of hydrocarbons and other environmentally hazardous chemicals and liquid waste are discussed in **Section 6.4**. Oily water (i.e. bilge water) discharges from ISV While in the operational area, the ISV may discharge oily water after treatment to an oil in water content of 15 ppm in a MARPOL approved oily water filter system. Hydraulic fluid, residual hydrocarbons and treated seawater Small amounts of hydraulic fluids, corrosion inhibitor, biocides, oxygen scavenger (treated seawater) and residual hydrocarbons are likely to enter the subsea marine environment from Van Gogh infill installation activities. During valve actuation of the subsea infrastructure and the use of ROVs, small volumes of hydraulic fluid (typically the water based hydraulic fluid Transaqua HT2) will be released (approximately 80L). Hydraulic fluids are medium oils of light to moderate viscosity and have a relatively rapid spreading rate and, like MGO, will dissipate quickly, particularly in high sea states. Leak testing during testing of the subsea system may also occur in which case, a small volume (estimated at ~10 L) of treated water and non-toxic dye will be used to detect leaks in a subsea system.

	The two rigid spools (~620 litres each) will be pre-flooded with treated seawater containing low concentrations of corrosion inhibitor (approximately 300 ppm). There is the potential for this to be released to the marine environment, when installing the spools, however, it is considered more likely that seawater will ingress into the spools during installation. Equipment/infrastructure may also be dosed with biocide (e.g. biocide sticks) prior to hook up to the existing infrastructure. Residual hydrocarbons may be released during long term protection cover removal for spool and gas lift jumper installation. Volumes are expected to be <0.5m^3 and will dissipate rapidly within the immediate vicinity of the release.
Potential Receptors	Threatened / Migratory Fauna – Fish (pelagic) & Sharks, Marine Mammals, Marine Turtles and Seabirds; Physical Environment / Habitat – Water Quality
Potential Impacts	Planned non-hazardous discharges will be small and intermittent, with volumes dependent on a range of variables. The discharge of non-hazardous wastes to the marine environment may result in a localised reduction in water quality in the vicinity of the release location. This would be expected to be temporary (minutes to hours) and localised. The discharges are expected to be dispersed and diluted rapidly, with concentrations of discharges significantly dropping with distance from the discharge point. Changes to ambient water quality outside of the operational area are considered unlikely to occur.
Impact assessment	
Receptors	**Consequence**
Threatened / Migratory Physical Environment/ Habitat	Operational discharges in the same release location may result in temporary water quality perturbations and alteration to marine fauna behaviour. Sensitive receptors that may be impacted include fish at surface, marine turtles and mammals, and seabirds. Given that the activity will be for a limited duration, and is located over 40 km from the nearest shoreline, impacts will be limited to short-term water quality impacts and temporary behavioural effects observed in fish and seabirds. Impacts to water quality will be experienced in the discharge mixing zone which will be localised and will occur only as long as the discharges occur (i.e. no sustained impacts), therefore, recovery will be measured in hours to days. Only short term behavioural impacts are expected with no decrease in local population size / area of occupancy of species / loss or disruption of habitat critical / disruption to the breeding cycle / introduction of disease. The Continental Slope Demersal Fish Communities KEF is found within the operational area. Any localised disturbance to benthic habitat is not expected to have an impact to demersal fishes although, localised and temporary displacement could occur during installation activities.
Overall Consequence Ranking	A - Negligible
Management Control	**Effectiveness of Control**
General chemical management procedures	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals
Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges)of hazardous chemicals to the sea by controlling the storage, handling and clean up
Chemical selection procedure	Reduced toxicity to marine environment

	Only environmentally acceptable chemicals would be released to sea from flushing and testing
Equipment pressure tested	Reduces hydrocarbon or chemical leaks during commissioning and operation
Sewage treatment system	Reduces potential impacts of inappropriate discharge of sewage. Ensure compliance with MARPOL requirements
Waste (garbage) management procedure	Reduces probability of garbage being discharged to sea, reducing potential impacts to marine fauna. Stipulates putrescible waste disposal conditions and limitations Ensure compliance with MARPOL requirements
Oily water treatment system	Reduces potential impacts of planned discharge of oily water to the environment Ensure compliance with MARPOL requirements
Deck cleaning product selection procedure	Reduced toxicity to marine environment Only environmentally acceptable chemicals would be released overboard
No discharge of food waste within the operational area	Eliminates localised nutrient enrichment, organic and particulate loading from food wastes

6.3.6 Atmospheric Emissions

Event: Atmospheric Emissions	The use of fuel (specifically MGO) to power vessel engines, generators, mobile and fixed plant and equipment will result in emissions of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), along with non-GHG such as sulphur oxides (SO_x) and nitrous oxides (NO_x). ISV may also use an incinerator for waste during the activity. ISV may utilise ozone-depleting substances (ODS) in closed-system rechargeable refrigeration systems.
Potential Receptors	Seabirds and humans
Potential Impacts	Hydrocarbon combustion may result in a temporary, localised reduction of air quality in the environment immediately surrounding the discharge point during the activity. Non-GHG emissions, such as NOX and SOX, and GHG emissions can lead to a reduction in local air quality which can impact humans and seabirds in the immediate vicinity and add to the national GHG loadings. The Van Gogh infill installation activities will occur in offshore waters, the combustion of fuels and incineration in such remote locations will not impact on air quality in coastal towns, the nearest being Exmouth (60 km). The quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding atmosphere. Accidental release and fugitive emissions of ODS has the potential to contribute to ozone layer depletion. Air emissions will be similar to other vessels operating in the region for both petroleum and non-petroleum activities. ODS may be used on board the ISV for refrigeration systems, the release of ODS contributing to the damage of the ozone layer, allowing ultra-violet radiation from the sun to pass through, which can result in human health impacts (e.g. skin cancers). Maintenance of refrigeration systems containing ODS is on a routine, but infrequent basis, and with controls implemented, the likelihood of an accidental ODS release of material volume is considered rare.
Impact Assessment	
Receptors	**Consequence**

Threatened / Migratory Fauna	No or negligible reduction to seabirds would be expected.
Physical Environment / Habitat	No or negligible reduction in physical environment/ habitat area/ function.
Overall Consequence Ranking	A – Negligible
Management Control	**Effectiveness of Control**
Waste incineration managed in accordance MARPOL	Eliminate the potential for emissions due to waste incineration to impact air quality
Air pollution prevention certification	Reduces probability of potential impacts to air quality due to ODS emissions, high NOx, SOx emissions.
Ozone-depleting substance handling procedures	Reduces probability of potential impacts to air quality due to ODS emissions.

6.3.7 Spill Response Operations

Event: Spill Response Operations	In the event of a hydrocarbon spill, response strategies will be implemented where possible to reduce environmental impacts to ALARP. The selection of strategies will be undertaken through the Net Environmental Benefit Analysis (NEBA) process, outlined in the *Van Gogh Infill Installation Oil Pollution Emergency Plan (OPEP*) (*TV-35-RE-100001.02*). Spill response will be under the direction of the relevant Controlling Agency, as defined within the OPEP, which may be Quadrant and/or another agency. In all instances, Quadrant will undertake a 'first-strike' spill response and will act as the Controlling Agency until the designated Controlling Agency assumes control. The response strategies deemed appropriate for the worst case oil spill scenarios identified for the activity are detailed in the OPEP and comprise: • Source control; • Monitor and evaluate (operational monitoring); • Mechanical dispersion (MGO only); • Chemical dispersion (Crude oil only) • Containment and Recovery (Crude oil only) • Protection and Deflection; • Shoreline Clean-up; • Oiled Wildlife Response; • Scientific Monitoring; and • Waste Management. While response strategies are intended to reduce the environmental consequences of a hydrocarbon spill, poorly planned and coordinated response activities can result in a lack of, or inadequate information being available, upon which poor decisions can be made, exacerbating or causing further environmental harm. An inadequate level of training and guidance during the implementation of spill response strategies can also result in environmental harm over and above that already caused by the spill. The greatest potential for impacts additional to those described for routine operations

	is from chemical dispersant on subsea receptors, shoreline clean-up and oiled wildlife response operations, where coastal and shoreline habitat damage and fauna disturbance may occur.
Potential Receptors	Threatened / Migratory Fauna - Fish, Marine Mammals, Marine Turtles and Seabirds; Physical Environment / Habitat; Protected Areas; Socio-Economic Receptors
Potential Impacts	<u>Light emissions</u> Lighting may cause behavioural changes to fish, birds and marine turtles which can have a heightened consequence during key life-cycle activities, for example turtle nesting and hatching. Turtles and birds, which includes threatened and migratory fauna, have been identified as key fauna susceptible to lighting impacts **Section 6.3.3** provides further detail on the nature of impacts to fish, birds and marine turtles. Spill response activities which require lighting may take place in protected areas important to turtles and birds, for example, shoreline locations of Ningaloo Reef and Muiron Islands are seasonally important for turtles, including BIAs and critical habitats. This could result in, indirect impacts on the values of the protected areas. As a consequence of impacts to fauna, lighting has the potential to impact supported industries such as tourism. <u>Noise emissions</u> Underwater noise from the use of vessels may impact marine fauna, such as fish (including commercial species), marine reptiles and marine mammals in the worst instance causing physical injury to hearing organs, but more likely causing short term behavioural changes, e.g. temporary avoidance of the area, which may impact key life-cycle process (e.g. spawning, breeding, calving). Underwater noise can also mask communication or echolocation used by cetaceans. Cetaceans have been identified as the key concern for vessel noise within the EMBA. The humpback migration BIA, pygmy blue whale migration and pygmy blue whale foraging BIAs are all within the EMBA. Spill response activities using vessels have the potential to impact fauna in protected areas, this includes the Ningaloo World Heritage Area. Noise and vibration from terrestrial activities on shorelines has the potential to cause behavioural disturbance to coastal fauna including protected seabirds and turtles. Shoreline activities involving the use of noise generating equipment may take place in important nesting areas for turtles and/or roosting/feeding areas for shorebirds. As a consequence of impacts to fauna (including shorebirds, marine mammals and fish), noise has the potential to impact supported industries such as tourism and commercial fishing. <u>Atmospheric emissions</u> Atmospheric emissions from spill response equipment will be localised and while there is potential for fauna and flora impacts, the use of mobile equipment, vessels and vehicles is not considered to create emissions on a scale where noticeable impacts would be predicted. Emissions may occur in protected areas, however, the scale of the impact relative to potential oil spill impacts is not considered great. <u>Operational discharges and waste</u> Operational discharges from vessels may create a localised and temporary reduction in marine water quality. Effects include nutrient enrichment, toxicity, turbidity, temperature and salinity increases. These may impact a different set of receptors than previously described in that section given vessel use may occur in shallower coastal waters during spill response activities. Discharge could potentially occur adjacent to marine habitats such as corals, seagrass, macroalgae, and in protected areas (i.e. receptors anywhere within the EMBA), which support a more diverse faunal community, however, discharges will be very localised and temporary.

	Cleaning of oil contaminated equipment, vehicles and vessels, has the potential to spread oil from contaminated areas to those areas not impacted by a spill, potentially spreading the impact area and moving oil into a more sensitive environment. Flushing of oil from shoreline habitats is a clean-up technique designed to remove oil from the receptor that has been oiled and remobilise back into the marine environment and result in further dispersion of the oil. The process of flushing has the potential to physically damage shoreline receptors such as mangroves and rocky shoreline communities, increase levels of erosion, and create an additional, and potentially higher, level of impact than if the habitat was left to bio-remediate. Sewage, putrescible and municipal waste will be generated from onshore activities at temporary camps which may include toilet and washing facilities. These wastes have the potential to attract fauna, impact habitats, flora and fauna and reduce the aesthetic value the environment areas, which may be within protected areas. The creation, storage and transport of oily waste and contaminated organics has the potential to spread impacts of oil to areas, habitats and fauna not previously contaminated. <u>Chemical dispersant application (Crude oil only)</u> While the aim of chemical dispersants is to provide a net benefit to the environment, the use of dispersants has the potential to increase the impact to receptors under the sea surface by increasing entrained oil and dissolved aromatic hydrocarbon concentration. Increased entrained and aromatic hydrocarbon concentration may also impact on marine fauna either directly or through impacts to subsea habitats. Direct impacts are most likely to be encountered by filter feeding invertebrates, fish and sharks. Fish and sharks include threatened/migratory species, which may ingest oil or uptake toxic compounds across gill structures. As a result of increased impact to marine fauna and subtidal habitats, including those that represent values of protected areas, socio-economic impacts may be felt through industries such as tourism and commercial fishing. <u>Physical presence and disturbance</u> The use of vessels may disturb benthic habitats in coastal waters including corals, seagrass, macroalgae and mangroves. Impacts to habitats from vessels include damage through the deployment of anchor/chain, nearshore booms and grounding. Vessel use in shallow coastal waters also increases the chance of contact or physical disturbance with marine megafauna such as turtles and dugongs. Booms create a physical barrier on the surface waters that has the potential to injure or entangle passing marine fauna that are either surface breathing or feeding. Vehicles, equipment, personnel used and cleaning activities during shoreline response activities have the potential to damage coastal habitats such as dune vegetation, mangroves and habitats important to threatened and migratory fauna including nests of turtles and birds and bird roosting/feeding areas. Shoreline clean-up may involve the physical removal of substrates that could cause impact to habitats and coastal hydrodynamics and alter erosion/accretion rates. The presence of camp areas, although relatively short-term, may disrupt normal behaviour of coastal species such as shorebirds and turtles, and could potentially interfere with nesting and feeding behaviours. Oiled wildlife response may include the hazing, capture, handling, transportation, cleaning and release of wildlife susceptible to oiling such as birds and marine turtles. While oiled wildlife response is aimed at having a net benefit, poor responses can potentially create additional stress and exacerbate impacts from oiling, interfering with life-cycle processes, hampering recovery and in the worst instance increasing levels of mortality. Impacts from invasive marine species released from vessel biofouling include out-competition, predation and interference with other ecosystem processes. The ability for a non-native species to establish is generally mitigated in deeper offshore waters where the depth, temperature, light availability and habitat diversity is not generally

	conducive to supporting reproduction and persistence of the invasive species. However, in shallow coastal areas, such as areas where vessel based spill response activities may take place, conditions are likely to be more favourable. Impacts from invasive terrestrial species are similar in that the invasive species can out-compete local species (e.g. weeds) and interfere with ecosystem processes. Non-native species may be transported attached to equipment, vehicles and clothing. Such an introduction would be especially detrimental to wilderness areas or protected terrestrial reserves which may have a relatively undisturbed flora and fauna community. The disturbance to marine and coastal natural habitat, as well as the potential for disruption to culturally sensitive areas, which may occur in specially protected areas, may have flow on impacts to socio-economic values and industry (e.g. tourism, fisheries). <u>Disruption to other users of marine and coastal areas and townships</u> The use of vessels in the nearshore and offshore environment and the undertaking of spill response activities at shoreline locations may exclude the general public and industry use of the affected environment. As well as impacting leisure activities of the general public, this may impact on revenue with respect to industries such as tourism and commercial fishing. The mobilisation of personnel to small communities has the potential to affect the local community through demands on local accommodation and business, reducing the availability of services to members of the public.
Impact Assessment	
Receptors	**Consequence**
Threatened / Migratory Fauna Physical Environment / Habitat Protected Areas Socio-Economic Receptors	<u>Light emissions</u> The receptors considered most sensitive to lighting from vessel and shoreline operations are seabirds and marine turtles, particularly over spring/summer months with respect to marine turtles where emerging hatchlings are sensitive to light spill onto beaches. Following restrictions on night time operations by spill response vessels, which will demobilise to mooring areas offshore with safety lighting only, impacts from vessels are considered to be negligible. The positioning of temporary camps will be done at the direction of DoT/ DBCA and following control measures on lighting colour and direction the consequence of shoreline lighting is considered negligible. These species are likely to be values of the protected area they occur in (e.g. Ningaloo Reef), and the impact to the protected area from light is also considered negligible. As a consequence of impacts to fauna, lighting has the potential to impact supported industries such as tourism however as impacts to fauna are considered negligible any indirect impacts on tourism will also be negligible. <u>Noise emissions</u> The receptor considered most sensitive to vessel noise disturbance are populations of humpback whales and pygmy blue whales during migration season. A temporary behavioural disturbance is expected only with a consequence of negligible. With respect to noise from onshore operations (mobile equipment and vehicles), nesting, roosting or feeding birds are considered to be the most sensitive to noise. The equipment used is not considered to have excessive sound levels and following direction by DoT and DBCA on the location of temporary camp areas, the consequence to birds from noise is expected to be negligible. As a consequence of impacts to fauna, noise has the potential to impact supported industries such as tourism and commercial fishing however as impacts to fauna are considered negligible any indirect impacts on socio-economic receptors will also be negligible. <u>Atmospheric emissions</u>

	Atmospheric emissions from spill response equipment will be localised and impacts to even the most sensitive fauna, such as birds, are expected to be negligible. Because of the localised and low level of emissions impacts to protected area values and the physical environment are predicted to be negligible. Operational discharges Operational discharges from vessels may create a localised and temporary reduction in marine water quality, which has the potential to impact shallow coastal habitats in particular, however, following the adoption of regulatory requirements for vessel discharges, which prevent discharges close to shorelines, discharges will have a negligible impact to habitats, fauna or protected area values. Furthermore, washing of vessels and equipment will take place only in defined offshore hot zones preventing impacts to shallow coastal habitats. As a consequence of impacts to fauna, operational discharges from vessels has the potential to impact supported industries such as tourism and commercial fishing however as impacts to fauna are considered negligible any indirect impacts on socio-economic receptors will also be negligible. Onshore, the use of flushing water has the potential to damage sensitive shoreline and intertidal habitats, e.g. mangroves, however, low pressure flushing only will be used, preventing further damage to habitats or erosion of sediments. For sensitive habitats the deployment of booms will be considered to retain flushed hydrocarbons, if this presents a net benefit. Following these control measures the use of flushing to clean shorelines and intertidal habitats is seen to have a negligible additional impact to habitats, fauna or protected area values. The cleaning of contaminated vehicles and equipment onshore has the potential to spread oily waste and damage habitats if not contained. Decontamination units will be in use during the spill response thus containing waste and preventing any secondary contamination. The consequence of cleaning discharges is therefore ranked as negligible in terms of impacts to habitats, fauna or protected area values. Sewage, putrescible and municipal waste generated onshore will be stored disposed of at approved locations. Chemical dispersant application (Crude oil only) The use of chemical dispersants has the potential to increase the concentration of entrained oil within the water column. Based on the expected distribution of entrained oil and dissolved aromatic hydrocarbons from a worst case crude oil spill, this increase would be expected to be located to primarily offshore waters. This increase in concentration could also impact fish and invertebrates which support fisheries and aquaculture in the region. The primary controls for reducing impacts to these receptors is in the selection of approved or environmentally risk assessed chemical dispersants and through the careful assessment of application areas such that sensitive receptor impacts are reduced to ALARP. It is important to note that dispersants will only be applied if the response is seen as having a net environmental benefit as per the overarching NEBA analysis of spill response strategies. In the event dispersants are used there is the potential for a minor additional impact, noting that even in the absence of dispersant use, a greater volume of oil may load onto shorelines adding to the level of impact on shoreline receptors. Physical presence and disturbance The use of vessels and nearshore booms has the potential to disturb benthic habitats including sensitive habitats in coastal waters such as corals, seagrass, macroalgae and mangroves. A review of shoreline and shallow water habitats, and bathymetry, and the establishment of demarcated areas for access and anchoring (along with other control measures) will reduce the level of impact to negligible. The use and movement of vehicles, equipment and personnel during shoreline response activities has the potential to disturb coastal habitats such as dune vegetation, samphire and mangroves, and important habitats of threatened and migratory fauna including nests of turtles and birds and bird roosting areas.

	Furthermore, clean-up can involve physical removal of substrates that could cause impact habitats, fauna and alter coastal hydrodynamics. As with vessel use, an assessment of appropriate vehicles and equipment to reduce habitat damage, along with the establishment of access routes/demarcation zones, and operational restrictions on equipment/vehicles use will limit sensitive habitat damage and damage to important fauna areas. The establishment of temporary camp areas will be done under direction of DoT and DBCA with suitable advice sought if access is needed to culturally significant areas. Following these and other control measures the resultant consequence to the physical environment and habitat is assessed as minor, indicating that there may be a detectable reduction in habitat area from response activities (as separate from spill impacts), but recovery will be relatively rapid, once spill response activities cease. As with all spill response activities, this disturbance will only occur if there is a net benefit to accessing and cleaning shoreline areas. The main direct disturbance to fauna would be the hazing, capture, handling, transportation, cleaning and release of wildlife susceptible to oiling impacts, such as birds and marine turtles. This would only be done if this intervention were to deliver a net benefit to the species, but may result in a minor consequence following compliance with the WA Oiled Wildlife Response Plan and the Pilbara Region Oiled Wildlife Response Plan. These habitats/environments are likely to be values of the protected area they occur in, and the impact to the protected area from physical disturbance is also considered minor. The disturbance to marine and coastal natural habitat, as well as the potential for disruption to culturally sensitive areas, which may occur in specially protected areas, may have flow on impacts to socio-economic values and industry (e.g. tourism, fisheries). This impact is considered minor. <u>Disruption to other users of marine and coastal areas and townships</u> The use of vessels in the nearshore and offshore environment and spill response activities at shoreline locations/close to townships, may exclude general public and industry use. It should be noted that this is distinct from the socio-economic impact of a spill itself which would have a far greater detrimental impact to industry and recreation. Following the application of control measures it is considered that the additional impact of spill response activities on affected industries would be minor.
Overall Consequence Ranking	A – Negligible (Light, noise and atmospheric emissions; operational discharges and wastes)
	B – Minor (Physical presence and disturbance; chemical dispersant application (Crude oil only); disruption to other users of marine and coastal areas and townships)
Management Control	**Effectiveness of Control**
Competent IMT and Oil Spill Responder personnel	Ensures that spill response strategy selection and operational activities consider the potential for additional environmental impacts.
Use of competent vessel crew/personnel	Reduces potential for environmental impacts from vessel usage.
Spill response activities selected on basis of a Net Environmental Benefit Analysis (NEBA)	Provides a systematic and repeatable process for evaluating strategies with net least environmental impact.

Noise and atmospheric emissions	
Support vessel and aircraft compliance with EPBC Act Regulation 8 (cetacean interactions)	Reduces potential for behavioural disturbance to cetaceans.
If required under MARPOL, vessels will maintain a current International Air Pollution Prevention (IAPP) Certificate.	Reduces level of air quality impacts.
Operational discharges and waste	
Vessels meet applicable MARPOL sewage disposal requirements	Reduces potential for water quality impacts.
Vessel meet applicable MARPOL requirements for oily water (bilge) discharges	Reduces potential for water quality impacts.
Ballast water management plan for international vessels	Improve water quality discharge to marine environment to ALARP. Reduce risk of introduced marine species.
Compliance with controlled waste, unauthorised discharge and landfill regulations	Ensures correct handling and disposal of oily wastes.
Chemical dispersant application (Crude oil only)	
Chemical dispersant selected from AMSA approved list or risk assessed through Quadrant Energy Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001).	Impacts on fauna / flora from toxicity of the dispersant
Dispersant Application Plan	Reduces potential impacts from dispersant and dispersed oil (entrained and dissolved) to sensitive shallow water habitats

(incl. application location, dosage and equipment use)	
Physical presence and disturbance	
Support vessel and aircraft compliance with EPBC Act Regulation 8 (cetacean interactions)	Reduces potential for behavioural disturbance to cetaceans.
Vessel Risk Assessment Score sheet (VRASS) completed for interstate and international spill response vessels (only).	Reduces risk for introduction of invasive marine species as part of vessel biofouling.
Use of shallow draft vessels for shoreline and nearshore operations	Reduces seabed and shoreline disturbance.
Oil Spill Response Team (OSRT) Team Leader assessment/ selection of vehicle appropriate to shoreline conditions	Reduces coastal habitat and fauna disturbance.
Conduct shoreline/ nearshore habitat/bathymetry assessment	Reduces shoreline habitat disturbance.
Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat	Reduces coastal habitat and fauna disturbance.
Operational restriction of vehicle and personnel movement to limit erosion and compaction	Reduces coastal habitat erosion and compactions.

Prioritise use of existing roads and tracts	Reduces coastal habitat and fauna disturbance.
Soil profile assessment prior to earthworks	Reduces habitat disruption and erosion.
Pre-cleaning and inspection of equipment (quarantine)	Prevents introduction of invasive species.
Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance	Reduces disturbance to culturally significant sites.
Adhere to WA Oiled Wildlife Response Plan and Pilbara Regional Oiled Wildlife Response Plan	Oiled wildlife hazing, capture, handling and rehabilitation meet minimum standards as outlined within the WA Oiled Wildlife Response Plan.
Disruption to other users of marine and coastal area and townships	
Stakeholder consultation	Early awareness of spill response activities which reduces potential disruption.
Accommodation assessment	Reduces strain on accommodation.
Security Management Plan	Reduces potential for security treat causing disruptions in the response activities.
Transport Management Plan	Reduces potential for traffic disruptions.

6.4 Environmental Risk Treatment Summary – Unplanned Events

Quadrant's environmental risk identification procedure identified seven potential sources of environmental impacts associated with the unplanned events.

6.4.1 Marine Gas Oil Release from Vessel Collision (Surface)

Event: Hydrocarbon spill from a ruptured vessel fuel tank as result of a collision	There is a possibility of a vessel collision occurring between vessels (ISV and a 3rd party vessel) within the operational area. The worst-case environmental incident resulting from a vessel collision is the rupturing of a vessel fuel tank resulting in the release of MGO to the environment. Vessel collision could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather. A maximum credible spill volume has been determined based on technical guidance provided by AMSA (AMSA 2015). This guidance states that for a vessel other than an oil tanker, the maximum credible spill from a collision can be determined from the volume of the largest single fuel tank. In reviewing the general arrangements and fuel tank capacities of a typical ISV likely to be utilised for the Van Gogh infill installation activities, the largest single fuel tank capacity identified was no greater than ~300 m^3 of MGO.
Potential Receptors	Plankton, fish, sharks, marine mammals, marine reptiles, seabirds, shorebirds shoreline (intertidal habitats) and socio-economic receptors.
Potential Impacts	Hydrocarbon spills will cause a decline in water quality and can cause chemical (e.g. toxic) and physical (e.g. coating of emergent habitats, oiling of wildlife at sea surface) and impacts to marine species. The severity of the impact of a hydrocarbon spill depends on the magnitude of the hydrocarbon spill (i.e. extent, duration) and sensitivity of the receptor. A loss of MGO to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column. There will be no shoreline contact above the defined thresholds as a result of the conservative 600 m^3 spill of MGO, however, there may be accumulated hydrocarbons along the Ningaloo shoreline. Transient fauna may traverse the area and may also be potentially impacted by a spill. The potential pathways and impacts of surface and entrained MGO to transient receptors are summarised in **Table 6-3**.
Impact Assessment	
Receptors	**Consequence**
Threatened / Migratory Fauna; Physical Environment / Habitats Protected Areas; Socio-Economic Receptors	In the event of a vessel collision, the volume of hydrocarbons released would be a finite amount, limited to the maximum credible spill of a full tank inventory release. Given the nature of the MGO and the distance from shorelines, dilution and dispersion from natural weathering processes such as ocean currents indicate that the extent of exposure will be limited in area and duration. The susceptibility of marine fauna (including fish and plankton) to hydrocarbons is dependent on hydrocarbon type and exposure duration, however, given that exposures would be limited in extent and duration impacts are expected to be minor (detectable but localised impacts). Habitat modification/degradation/disruption/loss, deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species in relevant Recovery Plans and Conservation Advice and more widely to marine vertebrates with the Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (2018). With the controls in place, in line with the relevant actions prescribed in Recovery Plans, the activity will be conducted in a manner that reduces potential impacts to ALARP and of acceptable level. In the unlikely event that a collision did occur within the operational area, the potential impacts to the environment would be greatest several kilometres from the spill when the toxic aromatic components of the fuel will be at their highest concentration and when the hydrocarbon is at its thickest on the surface of the receiving waters. The MGO will also rapidly lose toxicity with time and spread thinner as evaporation continues.

	The potential sensitive receptors in the surrounding areas of the spill will include fish, marine mammals, marine reptiles, seabirds at the sea surface and shorebirds as well as shoreline and intertidal habitats as discussed in **Table 6-3**. Marine and shoreline habitats may also be impacted as a result of shoreline accumulation as discussed in **Table 6-3**. Indigenous users may be impacted in the event that a land based response is required, however consultation will ensure potential impacts are reduced to acceptable levels. The low shipping and fishing activity expected in the direct area of the activity, and while there is likely to be oil & gas vessels, the control measures in place are considered to result in a low risk of a collision occurring. Given that a vessel collision hydrocarbon spill would not result in a decreased population size at a local or regional scale, it is expected that a spill of this nature would result in a minor consequence.		
Likelihood	A hydrocarbon release resulting from a vessel collision is unlikely to have widespread ecological effects given the nature of the hydrocarbons on-board, the finite volumes that could be released, the water depth in the operational area and transient nature of marine fauna in this area. The potential hydrocarbon releases as a result of vessel collision are not expected to significantly impact the receiving environment with control measures proposed. Additionally, long term impacts resulting in complete habitat loss or degradation are not considered likely given the controls proposed to prevent releases and therefore the activity will be conducted in a manner that is considered acceptable. The likelihood of a vessel collision releasing hydrocarbons to the environment which results in a minor consequence is considered to be rare.		
Likelihood Ranking	1- Rare	**Consequence ranking**	Minor
Residual risk	Low		
Management Control	**Effectiveness of Control**		
Maritime notices	Ensure other marine users are aware of the presence of the ISV and the relative low mobility of ISV to suddenly change course or avoid other vessels.		
Stakeholder Consultation			
Exclusion zone	Exclusion zones around the ISV prevents other vessels from getting too close and causing damage to equipment of either party.		
Navigation equipment and procedures	Reduces risk of environmental impact from vessel collisions due to ensuring safety requirements are fulfilled.		
Dynamic positioning system	Prevents unintentional movements by ISV decreasing risk of collision, reducing the risk of hydrocarbons being discharged to the marine environment		
Oil pollution emergency plan (OPEP)	Implements response plan for the effective management of an accidental hydrocarbon spill (discharge to sea) in order to reduce impacts to the marine environment.		
ISV spill response plans			
Fuel type used	Reduces the potential impacts to marine environment in the event of a vessel collision		

Table 6-3: Impacts of MGO on sensitive receptors found within the EMBA

Receptor	Impacts of MGO		
	Entrained and dissolved aromatic hydrocarbons	**Surface**	**Shoreline accumulated hydrocarbons**
Marine fauna			
Plankton (including zooplankton; fish and coral larvae)	There is potential for localised mortality of plankton due to reduced water quality and toxicity. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest.	Surface MGO is likely to have a negligible impact on plankton.	Shoreline accumulated hydrocarbons will have no impact on plankton
	The Van Gogh infill installation activities have the potential to overlap with spawning of some fish species given the year round nature of spawning of some species. In the unlikely event of a spill occurring, fish larvae may be impacted by MGO entrained in the water column. However, following release, the MGO will rapidly evaporate and disperse in the offshore environment, reducing the concentration and toxicity of the spill. Given the duration of fish spawning periods, lack of suitable habitat for aggregating fish populations near the surface, combined with the quick evaporation and dispersion of MGO, impacts to overall fish populations are not expected to be significant.		
Marine mammals	Lethal or sub-lethal physical and toxic effects such as irritation of eyes/mouth and potential illness.	At risk of direct contact with MGO due to the chance of surfacing within the slick. Effects include irritation of eyes/mouth and potential illness. Surface respiration could lead to accidental ingestion of hydrocarbons or result in the coating of sensitive epidermal surfaces.	Shoreline accumulated hydrocarbons will have no impact on marine mammals
	Twelve migratory cetacean species were identified by the EPBC Protected Matters search (**Table 4-4**). Of these, two are listed as endangered and three as vulnerable: Humpback whale: The operational area overlaps the humpback whale migration BIA and the activity may overlap with the humpback whale migratory period. In the unlikely event of an MGO spill during the migration season, migrating humpback whales may encounter entrained and surface MGO. However, given the rapid evaporation of MGO, significant numbers are not expected to be impacted. Blue whales: The project EMBA overlaps with the blue whale migratory path and a foraging BIA (off the coast of Ningaloo). In the unlikely event of an MGO spill during the migration season, pygmy blue whales may encounter entrained and surface MGO. However, given the rapid evaporation of MGO, significant numbers are not expected to be impacted. Southern right whales: neither the operational area nor EMBA overlaps with southern right whale migration path. In the unlikely event of an MGO spill, transient individuals may encounter entrained and surface MGO. However, the absence of any known feeding, resting or breeding areas means significant numbers are unlikely to be impacted. Fin whale: Fin whales have a worldwide distribution generally in deeper waters and their distribution in Australia is not clear due to the sparsity of		

	sightings. Given the absence of any known feeding, resting or breeding areas within the EMBA, significant numbers are unlikely to be impacted. Sei whale: Sei whales move between Australian waters and Antarctic feeding areas, however, they are only infrequently recorded in Australian waters (Bannister et al. 1996) and their movements and distribution in Australian waters is not well known. Given the absence of any known feeding, resting or breeding areas, significant numbers are unlikely to be impacted. Other migratory cetaceans may encounter either surface or entrained MGO, however, the absence of any known feeding, resting or breeding areas within the EMAB means significant numbers are unlikely to be impacted.		
Marine reptiles	Lethal or sub-lethal physical and toxic effects such as irritation of eyes/mouth and potential illness.	At risk of direct contact with MGO due to chance of surfacing within slick. Effects include irritation of eyes/mouth and potential illness. Surface respiration could lead to accidental ingestion of hydrocarbons or result in the coating of sensitive epidermal surfaces	At risk of direct contact with MGO if nesting along beaches with accumulated hydrocarbons. Effects include irritation of eyes/mouth and potential illness.
	Five species of threatened marine reptile were identified as possibly being impacted by a spill. Flatback, hawksbill, leatherback, green and loggerhead turtles are widely dispersed at low densities across the NWMR and in the unlikely event of a MGO spill occurring, individuals traversing open water may come into contact with entrained or surface MGO. The operational area does not overlap with any marine turtle BIA or critical habitat. The EMBA, however, overlaps with the flatback, green, hawksbill and loggerhead turtles internesting BIAs, as well critical habitats for the flatback, green and loggerhead turtles. Transient adults may encounter surface MGO slicks and entrained hydrocarbons resulting in hydrocarbon adherence to body surfaces (Gagnon and Rawson 2010) causing irritation of mucous membranes in the nose, throat and eyes leading to inflammation and infection (NOAA 2010). However, adult turtles are broadly distributed throughout the NWMR and therefore, impacts to individuals are unlikely to impact on population size. There is the potential for relatively small volumes of MGO to accumulate on shorelines at Ningaloo Coast. This could impact marine fauna that utilise beaches such as shorebirds and turtles, dependent upon the timing of a spill. Beaches on the Ningaloo Coast are important for green turtles, and to a lesser extent hawksbill turtles. Impacts would be most likely to nesting females as they move up and down nesting beaches or to turtle hatchlings as they emerge from nests 6-8 weeks following nesting. Metabolized oil and related products can pass to female eggs, thereby potentially exposing developing embryos and impairing the development and survival of embryos (Deepwater Horizon Natural Resource Damage Assessment Trustees 2016). Potential impacts may occur on nesting female turtles and hatchlings, however, it would unlikely to result in population changes.		
Seabirds	Lethal or sub-lethal physical and toxic effects such as irritation of eyes/mouth and potential illness. May encounter entrained MGO while diving and foraging.	Particularly vulnerable to surface MGO. As most fish, prey for seabirds, survive beneath floating slicks, they will continue to attract foraging seabirds, which typically do not exhibit avoidance behaviour. Smothering can lead to reduced water proofing of feathers and ingestion while preening. In addition, MGO can erode feathers causing chemical damage to the feather structure	May encounter MGO if breeding along affected shorelines. Impacts will be similar to those for 'Surface'

		that subsequently affects the ability to thermoregulate and maintain buoyancy on water.	
	Seven threatened seabird species, as identified by the EPBC Protected Matters database search, may be encountered during the Van Gogh infill installation activities and may have foraging or feeding habitat in the vicinity of the EMBA. The Australian fairy tern, wedge-tailed shearwater and roseate tern have breeding BIAs within the EMBA and so may be impacted by surface and entrained MGO while foraging (dive and skim feeding). Higher numbers would be expected during the breeding period of October to January. Due to the quick evaporation and dispersion of MGO, significant impacts are not anticipated. While other listed seabirds may occur in the EMBA, no BIAs designated for breeding or foraging were identified within the EMBA so significant numbers are not expected and any impacts would be limited to transient individuals. Therefore, the risk of surface and entrained MGO to seabirds is considered low.		
Shorebirds	Entrained/dissolved hydrocarbons not expected to impact on shorebirds	Floating slicks are not expected to impact on shorebirds	Smothering can lead to reduced water proofing of feathers and ingestion while preening. In addition, MGO can erode feathers causing chemical damage to the feather structure that subsequently affects ability to thermoregulate and maintain buoyancy on water. Exposure can also result in a decline in reproductive success and malformed eggs.
	Three threatened shorebird species, as identified by the EPBC Protected Matters database search may have foraging or feeding habitat in the vicinity of the EMBA. The risk to shorebird species would depend upon where surface oil accumulated; accumulation near nesting colonies or areas supporting feeding aggregations (i.e. sand/mud flats) would be the worst case scenario. Coating of feathers could occur for birds wading/roosting on oiled shorelines, although the low inherent stickiness and persistence of MGO makes this less likely than for crude oils or heavy bunker fuels. Oil-coated birds can suffer hypothermia, dehydration, drowning and starvation, and become easy prey. Ingestion of MGO, could occur either through oil-coated birds preening feathers of birds feeding on MGO contaminated prey such as benthic invertebrates within mud/sand flats. Toxicity from ingested MGO could occur as a result of toxic hydrocarbons such as PAHs present within weathered MGO.		
Fish and sharks	Hydrocarbon droplets can physically affect fish and sharks exposed for an extended duration (weeks to months). Smothering through coating of gills can lead to the lethal and sub-lethal effects of reduced oxygen exchange, and coating of body surfaces may lead to increased incidence of irritation and infection. Fish may also ingest hydrocarbon droplets or contaminated food leading to reduced growth.	While fish and sharks do not generally break the sea surface, individuals may feed at the surface, particularly whale sharks. However, since the MGO is expected to quickly disperse and evaporate (modelling results indicate approximately 40-50% by mass is predicted to evaporate over the first two days), and the low frequency of breaches at	Shoreline accumulated hydrocarbons are not expected to impact on fish and sharks

	The EMBA overlaps with the whale shark foraging BIA. However, given the distance to whale shark aggregation location (Ningaloo Marine Park, 37 km south southeast of the operational area) and activity being conducted outside the main whale shark aggregation period (Mar – May), significant impacts to whale shark are not expected, should a spill occur. There is potential for localised mortality of fish eggs and larva due to reduced water quality and toxicity. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest and therefore, demersal fish communities (including those associated with the KEF) are not expected to be impacted.	the surface, the probability of prolonged exposure to a surface slick by fish and shark species is low.	
	The NWS supports a diverse assemblage of fish, including 456 species of finfish, particularly in shallower water near the mainland and islands. Near the sea surface, fish are able to detect and avoid contact with surface slicks and as a result, fish mortalities rarely occur in open waters from surface spills (Kennish 1997; Scholz et al. 1992). Pelagic fish species are therefore, generally not highly susceptible to impacts from hydrocarbon spills. In offshore waters near to the release point, pelagic fish are at risk of exposure to the more toxic aromatic components. Pelagic fish in offshore waters are highly mobile and comprise species such as tunas, sharks and mackerel. Due to their mobility, it is unlikely that pelagic fish would be exposed to toxic components for long periods. Threatened species identified by the EPBC protected matters search include the great white shark, whale shark, grey nurse shark and green and dwarf sawfish which may be present in the EMBA. However, given the absence of critical habitat for most of these species, significant numbers are not expected to be impacted. The EMBA does overlap a BIA (foraging) for the whale shark. While this is for foraging it is not for high density prey where congregations are expected so impacts would be limited to transient migrating individuals.		
Socioeconomic			
Fisheries	Entrained MGO can have toxic effects on fish (as outlined above for 'Fish and Sharks') reducing catch rates and rendering fish unsafe for consumption.	In addition to the effects of entrained oil, exclusion zones surrounding a spill can directly impact fisheries by restricting access for fishermen.	Shoreline accumulated hydrocarbons is not expected to impact on fisheries
	Both entrained and surface MGO have the potential to lead to temporary financial losses.		
Tourism	There are many sources of marine-based tourism within the environment that may be affected. Aquatic recreational activities such as boating, diving and fishing are concentrated in the vicinity of the population centres such as Exmouth. In the waters immediately surrounding the operational area, tourism activities are expected to be low, however, exclusion zones surrounding a spill		

	will reduce access for vessels for the duration of the response undertaken for spill clean-up (if applicable).		
Shipping	Entrained oil will have no effect on shipping.	Exclusion zones surrounding a spill will reduce access for shipping vessels for the duration of the response undertaken for spill clean-up (if applicable); vessel may have to take large detours leading to potential delays and increased costs.	Shoreline accumulated hydrocarbons is not expected to impact on shipping.
Defence	The level of defence activities carried out in the vicinity of operational area is low, if any, and therefore, interference of defence activities due to a MGO spill are likely to be minimal.		
Shipwrecks	Surface oil will have no impact on shipwrecks. Entrained oil from a vessel collision will remain in the surface waters and is therefore, unlikely to have an impact on shipwrecks.		
Indigenous	The level of activities undertaken by indigenous users is expected to be low, if any, therefore interference due to an MGO spill are likely to be minimal, however, in event there is a requirement for land based response activities/ disturbance relevant representatives (identified in **Section 6.3.7**) will be contacted as outlined in the OPEP.		
Existing oil and gas activity	Exclusion zones surrounding spills may reduce access to existing facilities/infrastructure, potentially leading to delays to work schedules with subsequent financial implications. Both Woodside and BHP have FPSOs within 4 to 15 km of the operational area and therefore, may be impacted in the event of an unplanned spill event through exclusion from undertaking activities.		
Protected areas	Protected areas and their associated values are summarised below: Ningaloo Marine Park (including the WHA)– foraging area for whale sharks, foraging area and adjacent to important sites for marine turtles, important part of the migratory pathway for the humpback whale, provides protection for shelf and slope habitats Gascoyne Marine Park – important foraging area for migratory seabirds, hawksbill and flatback turtles and whale sharks, provides protection for may seafloor features Shark Bay Marine Park – important breeding areas for several species of migratory seabirds, part of the migratory pathway of humpback whales, adjacent to the largest nesting area for loggerhead turtles in Australia, provides protection for shelf and slope habitats Muiron Islands Marine Management Area - Adjacent to Ningaloo Marine Park around Muiron Island. Regionally significant loggerhead turtle nesting beaches. Contains coral reef and macroalgae habitat.		
	In the unlikely event of an MGO spill entrained, surface and accumulated hydrocarbons may result in the contamination of these protected areas and impact on the values identified. Impacts to the identified values are identified above. For example, marine mammals, seabirds, sharks and reptiles are at risk of direct contact with MGO due to chance of surfacing within slick. Effects include irritation of eyes/mouth and potential illness. Surface respiration could lead to accidental ingestion of hydrocarbons or result in the coating of sensitive epidermal surfaces.		
KEFs	KEFs are summarised below: Commonwealth waters adjacent to Ningaloo Reef – Supports high productivity and aggregation of marine life, including both benthic and pelagic		

	habitats Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula - Supports the productivity and species richness of Ningaloo Reef Continental Slope Demersal Fish Communities - Provides important habitat for demersal fish communities, characterised by high endemism and species diversity Ancient Coastline at 125 m depth contour - Contributes to higher diversity and enhanced species richness relative to soft sediment habitat and attracts opportunistic feeding by larger marine life including humpback whales, whale sharks and large pelagic fish
	A loss of MGO to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column. Therefore, any impact on KEFS will be limited to the values of KEFs where there is increased biological productivity (e.g. Ningaloo Reef). However, any impact is expected to be localised with rapid recovery.

6.4.2 Crude Release Due to Damaged Subsea Infrastructure

Event: Crude release due to damaged subsea infrastructure	Accidental dropped objects could occur from operations including lifting/moving of objects and equipment needed to complete infill installation activities. Equipment and other items lost at sea could be caused by crane failure, adverse weather, human error, rigging failure, unsecured equipment on deck and vessel motions, see **Section 6.3.2** (Seabed disturbance – installation of subsea infrastructure) for description and control measures for seabed disturbance and impacts to benthic communities. During the infill installation activities, a hydrocarbon release of Van Gogh/Coniston/Novara crude, due to damage to the 10" or 12" production flowline, could occur through a dropped object incident – namely the subsea structures (5 Tonne (Te) GLJ/EHFL deployment frames and 35 Te rigid spools) dropped during installation onto the production flowline. The maximum credible spill from a damaged (ruptured) production flowline has been determined based on spill volume guidance produced by AMSA (AMSA 2015). AMSA stipulates a worst case offshore pipeline rupture as 1 hour of maximum flow + the entire pipeline inventory. A loss of containment from a production flowline would escalate to a loss that would be detected and result in an almost instantaneous emergency shutdown (ESD) due to the pressure drop in the flowline and the presence of an automated ESD system. However, failures of multiple barriers have been assumed for conservatism in which case 1hr has been allowed before manual detection and isolation. Single flowline flow rate prior to isolation has been calculated. There are crossover lines connecting the two production flowlines and current operations have the valves between flowlines at one manifold open (the remaining manifold crossover valves are closed); therefore, once isolated the inventories in both flowlines could be released. This calculation provides a worst case Van Gogh/Coniston/Novara crude volume of 327 m^3. A loss of well control from P11 and P12 XTs are not considered credible.
Potential Receptors	Marine fauna – plankton, fish, cetaceans, marine mammals, marine reptiles, seabirds/shorebirds; Protected Areas; Socio-Economic Receptors
Potential Impacts	Hydrocarbon spills can cause chemical (e.g. toxic) and physical (e.g. coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species and a decline in water quality. The severity of the impact of a hydrocarbon spill depends on the magnitude of the hydrocarbon spill (i.e. extent, duration) and sensitivity of the receptor. The magnitude of potential environmental impact from a crude release is dependent on multiple factors including hydrocarbon type, release volume and rate, and ocean and weather conditions. An assessment of the sensitive environmental receptors at risk from a Van Gogh, Coniston, Novara crude blend release has been determined based on a literature review and trajectory and fate modelling. **Section 4** includes a description of the biological environment present in the operational and/EMBA. Fundamentally, such receptors are likely to be the same or similar to those described in **Section 6.4.1** and include: • Plankton; • Invertebrates (pelagic); • Pelagic fish (including those targeted by commercial and recreational fishers); • Marine mammals; • Whale sharks; • Marine turtles; • Seabirds; • Shorelines and associated habitats; and • Commercial fisheries.

	The spatial extent of impacts from entrained oil and dissolved aromatic hydrocarbons around the release site is predicted to be within a scale of ~80 km. Ecosystem recovery would be expected within weeks to months of return to normal water quality conditions. It is reasonable to conclude that the greatest ecological response will occur in the highest concentration zones of non-degraded hydrocarbons. Based on APASA (2013) modelling results and an understanding of environmental receptors that could be affected the following assessment is provided for a potential crude release: • Its limited propensity to affect deeper habitats reduces the scope of potential effects to environmental receptors (particularly subtidal benthic habitats); • Benthic habitats are predominately soft sediments with associated benthic fauna; with the epifauna and infauna unlikely to be restricted on a regional scale (**Section 4.2.2**); • No emergent, shoreline or shallow water habitats are predicted to be contacted by hydrocarbons at the defined impact thresholds; • Shoreline contact may occur below the predicted thresholds and may result in shoreline accumulation which could impact on nesting adult turtles and hatchling, seabirds and shorebirds and on shoreline and intertidal habitats. Any impacts will be limited and localised due to the small volumes predicted; • Shoreline accumulation along Ningaloo Coast and Shark Bay may also impact on tourism activities, these locations offer fishing, swimming and beach utilisation. If a spill occurred there could be restricted access at beaches until the hydrocarbons have been removed, either through natural process or spill response operations; • The operational area overlaps humpback whale, blue whale migration BIA and the blue whale foraging BIA. The EMBA also includes several marine turtle species' internesting BIAs and critical habitats for nesting, as well as whale shark foraging BIA. However, large numbers of encounters are not expected due to distance to whale shark aggregation locations and turtle nesting beaches (37 km and 41 km away respectively); • Other EPBC Act-listed threatened and migratory species (e.g. whales and seabirds) are known or likely to transit the modelled hydrocarbon-affected water mass. Notwithstanding this, the potentially affected area is not known to contain habitat or be an aggregation area of critical importance to these species; • Recovery of marine fauna or benthic habitats exposed to hydrocarbons and experiencing sub-lethal impacts would be expected within weeks to months of return to normal water quality conditions; • Marine fauna that surface to breathe and seabirds potentially at risk from surface hydrocarbons have widespread distributions and, given the relatively localised impacts, long-term consequences to populations are unlikely; and • Impacts to fish can have a subsequent impact on commercial fisheries and also a disruption to fishery activity during the release event and clean-up activities.
Impact Assessment	
Receptors	**Consequence**
Marine fauna – plankton, fish, cetaceans, marine mammals, marine reptiles, seabirds/shorebirds Protected Areas	In the event of a hydrocarbon release due to a flowline rupture, the volume of hydrocarbons released would be a finite amount limited to the maximum credible spill of a full content of the ruptured flowline. The susceptibility of marine fauna (including fish and plankton) to hydrocarbons is dependent on hydrocarbon type and exposure duration however given that exposures would be limited in extent and duration. Habitat modification/degradation/disruption/loss, deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species in relevant

Socio-Economic Receptors	Recovery Plans and Conservation Advice. With controls in place, the activity will be conducted in a manner that reduces potential impacts to ALARP and of acceptable level. The potential sensitive receptors in the surrounding areas of the spill will include fish, marine mammals, marine reptiles and seabirds at the sea surface as well as shoreline and intertidal habitats. Given that a hydrocarbon spill due to flowline rupture would not result in a decreased population size at a local or regional scale, it is expected that a spill of this nature would result in a minor consequence.		
Likelihood	A hydrocarbon release resulting from a flowline rupture caused by dropped objects is unlikely to have widespread ecological effects given the safety design of the production system, the finite volumes that could be released, the depth and transient nature of marine fauna in this area. The likelihood of a hydrocarbon release occurring due to flowline rupture caused by dropped object is limited given the set of control measures in place for this program. Subsequently the likelihood of a flowline rupture releasing hydrocarbons to the environment which results in a minor consequence is considered to be rare.		
Likelihood Ranking	1- Rare	**Consequence ranking**	Minor
Residual risk	Low		
Management Control	**Effectiveness of Control**		
Pre-installation seabed survey	Ensures any subsea hazards that may cause pipeline/ flowline rupture during installation resulting in hydrocarbon release are identified		
Installation procedures	Adhering to installation procedures (e.g. setting a pre-determined distance clear of subsea infrastructure), using acoustic positioning devices (metrology equipment) and approval of critical lifts helps prevent damaging of subsea infrastructures which resulting in hydrocarbon release		
Dynamic positioning	Prevents unintentional movements by vessel, decreasing risk of dropped object reducing the risk of hydrocarbons being discharged to the marine environment		
Oil pollution emergency plan (OPEP)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently in order to reduce impacts to the marine environment.		
Dropped object prevention	Minimises drop risk during lifting operations that may cause pipeline/ flowline rupture resulting in hydrocarbon release		
Lifting equipment Maintenance	Ensures that lifting equipment is maintained and certified, and that lifting procedures are followed reducing probability of dropped objects occurring with the potential to result in hydrocarbon spills.		
Van Gogh P11and P12 XTs will be function tested once installed, prior to infill installation activities	Reduces likelihood of hydrocarbon release and in the event of a spill will limit the release of hydrocarbons		
Field ESD testing	In the event of low pressure resultant from a pipeline rupture, production will be automatically shut in, therefore limiting the release of hydrocarbons		

6.4.3 Minor Hydrocarbon Release

Event: Minor Hydrocarbon Release at Sea Surface	The main engines and equipment such as pumps, cranes, winches, power packs and generators require MGO for fuel and a variety of hydraulic fluids and lubricating oils for efficient operation and maintenance of moving parts. These products are present within the equipment and also held in storage containers and tanks on the ISV. Minor accidental loss of hydrocarbon based liquids (e.g. used lubricating oils, cooking oil, and hydraulic oil) to the marine environment could occur via tank pipework failure or rupture, hydraulic hose failure, inadequate bunding and/or storage, insufficient fastening or inadequate handling which could result in impacts to water quality and hence sensitive environmental receptors. ROV operations can result in unplanned discharges (of hydraulic fluids) directly to the marine environment due to equipment failure, ROV interactions with the vessel thrusters and/or accidental contact with sub-sea infrastructure. The largest credible hydrocarbon spill from ROV operations would be an accidental release of approximately 50 L of hydraulic fluid from the deployed ROV.
Potential Receptors	Marine fauna – Fish, cetaceans, marine mammals, marine reptiles, plankton
Potential Impacts	Accidental disposal of hydrocarbons into the marine environment will result in pollution and contamination of the marine environment, localised decline in water quality and toxic effects to marine fauna. Hydrocarbons released into the marine environment through onboard spills and leaks directed through deck drainage or from a release of hydraulic oil from an ROV umbilical would disperse quickly in waters within the vicinity of the operational area. Lubricating and hydraulic oils will behave similarly to MGO if spilt to the marine environment, although lubricating oils are more viscous and so the spreading rate of a slick of these oils would be slightly slower. Hydraulic oils are medium oils of light to moderate viscosity and have a relatively rapid spreading rate and dissipate quickly in higher sea states. A release could potentially impact plankton, pelagic invertebrates, pelagic fish, marine mammals, marine reptiles and seabirds although given the highly dispersive waters within the operational area, the extent of the water column and the relatively small potential volumes associated with such a release, rapid dilution is expected and concentrations are unlikely to persist for periods of time where impacts would likely be felt. The greatest potential for impact would likely be for passive or low mobility fauna such as plankton, including both invertebrates and fish larvae which may be exposed for the greatest periods of time and likely have a permanent presence within the operational area. Pelagic fish in offshore waters are highly mobile and comprise species such as tunas, sharks and mackerel. Due to their mobility, it is unlikely that pelagic fish would be exposed to toxic components for long periods. Large, more mobile fauna (including protected species such as cetaceans, marine turtles, seabirds and whale sharks) are likely to be transient within the operational area and toxic impacts are unlikely to occur to these species in the event of a small liquid hazardous hydrocarbon. With respect to demersal fishes (and to the KEF 'Continental Slope Demersal Fish Communities') which overlaps the operational area, it is possible that some impact may occur through the release of hydraulic oil from an ROV near the seabed. However, given the small volume of any credible ROV release (~50 L), the lack of any natural seabed features that would indicate a high abundance or diversity of demersal fishes and the large area of this KEF in relation to the operational area, it is considered that such a release would have a negligible impact on the demersal fish populations and this KEF.

Impact assessment			
Receptors	**Consequence**		
Marine fauna – Fish, cetaceans, marine mammals, marine reptiles, plankton	In the event of a minor hydrocarbon spill, the quantities would be limited to approximately < 1 m^3 to the marine environment. The small volumes and dilution and dispersion from natural weathering processes such as ocean currents indicate that the extent of exposure will be limited in area and duration. The more toxic components would also rapidly evaporate and concentrations would significantly diminish with distance from the spill site, limiting the potential area of impact. Deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species in relevant Recovery Plans and Conservation Advice. The number of receptors, including marine turtles present at the operational area are expected to be limited to a small number of transient individuals The susceptibility of marine fauna (including fish and plankton) to hydrocarbons is dependent on hydrocarbon type and exposure duration however given that exposures would be limited in extent and duration, exposure to marine fauna from this hazard is considered to be low. Rapid dilution at depth would also result in the impacts to receptors declining rapidly with time and distance. For marine mammals and marine turtles that may be exposed to the more toxic aromatic components, chemical effects are considered unlikely since these species are mobile and therefore, will not be constantly exposed for extended durations that would be required to cause any major toxic effects. Although humpback and blue whales may be exposed if the spill were to occur in the migration season, this event is not expected to interfere with their migration activity. Deteriorating water quality is identified as a potential threat to turtles in the marine turtle recovery plan, and some bird and shark species. However, the potential minor hydrocarbon releases are not expected to significantly impact the receiving environment with control measures proposed to prevent releases and therefore, the activity will be conducted in a manner that is consistent with the plans. Given that a small hydrocarbon spill would not result in a decreased population size at a local or regional scale, it is expected that a spill of this nature would result in a negligible consequence.		
Likelihood	The likelihood of a small hydrocarbon release occurring is limited given the set of control measures in place for this activity and is considered to be unlikely.		
Likelihood Ranking	3- Unlikely	**Consequence ranking**	Negligible
Residual risk	Low		
Management Control	**Effectiveness of Control**		
General chemical management procedures	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals		
Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges)of hazardous chemicals to the sea by controlling the storage, handling and clean up		
Oil pollution emergency plan (OPEP)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently in order to reduce impacts to the marine environment.		

ISV spill response plans	
Maritime dangerous goods code	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction
ROV inspection and maintenance procedures	Minimises the risk of hydraulic fluid release to sea
Deck drainage	Reduces potential for hydrocarbon release to the marine environment during refuelling

6.4.4 Non-Hydrocarbon and Chemicals Release - Liquids

Event: Non-hydrocarbon and chemicals release to the marine environment	Hazardous liquids including miscellaneous chemicals (cleaning and cooling agents, stored or spent chemicals and leftover paint materials) used or stored on board the ISV during the activity. The presence of preservation chemicals (corrosion inhibitor, biocides etc.) and chemical dye used in treated water represents a potential spill risk during chemical storage and handling e.g. due to tank damage, or human error or during leak testing. Accidental loss of liquid wastes to the marine environment could occur via tank pipework failure or rupture, inadequate bunding and/or storage, insufficient fastening or inadequate handling may result in impacts to water quality and hence, sensitive environmental receptors.
Potential Receptors	Marine fauna – Fish, sharks, marine mammals, marine reptiles, seabirds, benthic habitat
Potential Impacts	Environmentally hazardous chemicals (liquids) lost to the marine environment may lead to contamination of the water column in the vicinity of the ISV. The potential impacts would most likely be highly localised and restricted to the immediate area surrounding the spill, with rapid dispersal to concentrations below impact thresholds likely to occur in the open area of ocean. The changes to water quality that may result could potentially lead to short-term impacts on marine fauna (e.g. plankton, pelagic/benthic fish, epifauna, cetaceans, marine reptiles and seabirds), with chronic impacts not expected owing to the short exposure times. The area that may be affected by this risk would most likely be restricted to a small area within the operational area. There is no emergent or inter-tidal habitat that could be impacted by a surface spill and the benthic habitat is predominately silty clay, with a sparse assemblage of deep-sea soft sedimentary and demersal fauna (Enesar 2007), any spilled material is unlikely to reach any of the demersal species or benthic habitats at the seabed. Sub-lethal or lethal effects from toxic chemicals, is considered unlikely given the expected low concentrations and short exposure times. Discharge of non-hydrocarbon liquids or chemicals from spills is unlikely to have widespread ecological effects given the nature of the chemicals on-board, the small volumes that could be released, and the depth and exposure of the location.
Impact Assessment	
Receptors	**Consequence**
Marine fauna – Fish, sharks, marine mammals, marine reptiles,	The small volumes, dilution and dispersion from natural weathering processes such as ocean currents indicate that the extent of exposure will be limited in area and duration. The susceptibility of marine fauna (including plankton and fish) to chemicals is dependent on the type and exposure duration however given that exposures would be limited in

seabirds, benthic habitat	extent and duration, exposure to marine fauna from this hazard is not expected to result in a fatality. Impacts from small volumes (1 m^3) discharged to the marine environment to water quality would be short-term and localised, due to the nature and behaviour of the chemicals / liquid wastes identified as being at risk of spilling; only pelagic fauna (e.g. plankton) present in the immediate vicinity of the spill would likely be at risk of impact. Habitat degradation, deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species in relevant Recovery Plans and Conservation Advice. However, the potential non-hydrocarbon releases of liquids are not expected to significantly impact to the receiving environment with control measures proposed to prevent releases. The lack of key aggregations areas within the operational area indicates that only a small number of marine fauna has the potential to be exposed to a small chemical spill given the transient nature of fauna in this area. Given that a small non-hydrocarbon or chemical spill would not result in a decreased population size at a local or regional scale, it is expected that a spill of this nature would result in a negligible consequence.		
Likelihood	A small non-hydrocarbon liquid release is unlikely to have widespread ecological effects given the nature of the chemicals on-board, the small volumes that could be released, the depth and transient nature of marine fauna in this area and the prevention and management procedures in place to clean up a spill. Quadrant reviewed non-hydrocarbon spills and leaks from equipment and machinery in recent history (due to split hoses, small leaks, or handling errors). Most of the spills and leaks reported occurred within bunded areas, were less than 100 L, did not reach the marine environment and were cleaned up immediately. The likelihood of releasing non-hydrocarbon liquids to the environment which results in a negligible consequence is considered to be very unlikely. The likelihood of a small non-hydrocarbon release occurring is limited given the set of control measures in place for this program.		
Likelihood Ranking	2- Very unlikely	**Consequence ranking**	Negligible
Residual Risk	Low		
Management Control	**Effectiveness of Control**		
General chemical management procedures	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals		
Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges) to the sea by controlling the storage, handling and clean-up of hazardous chemicals		
Chemical selection procedure	Reduced toxicity to marine environment Only environmentally acceptable flushing and testing chemicals would be released in the event of an accidental discharge to sea		
Deck cleaning product selection procedure	Improve water quality discharge (reduce toxicity) to the marine environment		
ISV spill response plans	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently in order to reduce impacts to the marine environment.		

Dropped object prevention	Minimises dropped object risk during vessel lifting operations that may cause secondary spill (discharges) resulting in reduction in water quality
Lifting equipment maintenance	Ensures that lifting equipment is maintained and certified, and that lifting procedures are followed reducing probability of dropped objects occurring with the potential to result in hydrocarbon spills.
Maritime Dangerous Goods Code	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction

6.4.5 Non-Hydrocarbon Release (Surface) – Solid

Event: Non-Hydrocarbon Surface Release – Solid	Non-hazardous solid wastes including paper, plastics and packaging, and hazardous solid wastes such as batteries, fluorescent tubes, medical wastes, and aerosol cans may be dropped unintentionally to the marine environment, potentially impacting on sensitive receptors. Release of these waste streams may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during transfers of waste. <u>Dropped objects</u> Accidental dropped objects to the seabed could occur during vessel and ROV activities such as operations including lifting of objects and equipment needed to complete installation activities. Equipment and other items lost at sea could be caused by crane failure, adverse weather, human error, rigging failure and vessel motions and potentially lead to loss of or changes to benthic habitats
Potential Receptors	Benthic habitats, Fish, Sharks, Marine Mammals, Marine Reptiles and Seabirds
Potential Impacts	Non-hazardous solids, such as plastics, have the potential to smother benthic environments and harm marine fauna through entanglement or ingestion. Marine turtles and seabirds are particularly at risk from entanglement. Marine turtles may mistake plastics for food; once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both potentially result in fatality. Marine debris has been highlighted as threat to marine turtles, humpback whales and whale sharks in the Marine Turtle Recovery Plan (2017), Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (2015) and Approved Conservation Advice for *Rhincodon typus* (whale shark) (2015) respectively. The Recovery plan and Approved Conservation Advice have specified a number of recovery actions to help combat this threat. Of relevance to this activity is the legislation for the prevention of garbage disposal from vessels. Release of hazardous solids (e.g. wastes such as batteries) may result in the pollution of the immediate receiving environment, leading to detrimental health impacts to marine flora and fauna. Physiological damage can occur through ingestion or absorption and may occur to individual fish, cetaceans, marine reptiles or seabirds. The area of potential disturbance due to a non-buoyant dropped object would be restricted to the operational area. The seabed within the operational area is primarily soft sediments with little epifauna; this habitat type is widely distributed and well represented in the NWS region. While soft sediment benthic habits will not be lost, disturbance of the communities on and within them (i.e. the epifauna) will occur in the event of a dropped object and depressions may remain on the seabed for some time after removal of the dropped object, as it gradually infills over time. Surveys of previous seabed disturbances from drilling activities indicate that recovery of benthic fauna in soft sediment substrates occurs between 6-12 months after the activity ceases (URS 2001). Subsequently any impacts are short term in duration. Any localised disturbance to benthic habitat is not expected to have an impact to any fishes attracted to the subsea infrastructure although, localised and temporary avoidance or

	attraction could occur during installation activities. Therefore, no impacts are expected on the Continental Slope Demersal Fish Communities KEF.		
Impact Assessment			
Receptors	**Consequence**		
Marine fauna- cetaceans, marine turtles, seabirds and fish	In the event of a non-hazardous or hazardous solid waste loss, the quantities would be limited. This waste stream could cause localised impacts to water quality and the benthic environment if the solid can degrade, leading to impacts on localised flora and fauna species. Ingestion of solid wastes could occur in small quantities. Only small volumes of this waste stream would be generated during the activity due to the duration of the activity, as a result, any accidental loss to the environment would be small in size. Any impacts would be restricted to a small number of individuals in the close proximity to the release, if any. As such, there is the potential for short term behavioural impacts only to a small proportion of a local population and not during critical lifecycle activity for cetaceans, marine turtles or fish. Marine debris is identified as a potential threat to a number of marine fauna species in relevant Recovery Plans and Conservation Advice and the Threat Abatement Plan for marine debris (2018). The above information demonstrates that the activity will be conducted in a manner that reduces potential impacts to ALARP and of acceptable level. The limited quantities associated with this event indicate that even in a worst case release of solid waste, fatalities would be limited to individuals and is not expected to result in a decrease of the local population size and the consequence level is therefore, negligible.		
Physical Environment – Seabed disturbance	In the event of a lost equipment/dropped object, it is expected to result in localised damage to the seabed. Any localised disturbance to benthic habitat is not expected to have an impact to any fishes attracted to the subsea infrastructure although, localised and temporary avoidance or attraction could occur during installation activities. Therefore, no impacts are expected on the Continental Slope Demersal Fish Communities KEF. The extent of the seabed damage will be limited to the size of the dropped object and given the size of standard materials lifted overboard, any impact is expected to be very small. Any impact to seabed through dropped objects would result in a negligible reduction in habitat area/function impacted.		
Likelihood	A set of control measures and checks have been proposed to ensure that the risks of dropped objects, lost equipment or release of solid waste to the environment has been minimised. The likelihood of transient marine fauna occurring in the operational area is limited and given the controls in place, the likelihood of releasing non-hydrocarbon solids to the environment resulting in a negligible consequence is considered very likely (assumes potential for a single loss of solid waste incident during the activity).		
Likelihood Ranking	2 – Very Unlikely	**Consequence Ranking**	Negligible
Residual Risk	Low		
Management Control	**Effectiveness of Control**		
Waste (garbage) management procedure	Reduces probability of waste being discharged to sea, reducing potential impacts to marine fauna. Ensure compliance with MARPOL requirements		
Dropped object prevention	Impacts to environment are reduced by preventing dropped objects and by retrieving dropped objects where possible		
Lifting equipment maintenance	Ensures that lifting equipment is maintained and certified, and that lifting procedures are followed reducing probability of dropped objects occurring.		

Maritime Dangerous Goods Code	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction
Dropped object analysis	To minimise risk of infrastructure damage due to dropped objects

6.4.6 Marine Fauna Collisions

Event: Vessels/ equipment colliding with marine fauna	There is the potential for vessel/equipment from the ISV involved in the activity to collide with marine fauna including cetaceans, fish, marine reptiles and seabirds. The main collision risk associated with the activity is through vessel collision or equipment collision with large, slow moving cetaceans; potentially resulting in severe injury or mortality.
Potential Receptors	Fish, Sharks, Marine Mammals, Marine Reptiles and Seabirds
Potential Impacts	Cetaceans are naturally inquisitive marine mammals that are often attracted to vessels underway; for example, dolphins commonly 'bow ride' with vessels. Marine fauna in surface waters that would be most at risk from vessel collision include marine mammals, marine turtles and whale sharks. The operational area overlaps with a humpback whale and blue whale migration BIA. The operational area is, however, in close proximity to several marine turtle internesting buffer BIAs, marine turtle critical habitats for nesting and a whale shark foraging BIA. Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (2015) indicates that humpback whales are one of the most frequently reported whale species involved in vessel strikes worldwide (Laist *et al*. 2001; Jensen and Silber 2003). This observation is supported by Australian studies referenced in The Draft National Strategy for Mitigating Vessel Strike of Marine Mega-fauna (2018). The increase in vessel numbers (Silber *et al*. 2012) is not only a threat to humpback whales in relation to vessel strikes but also in disturbance and displacement from key habitats. Similarly, boat strike is also recognised by the Approved Conservation Advice for *Rhincodon typus* (whale shark) (2015) as one of the threats to the recovery of whale sharks and to marine turtles by the Recovery Plan for Marine Turtles in Australia (2017). The worst potential impact from vessel collision would be mortality or serious injury of an individual. Collisions between vessels and cetaceans are most frequent on continental shelf areas where high vessel traffic and cetacean habitat occur simultaneously (WDCS 2006). There have been recorded instances of cetacean deaths as a result of vessel collisions in Australian waters (e.g. a Bryde's whale in Bass Strait in 1992) (WDCS 2006), though the data indicates this is likely to be associated with container ships and fast ferries. Whale and Dolphin Conservation Society (WDCS) (2006) also indicates that some cetacean species, such as humpback whales, can detect and change course in order to avoid a vessel. The humpback whale migrates between calving grounds in the Kimberley region off WA to feeding grounds in Antarctica; with the northbound migration from early June to early August (BHPB 2005), and the peak of the northbound migration between Exmouth Gulf and the Dampier Archipelago occurring around July, concentrated inshore of the 200 m depth contour (Jenner et al. 2001). The southern migration, which peaks around early September, with pods travelling in shallower waters, typically at 30 - 100 m. Based on the water depths and migration pathways, encounters in the operational area during humpback migration may occur, however significant number is not expected given the water depths at the operational area approximately 380 m. Nearly all blue whales sighted in the NWS region are likely to be pygmy blue whales. The pygmy blue whales may also transit through the operational area during their migrations which may result in interactions with pygmy blue whales during the activity.

	The reaction of whales to the approach of a ship is quite variable. Some species remain motionless when in the vicinity of a ship while others are known to be curious and often approach ships that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster moving ships (Richardson *et al*. 1995). Whale sharks are at a risk when feeding or foraging at the surface however the operational area does not overlap with whale shark foraging BIA. The operational area does overlaps the whale shark migration BIA, and transient individuals may be encountered during the activity. It is possible that individual flatback, green, hawksbill and loggerhead turtles may be encountered in the operational area, particularly due to its close proximity to their interesting buffer BIAs and critical habitats for nesting. However, given the depth of water, lack of suitable habitat and distance to the closest nesting beaches (Muiron Islands are approximately 41 km from the operational area), large numbers of turtle encounters are not expected. Marine turtle mortality due to boat strike has been identified as an issue in Queensland waters in the Marine Turtle Recovery Plan (2017). However, turtles appear to be more vulnerable to boat strike in areas of high urban population where incidents of pleasure crafts are higher. WA turtle populations have not been highlighted as those most affected by boat strike, possibly due to the relatively low human population density of the WA coast line. Given that the ISV will be predominantly stationary within the operational area, the risk of collision with marine fauna is low.
Impact Assessment	
Receptors	**Consequence**
Marine fauna – Fish, cetaceans, marine reptiles	In the event of a collision with marine fauna, there is the potential for injury or death to an individual. The number of receptors present in the operational area are expected to be limited to a small number of transient individuals. Boat strike and vessel disturbance are identified as potential threats to a number of marine fauna species in relevant Recovery Plan and Conservation Advice. The above information demonstrates that the activity will be conducted in a manner that reduces potential impacts to ALARP and of acceptable level. In addition, all vessel strikes will be reported by Quadrant in the National Ship Strike Database. With controls in place ensuring the ISV is compliant with EPBC Regulations and Ministerial condition 1 (EPBC 2007/3213), the risk of migrating marine fauna collision is reduced. As such, there is the potential for death or injury of EPBC listed individual species, however as they would represent a small proportion of the local population it is not expected that it would result in a decreased population size over what would usually occur due to natural variation, at a local or regional scale. In addition, given the ISV will be predominantly stationary during the activity, it is expected that a collision with an individual would result in a minor injury. Overall, the consequences of a striking an individual is not expected to decrease the local population size and therefore is assessed as negligible.
Likelihood	The Australian National Marine Safety Committee (NMSC) reports that during 2009, there was one report of a vessel collision with a marine animal (species not defined) (NMSC 2010). As the Van Gogh infill installation will occur within humpback whale southerly migration season, migrating individuals may traverse the operational area. No known aggregation areas occur within the operational area and therefore concentrations of milling individuals are unlikely. Pygmy blue whales may be encountered in the operational area, during their migrations.

	ISV will be predominantly stationary whilst inside the operational area, posing a low risk of collision with marine fauna. In addition, the noise generated from vessel operations will deter marine fauna from coming in close proximity to the ISV. Therefore, the likelihood of a collision with marine fauna is considered to be very unlikely.		
Likelihood Ranking	2 - Very unlikely	**Consequence Ranking**	Negligible
Residual Risk	Low		
Management Control	**Effectiveness of Control**		
Procedure for interacting with cetaceans	Reduces risk of vessel collision with cetaceans (and causing harm) by limiting speeds and approach distances in the presence of cetaceans and other marine fauna Ensures compliance with reporting requirements		
Marine fauna observations			

6.4.7 Introduction of invasive marine species (IMS)

Event: Introduction of IMS	IMS have been introduced and translocated around Australia by a variety of natural and human means including biofouling and ballast water. Invasive marine species (IMS) can be introduced into the operational area and surrounds by vessels carrying IMS on external biological fouling, internal systems (sea chests, seawater systems etc.), on marine equipment, or through ballast water exchange.
Potential Receptors	Marine ecosystem as a whole and commercial/ recreational users of the marine environment.
Potential Impacts	IMS are marine plants, animals and algae that have been introduced into a region that is beyond their natural range but have the ability to survive, and possibly thrive. The majority of climatically compatible IMS to the NWS are found in south-east Asian countries. Some IMS pose a significant risk to environmental values, biodiversity, ecosystem health, human health, fisheries, aquaculture, shipping, ports and tourism (Wells *et al*. 2009). IMSs can cause a variety of adverse effects in a receiving environment, including: • Over-predation of native flora and fauna; • Out-competing of native flora and fauna for food; • Human illness through released toxins; • Depletion of viable fishing areas and aquaculture stock; • Reduction of coastal aesthetics; and • Damage to marine and industrial equipment and infrastructure. Species of concern are those that are not native to the region; are likely to survive and establish in the region; and are able to spread by human mediated or natural means. Species of concern vary from one region to another depending on various environmental factors such as water temperature, salinity, nutrient levels and habitat type. These factors dictate their survival and invasive capabilities. It is recognised that artificial, disturbed and/or polluted habitats in tropical regions are susceptible to introductions which is why ports are often areas of higher IMS risk (Neil *et al*. 2005). However, in Australia, there are limited records of detrimental impact from IMS compared to other tropical regions (such as the Caribbean). Following their establishment, eradication of IMS populations is difficult, limiting management options to ongoing control or impact minimisation. Case studies in Australia indicate that from detection to eradication can take approximately 4 weeks (Bax 1999). However, this is dependent on the environmental conditions and species. For this reason,

	increased management requirements have been implemented in recent years by Commonwealth and State regulatory agencies. Biofouling on vessel hulls and other external niche areas, biofouling on internal niches, biofouling on equipment routinely immersed in water and ballast water exchange all pose a potential risk of introducing IMS into Australia. The potential biofouling risk presented by the ISV will relate to the length of time that the vessel has already been operating in Australian waters or, if they have been operating outside Australian waters, the location/s of the operations it has been undertaking, the length of time spent at these location/s, and whether the vessel has undergone hull inspections, cleaning and application of new anti-foulant coating prior to returning to operate in Australia.		
Impact Assessment			
Receptors	**Consequence**		
Marine fauna – Fish Benthic habitats Socio-Economic Receptors	Ballast water is responsible for up to 30% of all IMS incursions into Australian waters, however, research indicates that biofouling (the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces) has been responsible for more foreign marine introductions than ballast water (DAWR 2017). IMS, if they successfully establish, can out-compete native species for food or space, preying on native species or changing the nature of the environment and can subsequently impact on fisheries or aquaculture. If an IMS is introduced, they have been known to colonise areas outside of the areas they are introduced to. In the event that an IMS is introduced into the operational area, given the lack of diversity and extensiveness of similar benthic habitat in the region, there would only be a minor reduction in the physical environment. The overall consequence level was assessed as moderate.		
Likelihood	The pathways for IMS introduction are well known, and subsequently standard preventative measures are proposed. The ability for invasive marine species to colonise a habitat is dependent on a number of environmental conditions. It has been found that highly disturbed environments (such as marinas) are more susceptible to colonisation than open water environments where the number of dilutions and the degree of dispersal are high (Paulay *et al*. 2002). Given the depth of the operational area (380 m), it is unlikely that an IMS would be able to successfully translocate from the operational area to surrounding shallower habitats. With controls in place to reduce the risk of introduction of IMS the likelihood of introducing an IMS is considered rare.		
Likelihood Ranking	1 - Rare	**Consequence Ranking**	Moderate
Residual Risk	Low		
Management Control	**Effectiveness of Control**		
DPIRD vessel check tool applied to vessels	The risk of introducing IMS are reduced due to assessment procedure.		
Immersible equipment to be cleaned to 'low risk' of introducing marine pest species	Immersible equipment to be cleaned to 'low risk' of introducing marine pest species		

Anti-foulant system	The risk of introducing IMS are reduced due to anti-foulant systems
Ballast water management plan	Reduces the risk of introducing IMS through procedures managing ballast water exchange and identifying high risk ballast water.

7. MANAGEMENT APPROACH

The Van Gogh infill installation activity will be managed in compliance with all measures and controls detailed within the EP accepted by NOPSEMA under the OPGGS (E) Regulations, other environmental legislation and Quadrant's Management System (e.g. Environmental Management Policy).

The objective of the EP is to ensure that potential adverse environmental impacts from planned and unplanned events associated with the activity are identified and assessed, and to stipulate mitigation measures to avoid and/or reduce any adverse impacts to the environment to ALARP and acceptable levels.

The EP details specific performance outcomes, standards and procedures, and identifies the range of controls to be implemented (consistent with the standards) to achieve the performance outcomes. The EP also identifies the specific measurement criteria and records to be kept to demonstrate the achievement of each performance outcomes.

As described in the EP, the implementation strategy includes the relevant details of the following:

1. Environmental Management System;
2. Environmental Management Policy;
3. Leadership, accountability and responsibility;
4. Workforce training and competency;
5. Hazard identification, risk and impact assessment and controls;
6. Environmental performance outcomes, control measures and performance standards;
7. Workforce involvement and stakeholder communications;
8. Information management and document control; and
9. Operations management.

During the period that activities described in the EP are undertaken, Quadrant will ensure environmental performance is monitored and managed through an inspection and monitoring regime undertaken by Quadrant representatives or delegates based on the ISV.

Environmental compliance of an activity with the EP (and the EPO's) is measured using planned and systematic audits or inspections to identify weaknesses and non-conformances in the system and processes so that they can be identified. Continuous improvement opportunities identified through monitoring, audits and incident investigations are implemented in a controlled manner and communicated to all relevant workforce, contractors and relevant third parties. Audits and inspections are in place to identify possible incidents and actions taken to prevent them from happening.

Non-conformances found are addressed and resolved by a systematic corrective action process and are reported to NOPSEMA where relevant.

Senior Quadrant and vessel contractor personnel will be accountable for ensuring conformance with environmental performance outcomes and standards and all personnel will be empowered to 'stop-the-job' to ensure the activity is being implemented in an environmentally responsible manner. The EP identifies specific responsibilities for each role during the activity.

Incident notification and reporting to NOPSEMA and other regulators will be conducted as per the OPGGS (E) Regulations, as detailed within the EP. Reported HSE incidents and hazards will be communicated to personnel during daily operational meetings, and HSE incidents and hazards will be documented in the incident management systems as appropriate. Significant HSE incidents will be investigated using root cause analysis.

7.1 Management of Change

Quadrant's *Environmental Management of Change Procedure (EA-91-IQ-10001)* (MOC) process provides a systematic approach to initiate, assess, document, approve, communicate and implement changes to EPs and OPEPs (currently in force) whilst meeting the requirements of the OPGGS (E) Regulations.

The MOC process considers Regulation 7, 8 and 17 of the OPGGS (E) Regulations, and determines if a proposed change can proceed and the manner in which it can proceed, or if a revision of the EP and OPEP needs to be submitted to NOPSEMA. For a change to proceed, the associated environmental impacts and risks must be demonstrated to be acceptable and ALARP. Additional stakeholder consultation may be required depending on the nature and scale of the change. The MOC procedure also allows for the assessment of new information that may become available post EP acceptance, e.g., new Management Plans for marine reserves, Recovery Plans or Conservation Advice for species and changes to the EPBC Act Protected Matters Search results. If review identifies new information, this is treated as "Change that has an impact on Environment Plan" and the MOC process is followed accordingly.

Accepted MOCs become part of the in force EP or OPEP, will be tracked on a register and made available on Quadrant's intranet. Where appropriate, Quadrant's environmental compliance register will be updated to ensure control measure or environmental performance standard changes are communicated to the workforce and implemented.

8. HYDROCARBON SPILL RESPONSE ARRANGEMENTS

In the event of a hydrocarbon spill, oil spill response strategies will be implemented where possible to reduce environmental impacts to ALARP and acceptable levels. The selection of strategies will be undertaken through the Net Environmental Benefit Analysis (NEBA) process, outlined in the OPEP.

The following response strategies may be applicable to the identified credible spill scenarios:

- Source control;
- Monitor and evaluate / surveillance;
    - Vessel surveillance
    - Aerial surveillance
    - Tracking buoys
    - Spill fate modelling
    - Satellite imagery
    - Initial oil characterisation
    - Operational water quality monitoring
    - Shoreline coastal and habitat assessment
- Chemical dispersion (Crude only);
- Mechanical dispersion (MGO only);
- Containment and recovery (Crude only);
- Nearshore and shoreline protection and deflection;

- Shoreline clean-up;
- Oiled wildlife response; and
- Scientific monitoring.

8.1 Preparedness and Implementation of Response Arrangements

The ISV is required to have and implement incident response plans, such as an emergency response plan and SMPEP/ SOPEP. Regular incident response drills and exercises (e.g. as defined in emergency response plan, SMPEP/ SOPEP, etc.) will be carried out on the ISV to refresh the crew in using equipment and implementing incident response procedures.

Quadrant will implement the Van Gogh Installation and Commissioning Oil Pollution Emergency Plan (TV-35-RE-100001.02) in the event of a significant hydrocarbon spill (Tier 2 or 3). To maintain a state of oil spill preparedness, personnel with OPEP responsibilities will be made aware of their obligations, oil spill response equipment will be maintained, contracts with critical equipment and personnel suppliers will be managed, and agreements will be in place with national regulatory agencies for support in oil spill response. Quadrant will also implement its oil spill response exercise and training schedule. Further information on oil spill response is provided in the OPEP.

A communications test for the activity is completed prior to commencement of the activity.

8.2 Net Environmental Analysis Benefits (NEBA)

During any response incident, there is a documented decision making process to ensure that response strategies are identified and evaluated prior to implementation via the Incident Action Plan (IAP). The Controlling Agency Incident Management Team (IMT) will use a Net Environmental Benefit Analysis (NEBA) process to inform the development and refinement of the IAPs, so the most effective response strategies with the least detrimental environmental impacts are identified, documented and executed. Within Quadrant's IMT, the Environmental Team Lead is responsible for reviewing the priority receptors identified within the EP and the OPEP, and apply NEBA to identify which response options are preferred for the situation, oil type and behaviour, environmental conditions, direction of plume and priorities for protection.

The application of the NEBA is to:

- Identify sensitivities within the area potentially affected by a spill at that time of the year;
- Assist in prioritising and allocating resources to sensitivities with a higher ranking; and
- Assist in determining appropriate response strategies with support of real time metocean conditions, oil spill tracking and fate modelling.

8.3 Oil Spill Response Resources

Oil spill response equipment and resources are a combination of Quadrant, AMOSC (Australian Marine Oil Spill Centre Pty Ltd), AMSA, DoT, National Plan (NatPlan), OSRL (Oil Spill Response Limited), and other operator resources available through the AMOSPlan mutual aid arrangements. Under the Memorandum of Understanding (MOU) between AMSA and Quadrant, AMSA will provide all resources available through NatPlan to support a Quadrant spill response.

In the event of an oiled wildlife response, Quadrant will activate the West Australian Oiled Wildlife Response Plan (WAOWRP) and work with DBCA in determining resources and capability requirements. DBCA and Industry (AMOSC) Oiled Wildlife Advisors (OWAs) ensure minimum standards for oiled wildlife response, as outlined within the WAOWRP, are met and ensure timely mobilisation of appropriate resources (equipment and personnel) through communication with the wildlife logistics team. Quadrant are able to access:

- AMOSC core group responders;
- DBCA staff and approved volunteers/subject matter experts;
- Additional local resources under current contracts and suppliers; and

- Access international support through Wildlife Response Services.

During and post-spill scientific response monitoring activities require resources external to Quadrant and include specialist technical capabilities. If additional support is required, Quadrant has Master Service Agreements with other service providers to support scientific response monitoring activities.

9. CONTACT DETAILS

Further information about the Van Gogh Infill and Installation activity can be obtained from:

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