Wellhead Removal Environment Plan Summary

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1. Introduction

Shell Australia Pty Ltd (Shell) proposes to remove seven (7) wellheads located in Commonwealth marine waters in the northern Browse Basin, 200km offshore northwest Australia and 460km north-north east of Broome (Figure 1). Four (4) of the wellheads (Crux 2ST1, Crux 3, Crux 4 and Auriga West-1) are in permit area AC/RL9. One wellhead (Prelude-1A) is in permit area WA-44-L. One wellhead (Crescendo-1) is in permit area WA-371-P, and the Trio-1 wellhead currently lies within WA-85-AA. The seven wellheads will be removed using a light well intervention vessel.

This wellhead removal activity is to comply with Section 572 of the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* on the 'Maintenance and Removal of Property etc. by titleholder' where (3) requires that: *A titleholder must remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with operations;*

(a) in which the titleholder is or will be engaged; and

(b) that are authorised by the permit, lease, licence or authority.

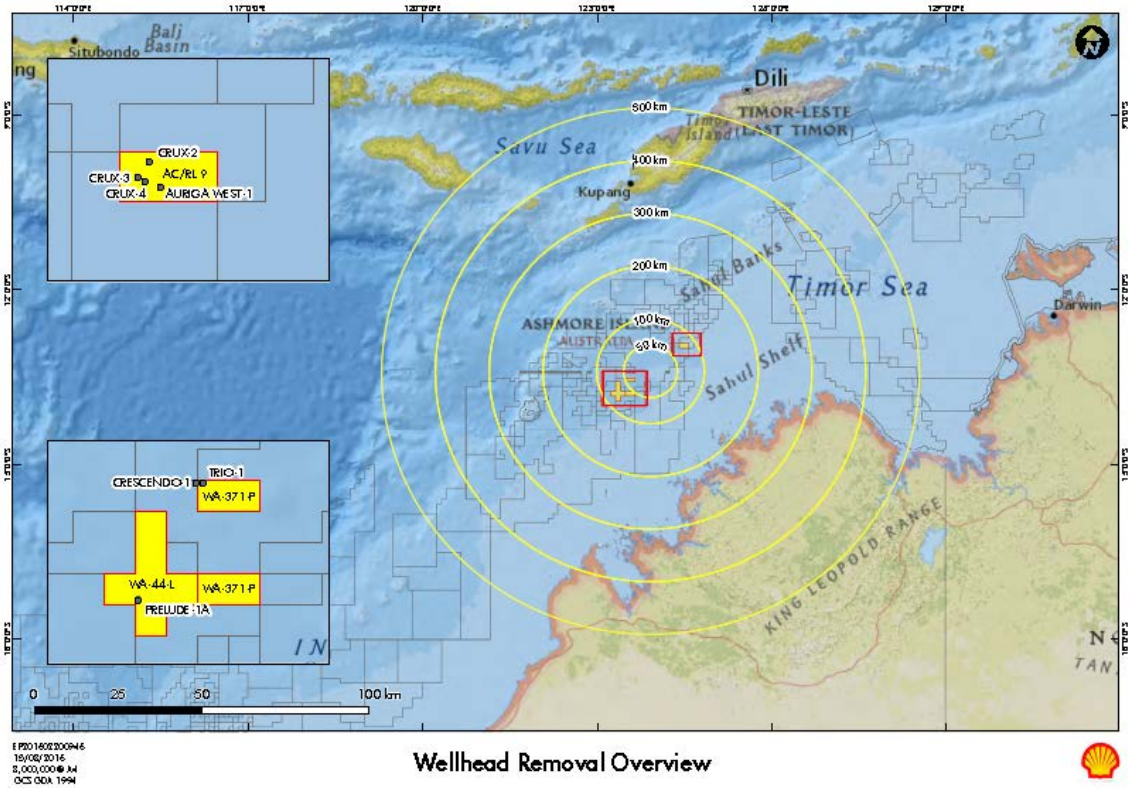


Figure 1: Location of the 7 wellheads

Environmental management for the wellhead removal activity will be undertaken in accordance with this Environment Plan (EP), which is consistent with the requirements of the *Offshore Petroleum* and *Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS (E) Regulations) as administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), and describes the following:

- The area of operations, the proposed activities and its expected time frame;

- The environmental management framework for the activity including legislation and other requirements;
- The existing natural, social and economic environments of the region, including issues or sensitivities particular to the activity;
- The impacts and risks to the environment from the activity;
- Shell's Health, Security, Safety and Environment and Social Performance (HSSE and SP) Commitment and Policy and the environmental performance objectives that derive from the Policy;
- The management standards and criteria against which environmental performance are measured;
- The Implementation Strategy, including key roles and responsibilities that are employed to achieve the program's environmental performance goals[1;] and
- A system for documenting, monitoring and reviewing the success of the Implementation Strategy to facilitate improvement of environmental performance.

2. Description of the Activity

Shell proposes to remove wellheads: Crux 2ST1, Crux 3, Crux 4 and Auriga West-1 located in AC/RL9, Crescendo-1 located in WA-371-P, Prelude-1a located in WA-44-L, and Trio-1 outside of existing Shell permit area in block 1338. All seven (7) wellheads are situated in Commonwealth marine waters ~460km north-north east of Broome (Figure 1).

Removal of the wellheads will remove the visual and structural evidence of the wells from the seabed, and eliminate presence or future hazards to the environment or other users of the area.

The wellhead removal activity is scheduled to commence in Q2-Q3 2017. Three (3) weeks is the total estimated duration for the actual wellhead removal activity across all of the specified permit areas. If there are any unforeseen delays and operational complications (e.g. equipment failure, extended non-productive time), the activity duration could take up to 3 months within the 2017 calendar year.

The coordinates and water depth for the wellheads are:

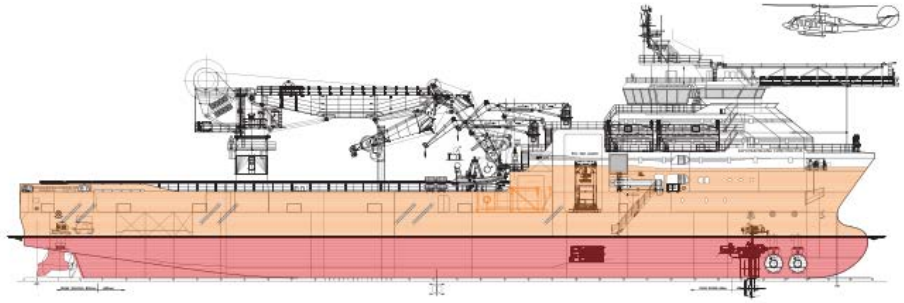
Wellhead	Approximate Latitude (GDA94)	Approximate Longitude (GDA94)	Water Depth (m LAT)	Permit Area	Year drilled	Well Type
Trio-1	13° 30' 20" S	123°29' 48" E	265.8	WA-85-AA	2007	Exploration
Crescendo-1	13° 30' 16" S	128°30' 50"E	259.7	WA-371-P	2009	Exploration
Prelude-1a	13° 49' 10" S	123°20' 31"E	237.6	WA-44-L	2006	Exploration
Crux-2 ST1	12° 55' 50 " S	124° 28'	157.7	AC/RL9	2006	Appraisal

[1] The Wellhead Removal Oil Pollution Emergency Plan (OPEP) is presented in a standalone document (HSE_GEN_010428), submitted together with this EP.

		04" E				
Crux-3	12° 57' 33" S	124° 26' 50" E	165.5	AC/RL9	2007	Appraisal
Crux-4	12° 57' 53" S	124° 27' 38" E	167.1	AC/RL9	2008	Appraisal
Auriga West-1	12° 58' 33" S	124° 29' 10" E	168	AC/RL 9	2015	Exploration

2.1. Details of Light Well Intervention Vessel

The wellhead removal activity will be conducted using a light well intervention vessel. The vessel will be equipped with remotely operated vehicles (ROVs), dynamic positioning (DP) system, moon pool, helideck and accommodation (for personnel onboard of ~120 crew). An example of a light well intervention vessel is the shown below:



Length overall : 117.35 m
Breadth moulded : 22.0 m
POB: 120 persons
Enclosed lifeboats : 4 x 60 man
DP System: Kongsberg Maritime AS, SDP21

The largest marine diesel oil (MDO) storage tank on a typical light well intervention vessel has a capacity of 190m3 and is located in the substructure.

Shell will ensure that such a vessel shall have required vessel documentation accepted by the various legislative bodies for use offshore in Australian waters.

Helicopter flights to and from the vessel will be conducted on an ad-hoc basis and in the case of emergencies.

2.2. Operational Scope

The Trio-1, Prelude-1a, Crescendo-1, Auriga West-1 wells were permanently abandoned by Shell in 2007, 2007, 2009 and 2015, respectively. The Crux 2ST1, Crux 3 and Crux 4 wells were permanently abandoned by Nexus Energy Ltd in 2006, 2007 and 2008, respectively. The wellheads are from exploration/appraisal non-producing wells with no associated subsea infrastructure. The stick-up length of the wellheads are between 2.6m to 3.9m from the seabed. All associated permanent guide bases (PGB) for each wellhead will be severed and removed. All reasonable attempts will be made to severe and remove temporary guide bases (TGB) for each wellhead (refer Figure 2). Temporary Guide Bases (TGB) will be pulled from the seabed using the light well

intervention vessel crane. However, if they are not retrievable due to being partially or fully subsided into the seabed, and/or being held in place from a combination of cuttings and cement returns during well construction, they will be left in place and NOPTA will be notified. This is because removing them using other options would increase seabed disturbance and the dimensions of the TGBs will not have any environmental impact based on physical presence or seabed disturbance. In the case where wellheads or associated guide bases cannot be retrieved despite 'best endeavours' in the campaign, they will be left in-situ on the seabed.
'Best endeavours' for this campaign means that the campaign has allowed for a certain cost, time and HSSE & SP risk exposure that is required to remove the structures, and will not exceed the cost, time and risk exposure allowed for when structures cannot be removed through multiple attempts.
'Best endeavours' for wellheads where there have been no previous attempts to recover the wellhead, would be two attempts at cutting. For Trio and Crescendo, where there have been previous attempts made already (using a rig) unless there is clear evidence of equipment failure resulting in an incomplete cut, only a single attempt will be made using the AXE tool.
One 'attempt' to remove wellheads and associated structures from the seabed in this campaign means using the vessel crane once to pull up a wellhead or guide base after it had been cut. Another 'attempt' to remove wellheads and associated structures would be running the cutting tools again (if required) and trying again to pull the structure up with the vessel crane. The space out of the cut will be adjusted upwards by 0.5m between each attempt to avoid running the AXE tool back past a potential snag point and also to reduce the length of annular cement column holding the wellhead in place.

The light well intervention vessel will deploy an ROV supported wellhead retrieval package to cut and recover the wellheads for onshore disposal. The cut to remove the wellheads will be below the seabed (nominally 0.5-1.5m below the seabed) which is determined by a combination of the following criteria in a base plan:
1. Must be below the seabed to eliminate future hazards to the environment or other users of the area.
2. To allow for space out accuracy of the cutting tool.
3. To minimise the risk of not being able to pull the cut wellhead free of the seabed.
4. To account for previous cut attempts on Trio-1 and Crescendo-1.
The deeper the cut, the increased risk that the wellhead cannot be removed.

The wellheads will be cut from the inside. There is no plan for dredging around the wellhead to minimise seabed disturbance. A parking frame with a footprint of ~5x5m will be temporarily located on the seabed to enable parking of the cut wellhead in order to install lifting gear for retrieving the wellhead to surface. No dredging is required for installation of the parking frame.
The wellheads will be cut with an abrasive cutter utilising high pressure water and abrasive sorted grit particles. The abrasive grit is discharged at the cut point below seabed so is expected to either fall down on top of the shallowest abandonment plug (~40m below seabed) inside the well, or below seabed level after passing through the conductor pipe.

This method of wellhead removal has been used in offshore Australian since 2003 and is designed for the removal of multi-casing wellheads, piles and platform conductors without the need for a rig or explosives.

Each wellhead is expected to take a minimum of 2 days to remove.

Once onshore, the wellheads will be managed and disposed of by a licensed waste facility.

No refueling at sea will occur during the petroleum activity.

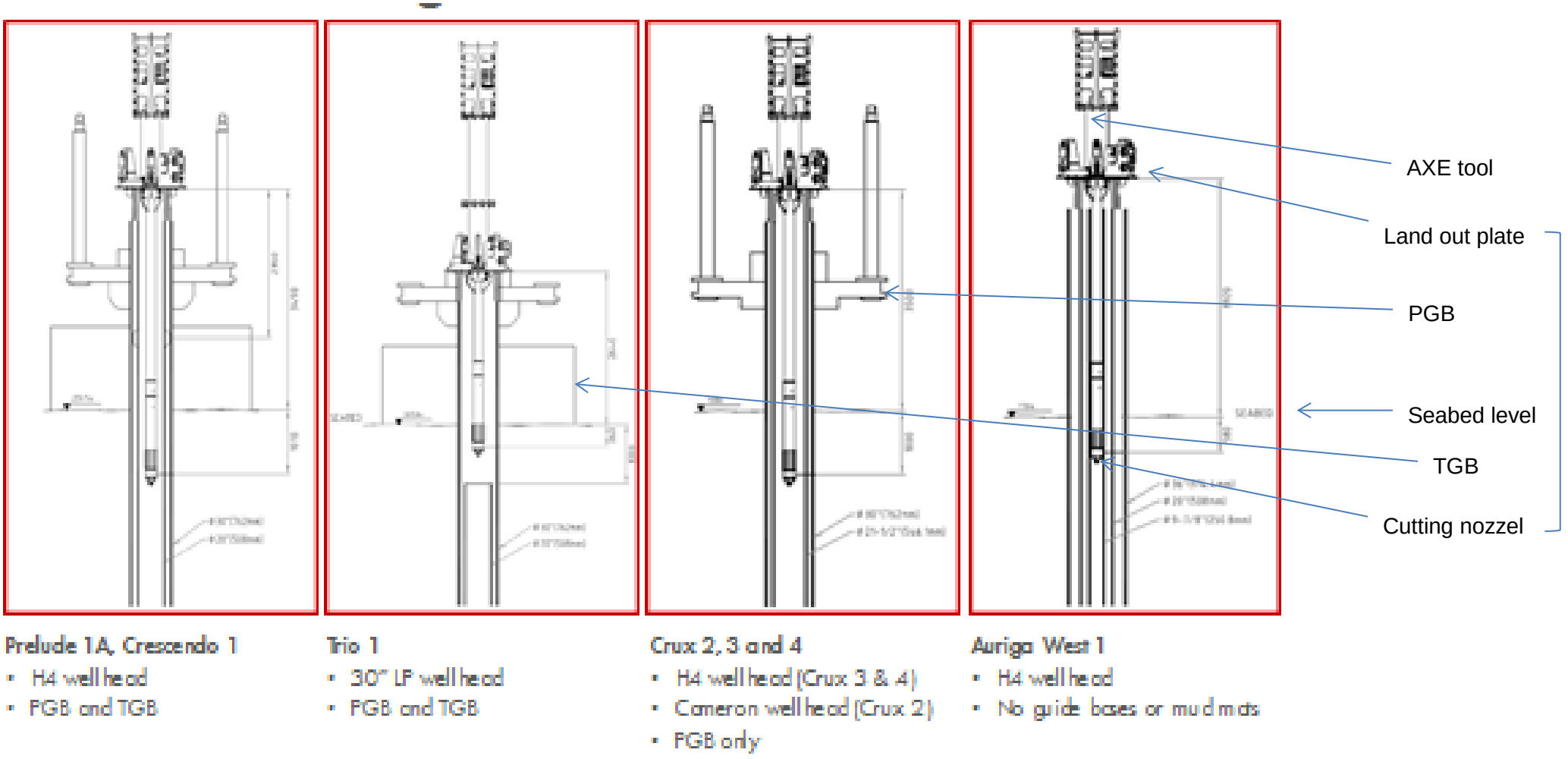


Figure 2: Wellhead Configuration: showing key components and the seabed

3. Description of the Receiving Environment

3.1. Physical Environment

The activity is located in Commonwealth waters within the Timor Province. The Timor Province is part of the wider North West Marine Region (NWMR), as defined under the Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0).

3.1.1. Sea Bathymetry, Seabed Features and associated habitats

The Crescendo-1, Trio-1 and Prelude-1a wellheads are located in or near waters on the continental slope between 200m and 300m depth. Prelude EIS survey reports and review of ROV footage from the Trio/Crescendo locality show there are no significant topographical features in the region (Shell, 2009 and 2007 ROV footage).. The Trio-1 and Crescendo-1 wellheads are considered to be part of the Prelude location. ROV footage around the two wellheads showed the seabed shared the same characteristics as those that are around Prelude-1A. No reefs or extensive areas of rocky substrate have been observed. A number of small (up to 6m diameter) anomalies have been detected. However, none of which occur within the vicinity of the wellheads and they will not be affected by the activity. Sediments within the vicinity of the wellhead locations are described as very soft siliceous carbonate silts to a depth of about 10m below the seabed where siliceous carbonate sands are found.

The Auriga-1, Crux 2ST1, Crux 3 and Crux 4 wellheads are on the Sahul Shelf in the Australian waters of the Territory of Ashmore and Cartier Islands Adjacent Area in permit AC/RL9. Water depths in the field range from 110 m to 170 m. The most sensitive seabed features in the broader Browse Basin are the coral reefs and islands that occur in the region.

Browse Island, is located some 40km south-southeast of Prelude-1a wellhead. Browse Island is a sand and limestone cay situated on a limestone and coral reef and covers an area of ~13 ha. The reef complex is an outer-shelf, biohermic structure rising from a depth of ~200 m. It is a flat topped, oval shaped platform reef with a diameter of 2.2 km at its widest point (INPEX, 2010). The remnants of historical phosphate mining on the island have left a significantly disturbed surface. The width of the shallow subtidal zone (<20 m depth) ranges from 50 to 200 m wide and is comprised mainly of bare limestone, with the most diverse coral communities (including *Hydnophora rigida, Acropora* and to a lesser extent *Porites)* recorded in raised coral reefs in shallower areas around the island. The benthic habitats are characteristic of coral platform reefs throughout the Indo-West Pacific region and are limited in their extent in the subtidal region.

Heywood Shoals are 50km east-northeast of Crescendo-1 and Trio-1. Heyward shoals rise out of approximately 150 m depth and peak at 10 to 15 m below mean sea level. The shoals are approximately 32 km^2 in area and of an oval shape (Burns et al., 2012).

Vulcan Shoals and Eugene McDermott Shoals are 25km northwest and 15km south-southeast of the wellheads in AC/RL9, respectively. Both Vulcan Shoals and Eugene McDermott Shoals were surveyed as part of the Montara spill monitoring program. They rise steeply from 100-200 m depths on the outer continental shelf and begin to flatten out into a plateau at around 40-50 m depth. (Heyward *et al*, 2010)

Due to the distance of the wellheads from these seabed features, none are affected by any planned impacts associated with the wellhead removal activity, but could be affected by unplanned impacts as discussed in Section 5.

3.2. Ecological Environment

3.2.1. Benthic and Pelagic Communities

In the general region of the wellheads, there is little evidence of hard substrates and extensive epibenthic communities. Thus, with little sea floor topography, such areas offered minimal habitat diversity or niches to occupy. Specifically, the absence of hard substrate is considered a limiting factor for the recruitment of epibenthic organisms (Heyward & Smith 1996).

3.2.2. Protected Marine Fauna and Habitats

The Environment Protection Biodiversity Conservation (EPBC) Protected Matters Report identified threatened and migratory species that may occur within the vicinity 1km radius) of the wellhead locations. Table 1 lists a total of 18 listed threatened species and 28 listed migratory species (which includes threatened species), and their associated Biologically Important Areas (BIAs) (based on the National Conservation Value Atlas) that may potentially occur within the vicinity of the wellhead locations. There are no breeding or nesting areas for any of the listed species known in the area. One key ecological feature was identified from the report and this is the Continental Slope Demersal Fish Communities (Section 3.3). No critical habitats or threatened ecological communities have been identified as existing within the activity area, as documented in the EPBC Act Protected Matters Report.

Table 1: EPBC listed threatened and/or migratory species identified from the EPBC Act Protected Matters Search Tool as potentially occurring within vicinity of wellhead locations

Scientific Name	Common Name	Threatened	Migratory	BIAs vicinity of wellheads	BIAs Regional (~100km radius)
Birds					
Anous tenuirostris melanops	Australian lesser noddy	Vulnerable		none	none
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	☑	none	none
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	Critically Endangered	☑	none	none
Anous stolidus	Common Noddy		☑	none	none
Calonectris leucomelas, Puffinus leucomelas	Streaked Shearwater		☑	none	none
Fregata minor	Great Frigatebird, Greater Frigatebird		☑	none	Breeding Foraging
Fregata ariel	Lesser Frigatebird, Least Frigatebird		☑	none	Breeding Foraging
Cetaceans					
Balaenoptera borealis	Sei Whale	Vulnerable	☑	none	none
Balaenoptera musculus	Blue whale	Endangered	☑	none	Distribution Migration
Balaenoptera	Fin Whale	Vulnerable	☑	none	none

Scientific Name	Common Name	Threatened	Migratory	BIAs vicinity of wellheads	BIAs Regional (~100km radius)
physalus					
Megaptera novaeangliae	Humpback whale	Vulnerable	☑	none	none
Balaenoptera bonaerensis	Antarctic minke whale		☑	none	none
Balaenoptera edeni	Bryde's whale		☑	none	none
Orcinus orca	Killer whale		☑	none	none
Physeter macrocephalus	Sperm whale		☑	none	none
Reptiles					
Caretta caretta	Loggerhead turtle	Endangered	☑	none	Known Foraging
Dermochelys coriacea	Leatherback turtle	Endangered	☑	none	none
Lepidochelys olivacea	Olive ridley turtle	Endangered	☑	none	none
Chelonia mydas	Green turtle	Vulnerable	☑	none	Internesting Nesting
Eretmochelys imbricate	Hawksbill turtle	Vulnerable	☑	none	Internesting Foraging
Natator depressus	Flatback turtle	Vulnerable	☑	none	none
Fish and Sharks					
Rhincodon typus	Whale shark	Vulnerable	☑	Foraging	Foraging
Glyphis garricki	Northern River Shark	Endangered		none	none
Carcharodon carcharias	Great White Shark	Vulnerable	☑	none	none
Pristis pristis	Largetooth Sawfish	Vulnerable	☑	none	none
Pristis zijsron	Green Sawfish	Vulnerable	☑	none	none
Isurus oxyrinchus	Shortfin mako		☑	none	none
Isurus paucus	Longfin mako		☑	none	none
Manta birostris	Giant Manta Ray		☑	none	none
Manta alfredi	Reef Manta Ray		☑	none	none

Birds

The Australian lesser noddy is thought to be sedentary, mainly staying near to its breeding islands in the non-breeding season, though it probably forages widely for its diet of small fish taken by surface-seizing (Higgins and Davies, cited in DOE, 2014). The main breeding islands are the Houtman Abrolhos Islands, with the total population estimated at 48,885 to 79,550 pairs. The breeding season is varied, though usually extends from mid-August to early April (Higgins and Davies, Garnett and Crowley, cited in DOE, 2014). Fledged young first go to sea between late January and early April (Storr *et al.*, cited in DOE, 2014). However, in the latest survey on Ashmore Reef by Clarke (2010), it was found that nesting of the Australian Lesser Noddy occurred between April and May. It is unlikely that large numbers of these birds will be present at the activity location.

The curlew sandpiper is widespread around the coast of Australia and further inland, although in smaller numbers. Curlew sandpipers mainly occur on intertidal mudflats in sheltered bays and estuaries, inlets, lagoons, swamps, lakes, ponds, salt works, sewage farms, dams, waterholes and bore drains (DoE, 2014).

The eastern curlew has a primarily coastal distribution and found in all states and territories of Australia. Eastern curlews are continuous in their distribution across the Top End of Australia and are patchily distributed elsewhere. This species is rarely recorded inland (DoE, 2014).

The streaked shearwater is listed as migratory under the EPBC Act, and is classified as Least Concern on the World Conservation Union's Red List of Threatened Species (IUCN, 2014). The streaked shearwater is listed in the CAMBA as *Puffinus leucomelas*, and the JAMBA as *Calonectris leucomelas*. The streaked shearwater is a broadly distributed pelagic species which is known to breed along the coast and on offshore islands of north-east Asia and migrates south during winter to Australia (Birdlife International, 2013). The streaked shearwater is regularly recorded in northern Australia from October to March, despite the species not breeding in Australia (Marchant and Higgins, 1990). The streaked shearwater mostly occurs over pelagic waters; in Northern Australia, it is usually found in offshore waters more than 18 km from the mainland, while in the Gulf of Carpenteria, it mostly occurs in waters more than 100km from the mainland (Blaber and Milton, 1994; Marchant and Higgins, 1990). Large numbers are unlikely near to the activity location.

The lesser frigatebird and great frigatebird are listed as migratory and marine under the EPBC Act. They are known to forage in the NWMBR and breed in areas adjacent to the region. The great frigatebird's known regional breeding grounds are Adele Island (200 -300 pairs) and Ashmore Reef (small numbers). Breeding mostly occurs between March and November. The species is pelagic, although breeding birds probably forage within 100 - 200km of the colony during the early stages of the breeding season (Nelson, 2005). Hence, large numbers are unlikely to be found near to the activity.

The lesser frigatebird is known to breed on Ashmore Reef and Adele, Bedout, West Lacapede and Cartier Islands (Marchant and Higgins, 1990; Mustoe and Edmunds, 2008). It breeds from March through to September and may also be present during the non-breeding season. Whilst Pelagic, the lesser frigatebird generally forages close to breeding colonies (Jaquemet *et al.*, 2005). Hence, large numbers are unlikely to be found near the activity.

Potentially occurring within the ZPI of a worst-case spill scenario is also the migratory osprey (*Pandion haliaetus*), White-tailed Tropicbird (*Phaethon lepturus*), and Red-footed Booby (*Sula sula*)

Cetaceans

There are no known critical habitats (including breeding, calving or feeding grounds for any listed threatened or migratory cetacean species within or in the immediate vicinity of activity location. Several whale species occur in and/or migrate through the NWMB. The endangered pygmy blue whale and the vulnerable humpback whale (discussed below) are two whale species that have seasonal migration routes within the NWMB as they travel between northern breeding grounds and southern feeding grounds. Other cetacean species (as listed) are likely to occur at low densities and may traverse the permit area infrequently throughout the year.

The humpback whale is listed as vulnerable under the EPBC Act and is classified as Least Concern on the World Conservation Union's Red List of Threatened Species (International Union for Conservation of Nature and Natural Resources [IUCN], 2014).

As presented in Jenner *et al.* (2001), humpback whales migrate seasonally through the waters of northwest Australia, from Antarctic summer feeding grounds to winter calving grounds off the Kimberley coast. The northward migration is generally offshore (rather than nearshore) and the predominant migration route is understood to pass to the west of the Lacepede Islands and remain offshore until the whales reach Camden Sound which is ~200km from the activity location.

The blue whale is listed as Endangered under the EPBC Act, and is also classified as Endangered on the World Conservation Union's Red List of Threatened Species (IUCN, 2014). They have an extensive oceanic distribution and have been recorded from all Australian states. Australian migration paths are widespread and have not been observed to follow coastlines or oceanographic features (Bannister *et al.*, 1996).

Branch *et al.* (2007) indicated that the Western Australian continental slope, from the Perth Canyon, is a likely migratory path between feeding areas in the south and an undetermined northern calving area. A total of seven pygmy blue whales where observed during a 2008 cetacean study (Jenner *et al.*, 2009) comprising 80 days of observation. One pygmy blue whale was sighted migrating north in an area east of Browse Island during June, while six pygmy blue whales were sighted at Scott Reef, migrating south in October/ November. Figure 3 shows that the likely migratory path for pygmy blue whales is within ~100km of the activity area.

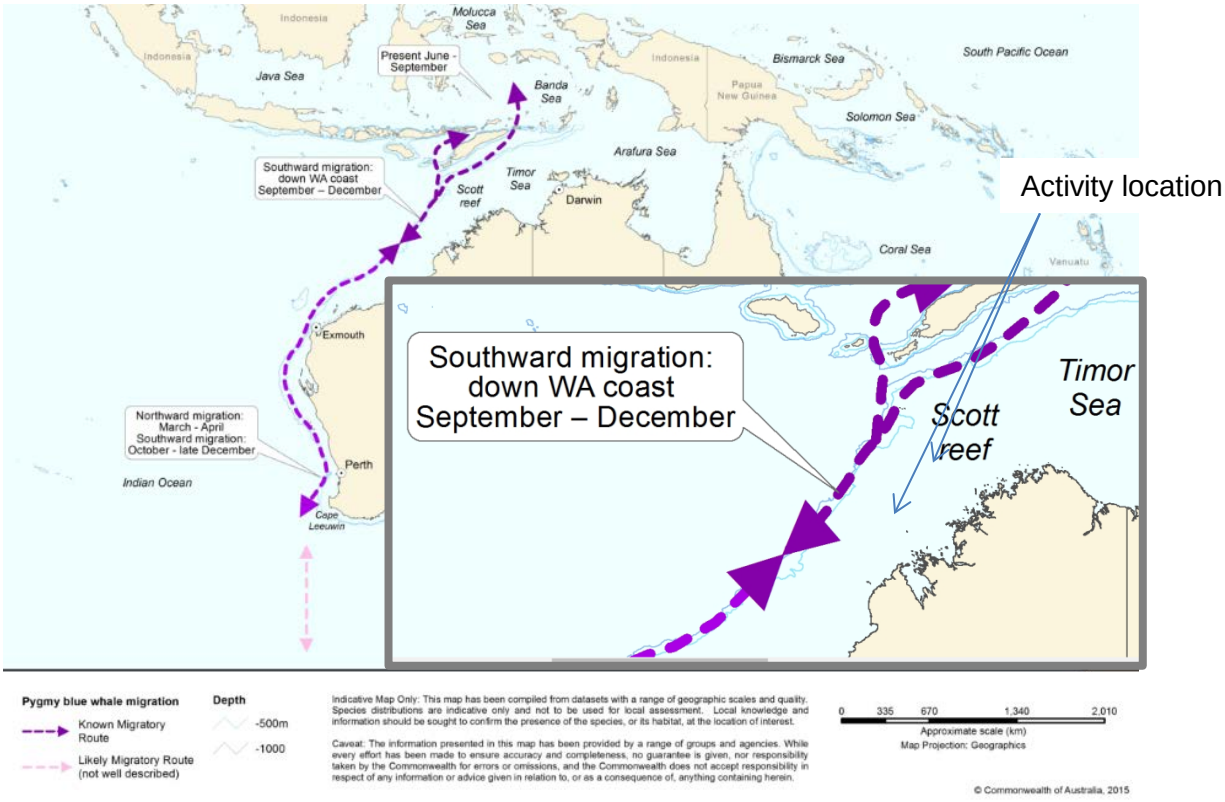


Figure 3: Migratory path of pygmy blue whales (CoA, 2015)

Potentially occurring within the ZPI of a worst-case spill scenario is also the migratory dugong (*Dugong dugon*) and migratory Spotted Bottlenose Dolphin (Tursiops aduncus), and Irrawaddy Dolphin (*Orcaella brevirostris*).

Reptiles

The EPBC Act Protected Matters Report lists up to six species of marine turtle species which may occur in the activity area. All of these turtles are listed as Threatened species under the EPBC Act.

Flatback turtle nesting is only known to occur in Australia, with six major aggregations recognised, including the Kimberley region. Nesting sites are widely distributed along the mainland coast and among off shore islands. The closest sites to the activity area are Lacrosse Island, Cape Thouin, Cape Dommett, Barrow Island, all of which are located hundreds of kilometers away.

Green turtles are found in tropical and subtropical waters throughout the world (Bowen *et al.*, 1992) and are the most common species of turtle observed in Western Australia. The nearest known green turtle breeding, nesting, or feeding grounds are located on Ashmore Reef and Cartier Islands and Browse Island, these are regionally important turtle nesting sites for green turtles. Other breeding sites include Scott Reef. Smaller breeding populations are also supported on the beaches of North and South Maret islands.

The Leatherback turtle has the widest distribution of any marine turtle, (Cogger *et al.*, 1993), and can be found in tropical, subtropical and temperate waters throughout the world (Marquez, 1990). No major nesting has been recorded in Australia, although scattered isolated nesting (1-3 nests per annum) occurs in southern Queensland, where nesting is thought to occur in summer between December and January (Limpus and McLachlan, 1994). Hence, it is unlikely that large numbers of this species would be encountered during the activity.

Hawksbill turtles are found in tropical, subtropical and temperate waters in all the oceans of the world. Hawksbill turtles are known to inhabit the open ocean, particularly during their earlier years (DOE, 2014). Nesting is mainly confined to tropical beaches (Marquez, 1990), and in Western Australia, occurs year round with a peak between October and January (Robinson, cited in Limpus, 1995). The known major Australian breeding/nesting grounds to are located on the Ningaloo Coast, Dampier Archipelago, Thevenard, Barrow, Montebello and Lowendal Islands, all of which are located hundreds of kilometres away from the activity (DOE, 2013). Hence, it is not expected that large numbers of this species would be encountered during the activity.

No concentrated nesting of Olive ridley turtles has been found in Australia. In Australia, detailed information on the size of nesting and foraging populations is unknown although the nesting population is expected to be in the order of a few thousand females annually (Limpus, cited in DOE, 2014). Olive ridley turtles have been recorded nesting in WA twice, both in the Kimberley region (RPS, cited in Woodside Energy Limited [WEL], 2011). Most nesting is known to occur in Arnhem Land (DOE, 2014). Hence, it is not expected that large numbers of this species would be encountered during the activity.

The loggerhead turtle has a global distribution throughout tropical, sub-tropical and temperate waters. Nesting is mainly concentrated on subtropical beaches (Marquez, 1990). Mating occurs from October to early December. From late October to March, females crawl up their beach each night to dig nests and lay clutches of about 120 leathery-shelled eggs and hatchlings begin emerging from January to May at night (DEC, 2009b). Closest known breeding/ nesting grounds to the activity location are Ashmore Reef, the Murion Islands, Dirk Hartog Island, beaches of the North West Cape, Barrow Island, Lowendal Islands and Dampier Archipelago (Prince, 1993; 1994).

Ashmore Reef is the closest loggerhead turtle breeding/ nesting ground from the activity location.

Potentially occurring within the ZPI of a worst-case spill scenario is also the critically endangered short-nosed seasnake (*Aipysurus apraefrontalis*), migratory Salt-water Crocodile *(Crocodylus porosus).*

Fish and Sharks

Relatively limited information is available on population trends of whale sharks. They have a broad distribution usually between latitudes 30°N and 35°S in tropical and warm temperate seas, both oceanic and coastal (DEH, 2005). Studies using satellite telemetry have indicated that whale sharks swim an average of 24km/day and have a minimum range of 200km (Eckert *et al.* 2001, Eckert *et al.* 2002). Whale sharks are generally encountered singly, but occasionally occur in large aggregations. In Australia, whale sharks are known to aggregate seasonally in coastal waters off Ningaloo Reef between March and July, to a lesser extent at Christmas Island between December and January and in the Coral Sea between November and December (Wilson *et al.*, 2001). These aggregations are thought to be associated with feeding in the seasonally productive waters. There are no known mating areas in Australian waters.

Information on the distribution and migration patterns of whale sharks in Australia is based primarily on seasonal surveys at Ningaloo Marine Park, with very limited records collected elsewhere. Preliminary research on the migration patterns of whale sharks in the western Indian Ocean, and isolated and infrequent observations of individuals indicate that a small number of the Western Australian population migrate through the Browse region (Jenner *et al.*; Meekan and Adford; Mckinnon *et al.*; Wilson *et al.*, cited in WEL, 2011). There are no oceanographic features in the vicinity of the activity location which are likely to encourage feeding aggregations.

The shortfin mako shark is a wide-ranging oceanic and pelagic shark preferring waters above 16°C (DOE, 2014). The longfin mako shark is also widely distributed but rarely encountered oceanic tropical shark, found in Australian waters between Geraldton in Western Australia and Port Stephens in New South Wales (DOE, 2014). It is thought that these sharks have undergone considerable decline globally primarily due to their continued interaction with fisheries, low reproductive capability and longevity. Given that both of these species are wide-ranging in deep offshore waters, these sharks may potentially travel through the activity location and the ZPI for a worst-case spill incident. However, the activity area or the ZPI for a worst-case spill do not contain any recognised feeding, breeding or aggregation areas and therefore is unlikely to support significant numbers of these sharks.

3.3. Key Ecological Features

A number of key ecological features (KEF) have been identified near the activity area and may fall within the zone of potential impact (ZPI) for a worst case spill from a hyrdocarbon release from the vessel collision scenario. KEFs are elements of the Commonwealth marine environment that are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity (Commonwealth of Australia [CoA], 2011).

The nearest distances of KEF's from the wellhead removal activity are as follows –
From Trio-1 and Crescendo-1:

- Continental Slope Demersal Fish Communities: ~ 0km

- Ashmore Reef and Cartier Island: ~ 100km

From Prelude-1a:
- Ancient coastline: ~40km
- Seringapatam Reef: ~140km

From Crux 2ST1, Crux 3, Crux 4 and Auriga West-1:
- Ancient coastline: ~30km
- Carbonate Bank and terrace system of the Sahul Shelf: ~55km
- Continental Slope Demersal Fish Communities: ~80km
- Ashmore Reef and Cartier Island: ~ 105km

A summary of the KEFs within the vicinity of the ZPI is listed in Table 2 below.

Table 2: Key Ecological Features within the ZPI

KEF	Summary of KEF's Regional Importance
Continental slope demersal fish communities	The diversity of demersal fish assemblages on the Australian continental slope from North West Cape to the edge of the region is high. Specifically, the continental slope between North West Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in the whole of Australia. The Timor Province and Northwest Transition bioregions are the second-richest areas for demersal fish across the entire continental slope.
Ancient coastline at 125 m depth contour	• Parts of the ancient coastline, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments. • The topographic complexity of these escarpments may also facilitate vertical mixing of the water column providing a relatively nutrient-rich environment for species present on the escarpment.
Ashmore Reef and Cartier Islands and surrounding Commonwealth waters	• Ashmore Reef is the largest of only three emergent oceanic reefs present within the north-eastern Indian Ocean and is the only oceanic reef in the region with vegetated islands. Emergent reefs are areas of enhanced primary productivity in an otherwise oligotrophic environment. • Ashmore Reef and Cartier Islands and the surrounding Commonwealth waters are regionally important for feeding and breeding aggregations of seabirds and shorebirds, and other marine life. • Ashmore Reef supports the highest number of coral species of any reef off the Western Australian coast. • The marine habitats among the reefs are nationally and internationally significant supporting diverse and abundant marine reptile and mammal populations, including dugong.
Seringapatam Reef and Commonwealth waters in the Scott Reef complex	Seringapatam Reef and Commonwealth waters in the Scott Reef complex are regionally important as they support diverse aggregations of marine life, have high primary productivity relative to other parts of the region, are relatively pristine and have high species richness.
Carbonate Bank and Terrace System of the Sahul Shelf	The carbonate banks and terrace system of the Sahul Shelf are regionally important because of their role in enhancing biodiversity and local productivity relative to their surrounds. Little is known about the banks, terraces and associated channels but they are believed to be areas of enhanced productivity and biodiversity due to the upwellings of cold nutrient-rich water at the heads of the channels.

3.4. Marine Reserves

A search of the EPBC Protected Matters Database identified that the location of the wellheads do not overlap with any marine reserves. As a result, the planned activity will not impact the values and sensitivities of Commonwealth Marine Reserves. In the worst-case spill scenario of a vessel collision, some Commonwealth Marine Reserves (Table 3) may lie within the vicinity of the ZPI. Western Australia Conservation Reserves (i.e. Browse Island Nature Reserve and Scott Reef Nature Reserve) may also lie within the vicinity of the ZPI.

Table 3: Commonwealth Marine Reserves within the ZPI

Commonwealth Marine Reserves	IUCN Cateory	Values & Sensitivities
Ashmore Reef Commonwealth Marine Reserve	IUCN Category Ia - Sanctuary Zone IUCN Category II - Recreational Use Zone	Ecosystems, habitats and communities associated with: the North West Shelf, Timor Province, emergent oceanic reefs. The island and reef is an important area for the following protected species: abundance and diversity of sea snakes (even though anecdotal reports suggest the abundance has crashed within the last decade), critical nesting and internesting habitat for green turtles, supporting one of three genetically distinct breeding populations in the North-west Marine Region. Low level nesting activity by loggerhead turtles has also been recorded. Large and significant feeding populations of green, hawksbill and loggerhead turtles occur around the reefs. It supports a small dugong population and support seabird rookeries on the North West Shelf, important staging points/feeding areas for many migratory seabirds. Cultural and heritage sites: Indonesian artefacts, Grave sites
Cartier Island Commonwealth Marine Reserve	IUCN Category Ia - Sanctuary zone	Ecosystems, habitats and communities associated with: the North West Shelf, Timor Province, emergent oceanic reefs. The island and reef is an important area for the following protected species: abundance and diversity of sea snakes (even though anecdotal reports suggest the abundance has crashed within the last decade), large and significant feeding populations of green, hawksbill and loggerhead turtles occur around the reefs. Support seabird rookeries on the North

Commonwealth Marine Reserves	IUCN Cateory	Values & Sensitivities
		West Shelf, important staging points/feeding areas for many migratory seabirds. Cultural and heritage sites: Ann Millicent historic shipwreck.
Kimberley Commonwealth Marine Reserve	IUCN Category VI – Multiple Use Zone * Although the Kimberley Commonwealth Marine Reserve also consists of IUCN Category IV – Habitat Protection Zone and IUCN Category II – Marine National Park Zone, these areas are not within the ZPI of the activity.	Important foraging areas for migratory seabirds, migratory dugongs, dolphins and threatened and migratory marine turtles Important migration pathway and nursery areas for the protected humpback whale Adjacent to important foraging and pupping areas for sawfish and important nesting sites for green turtles. The reserve provides protection for the communities and habitats of waters offshore of the Kimberley coastline. Two key ecological features are included in the reserve: ancient coastline and continental slope demersal fish communities.

Based on the spill model (Section 5.6.1), the marine reserves are unlikely to be impacted. Spill response strategies on the islands within the Commonwealth Marine Reserves is possible with emulsified marine diesel oil spill. The environmental impact of oil spill response activities on the Commonwealth Marine Reserves will be evaluated based on the ecological values and IUCN reserve management principles as part of managing environmental risks to ALARP and acceptable levels (Section 5.7).

3.5. Socio-Economic Environment

3.5.1. World Heritage Sites

There are no World Heritage Sites within the vicinity of the wellhead locations or within the ZPI of the worst-case vessel collision scenario. The nearest World Heritage Site is the Ningaloo Coast (~1,300km to the south-west).

3.5.2. National Heritage Sites

There are no National Heritage Sites within the vicinity of the wellhead locations or within the ZPI of the worst-case vessel collision scenario. The nearest National Heritage Site is the West Kimberley (~110km south-east of the activity location).

3.5.3. Cultural Heritage

Indonesian Fishermen

In 1974, Australia recognised access rights for traditional Indonesian fishers in shared waters to the north of Australia, granting long-term fishing rights in recognition of the long history of traditional Indonesian fishing in the area (Environment Australia, 2002). The Memorandum of Understanding (MoU) between the Governments of Australia and

Indonesia enables Indonesian traditional fishers to continue their customary practices and to harvest species such as trepan, trochus, clams, finfish, abalone, shark (for dried fins) and sponges in Australian waters (Environment Australia, 2002).

The MOU covers Scott Reefs, Seringapatam Reef, Browse Island, Ashmore Reef, Cartier Islands and various banks, which are included in the worst-case spill zone of potential impact. It represents an area of approximately 50,000km^2 within the Australian Fishing Zone (AFZ) (Environment Australia, 2002), an area extending roughly 200 Nm from the mainland. This area is known as the 'MoU Box' and the wellheads lie within this area (Figure 4).

Studies carried out by Woodside in partnership with the Australian National University tracked the fishers and their fishing patterns at Scott Reef over 2007 and 2008. The study found that most traditional sailing vessels come and go from the north of Scott reef. The majority of Indonesian fishers travel to Scott Reef from the islands of Rote (near West Timor) and Tonduk and Rass (in East Java) during July to October. Target marine resources fished were shallow water lagoon trepan and trochus shells, and some finfish taken primarily for consumption. Estimates of the monetary value of the resources gathered were as much as 50% of the fishers' total annual income and hence the fishing trips to Scott Reef are a major source of income (Woodside Energy Limited, 2012).

Traditional Indonesian fishermen are likely to be found in deepwater areas only during transit to and from the reef locations. Both the proposed activity period and location are outside of the area which Indonesian fishermen are likely to be in transit, so the wellhead removal activity is unlikely to affect traditional Indonesian fishermen. However, traditional Indonesian fishing grounds may be within the ZPI of a worst-case vessel collision spill scenario.

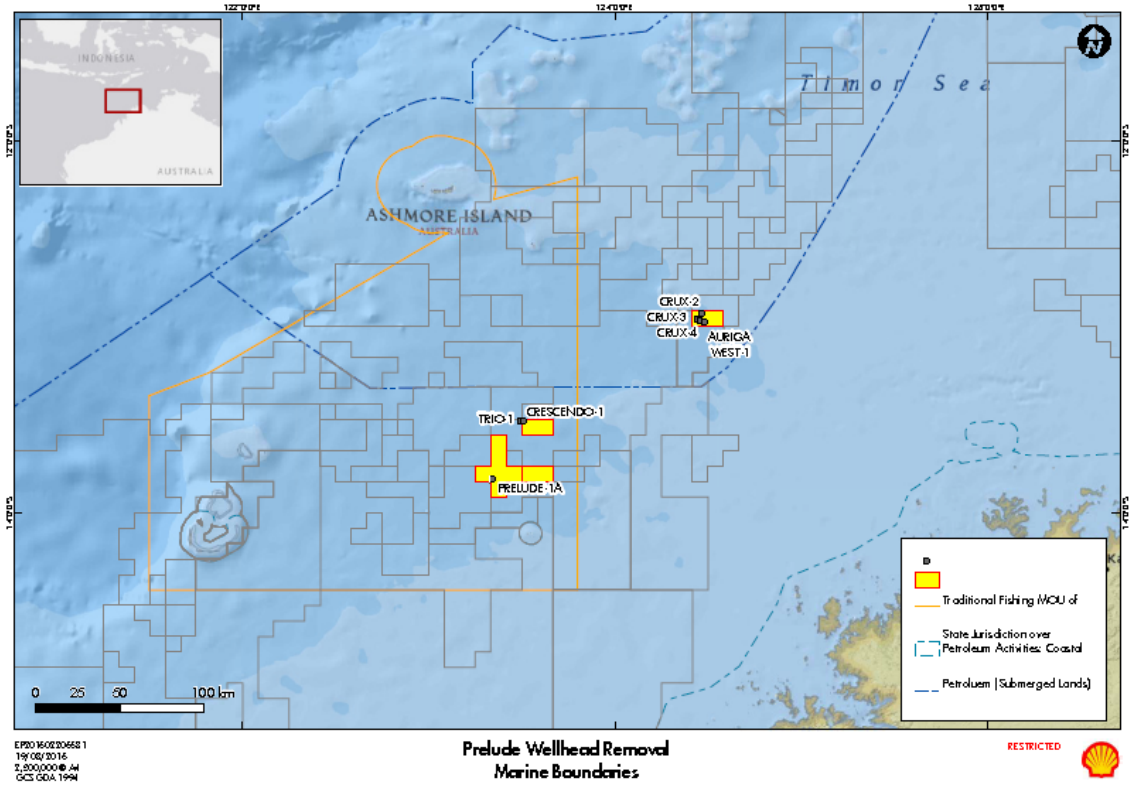


Figure 4: Boundary of Australian-Indonesian MoU Box

Australian Aboriginal Heritage

A review of the Department of Indigenous Affairs (DIA) Heritage register identified no known sites of Aboriginal cultural significance within the vicinity of the wellhead locations (Department of Indigenous Affairs [DIA], 2016). Given that the location of the wellheads is more than 200km from the mainland, it is highly unlikely that the area is used for hunting or fishing by Australian Aboriginal people. Therefore, it is not expected that the activity will have an impact on any of Aboriginal cultural heritage sites.

Shipwrecks and European Heritage

Australia protects its shipwrecks and associated relics older than 75 years through the *Historic Shipwrecks Act 1976,* which applies to Australian waters that extend from the low tide mark to the end of the continental shelf and is administered by the Commonwealth in collaboration with the States, Northern Territory and Norfolk Island (DOE, 2014i). Information on historic shipwrecks is maintained in the National Shipwrecks database, a searchable database of Australian shipwrecks containing shipwreck records provided by the Australian State and Territory governments. A search of the database revealed no known shipwrecks within the vicinity of the activity location.

3.5.4. Commercial Fishing

The activity area and ZPI of the worst case spill scenario overlaps with a variety of commercial fishing management areas. Commercial fisheries include tuna and tropical finfish, particularly emperor, snapper and cod. Within the northwest region there are also significant commercial fisheries for Spanish mackerel, barramundi, threadfin salmon and shark.

Western Australia State Managed Commercial fisheries permitted to operate within the vicinity of the wellhead locations and ZPI of the worst case spill scenario are:

- Marine Aquarium Fish Managed Fishery
- Instrument of Exemption - Beche de mer
- Mackerel Fishery
- Abalone Managed Fishery
- Specimen Shell Managed Fishery
- West Coast Deep Sea Crustacean Fishery
- Kimberley Prawn Managed Fishery
- Northern Demersal Scalefish Fishery
- Northern Shark Fishery IOE
- Northern Shark Fishery
- Broome Prawn Managed Fishery
- Pearl Oyster Managed Fishery

Commonwealth managed commercial fisheries within the vicinity of the activity area and the ZPI of the worst case spill scenario include:

- North-west Slope Trawl Fishery
- Southern Bluefin Tuna Fishery
- Southern Tuna and Billfish Fishery
- Western Skipjack Fishery
- Western Tuna and Billfish Fishery

Commercial fishing is concentrated mostly in coastal waters and minimum fishing occurs within the vicinity of the wellheads.

3.5.5. Tourism and Recreational Fishing

Whilst charter fishing companies frequent the broader region, there are no known tourist attractions or destinations within the vicinity of the wellhead locations. The activity area is too far from shore to be accessed by recreational fishermen. Even at relatively high speeds (e.g. 30km/hour), it would take at least fifteen hours for a recreational boat to reach the activity area from the nearest Port of Broome.

3.5.6. Petroleum Activities

Oil exploration activities in the Timor Sea commenced in the late 1960s. Since this time numerous wells have been drilled throughout the region. Specifically, petroleum exploration has been active in the Browse Basin since the 1980s, with several commercial discoveries since that time. The Montara field is ~30km from AC/RL 9. The Ichthys gas field in Exploration Permit Area WA-285-P is ~20km to the south of the Prelude-1a wellhead, and the 7 Prelude wells to hook up to Prelude FLNG facility ~1.8km from the Prelude-1a wellhead, but both are yet to go into production.

3.5.7. Shipping

None of the major commercial shipping routes through the Timor Sea passes through the vicinity of the wellhead locations. The nearest major shipping lane to the west of the project area is over 200km away. The nearest shipping lane to the north of the project area is approximately 100km. Given the distances between the proposed activity area and shipping lanes, the wellhead removal activities pose a minimal navigational risk to commercial shipping.

4. Environment Management Framework

4.1. Shell Framework

The Shell Commitment and Policy on Health, Safety, Security, Environment and Social Performance (HSSE & SP) applies across Shell globally and is designed to protect people and the environment. The Shell HSSE & SP Policy is outlined below and is presented in Appendix 1. Key features of the policy are:

- Systematic approach to HSSE & SP management designed to ensure compliance with the law and to achieve continuous performance improvement;
- Targets for improvement and measurement, appraisal and performance reporting;
- Requirement for contractors to manage HSSE & SP in line with this policy; and
- Effective engagement with neighbours and impacted communities.

All Shell's operations are conducted in accordance with Shell's HSSE & SP Control Framework, a comprehensive corporate management framework. This Framework contains the HSSE and SP requirements that apply to every Shell company, contractor and joint venture under Shell's operational control. It contains a simplified set of mandatory requirements that define high level HSSE & SP principles and expectations, which are documented in a set of supporting manuals. The framework covers areas including contractor HSSE & SP management, safety, environment, health, security and social performance management systems.

The requirements of Shell's HSSE & SP Control Framework and Shell Australia HSSE & SP Management System are included in the Shell Australia Business Management System and are included in the contractual requirements for all contractors.

4.2. Applicable Legislation, Conventions and Other Regulations

A broad range of legislation, conventions and other regulations apply to this activity and are outlined below. The specific aspects or components of the various requirements are referred to in later sections of this document as appropriate.

The wellheads are located in Commonwealth marine waters and are subject to Commonwealth legislation. The principal acts and regulations governing petroleum operations in Commonwealth waters are as follows:

- *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act)*;*
- *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS (E) Regulations)*;*
- *Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009;*
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and
- *Environment Protection and Biodiversity Conservation Regulations 2000* (EPBC Regulations)*.*

Other Commonwealth legislation of potential relevance to the proposed activity includes:

- *Environment Protection (Sea Dumping) Act 1981;*
- *Protection of the Sea (Prevention of Pollution from Ships) Act 1983;*
- *Australian Maritime Safety Authority Act 1990;*
- *Biosecurity Act 2015* and associated regulations – Australian ballast water management requirements;
- *Navigation Act 1912; and*
- *Australian Maritime Safety Authority Act 1990.*

The principal international agreement governing petroleum operations in both State and Commonwealth waters is the United Nations Convention on the Law of the Sea, 1982 (UNCLOS). Australia is also a signatory to a number of international conventions of potential relevance to the activity, including:

- The International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 (MARPOL 73/78);
- The Convention on Wetlands of International Importance (Ramsar 1975);
- The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979;
- The International Convention on Oil Pollution Preparedness, Response and Co-operation 1990 (OPRC 90);
- International Convention for the Safety of Life at Sea(SOLAS)
- The Protocol to International Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter 1972 (London Dumping Convention);
- The Convention for the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal 1989 (Basel Convention);
- Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS);
- The Japan Australia Migratory Birds Agreement (JAMBA);
- The Republic of Korea Migratory Birds Agreement (ROKAMBA);
- The China Australia Migratory Birds Agreement (CAMBA); and
- United Nations Framework Convention on Climate Change.

Guidance documents of relevance to this EP include:

- National Biofouling Management Guidance for the Petroleum Production and Exploration Industry 2009 (Commonwealth Government of Australia, 2009);
- Australian National Guidelines for Whale and Dolphin Watching (Commonwealth Government of Australia, 2005); and
- Australian Quarantine and Inspection Service Australian Ballast Water Management Requirements (DAFF, 2006).

NOTE: The Prelude project received its primary environmental approval on the 12th November 2010 from the Federal Environment Minister and then Department of Sustainability, Environment, Water, Population and Communities (now Department of Environment and Energy, DoEE) under approval EPBC 2008/4146. On 8th September 2015, Shell Australia received the variation of conditions of the EPBC approval in accordance with section 143 of the EPBC Act.

Prelude-1a was drilled in 2006. The EPBC approval conditions for the Prelude Project and the accepted Prelude FLNG Environment Plan does not apply to Prelude-1a. Shell Australia has ongoing consultation with the Department of Environment.

4.3. EPBC Management Plans

Table 4: EPBC Management Plans and Relevant sections in the EP shows how the various EPBC management plans related to the sensitivities associated with the activity are addressed in this EP.

Table 4: EPBC Management Plans and Relevant sections in the EP

Sensitivities	EPBC Management Plan	Relevant environmental risks	Relevant EP section
Fishes and sharks	Department of the Environment and Heritage. 2005. Whale shark (Rhincodon typus) recovery plan 2005-2010. Department of the Environment and Heritage,Canberra. Threatened Species Scientific Committee. 2015. Approved Conservation Advice for Rhincodon typus (whale shark). Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities. 2013. Recovery Plan for the White Shark (Carcharodon carcharias). Commonwealth of Australia. Threatened Species Scientific Committee . 2014. Approved Conservation Advice for Glyphis garricki (northern river shark). Commonwealth of Australia. Threatened Species Scientific Committee. 2009. Commonwealth Conservation Advice on Pristis clavata (Dwarf Sawfish). Commonwealth of Australia. Threatened Species Scientific Committee. 2008. Approved Conservation Advice for Pristis zijsron (Green Sawfish). Commonwealth of Australia. Department of Parks and Wildlife. 2014. Manta Ray (Manta birostris) Factsheet. Department of	Lighting Noise Vessel collision with marine life Introduction of non-native marine species Liquid discharges Accidental discharge of wastes Hydrocarbon releases	Section 5.2.2 Section 5.2.3 Section 5.2.5 Section 5.2.6 Section 5.2.7 Sections 5.5 Sections 5.6 OPEP OSMP

Sensitivities	EPBC Management Plan	Relevant environmental risks	Relevant EP section
	Parks and Wildlife, Perth, Western Australia. Department of the Environment, Water, Heritage and the Arts. 2009. Threat abatement plan for marine debris on vertebrate marine life. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2012. Marine Bioregional Plan for the North Marine Region. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2008. Marine Bioregional Plan for the North-West Marine Region. Commonwealth of Australia. Survey Guidelines for Whale Shark Refer to Whale Shark Species Profile and Threats Database (SPRAT).		
Cetaceans	Commonwealth of Australia. 2015. Conservation Management Plan for the Blue Whales - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999. Commonwealth of Australia, Canberra. Department of the Environment and Heritage. 2005. Humpback Whale Recovery Plan 2005 - 2010. Environment Australia, Canberra ACT. Department of the Environment, Water, Heritage and the Arts. 2008. EPBC Act Policy Statement 2.1 - Interaction between offshore seismic exploration and whales. Commonwealth of Australia. Department of the Environment and Heritage, 2005. Australian National Guidelines for Whale and Dolphin Watching - Information Sheet. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2009. Threat abatement plan for marine debris on vertebrate marine life. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2012. Marine Bioregional Plan for the North Marine Region. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2008. Marine Bioregional Plan for the North-West Marine Region. Commonwealth of Australia Survey Guidelines for cetacean Refer to Blue Whale and Humpback Whale Species Profile	Lighting Noise Vessel collision with marine life Introduction of non-native marine species Liquid discharges Accidental discharge of wastes Hydrocarbon releases	Section 5.2.2 Section 5.2.3 Section 5.2.5 Section 5.2.6 Section 5.2.7 Sections 5.5 Sections 5.6 OPEP OSMP

Sensitivities	EPBC Management Plan	Relevant environmental risks	Relevant EP section
	and Threats Database (SPRAT).		
Marine reptiles including turtles	Environment Australia. 2003. Recovery Plan for Marine Turtles in Australia. Prepared by the Marine Species Section Approvals and wildlife division, Environment Australia in consultation with the Marine Turtle Recovery Team. Canberra, Australia. Department of the Environment, Water, Heritage andvthe Arts. 2009. Threat abatement plan for marinevdebris on vertebrate marine life. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2012. Marine Bioregional Plan for the North Marine Region. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2008. Marine Bioregional Plan for the North-West Marine Region. Commonwealth of Australia. Survey Guidelines for marine turtles Refer to Green/Hawksbill/Flatback/Loggerhead/Olive Riddley Turtle/s Species Profile and Threats Database (SPRAT).	Lighting Noise Liquid discharges Accidental discharge of wastes Hydrocarbon releases	Section 5.2.2 Section 5.2.3 Section 5.2.7 Sections 5.5 Sections 5.6 OPEP OSMP
Migratory birds and seabirds	Department of the Environment. 2015. Draft referral guideline or 14 birds listed as migratory species under the EPBC Act. Department of the Environment, Canberra. Australian Government Department of the Environment and Energy 2015. Wildlife Conservation Plan for Migratory Shorebirds. Commonwealth of Australia. Australian Government Department of the Environment and Energy. 2015. EPBC Act Policy Statement 3.21. Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species. Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities. 2012. Species group report card - seabirds and migratory shorebirds. Supporting the marine bioregional plan for the Northwest Marine Region. Prepared under the Environment Protection and Biodiversity Conservation Act 1999. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2009. Threat abatement plan to reduce the impacts of exotic rodents on biodiversity on Australian offshore islands of less than 100 000 hectares. Commonwealth of	Lighting Noise Accidental discharge of wastes Emergency Events	Section 5.2.2 Section 5.2.3 Sections 5.5 Sections 5.6 OPEP OSMP

Sensitivities	EPBC Management Plan	Relevant environmental risks	Relevant EP section
	Australia. Department of the Environment, Water, Heritage and the Arts. 2009. Threat abatement plan for marine debris on vertebrate marine life. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2012. Marine Bioregional Plan for the North Marine Region. Commonwealth of Australia. Department of the Environment, Water, Heritage and the Arts. 2008. Marine Bioregional Plan for the North- West Marine Region. Commonwealth of Australia. Survey Guidelines for seabirds and shorebirds Refer to relevant seabird and shorebird Species Profile and Threats Database (SPRAT).		
Ashmore Reef Nature Reserve and Martier Island Marine Reserve	Ashmore Reef Nature Reserve and Martier Island Marine Reserve Management Plans	Shoreline clean-up and Oiled Wildlife Response	Sections 5.7.2 and 5.7.3
Marine Protected Areas	Australian IUCN Reserve Management Principles for Commonwealth Marine Protected Areas	Shoreline clean-up and Oiled Wildlife Response	Sections 5.7.2 and 5.7.3

5. Environmental Effects, Risk Assessment and Management Actions

5.1. Introduction

The Hazards & Effects Management Process (HEMP) is the process by which Shell identifies and assesses hazards, implements measures to manage them, and demonstrates that risks are reduced to a level that is ALARP. This is consistent with the principles outlined in the Australian Standard AS/NZS ISO 31000:2009 Risk Management and HB 203:2006 Environmental Risk Management (Figure 5). HEMP is a fundamental element of the Shell Group HSSE & SP Control Framework and is a process that is applied at every phase of projects and operations.

The risks for each planned and unplanned event have been determined using HEMP. The level of risk has been determined by assessing risk likelihood and consequence using the Shell Risk Assessment Matrix (RAM) and the Environment Consequence Categories presented in Figure 6 and Figure 7 below. Risk Assessment results are shown in Table 5 and discussed in detail in the succeeding sections.

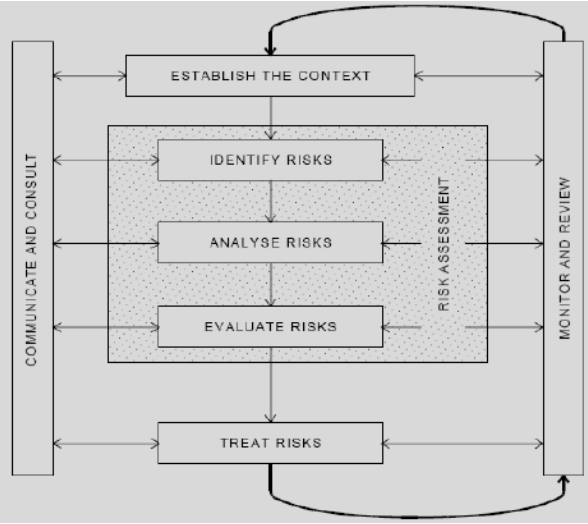


Figure 5: Risk management framework (AS/NZS 4360:2004 Risk Management)

SEVERITY	CONSEQUENCES				INCREASING LIKELIHOOD				
	People	Assets	Environment	Reputation	A	B	C	D	E
					Never heard of in the Industry	Heard of in the Industry	Has happened in the Organisation or more than once per year in the Industry	Has happened at the Location or more than once per year in the Organisation	Has happened more than once per year at the Location
0	No injury or health effect	No damage	No effect	No impact					
1	Slight injury or health effect	Slight damage	Slight effect	Slight impact					
2	Minor injury or health effect	Minor damage	Minor effect	Minor impact					
3	Major injury or health effect	Moderate damage	Moderate effect	Moderate impact					
4	PTD or up to 3 fatalities	Major damage	Major effect	Major impact					
5	More than 3 fatalities	Massive damage	Massive effect	Massive impact					

Figure 6: Shell Risk Assessment Matrix (RAM)

Environment

Level	Definition
0	**No Effect** No Impact to the Environment
1	Slight Effect Slight environmental damage contained within the premises. Examples include but are not limited to: Small spill in process area or tank farm area that readily evaporates.
2	**Minor Effect** Minor environmental damage, but no lasting effect. Examples include but are not limited to: Small on-site spill with potential to harm the environment that has no off-site impact. On-site groundwater contamination with no potential for off-site contamination. Single exceedance of statutory or other prescribed limit.
3	**Moderate Effect** Limited environmental damage that will persist or require cleaning up. Examples include but are not limited to: Spill with potential to harm the environment that requires removal and disposal of over 100m³ of impacted soil/sand. Spill with potential to harm the environment which reaches surface water off-site. Off-site groundwater contamination. Off-site habitat and/or ecology effects or damage, e.g. fish kill or damaged vegetation. Repeated exceedance of statutory or other prescribed emission limit for longer than 3 months and/or, with potential long term effect.
4	**Major Effect** Severe environmental damage that will require extensive measures to restore beneficial uses of the environment. Examples include but are not limited to: Spill to water with a potential to reach a shore and cause harm to the environment. Off-site contamination of surface or groundwater over an extensive area. Requirement for Tier 2 oil spill emergency response. Off-site habitat and/or ecology effects or damage for greater than 1 year. Extended exceedances of statutory or other prescribed emission limits for greater than 1 year and/or with potential long term effect.
5	**Massive Effect** Persistent severe environmental damage that will lead to loss of natural resources over a wide area. Examples include but are not limited to: Spill resulting in pollution of a large tract of wetlands, ocean, part of a river estuary or beach/coastal habitat Requirement for Tier 3 oil spill emergency response. Persistent off-site habitat and/or ecology effects or damage with proven long term effect.

Figure 7: RAM Environment Consequence Categories

The Shell RAM sets the level of control required to manage risk:

- **Light blue** – manage for continuous improvement through effective implementation of the HSSE management system. The business may set lower priority for further risk reduction.
- **Dark blue** – manage for continuous improvement through effective implementation of the HSSE management system.
- **Yellow** (non 5A/5B areas) – apply the hierarchy of control to reduce the risks to ALARP.
- **Yellow** 5A/5B and **Red** – apply a Bow-tie or equivalent methodology to reduce to risks to ALARP.

The *OPGGS (Environment) Regulations* 13 5 (b) requires that the Environment Plan includes '*an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk*'. This is further clarified by Reg. 13 6 which states that: '*To avoid doubt, the evaluation mentioned in paragraph (5) (b) must evaluate all environmental impacts and risks arising directly or indirectly from (a) all operations of the activity; and (b) potential emergency conditions, whether resulting from accident or any other reason.*' Based on this, Shell has chosen to present ALARP demonstrations for all identified risks to the environment.

Shell's HSSE Management System (HSSE MS) is continually improving due to incorporation of increasing legislative requirements, increasing community expectations, improved available technology, learning from incidents industry wide and within Shell, and regular review cycle. Assurance that the HSSE MS is working, continually improving and new Shell standards are applied occurs via Shell Australia internal audits and Shell Global auditing process. Company standards are at least equal to, but in many cases more stringent than legislation. Both legislation and company standards are continually being updated and requiring a higher level of performance over time. Concurrently, new technologies are becoming available and making improved performance possible and more affordable. This continual improvement is reflected in more challenging ALARP and tolerable benchmarks, leading to better environmental outcomes over time.

The succeeding sections detail the environmental risks of operations associated with the wellhead removal activity on the local and wider environment, including socio-economic considerations. Activities are described in terms of the scale and likelihood of impact and an assessment of environmental consequence of the potential impact generated by the activity. A description of management actions proposed to reduce any effect on the environment to ALARP is presented.

5.1.1. Demonstration of ALARP

Controlling risks to ALARP for Shell means meeting legal requirements and other agreed tolerability criteria (e.g. Shell/ industry standards) (for the purpose of this EP tolerability is deemed to satisfy the 'acceptability criteria' – see next section) and going beyond them to the extent that is reasonably practicable i.e. the option which is at least acceptable and with the lowest residual risk achievable without incurring significant incremental costs or effort that is grossly disproportionate to the additional risk reduction obtained.

There is no scientific formula to calculate ALARP. ALARP can be achieved through a number of mechanisms via:

- a quantitative method, where the costs of the various options can be compared with the respective risk reduction;
- semi quantitative method where risks within a certain level on the Risk Matrix require a pre-defined number of barriers of a certain effectiveness in place to prevent this hazard being released; or via
- qualitative analysis, whereby ALARP is established using standards, legislative requirements and judgement based on experience.

Quantitative and semi-quantitative ALARP demonstration methods are generally employed for major installation investment decisions, design or major facilities, where ensuring that the decision-making process is transparent and systematically addresses the full spectrum of business risks is important.

In accordance with Regulation 10A(b) of the OPGGS (E) Regulations, Shell demonstrates that risks are reduced to ALARP where:

The RAM risk is **light blue** and **dark blue**:

- Good industry practice or comparable standards have been applied to control the risk, because any further effort towards risk reduction is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.

The RAM risk is **yellow**:

- Good industry practice is applied.
- All mitigation measures according to the hierarchy of control (Figure 8) are considered. Where these measures are reasonably practicable, they are implemented. This qualitative analysis approach has been used to justify that the risk has been managed to ALARP and is suitable for the risks presented by 22

The RAM risk is **yellow** (5a or 5b) or **red**:

- Good industry practice is applied.
- The hierarchy of control is applied.
- Apply a Bow-Tie or equivalent methodology.

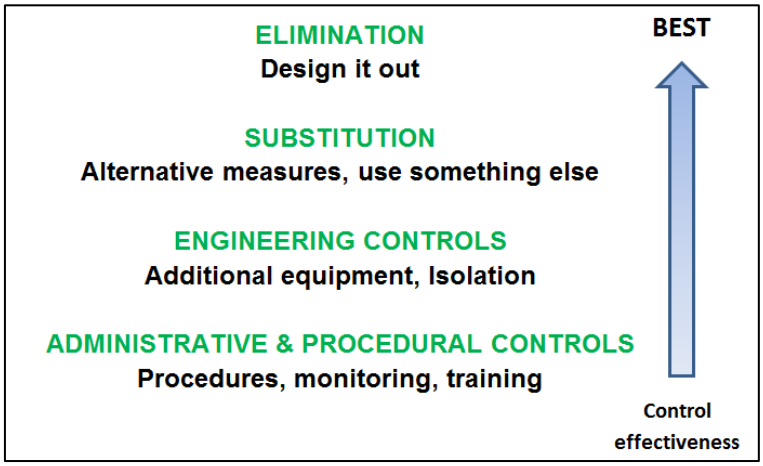


Figure 8: Hierarchy of Controls

5.1.2. Definition of residual risk acceptability

Environmental risks are only deemed acceptable when all reasonably practicable mitigating and management measures have been taken to reduce the potential impacts to ALARP.

In accordance with Regulation 10A(c) of the OPGGS (E) Regulations, Shell applies the following process to demonstrate acceptability:

- **Light Blue** and **Dark Blue** risks are 'Acceptable', if they meet legislative requirements, industry codes and standards, regulator expectations, Shell Standards and industry guidelines.
- **Yellow** and **Red** risks are 'Acceptable' if ALARP can be demonstrated, if legislative requirements are met, stakeholder concerns are accounted for and the alternative control measures are grossly disproportionate to the benefit gained. In this acceptability evaluation, the following criteria are accounted for:

- Principles of Ecological Sustainable Development (ESD) as defined under the EPBC Act
- Internal context - the proposed controls and residual risk level are consistent with Shell policies, procedures and standards
- External context – consideration of the environment consequence and stakeholder expectations
- Other requirements – the proposed controls and residual risk level are consistent with national and international standards, laws and policies.

Table 5: Summary of Environmental Hazards, Potential Effects and Environmental Risks

Hazard / Event	Potential Hazard Consequence	Likelihood of Occurrence	Consequence	RAM Risk Level
Physical presence	Disruption to commercial or recreational fishing, shipping activity and other marine users.	**B** Frequent encounters with shipping traffic are unlikely as the activity location is distant to major shipping lanes. Fishing effort in area is very low and no tourism activities are expected to occur in area due to the distance offshore of the activity. No impacts expected to cultural heritage or petroleum activities.	**1 – Slight effect** May cause small and temporary deviations to shipping routes and or fishing activities. Consequences minimal due to unobstructed open waters and comparably small footprint of the activities.	***Light blue***
Lighting	Localised attraction and temporary disorientation of fauna, potentially leading to increased predation or feeding rates.	**B** No impacts expected given open ocean environment, short duration of vessel presence, and the activity is not located on major bird or marine fauna migration corridor.	**1 – Slight effect** Activity occurs in remote location and distant from known migratory routes or aggregation areas for birds or marine fauna.	***Light blue***
Noise generated	Disruption to behaviour patterns of sensitive marine fauna from wellhead removal operations and/ or vessel movements.	**B** Low abundance of noise sensitive fauna at the activity location and any animals in vicinity are likely to move away and not be subject to highest levels of noise.	**2 – Minor effect** Given the short duration of the activity, location and distance from migratory routes or aggregation areas for marine fauna, potential effect of behavioural disruptions has no lasting effect and is localised.	***Dark blue***
Seabed Disturbance	Disturbance to benthic communities as a result of physical disturbance.	**B** Low potential of significant seabed disturbance affecting the seafloor and associated benthic communities.	**1-Slight Effect** Physical impacts are short-lived effects, and temporarily affected areas recover in a short time.	***Light blue***
Vessel collision with marine life	Injury and/ or death of a cetacean or other protected fauna.	**B** Cetacean abundance in the activity area is low and adherence to EPBC Regulations should result in marine life being observed and avoided.	**2 – Minor effect** Minor impact on overall population in the event that a marine life is injured or killed.	***Dark blue***
Introduction on invasive marine species from	Introduction of exotic marine species via ballast water	**B** Compliance with Quarantine requirements, low volumes of	**2 – Minor effect** Location is in oceanic environment lacking environmental	***Dark blue***

Hazard / Event	Potential Hazard Consequence	Likelihood of Occurrence	Consequence	RAM Risk Level
the vessel	exchange or biofouling causing alteration to community composition and function, competition with indigenous species.	ballast (if any) and oceanic environment of location, lacking embayment's for enhanced larval retention times and hard substrates for larval settlement, results in low likelihood of successful introduction of invasive marine species.	sensitivities. The Trio-1, Crescendo-1 and Prelude-1a wellhead locations are >12Nm from land and deeper than 200m water depth and considered a suitable location for the exchange of high risk ballast according to Australian Ballast Water Management Requirements. No ballast water exchange will take place in waters less than 200m depth.	
Discharge of bilge and deck drainage into the sea	Localised and toxic effects caused by contaminants in drainage discharge stream.	**B** Likelihood of discharge causing toxic effects is low as the activity duration is short, oil/ water separator limits toxicity of discharges in an open ocean environment which facilitates high dispersion-dilution rates and volumes of oily water low.	**1 – Slight effect** Operations in open ocean well away from environmental sensitivities, any effect short lived and highly localised.	***Light blue***
Discharge of sewage, grey water and putrescible waste into the sea	Localised and toxic effects caused by contaminants in waste stream. (e.g. nutrient enrichment).	**B** Likelihood of discharge causing reduction in water quality is low given the short activity duration, treatment of sewage and open ocean environment facilitates high dispersion-dilution rates.	**1 – Slight effect** Operations in open ocean well away from sensitivities, any effect is highly localised due to rapid dilution.	***Light blue***
Use of wellhead cutting fluids	Localised and toxic effects caused by contaminants in fluid.	**B** Likelihood of discharge causing toxic effects is low due to no planned discharge into the sea, chemical selection process was applied, open ocean environment facilitates high dispersion-dilution rates in case of discharge.	**1 – Slight effect** Operations in open ocean well away from sensitivities, any effect short lived and localised.	***Light blue***
Atmospheric emissions from fuel combustion	Reduction in air quality and emission of greenhouse gases through combustion of liquid fuel used by the vessel	**B** Likelihood of emissions causing reduction in air quality is remote given small volumes of emissions and rapid dispersion in offshore atmospheric environment.	**1 – Slight effect** Insignificant addition of greenhouse gases or other emissions to the atmosphere with no local receptors.	***Light blue***

Hazard / Event	Potential Hazard Consequence	Likelihood of Occurrence	Consequence	RAM Risk Level
Accidental discharge of non-hazardous wastes into the sea	Localised and temporary reduction in habitat/ water quality or aesthetics from accidental disposal of debris into the marine environment.	**B** No disposal of wastes overboard is planned.	**1 – Slight effect** Operations in open ocean well away from sensitivities, any effect short lived and localised.	***Light blue***
Accidental discharge of hazardous waste or chemicals into the sea	Localised and temporary acute toxic effects caused by hazardous waste and chemicals from accidental disposal into the marine environment.	**C** Likelihood of discharge causing toxic effects is low as low toxicity of chemicals, open ocean environment facilitates high dispersion-dilution rates and volumes of discharges are low.	**1 – Slight effect** Operations in open ocean well away from sensitivities including Browse Island, any effect short lived and localised.	***Dark blue***
Hydrocarbon spill resulting from vessel collision	Potential acute/ chronic toxic effects and direct physical smothering of marine organisms.	**B** Given the low vessel traffic in the region, low likelihood of more than one vessel being onsite at any one time, the vessel safety and navigational controls, notification to AMSA, collision likelihood is low.	**4 – Major effect** Spill modelling (Section 5) shows a significant extent of possible environmental impact upon a spill from vessel collision.	***Yellow***
The wells have been permanently abandoned (refer to Well Operations Management Plan (TEC_GEN_005508), as a result, well blow-out is not credible for this activity. Therefore, this is not identified as a hazard for this activity.				***N/A***

5.2. Physical Presence of the Activity

5.2.1. Physical presence

Activity

The physical presence of the vessel could potentially affect cultural heritage, commercial fishing, tourism, marine protected areas, petroleum activities, commercial shipping and marine environment receptors in the region.

Assessment

The expected impact of the wellhead removal activities on fishing (both commercial and traditional) is expected to be slight to none because of the very low fishing effort in the region and the limited activity area around the wellheads in relation to the area available for fishing.

There are no known shipwrecks close to the activity location, nor are there any known sites of indigenous cultural significance within the activity area. No tourism activities are known to occur in the area due to the water depths and distance offshore. Therefore, impacts to tourism are unlikely.

The nearest marine protected area (Browse Island) is 40km from the Prelude-1a wellhead and the wellhead removal activity is not expected to affect Browse Island or the more distant protected areas.

Given the wellheads will all be removed below seabed level at a depth of nominally 0.5-1.5m, this is not considered to pose any material permanent risk to bottom trawler fisheries as a snag risk due to seabed scouring and erosion. There will be no structure left remaining to cause any potential scouring. Additionally, given the depth of the wellheads, associated ocean currents and sediment deposition are unlikely to pose any risk of erosion causing re-exposure of the conductor pipe.

The closest permanent petroleum infrastructure to the wellheads would be the Ichthys project of Inpex (about 20km south of Prelude-1a), and the Montara field (~30km from AC/RL9). Petroleum activities undertaken by other operators are also planned in the region. The short duration of the wellhead removal activity is not expected to affect these other activities.

Overall the impact is considered slight and the residual risk of interference with other users is assessed to be low.

Management to ALARP and Acceptability

As per section 616 of the OPGGS Act, a petroleum safety zone is established for the wellheads.

Australian Hydrographic Service (AHS) will be given notification to enable a 'Notice to Mariners' is issued prior to the commencement of the activity. There will be regular communication with AMSA and AFMA to ensure the location of the wellhead removal activity is known by vessels that may be operating in the region.

As engineering controls, the light well intervention vessel will be equipped with suitable navigation aids and competent crew maintaining 24 hour visual, and radio and electronic surveillance, in accordance with the Shell Australia Marine Vessel Assurance Control Procedures (OPS_PRE_000210).

The distance between the landout plate and the cutting nozzle is fixed thereby ensuring a fixed cut depth and that the cut will be made below the seabed (refer to Figure 2).

Any significantly deeper wellhead cuts would likely complicate retrieval resulting in a significantly greater risk of not retrieving wellheads. Therefore, deeper wellhead cuts are not considered technically feasible. Additionally, the stated wellhead cut depth of nominally 0.5-1.5m below seabed is broadly in line with standard industry practice in the region. And further, the AXE tool being used for the campain also has a current cutting length design limitation of 4.5m, thereby restricting the capability of the cut depth to a maximum of 4.5m from the stick-up lengths refered to in Section 2.2.

Given the minimal disruption posed by the activities, and that regulatory requirements and Shell standards are incorporated, and all good practice developed from Shell's global vessel operations, industry guidelines and practical mitigations to reduce the risk associated with the presence of the wellhead removal activity have been undertaken, and no stakeholder concerns have been raised, the residual risk is considered to be acceptable.

5.2.2. Lighting

Activity

The wellhead removal operations require 24-hour external illumination to meet maritime and operational safety standards. The activity is conducted 24 hours a day and requires lighting for safety and navigational purposes. Lighting can create light spill, which has the potential to impact both positively and negatively on marine fauna populations for animals that show avoidance or attraction to lights, by potentially changing navigational cues that ultimately affect energy expenditure or altering predation and/or feeding rates. For example, marine turtle hatchlings use celestial lights as navigational markers during oceanic migrations and are attracted towards bright lights. Hatchlings can become disorientated and trapped within light spill around platforms and vessels, resulting in increased energy expenditure, increased predation and decreased survival rates (Witherington & Martin 1996; cited in Lorne et al. 1997).

Assessment

Impacts may include the following:

- disorientation, attraction or repulsion;
- disruption to natural behavioural patterns and cycles;
- secondary impacts such as increased predation; and
- reduced fitness.

However, given the very short time frame associated with the activity, the distance from major nesting grounds (hundreds of kilometres) and the low abundance of fauna in the open ocean environment, the light associated with the vessel is not expected to significantly disrupt the behaviour of any population. Overall, any impacts arising from light emissions are considered to be slight, the residual risk level is considered low.

Management to ALARP and Acceptability

Vessel lighting will be maintained as required for vessel navigation, vessel safety and safety of deck operations. As an administrative control, lighting directed towards the sea will be minimised.

The potential impacts to marine fauna from light emissions of vessels is expected to be restricted to localised attraction and temporary disorientation, and as such, any impacts

arising from light emissions are considered to be minor and localised to a small proportion of the population. No additional mitigations measures are practical and the residual risk is considered ALARP.

Given the offshore location, distance to environmental sensitivities and very short duration of vessel activities, the additional risk introduced by lighting of vessels is considered acceptable. No additional operational mitigations measures are practical, no stakeholder concerns were raised, and the residual risk is considered acceptable.

5.2.3. Noise generated

Activity

The main sources of noise from vessels are typically from engines and machineries. Vessel noise varies with the size, speed, engine type of the vessel and the activities being undertaken.

The activity will be undertaken by the light well intervention vessel with DP thrusters to allow manoeuvrability and avoid anchoring when undertaking works in close proximity to the wellheads. The vessel holding station (e.g. while using dynamic positioning (DP) systems; relying on thrusters and main propellers) are considered to be the main source of underwater noise generated during the activity. McCauley (1998) measured underwater broadband noise equivalent to approximately 182 dB re 1µPa at 1 m rms (SPL) from a support vessel holding station in the Timor Sea. It is expected that similar noise levels will be generated in this activity.

The wellhead removal activity also requires the use of an abrasive jet cutting tool. In the absence of any literature on noise data from the tool, maximum drilling noise levels of 185dB re 1µPa at 1m were used as a substitution for noise generated from the wellhead cutting tool. The noise generated during the wellhead cutting operations would be very short lived (approximately 6 hours) and have lower noise impact compared to other wellhead removal methods such as the use of explosives.

Helicopter flights may be required from an operating base to the site on an ad-hoc basis. The main acoustic source associated with helicopters is the impulsive noise from the main rotor. Dominant tones in noise spectra from helicopters are generally below 500Hz (Richardson et al. 1995). The level of underwater sound from helicopters is affected by helicopter altitude, aspect and strength of noise emitted, and the receiver depth, water depth and other variables (Richardson et al. 1995).

Assessment

The effects of sound on organisms have mostly been studied in cetaceans, with much less known about the effects of sound on other groups of animals.

The use of sound in the underwater environment is important for marine animals, particularly cetaceans, to navigate, communicate and forage effectively. Underwater noise may impact on marine organisms in the following ways:

- disturbance, leading to behavioural changes or displacement from areas;
- masking or interference with other biologically important sounds such as communication or echolocation (used by certain cetaceans for location of prey and other objects);
- physical injury to hearing or other organs; and
- indirectly, by inducing behavioural and physiological changes in predator or prey species.

Marine Mammals

The extent of the impacts of underwater noise on marine animals depends upon the frequency range and intensity of the noise produced, and upon the hearing, vocalisation and other biological characteristics of the organism affected. Direct studies of hearing in marine animals are limited to a few species. Where direct measurements of hearing are not available, vocalisation frequencies can provide an indication of hearing sensitivities i.e. it is likely that marine animal hearing is particularly sensitive for sound frequencies that are the same as their social calls and echolocation clicks (Simmonds et al. 2004). Similarly, vocalisations can indicate the range of noise frequencies that have the potential to mask or interfere with communication.

Table 6 provides a comparison of sound frequencies and source levels expected from noise produced by project activities and the frequencies understood to be utilised by marine fauna.

Table 6: Expected Sound Frequencies and Broadband Source Levels of Project Activities and Frequencies Utilised by Marine Fauna

Source	Dominant Frequency Range (Hz)	Source levels (dB re 1µPa-1m)
Baleen whales (including humpback and blue)	7-22,000	-
Toothed whales (vocalisation)	500 – 25,000	-
Toothed whales (echolocation)	12,000 – 130,000	-
Fish	20-1,000	-
Turtles	100 – 700	-
Whale Sharks	< 1,000	-
Support vessels	100 -2,000	164-182
Drilling	100- 2,000 (peak <500)	59 – 185
Helicopters	< 500	Received levels at 3m water depth of 101-109dB for a Bell 212 helicopter at an altitude of 610-152m respectively.

Source: Woodside Energy Limited 2011 and Shell 2009

The noise frequencies produced during the activity overlap with hearing and vocalisation frequencies of baleen whales and to a lesser extent with those of toothed whales.

A report by Southall et al (2007) has summarised observed marine mammal response to anthropogenic noise according to category of marine mammal and type of noise. For low frequency hearing marine cetaceans (baleen whales such as blue, humpback and minke whales), limited or no response has generally been observed for anthropogenic sound levels of 90-120dB re 1µPa. Increasing probability of avoidance and other behavioural effects have been reported for sound levels in the 120–160dB re 1µPa range. No extreme behavioural responses have been reported. For mid frequency hearing cetaceans (toothed whales such as sperm whales and bottlenose dolphins), limited or no response has generally been observed for anthropogenic sound levels below 130dB re 1µPa.

Noise from the activity will not be detected by the overwhelming majority of migrating humpback whales located ~200km away from the wellheads. The small number of whales occurring in deeper waters, closer to the activity location, may show behavioural responses conservatively out to within three kilometers (based on noise modelling undertaken in the Prelude FLNG Environment Plan (section 5.2.3)). However, given the open ocean environment with no geomorphic restrictions on whale

migration, whales are expected to swim past the vessels at a distance they are comfortable.

Turtles

There is little information available in relation to noise impacts on turtles. Turtles have been shown to respond to low frequency sound, with indications that they have the highest hearing sensitivity in the frequency range 100 – 700Hz (Bartol and Musick 2003). Reported responses of turtles to high levels of man-made noise include increased swimming activity and erratic swimming patterns (McCauley et al. 2002). Conversely, turtles have been observed around shallow water production platforms, drilling rigs and inside busy ports with no obvious behavioural impact.

Studies into the effects of seismic surveys on turtles also indicate that sea turtles may begin to show behavioural responses to an approaching seismic array at received sound levels of approximately 166dB re 1 µPa root mean square (rms), and avoidance at around 175dB re 1µPa (rms) (Woodside Energy Limited, 2010). These sound levels are similar to the maximum levels produced from the activity.

Six species of protected marine turtles may occur in the vicinity of the activity, with green turtles known to nest on Browse Island (~40km from the Prelude 1A wellhead). For most inter-nesting periods, female green turtles stay within 5km up to 18km of nesting beaches (Hays et al, 1999). Given the distance to Browse Island including the inter-nesting area and deep water at the activity location, the area is not expected to support significant numbers of turtles and it is unlikely that the noise produced by the activity would cause disruption to normal breeding behaviour.

Fish and Sharks

Fish hearing sensitivity is a function of the inner ear, specialised auditory structures and the swim-bladder (a gas filled internal organ used to control buoyancy). Cartilaginous fish (such as sharks and rays) lack a swim-bladder and are considered less sensitive to sound than bony fishes. Fish use sound to communicate, locate prey, detect predators and as a cue for orientation (McCauley and Cato 2000). The majority of fish have a hearing frequency range between 100 – 1,000Hz (with peak hearing from 100 – 400Hz), although some 'hearing specialists' can detect sounds to over 3kHz (Popper 2003). Fish have been shown to respond to high levels of man-made noise by changing schooling behaviour, moving away from the source of noise or in extreme situations, by becoming stunned and disoriented. Surface and mid water dwelling fishes may be initially affected by vessel movements and normal production noise. However, the accumulation of fish adjacent to operating facilities (Lindquist et al. 2005) indicates that in the absence of any associated threats, they can be expected to habituate to this noise.

Intense sound wave vibrations (e.g. from blasting or piling) can cause fish swim bladders and auditory structures to be damaged or destroyed. However, sound intensities from the activity are unlikely to reach a level that would result in physical damage to fish.

The approximate received level threshold for behavioural disturbance in fish is variable but indicated to be greater than 90dB re 1µPa above hearing thresholds (Popper et al. 2003, Scholik and Yan 2002a, 2002b, Xodus 2009, Hastings et al. 1996; cited in Woodside Energy Limited 2011).

The Longfin and Shortfin Mako are both highly mobile with a wide-ranging distribution in deep offshore waters and are not likely to be significantly impacted by the activity. Similarly, whale sharks may transverse through the area around the activity location,

however, given the location and the lack of known aggregation areas in close proximity, whale sharks are not likely to be significantly impacted by the activity.

Overall, the consequence of disruption to behaviour patterns to marine fauna is assessed as minor.

Management to ALARP and Acceptability

The vessel will adhere to the following requirements based on the EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.04) Interacting with cetaceans, specifically: vessels will not travel greater than 6 knots within 300 m of a whale (caution zone) and not approach closer than 100 m from a whale; and a vessel will not approach closer than 50 m for a dolphin and/or 100 m for a whale (with the exception of animals bow riding).

Interaction between the vessel and cetaceans within the activity area will be consistent with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.06) – Interacting with calves, which requires vessels to not approach closer than 300 m to a calf (whale or dolphin) (the caution zone). If a calf appears in the caution zone, then:

- the vessel must be immediately stopped; and
- must either
    - turn off the vessel's engines; or
    - disengage the gears; or
    - withdraw the vessel from the caution zone at a constant speed of less than 6 knots.

However, the above does not apply to with the vessel is operating under limited/constrained manoeuvrability (e.g. tethered to the seabed) or in the event of an emergency.

The vessel will also apply the Whale Shark Code of Conduct (DpaW 2013) by not traveling greater than 8 knots within 250 m of a whale shark (exclusive contact zone) and not allowing the vessel to approach closer than 30 m of a whale shark.

Relevant personnel on the vessel will be trained in the above EPBC Regulations 2000 – Part 8, Division 8.1 and Whale Shark Code of Conduct. Dedicated marine mammal observers on board the vessel to observe for marine fauna interactions during the activity was considered. However, due to the short duration of the activity, the cost of doing this is grossly proportionate to the benefit gained; the cost of the additional marine mammal observer compared to the benefit gained is minimal due to the lack of effectiveness of this control. There is little confidence that the mitigation of stopping the wellhead cutting activity would reduce the impact.

Infield environmental noise monitoring was considered but, due to the short duration of the activity, costs to implement would be in the order of approximately $200k-500k. This is grossly disproportionate to the potential benefit gained from potentially understanding that noise levels are worse than expected from the wellhead cutting tool and potentially more accurately monitoring behavioural response from marine fauna. In addition, there is little confidence that the mitigation of stopping the wellhead cutting activity would reduce the impact. This control is grossly disproportionate to the benefit gained due to the cost of the overall activity.

The risk is deemed acceptable, as applicable regulatory guidelines are being implemented, no stakeholder concerns were raised, and disruption to behaviour

patterns to marine fauna is assessed to be minor. Given the offshore location, expected source volumes and distance from Browse Island and coastal sensitivities including the whale migration corridor, no additional mitigations measures are practical and the risk is ALARP.

5.2.4. Disturbance to Seabed

Activity

ROV activities may result in seabed disturbance and suspension of sediment as a result of working close to, or occasionally on, the seabed. The footprint of a typical ROV is approximately 2.5 m x 1.7 m. The wellhead removal activity is to be conducted by ROV and is expected to be of short duration rather than extended campaigns.

Whilst there is no plan for dredging around the wellhead to minimise seabed disturbance, a parking frame with a footprint of ~5x5m will be temporarily located on the seabed to enable parking of the cut wellheads in order to install lifting gear for retrieving the wellhead to surface. No dredging is required for installation of the parking frame.

Assessment

Physical disturbance to seabed habitat due to ROV activities and the parking frame can cause movement of sediments, localised seabed deposition and short-term, localised elevated turbidity of water column and possible sediment deposition of physical habitat that may bury epifauna/infauna.

The other potential options for removing the TGBs considered were:

1. The use of explosives to “jolt” the TGB free of the cement holding it to the seabed. Explosives is not the preferred method as it will have a worst impact on the local marine life and seabed disturbance caused by the detonation of a sufficiently large explosive charge near seabed level.
2. Dredging using the ROV around the guide base. Dredging is also not preferred due to the low probability of success of the level of seabed disturbance which will result from the dredging operation.

It is on this basis, that leaving the TGB in place if it cannot be pulled free using the vessel crane is deemed to have the lowest environmental impact. Furthermore, based on the dimensions of the TGBs, leaving them in place will not have any environmental impact based on physical presence or seabed disturbance.

The seabed at the Prelude location has little evidence of epibenthic communities due to the low variance of sea floor topography and absence of hard substrates limiting habitat for epibenthic organisms (Heyward & Smith 1996). This has been determined for the Prelude location from side scan sonar, a 3D seismic survey and geotechnical data collected across the permit area. The Trio-1 and Crescendo-1 wellheads are considered to be part of the Prelude location. ROV footage around the two wellheads showed the seabed shared the same characteristics as those that are around Prelude-1A

The seabed at the Crux location has little evidence of epibenthic communities due to the low variance of sea floor topography and absence of hard substrates limiting habitat for epibenthic organisms (Heyward & Smith, 1996). Seafloor topography at the Crux location has been determined using published hydrographic charts and a bathymetry dataset derived from mapping of available 3D seismic survey over the well

location. The properties of the shallow seafloor sediments have been evaluated from previously acquired geotechnical sampling at the Crux location.

The soft seabed comprised of very soft siliceous carbonate silts, has been shown to support a high diversity but low abundance communities of infauna and epifauna. The likely impacts to the benthic communities include smothering and temporary disturbance but soft sedimentary communities have been shown to respond rapidly to disturbance and impacts are thus expected to be slight and short lived (Shell, 2009).

Given the widespread extent of similar habitat, the low sensitivity of the locations, and the high likelihood that temporarily localised affected areas recover in a short time, the environmental effects are considered to be of minimal ecological significance, thus the overall impact is considered slight.

Management to ALARP and Acceptability

High pressure cutting was chosen as the method of wellhead removal over the use of explosives, which would have a higher level of seabed disturbance. A record of the footprint of temporary equipment on the seabed will be kept, through before and after disturbance ROV surveys or calculations based on the footprint of the equipment used.

The wellhead removal methodology is considered ALARP and Acceptable because pre-planning of this activity has taken into account of all relevant well information and the proposed removal approach is considered having the highest probability of success with the lowest environmental impact. This is still considered consistent with achieving the EPO for seabed disturbance outlined in Table 10. In the event a TGB is left in place, it will likely be partly or whole submerged below the seabed anyway. Therefore, presenting no impact to seabed or associated marine users.

Given the non-sensitive nature of the seabed at the activity location and no external stakeholder concerns have been raised, no additional mitigations measures are practical and the residual risk is considered both acceptable and ALARP.

5.2.5. Vessel collision with marine life

Activity

The presence of the intervention vessel at the wellhead locations poses a potential collision risk to cetaceans that may frequent the activity area (though the abundance of cetaceans in and around the activity area has been shown to be low).

Assessment

The wellheads are not nearby to known cetacean feeding or breeding areas and are distant to the humpback whale migration routes; therefore, the abundance of cetaceans within the vicinity of the wellheads is expected to be very low. The activity area overlaps with a BIA for whale shark foraging. Animals are expected to alter course away from vessel. The vessel will maintain a watch and alter course for cetaceans in line with the requirements of Part 8 of the EPBC Regulations 2000, Australian National Guidelines for Whale and Dolphin Watching (Commonwealth Government of Australia 2005), and therefore the risk is considered acceptable.

This activity is identical to vessel movements from other ports along the Western Australian coast where the incidence of vessel strike is low. The impact from injury or death of a cetacean from a collision is considered minor.

Management to ALARP and Acceptability

The vessel will adhere to the following requirements based on the EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.04) Interacting with cetaceans, specifically: vessels will not travel greater than 6 knots within 300 m of a whale (caution zone) and not approach closer than 100 m from a whale; and a vessel will not approach closer than 50 m for a dolphin and/or 100 m for a whale (with the exception of animals bow riding).

Interaction between the vessel and cetaceans within the activity area will be consistent with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.06) – Interacting with calves, which requires vessels to not approach closer than 300 m to a calf (whale or dolphin) (the caution zone). If a calf appears in the caution zone, then:

- the vessel must be immediately stopped; and
- must either
    - turn off the vessel's engines; or
    - disengage the gears; or
    - withdraw the vessel from the caution zone at a constant speed of less than 6 knots.

However, the above does not apply to with the vessel is operating under limited/constrained manoeuvrability (e.g. tethered to the seabed) or in the event of an emergency.

Impacts to whale sharks will be reduced by applying the Australian National Guidelines For Whale And Dolphin Watching 2005: National standards for vessels (Tier 1) to whale sharks.

- The whales shark code of conduct is consistent with the Australian National Guidelines For Whale And Dolphin Watching 2005: National standards for vessels (Tier 1).
- Key points from each include for example:
- Whale shark code of conduct: Only one vessel can approach a whale shark within 250m (all other >400m), cannot approach closer than 30m to a shark.
- NATIONAL GUIDELINES FOR WHALE AND DOLPHIN WATCHING 2005: Caution zone of 300m applies for whales (150m for dolphins), vessels cannot approach whales within 100m (50m for dolphins). No waiting ahead of the direction of travel.

Relevant personnel on the vessel will be trained in the above EPBC Regulations 2000 – Part 8, Division 8.1.

Given this activity is identical to vessel movements from other ports along the Western Australian coast where the incidence of vessel strike is low and the fact that these activities comply with applicable regulatory guidelines, and no stakeholder concerns were raised, the residual risk is deemed acceptable. No additional mitigations measures are practical and the residual risk is considered ALARP.

5.2.6. Introduction of invasive marine species from the vessel

Activity

Invasive marine species are marine plants or animals that have been introduced into a region beyond their natural range and have the ability to survive, reproduce and establish populations.

The three primary mechanisms causing the inadvertent introduction and spread of these unwanted species are hull fouling, ballast water discharges and aquaculture activities. The overwhelming majority of these introductions are confined to coastal waters with a significantly greater occurrence in temperate waters than tropical waters. The published 'Proposed Australian Biofouling Management Requirements' reports that there are approximately 450 marine species of non-indigenous or unknown origins in Australia (Hewitt 2011; cited in DAFF 2011a). It also states that studies show that up to 69 per cent of these are associated with biofouling (Hewitt et al. 2010, 2004, 1999; cited in DAFF 2011a). It predicts that 3 to 4 new non-indigenous marine species (NIMS) continue to establish in Australian waters each year (Hewitt 2011; cited in DAFF 2011a).

Biofouling management is assessed and controlled through pre-mobilisation Invasive Marine Species risk assessment and screening as per the Shell Australia Marine Biosecurity Management Manual (HSE_GEN_005791). The Manual is in accordance with the International Maritime Organization (IMO) 2011 Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species. This is outlined in the Shell Australia Marine Biosecurity Management Manual that was developed in line with the *Biosecurity Management Act (Cwlth*), with reference to the *Fish Resources Management Act 1994*. The Guidelines incorporated into the Shell Australia Biosecurity Management Manual are the:

- National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (2009), e.g. offshore support vessels, seismic vessels, rigs, pipelay vessels, anchor handle tug vessels;
- National Biofouling Management Guidance for Non-Trading Vessels (2009), e.g. dredges, barges, research vessels;
- National Biofouling Management Guidelines for Commercial Vessels (e.g. LNG tankers, condensate carriers etc); and
- Western Australia Department of Fisheries Good Vessel Maintenance Guide.

The measures presented in the guidelines (for the petroleum sector, non-trading vessels and commercial vessels) have been adopted in the Manual to provide a consistent, codified framework in which to demonstrate to regulatory authorities the effective management of biofouling risks. Australia's guidelines for marine biosecurity are consistent with those of the International Maritime Organization (IMO) 2011 *Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species*.

Under the International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 and the Australian Ballast Water Management Requirements (DAWR, June 2016), the vessel is required to implement ballast water and sediment management plan and ships must carry a Ballast Water Record Book. Ballast water exchange must also be done in open waters.

Assessment

The vessel contractor is to conduct Invasive Marine Species risk assessments for vessels use for the activity. The assessment identifies the pre-voyage actions that are required per vessel (e.g. dry-docking, antifouling, hull cleaning).

If the vessel has an overseas 'last port of call' all required quarantine clearances prior to entering Australian waters will be obtained.

Vessel hulls are typically surveyed twice during a 3-5 year maintenance cycle that includes dry-docking and replacement antifouling. Some operators follow a 30 month dry-docking and antifouling renewal interval to avoid excessive drag and fuel consumption from heavy bio-fouling. All vessels with an overseas 'last port of call' will obtain all required quarantine clearances prior to entering Australian waters.

Vessel cruising speeds during transit are typically held around 10 knots to avoid high fuel consumption. These slow voyaging speeds permit retainment of fouling growth that typically requires higher cruising speeds for efficient control.

Intervention vessels carry comparatively little ballast water for trimming purposes compared to other merchant ships. As a result, the vessel does not represent a significant risk for the introduction of marine pests. Nonetheless, as per the Department of Agriculture and Water Resources (DAWR) Ballast Water Management requirements, all vessels with an overseas 'last port of call' will be required to undertake exchange of high risk ballast outside Australia's territorial sea prior to arrival.

All known and potential marine pests listed by Australian agencies are nuisance foulers, predators, invasive seaweeds or noxious dinoflagellates that inhabit harbours, embayment's, estuaries, shorelines and/ or shallow coastal waters less than 200m deep (Hayes et al. 2004, Barry et al. 2006). The water depth at the activity location is in > 150m.

The vessel (if required i.e. high risk ballast) will only exchange ballast water outside of the 12 Nm limit and > 200 m deep and comply with the Australian Ballast Water Management Requirements (DAWR, 2016). The deep water and open ocean environment provides minimal larval retention times or suitable habitat for coastal adapted exotic species. Hence, the likelihood of the introduction of exotic or introduced marine species is extremely remote.

The impact of potentially introducing exotic marine species into a deep water and open ocean environment at the wellhead locations is considered minor.

Management to ALARP and Acceptability

The vessel used in the activity will comply with the requirements of the *Biosecurity Act 2015*.

If the vessel has an overseas 'last port of call', a Pre-Arrival Report will confirm that the vessel meets ballast and quarantine requirements.

The following management practices reduce the potential risk of the introduction of invasive species to ALARP:

- Shell Australia Marine Biosecurity Management Manual (HSE_GEN_005791)
- The vessel will comply with the requirements of the *Biosecurity Act 2015* and associated regulations including the exchange of high risk ballast outside Australia's territorial sea prior to arrival.

- Adherence to the Australian Ballast Water Management Requirements (if the vessel this mobilised from international waters, then assessment and management of their ballast water is required in accordance with the requirements);
- Discharge of high risk ballast water is prohibited within Australian territorial seas (within 12 Nm of Australian territories) including Australian ports.
- Should ballasting be required, the exchange(s) will be conducted as far as possible away from shore and in water at least 200 m deep, greater than 50 nm from land.
- Ballast water exchange records shall be maintained.
- Vessel movements will be managed such that they have low/acceptable risk rating prior to entry to Australian territory and state waters.
- Reporting requirements in case of suspected detections of marine pest in state waters.

Given that activities are comply with regulations, the residual risk of introducing invasive marine species is assessed to be acceptable. All concerns relating to biosecurity were addressed to the expectations of from WAFIC and the Department of Fisheries through stakeholder consultation (Section 7.9). WAFIC requested Shell engage directly with the licence holders which was done by Shell (Ref Section 7.9.5) and no objections were made by the fishery licence holders. DOF requested Shell's consultation with the fisheries suggested by DOF which was done by Shell (Ref Section 7.9.5) and no objections were made by those fisheries. DOF requested notification upon pollution events which was confirmed and incorporated in the OPEP for Level 2 or 3 spills and the reporting table in Section 5.7.1. DOF also requested notification upon suspected detection of marine pests and this is reflected in Section 5.7.1. DOF also requested for details on how Shell will manage risks associated with introduced marine species which were provided by Shell and DOF raised no concerns for the way Shell intends to manage the risk.

Additional mitigation measures have been taken where practical and the residual risk is considered ALARP.

5.2.7. Unsuccessful removal – wellheads or assocaited guide bases left in-situ

Activity

Although ‘best endeavours’ (see definition in Section 2.3) will be made to remove wellheads and associated guide bases from the seabed using the light well intervention vessel crane, there is a possibility that these structures are not retrievable. This can be due to being partially or fully subsided into the seabed, or being held in place from a combination of cuttings and cement returns during well construction. If the structures are not retrievable, they will be left in-situ on the seabed and the campaign will not exceed the allowed cost, time, and health and safety risk exposure. The stick-up length of the structures is between 2.6m to 3.9m from the seabed.

The activity will be conducted as per the Light Well Intervention - WRA Well Program (30302-PR-50-G-0001). ‘Best endeavours’ for this campaign means that the campaign has allowed for a certain cost, time, and health and safety risk exposure that is required to remove the structures, and will not exceed the cost, time and risk exposure allowed for when structures cannot be removed through multiple attempts.

‘Best endeavours’ for wellheads where there have been no previous attempts to recover the wellhead, would be two attempts at cutting. For Trio and Crescendo, where there have been previous attempts made already (using a rig) unless there is

clear evidence of equipment failure resulting in an incomplete cut, only a single attempt will be made using the AXE tool.

One 'attempt' to remove wellheads and associated structures from the seabed in this campaign means using the vessel crane once to pull up a wellhead or guide base after it had been cut. Another 'attempt' to remove wellheads and associated structures would be running the cutting tools again (if required) and trying again to pull the structure up with the vessel crane. The space out of the cut will be adjusted upwards by 0.5m between each attempt to avoid running the AXE tool back past a potential snag point and also to reduce the length of annular cement column holding the wellhead in place.

The Wellhead and PGB is to be lifted using recovery rigging choked around either the PGB, or in the case of Auriga, the wellhead itself. The TGB will be lifted separately using recovery rigging attached to the lifting padeyes on the TGB itself.

In both cases, it is programmed that if the wellhead and/or guide bases do not pull free, we will increase the pull to the lower of: a) the safe working load of the recovery rigging or b) 2x the expected weight of the items being lifted. This will be done with the heave compensated crane in constant tension mode and the reason for limiting the overpull to twice the expected weight of the items being lifted is to avoid excessive recoil should the load full free suddenly.

Each wellhead removal attempt introduces significant safety risks (e.g. heavy lifts, worker exposure to offshore occupational risks) as well as environmental impacts (e.g. greenhouse gas emissions from the vessel, unnecessary seabed disturbance) that outweigh the impact of leaving a wellhead or guide base in situ if multiple attempts have already been made to remove the structures.

Assessment

Failure of removing any wellheads or guide bases from the seabed and leaving them in-situ will have minor impacts due to the small footprint given the large regional area for fishing, and stick-up height above seabed (max. 3.9m). There is a possibility for fishing gear becoming snagged on equipment on rare occasions. However, this is not considered to be a significantly greater snagging risk than the broader existing environment (e.g. rock snags, shipwrecks in other areas). Furthermore, there has been no reports of fishing gear snags since the wellheads were put in place.

Engineering options considered to minimise the risk of fishing gear snags were:

1. Pre-fabricated concrete dome or mattresses. However, given the vessel space will be restricted to a 5mx5m footprint, it would only be able to carry one. This incurs an extra $400,000 due to additional vessel time and fabrication costs for the dome/mattresses.
2. Rock dump which requires a special vessel for accurate rock placement. This incurs an extra cost of over $1 million.
3. Concrete slurry poured offshore, box required to set and accurately pouring restricted. Not feasible with the equipment available on the vessel. This incurs an extra cost of over $2 million. In addition, this option is not considered to reduce the risk of trawl fishery either.

Provided that there is limited measurable impact on the benthic community by leaving the wellheads or guide bases in-situ, the cost and health and safety risk exposure associated with the engineering options considered to minimise the risk of fishing gear snags greatly outweigh the environmental benefits.

As a result, only administrative controls were considered ALARP. Notice to mariners and consultation with potentially impacted fisheries will minimise the risk of snagging in the future to ALARP and acceptable levels.

Management to ALARP and Acceptability

Leaving the wellheads or guide bases in-situ on the seabed in case of failure of removal, provided that adequate consultation had been conducted (refer to Table 17 of the full EP) is considered the ALARP position. This is primarily because of the additional risk to health, safety, cost and schedule greatly outweighs the minimal environmental risks posed by leaving the structures in-situ; especially given the wellhead will only extend maximum 3.9m above the seabed which already has an undulating topography. Furthermore, there will be minimal measurable impact on the benthic community.

Given planned activities are in compliance with good industry practice of wellhead removal, the residual risk is considered acceptable. Additional mitigation measures have been put in place (e.g. stakeholder consultation) where they are considered practical, and hence the residual risk is deemed ALARP.

5.3. Liquid Discharges

5.3.1. Discharge of bilge and deck drainage into the sea

Activity

Deck drainage from the vessel consists mainly of wash down water, seawater spray and rainwater. Deck drainage may contain small quantities of oil, grease and biodegradable detergents present on the deck, which has the potential to create surface sheens and short term, localised reduction in water quality if it enters the marine environment via the direct overboard drain.

Only small volumes of deck drainage runoff, if any, are expected during the wellhead removal activity. Due to these low expected volumes, any discharged run-off is likely to rapidly dilute and disperse and the overall environmental effects are considered to be temporary and localised. All discharges will be in accordance with *The Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and MARPOL 73/78 Annex I regulations.

Assessment

Liquid effluents have the potential to damage the marine environment through acute or chronic toxicity, oxygen depletion, thermal or salinity stress. Liquid wastes from the vessel are treated to MARPOL 73/78 Annex I standards, prior to discharge to sea.

The following receptors including those identified as protected under the EPBC Act that may potentially be impacted by liquid wastes, have been identified: cetaceans, turtles, fish, birds, benthic fauna and plankton.

With the exception of seabirds, all of the above receptors are marine organisms that are reliant on suitable marine water quality in which to live, breed and move from one location to another. Liquid wastes have the potential to affect the physical, chemical and biological marine environment, which could pose a threat to the identified receptors. However, no adverse ecological effects are anticipated because of the low concentration of contaminants, the lack of nearby sensitive habitats, low abundance of receptors in the project area and rapid dilution rates in an open ocean environment.

Overall, the impact of the discharge of bilge and deck drainage to the environment is considered slight and the residual risk low.

Management to ALARP and Acceptability

All drainage from areas likely to have significant oil contamination is sent to an oil/water separator where oil is recovered, stored and returned to shore for treatment and appropriate disposal.

Spills will not be deliberately discharged to the ocean and contained on deck where safe to do so. Minor chemical and oil spills will be contained and cleaned with absorbent materials that are then disposed of as hazardous waste. Stocks of absorbent materials (e.g. spill kits) aboard the vessel will be checked for their adequacy and replenished as necessary prior to the commencement of the activity and regularly during the activity. Pollution drills will be carried out and recorded in the ships log.

In accordance with MARPOL 73/78 Annex I, Regulation for the Prevention of Pollution by Oil from Ships under the *Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983* requires that any planned discharge into the sea shall have a maximum oil content of 15 ppm and no visible traces of oil are to be observed on or below the surface of the water or that it is stored and disposed of onshore.

The vessel will be certified for its class and have MARPOL 73/78 compliant oil/water systems such that oil in water content of bilge and deck drainage discharge is not greater than 15ppm. Furthermore, the vessel will have an appropriate Shipboard Oil/Marine Pollution Emergency Plans (SOPEP/SMPEP).

Records of discharge or disposal of bilge water will be recorded in the vessel's Oil Record Book.

Given the low abundance of receptors and rapid dilution of any discharge, and that regulatory requirements are met, the residual risk is deemed acceptable. All additional practical mitigations have been adopted, and no additional mitigations measures are considered practical, hence the residual risk is deemed ALARP.

5.3.2. Discharge of sewage, grey water and putrescible waste into the sea

Activity

The vessel may routinely discharge relatively small volumes of sewage and putrescible wastes to the marine environment but as the activity duration is short and the crew small (~120 people), the discharge volumes will be minimal.

Disposal of the wastes to the ocean may cause some temporary, localised nutrient enrichment of the surface waters surrounding the discharge point. Given the short duration of the activity at each location, low volumes of discharge, and the solubility and dispersion properties of the discharge, expelled waste will rapidly dilute and naturally attenuate. This results in a prompt return to normal nutrient levels away from the vessels.

Assessment

An increased nutrient content in the water column over a localised area may stimulate a corresponding increase in local population numbers of some planktonic organisms. However, given that there are no nearby sensitive habitats, the short duration of the wellhead removal activity and relatively small volumes of discharge, combined with the high biodegradability/ low persistence of the wastes and the localised area of potential affect, the risk of any impact is low. The vessel will only discharge wastes in

accordance with *The Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which enacts the MARPOL 73/78 requirements (detailed below) in Australian Commonwealth waters.

No significant impacts are anticipated because of the minor quantities involved, localised area of impact, the expected high level of dilution into deep oceanic waters and the high biodegradability/ low persistence of the wastes.

Overall, the impact of discharge to the surrounding environment is considered slight and the risk is considered low.

Management to ALARP and Acceptability

All discharges from the vessel will comply, as a minimum, with the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which enacts MARPOL 73/78 requirements:

- MARPOL 73/78 Annex IV: Sewage; and
- MARPOL 73/78 Annex V: Garbage.

All wastes generated on the vessel will be managed and treated in accordance with the vessel's Garbage Management Plan and MARPOL 73/78 to avoid adverse environmental effects.

Given the low abundance of receptors and rapid dilution of any discharge, and that regulatory requirements are met, the residual risk is deemed acceptable. No additional mitigations measures are practical and the residual risk is considered ALARP.

5.3.3. Use of Wellhead Cutting Fluids

Activity

As part of the wellhead cutting operations, a mix of water, abrasive grit and flocculant (NALCO® H199 or the equivalent NALCO® 85113) is used. The proposed volumes of fluid used for the activity is ~45 tonne of abrasive grit and less than 2,400 Litres of flocculant which will be discharged within the well below seabed. All chemicals which have the potential to come in contact with the sea will comply with the chemical selection process (Section 7).

Assessment

The Based on the SDS, the potential environmental hazard of the flocculant used for the activity (NALCO® H199 or the equivalent NALCO® 85113) is low. There are no known ecotoxicological effects of the flocculant and the chemical is not expected to bioaccumulate. Furthermore, the CHARM evaluation on this product concluded a CEFAS Gold rating (HQ<1).

The abrasive grit used for the activity is a non-CHARM product, has no OCNS grouping or Norwegian classification, as it does not fall into any of the assessment criteria. As the cut to remove the wellheads will be below the seabed, the abrasive grit is discharged at the cut point 0.5-1.5m below seabed so is expected to either fall down on top of the shallowest abandonment plug (~40m below seabed) inside the well, or below seabed level after passing through the conductor pipe.

In the event there was contact of the abrasive grit with water, it is unlikely all heavy metals (Table 7) would be partitioned. Bioavailability of heavy metals would dictate toxicity profile, and this would be a function of temperature and time. Low seawater temperatures at depths >150m act against fast leeching of any ions into water.

Table 7: Composition of abrasive grit (from manufacturer)

Component	Name	wt% (assumed)	CAS (assumed)
Fe2O3	Hematite	> 45	12259-21-1
SiO2	Quartz	> 31	14808-60-1
Al2O3	Aluminium oxide	> 4	1333-84-2
Zn	Zinc	< 1	7440-66-6
CaO	Calcium oxide	< 7	1305-78-8
Cu	Copper	< 1	7440-50-8
MgO	Magnesium Oxide	> 1.5	1309-48-4
TiO2	Titanium Oxide	< 2	1317-80-2
Free silica		< 1	7631-86-9
Lead		0.1	7439-92-1
Tin		0.08	7440-31-5
Antimony		0.07	7440-36-0
Chromium		0.02	7440-47-3
Cobalt		0.02	7440-48-4
Nickel		0.02	7440-02-0
Cadmium		0.004	7440-43-9
Other trace elements		<0.5	NA
Moisture		<1	NA

The short duration, low volumes of the abrasive grit and floccuant used per well, and the open ocean environment lacking human receptors means that the impact of the products used for wellhead cutting is insignificant. Slight adverse environmental effects are anticipated.

Management to ALARP and Acceptability

The activity has been designed so that the wellheads are cut 0.5-1.5m below the seabed, abrasive cutting grit will fall on top of the shallowest abandonment plug at ~40m below the seabed with minimal risk to mix with the environment based on the chemical component analysis above. A small volume will enter the seabed at the cutting depth, once the grit cuts through the outer conductor pipe. This is expected to have very localised, negligible impacts.

Chemical management (Section 7.1.1) is in accordance to the Shell Global Product Stewardship Guidelines and the Shell Australia Chemical Management Process (HSE_GEN_007879). Chemical management starts from purchase selection of chemicals and change out of any applications all the way to disposal. This includes the detailed steps associated with all risk assessments.

Records of the cutting operations and the amount of flocculant and abrasive grit used for the activity will provide evidence for the amount used for the activity.

The guiding principle for the selection of chemicals is to select those with the most acceptable environmental footprint that meets technical requirements. Given Shell standards (HSSE and SP Control Framework) and regulations have been taken into account, the low volumes and the fact that low toxicity chemicals have been selected, and the rapid dilution in the open ocean environment, the overall resulting impacts are considered minor with no long term effects anticipated, hence the risk is deemed acceptable. Furthermore, no stakeholder concerns were raised. No additional mitigations measures are considered practical and the risk has been reduced to ALARP and acceptable.

5.4. Atmospheric Emissions

5.4.1. Atmospheric emissions from fuel combustion

Activity

Greenhouse gases and other atmospheric emissions (which may include sulphur dioxide (SO_2), nitrogen oxides (NOx), carbon dioxide (CO_2), carbon monoxide (CO), volatile organic compounds (VOC) and particulates) will be produced through fossil fuel combustion in vessel engines and onboard power generators. Emissions are likely to disperse rapidly in the atmosphere via prevailing winds and, given the volumes involved, have an insignificant impact on the environment.

Assessment

Due to the short time frame and small scale of the activity, and the open ocean environment lacking human receptors, the impact of the additional pollutants is insignificant. No adverse environmental effects are anticipated and overall, the associated impacts are expected to be slight.

Management to ALARP and Acceptability

The following management practices will reduce the potential impacts of atmospheric emissions to ALARP:

- All internal combustion engines onboard the vessel will be maintained in accordance with the vessel's maintenance standards and requirements.
- Engine emissions are strongly influenced by the quality of fuel used and only marine grade low sulphur diesel (max. 3.5% sulphur) will be used (per the AMSA Marine Orders – Part 97 Marine Pollution Prevention – Air Pollution under the Navigation Act 1912).

Fuel use of the vessel will be monitored and Greenhouse Gas emissions reported (Section 7.2.1).

Given compliance with regulations requiring low sulphur diesel and the engines maintenance system, the residual risk of atmospheric emissions is considered acceptable. Furthermore, the isolated location of the vessel and the continuous movement of the vessel during transit will lead to the rapid dispersion of low volumes of atmospheric emissions. No stakeholder concerns were raised on this risk. Additional mitigation measures have been put in place where they are considered practical, and hence the residual risk is deemed ALARP.

5.5. Waste

5.5.1. Accidental discharge of non-hazardous waste into the sea

Activity

Solid wastes generated by the vessel during the wellhead removal activity may include: paper; rope; cardboard; sacking; timbers; metal scrap; domestic packaging (food and drink containers etc.); and plastic. No solid wastes will be disposed of at sea. All wastes will be stored and transported back to shore for correct management according to the vessel Garbage Management Plan.

Assessment

Improper disposal of solid waste may reduce water quality, with subsequent impacts on nearby environmental sensitivities. Benthic habitats may also be temporarily polluted or smothered by improper disposal of solid waste, and marine fauna may become entangled or ingest discarded waste. In the unplanned event, the impact of solid waste to the marine environment is considered slight and the residual risk low. No adverse environmental effects are anticipated due to the expectation that the management procedures are appropriate and implemented effectively.

The waste generated as part of the activity is likely to be very small and therefore the overall environmental consequence is considered slight and the risk low.

Management to ALARP and Acceptability

All solid wastes disposal will be managed in strict accordance with the survey vessel's Garbage Management Plan and meet MARPOL 73/78 Annex V – Regulation for the Prevention of Pollution by Garbage from Ships under the *Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983* requirements.

Vessel Garbage Management Plan includes:

- Appropriate identification, segregation, labelling and of storage practices.
- Good housekeeping in waste storage area (including segregation/ compaction and recycling).
- Wastes secure and containers covered for loose material that could be blown to sea
- Waste records is maintained, showing records of waste produced and transported and disposed of onshore by a licenced waste facility.

Any accidental discharges into the sea shall be reported, recorded and investigated via the Shell Fountain Incident Management System (Section 7.2.5).

Given activity complies with regulations, and that no adverse environmental effects are anticipated, no stakeholder concerns were raised, the residual risk is considered to be acceptable. The residual risk is deemed to be managed to ALARP.

5.5.2. Accidental discharge of chemicals, hydrocarbons or hazardous waste or into the sea

Activity

During the wellhead removal activity, there is the potential for spills and leaks to occur. Spills may result in localised impacts on water quality and toxicity effects on marine fauna and flora.

Assessment

Hydrocarbon based or chemical spills may result in localised impacts on water quality and toxicity effects on marine fauna and flora. Specific effects on individual receptors would depend upon the type and volume of chemical released, but they are broadly similar to the receptors discussed in relation to hydrocarbon spills.

Depending on the volume released, the impact of hydrocarbons/hazardous wastes/ chemicals to the marine environment at the wellhead locations from incorrect disposal/ spill is considered slight to minor and the residual risk low to medium depending on the spill size.

Management to ALARP and Acceptability

The management practices included in the vessel Garbage Management Plan and SOPEP/SMPEP will reduce the potential risk of the unplanned disposal of hazardous wastes or chemicals into the ocean to ALARP.

In the event of an unexpected loss of containment, the SOPEP/SMPEP will be activated by the crew and any spills will be collected with the onboard inventory of the absorbent materials where safe to do so. Pollution drills are carried out and recorded in the ships log.

In the unlikely event hazardous wastes are lost overboard, incident reporting will be carried out as per the requirements of this EP. Any accidental discharges into the sea shall be reported, recorded and investigated via the Shell Fountain Incident Management System (Section 7.2.5).

Given the activities are in compliance with regulations, and that no adverse environmental effects are anticipated, the residual risk is considered to be acceptable. Additional controls have been put in place where practical, and the residual risk is deemed to be managed to ALARP.

5.6. Emergency Events

5.6.1. Hydrocarbon spill resulting from vessel collision

Activity

Vessel traffic to and from the wellheads' location poses a potential collision risk with other vessels. Grounding risk is not considered a credible scenario within the vicinity of the wellhead removal activity due to the deep water >150m.

Consequences of a vessel to vessel collision could potentially include loss of hydrocarbons from a fuel tank rupture, though the collision risk is low. Of the 111 spills greater than 1 tonne in Australian waters between 1982 and 2010, six were caused by vessel to vessel collisions. This spill frequency is low, compared to the 26,235 commercial vessel visits to Australian ports in 2010 alone (DNV 2011).

The risk of a spill from vessel to vessel collision depends on the severity, i.e. speed and aspect of the vessels during the event. The light well intervention vessel chosen for the wellhead removal activity would be typical of operational support vessels that have diesel storage capacities of around 1,000m^3 (total), stored in multiple tanks. The worst case scenario is if the intervention vessel is hit from the broadside by another vessel moving at near full speed resulting in a puncture of the diesel tanks below the waterline.

The largest marine diesel oil (MDO) storage tank on a typical light well intervention vessel has a capacity of 190m^3 and is located in the substructure. As a result of a vessel collision, a fuel spill arising from the rupture of this single tank with the largest fuel capacity has been considered as the worst credible diesel spill scenario.

Assessment

The loss of hydrocarbons to the surrounding marine environment can cause potentially localised chronic and acute toxic effects to marine organisms as well as reducing the localised water quality. The toxic components in marine diesel include alkylated naphthalenes, which can be rapidly accumulated by marine oysters, clams, shrimp, fish etc. Marine diesel also contains additives that contribute to its toxicity. However, diesel has volatile characteristics that allow for its rapid evaporation into the atmosphere; therefore diesel spills to the marine environment will generally only have short-term, localised effects.

Effects of hydrocarbon on habitats and wildlife can be broadly summarised as:

- direct physical and chemical alteration of natural habitats;
- direct physical smothering effects on flora and fauna;
- direct toxic effects and physiological effect on flora and fauna; and
- indirect changes on flora and fauna resulting from changes to prey and predator and habitat alterations.

Generic impacts from hydrocarbon contact are described below.

Benthic Communities

Benthic communities in deeper waters will be separated from surface slicks by the water column and remain unaffected.

Fish and fishers

A wide variety of fish species occur in the waters of the region with varying physiology, feeding behaviours and habitats. In addition, the endangered whale shark and the migratory short fin and long fin mako have been identified as being present near the activity location (see Section 3).

In the open ocean, most pelagic fish and all demersal fish live relatively deep in the water column and are unlikely to contact surface spills or be exposed to acutely toxic concentrations of dissolved hydrocarbon fractions as concentrations rapidly decrease to low levels beneath a slick (a few ppm or less) (IPIECA 2000). PAHs are readily accumulated in aquatic filtering organisms such as mussels, but not in fish, birds and mammals because vertebrate species are capable of metabolising PAHs at rates that prevent significant bioaccumulation (Hartung 1995).

Direct impacts from contact with hydrocarbon in the water column on sharks should only result in sub-lethal impacts such as minor adherence, irritation and adsorption.

Wide-ranging pelagic and demersal fish are not highly susceptible to impacts from surface hydrocarbon spills (Woodside Energy Limited 2011). Tsvetnenko (1998) in the ANZECC water quality guidelines measured LC50 across a range of petroleum products ranging from 600-8100ppb for fish. Other studies have found concentrations in the range 0.1 – 0.4μg/L has been shown to cause fish deaths in laboratory experiments (96hr LC50) for periods of continuous exposure (INPEX 2010). Eggs, larvae and young fish are comparatively sensitive to hydrocarbon than adult fish

(particularly to dispersed hydrocarbon); however, there is no definite evidence from case histories to suggest that hydrocarbon pollution has significant effects on fish populations in the open sea. NRC (2005) reports LC50 values for marine fish larvae after 24 hours exposure as low as 45 ppb. Other studies report adverse toxic effects on salmon and herring embryos and larvae from chronic exposure to concentrations of oil in water of 1μg/L (Carls, Rice & Hose 1999, cited in INPEX 2010). This is partly because fish may practice avoidance (Scholz et al. 1992, Kennish 1997) and partly because the hydrocarbon-induced deaths of young fish are often of little significance compared with significantly larger natural losses each year through natural predation and fishing.

Any impact to fish has an impact to the fishing industry. Section 3 outlines levels of activity and the potential economic impacts should fisheries be adversely affected by a spill. As the activity area does not contain any recognised feeding, breeding or aggregation areas, it is therefore is unlikely to support significant numbers of these identified endangered/ migratory species.

Cetaceans

Cetaceans may occur near the activity area, two of which are considered threatened under the EPBC Act: the humpback and blue whales (see Section 3 for more detail). Cetaceans surface to breathe air and are therefore vulnerable to exposure to a hydrocarbon slick on the sea surface; particularly vulnerable are their respiratory systems and nervous systems. They are relatively smooth-skinned and hairless so contact with spilt hydrocarbon on the surface and in the water column should not stick to their skin or affect insulation. More likely results are sub-lethal impacts such as minor adherence, irritation and adsorption, but there is potential for impact to eyes and airways. Inhalation of vapours or the ingestion of hydrocarbons can potentially be lethal to cetaceans. Baleen whales, such as blue whales and humpback whales, are the most likely to be susceptible to hydrocarbon ingestion due to their feeding through baleen plates including from near water surface. Toothed whales and dolphins are less susceptible due to their ‘gulp’ feeding approach, often targeting individual specific prey away from the sea surface (Woodside Energy Limited 2011). However, cetaceans are highly mobile, capable of long migrations, and only occur in low numbers in the activity area. A number of experimental and field observations indicate that whales and dolphins may be able to detect and actively avoid hydrocarbon slicks, but at other times have not done so and have been exposed to floating oil (Smith et al. 1983, Geraci and St. Aubin 1990).

Impacts on cetaceans from entrained oil depend on their spatial and temporal distribution and feeding preferences at the time of the spill.

Potential impacts will depend on the cetaceans’ spatial and temporal distribution and feeding preferences at the time of the spill. Baleen whales may be susceptible to oil ingestion while surface feeding as they take in large quantities of water when filtering out their prey. However, humpback, blue and the other baleen whales are unlikely to be feeding as they migrate so impacts should be limited to direct contact with hydrocarbons.

Reptiles

The impact on reptiles should be limited as their abundance in offshore waters is limited. Six species of protected marine turtles may occur near the project, with the closest known green turtle nesting on Browse Island, approximately 40km away (see Section 3).

Turtles are air breathers and smooth skinned so contact with hydrocarbon on the surface and in the water column is likely to result in sub-lethal impacts such as minor adherence, irritation and adsorption.

At sea, turtles are vulnerable to the effects of hydrocarbon spills at all life stages as they are frequently making contact with the sea surface for resting or feeding. Spilt hydrocarbon will affect their eyes and potentially damage airways or lungs and may be absorbed through the skin.

Seabirds and shorebirds

Seabirds and shorebirds are present in the region (see Section 3 for details). Seabirds are particularly vulnerable to hydrocarbon spills owing to high potential for contact with the sea surface where they feed, rest or moult. Feeding by seabirds recorded in the region involves snatching prey items from or below the water surface by paddling or aerial diving, and these birds also rest on the ocean surface. Migrating and residential shorebirds by contrast are less susceptible to severe oiling and associated physical effects as they confine feeding to shorelines (Sholz et al. 1992; cited in Woodside Energy Limited 2011) and they do not land on the water surface. In cases where the hydrocarbon spills comes ashore large number of shorebirds can be impacted. Shoreline contact of significant levels is not predicted by modelling for the vessel collision spill scenario presented.

Seabirds and shorebirds have a high risk of contact with spilled hydrocarbons due to the amount of time they spend on or near the surface of the sea and on affected foreshores. Contact with hydrocarbon may impact a bird's ability to fly due to external and/ or internal exposure potentially leading to death by drowning, starvation or predation. Hydrocarbon contamination affects the feathers insulation, buoyancy and waterproofing properties and ultimately the bird's survival. The overriding behaviour of a bird with oiled feathers is preening to the exclusion of all other normal activities. As an affected bird preens, it ingests and inhales hydrocarbons, which can cause damage to internal organs such as the lungs, intestines and liver. Suppression of the immune system can also occur and other effects include impacts to reproductive success through decreased fertility of eggs and reduction in egg shell thickness. Specifically, estimates for the minimal thickness of floating oil that might result in harm to seabirds through ingestion from preening of contaminated feathers, has been estimated by different researchers at approximately 10g/m^2 (French 2000) to 25g/m^2 (Koops et al. 2004). Mass mortalities however are not expected given the low reported density of shorebirds and seabirds in the area and the fact that no known seabird or shorebird breeding colonies are present in the area.

The main area of sensitivity for migratory birds are the Ashmore Reef and Cartier Islands, which are recognised as particularly important for feeding migratory shore birds during non–breeding periods. These islands are an important staging point during the migration between the Northern Hemisphere and Australia. During October to November and March to April large flocks of birds protected under the JAMBA, CAMBA and ROKAMBA are more likely to be present in the area and sensitive to shoreline oil contact. Browse Island, and Seringapatam and Scott Reefs are recognised as important habitat for seabirds. Due to the distances from the activity (~150km), impacts are considered highly unlikely.

Thresholds

A conservative approach adopting accepted contact thresholds that are documented to impact the marine environment are used to define the zone of potential impact (ZPI). These hydrocarbon thresholds are presented in Table 8.

Table 8: Summary of hydrocarbon contact thresholds applied to spill modelling outputs

Surface Hydrocarbon (g/m2)	Entrained Hydrocarbon (ppb)	Dissolved Hydrocarbon (ppb)
10	500	500

The spill modelling outputs defined the ZPI for surface hydrocarbon spills (contact on surface waters) using the ≥10 g/m2 (dull metallic colours) based on the relationship between film thickness and appearance (Bonn Agreement 2004). This threshold concentration expressed in terms of g/m2 is geared towards informing potential oiling impacts for wildlife groups and habitats that may break through the surface slick from the water or the air (for example: emergent reefs, vegetation in the littoral zone and air-breathing marine reptiles, cetaceans, seabirds and migratory shorebirds).

Thresholds for registering biological impacts resulting from contact of surface slicks have been estimated by different researchers at approximately 10-25 g/m^2 (see French et al. 1999; Koops et al. 2004) and NOAA 1997). Potential impacts of surface slick concentrations in this range for floating hydrocarbons may include harm to seabirds through ingestion from preening of contaminated feathers or the loss of the thermal protection of their feathers. The 10 g/m2 threshold is the reported level of oiling to instigate impacts to seabirds and is also applied to other wildlife though it is recognised that 'unfurred' animals where oil adherence is less, may be less vulnerable. Oiling at this threshold is taken to be of a magnitude that can cause a response to the most vulnerable wildlife such as seabirds. Due to weathering processes, surface oils will have a lower toxicity due to change in their composition over time. Potential impacts to shoreline sensitive receptors may be markedly reduced in instances where there is extended duration until contact.

The threshold for dissolved hydrocarbon concentration has been set at 500 ppb, with the purpose to inform the assessment of the potential for toxicity impacts of dissolved aromatic hydrocarbons to sensitive marine biota. This threshold is presently justified with reference to a literature review of existing results of eco-toxicity tests for marine diesel.

The threshold concentration of entrained hydrocarbons that may result in a biological impact cannot be determined directly using available eco-toxicity data based on the Water Accommodated Fractions (WAF) for marine diesel. However, it is likely that the review data, which are specific to dissolved hydrocarbons, represent a worst case scenario for entrained hydrocarbons. This is due to the inclusion of low or insoluble hydrocarbon fractions in entrained hydrocarbon droplets which are less biologically available to organisms (such as through absorption into their tissues). Therefore, it is expected that the entrained threshold concentration of ≥500 ppb will represent a potential impact substantially lower than the dissolved hydrocarbon concentrations presented.

Modelling

Spill modelling was previously conducted for 750m^3 of MDO at the Prelude FLNG location for the Prelude FLNG Environment Plan (2000-010-G000-GE00-G00000-HE-5880-00002). Although the spill scenario is 190m^3 for this activity, environmental

assessment and spill response planning was conducted based on the conservative 750m^3 as previously modelled. This conservative approach was taken because the model was adapted to the wellheads at the Prelude location and the Crux location. Furthermore, the closest shoreline (Browse Island ~40km) for the original modelling location (at Prelude FLNG) also applies to this activity. The spill map for the wellheads in the Crux location was generated from superimposing the existing spill model from the Prelude location to the centroid of the four Crux wellheads.

Spill modelling for the wellhead removal activity shows that floating oil greater than 10g/m^2 is expected to remain within a ~100km radius of the spill site. The annualised probability of floating oil greater than 10g/m^2 is less than 0.5% at all sensitive receptors. There are potential oiling impacts for birds within the ~100km radius of the spill site if the birds are at sea, particularly during the migratory periods October-November and March-April. However, oiling impacts to nesting sites are highly unlikely to occur due to the limited persistence of MDO.

Reptiles such as green turtles, particularly in summer, foraging near Browse Island may be impacted. Contact with diesel may cause burns, eye irritation, neurological signs, and lung damage from inhalation of fumes than heavy oiling as it evaporates from the surface of the water quickly and the likelihood of widespread concentrations greater than 10g/m^2 close to receptors is low.

Based on modelling done at the Prelude location (which is considered representative of this spill scenario), the annualised maximum accumulated volume averaged over all replicate spills is 683L, 415L, 96L, 72L, 4L and <1L at Browse Island, Scott Reef, Cartier Island, Ashmore Reef, Rowley Shoals & Clerke Reef and Imperieuse Reef, respectively, with no contact at any other emergent features (APASA, 2014). The minimum time for 10g/m^2 of hydrocarbon to reach a sensitive receptor is 44 hours to Browse Island.

The maximum local accumulation averaged among replicate spills is 25g/m^2 at Browse Island 7.2g/m^2 at Cartier Island and 5.5g/m^2 at Scott Reef, with less than 1g/m^2 at all other emergent features. The annualised probability of entrained oil greater than 500ppb is less than 0.5% at all sensitivities, with the annualised maximum entrained oil concentration averaged over all replicate spills being less than 12ppb (APASA, 2014). The annualised probability of dissolved aromatic hydrocarbons greater than 400ppb is less than 0.5% at all sensitivities. The annualised maximum dissolved aromatic hydrocarbon concentration averaged over all replicate spills being less than 1ppb at all sensitivities (APASA, 2014).

Given the open ocean location, low likelihood and concentrations at sensitivities, and limited volumes of fuel spillage, the potential impacts are limited to localised reductions in water quality and a low probability of smothering and/ or poisoning of marine fauna and the impact of a collision resulting in a spill is considered moderate and the risk ranked as medium.

Management to ALARP and Acceptability

The wellhead removal activity represents a minor increase in the existing low collision risk associated with current maritime traffic in the region. The activity is acceptable, as it will be undertaken in compliance with regulations and industry standards as outlined below, together with additional management controls to reduce the risk of collision to ALARP:

- The activity is located in open waters and the vessels and the vessel will be well lit at night and during times of poor visibility.

- Vessel routes are pre-determined and risk assessed.
- Vessel monitors any approaching vessels during operations.
- The Shell Australia Marine Operation Manual is consistent with *Marine Order 30 (Prevention of Collisions) 2009* which requires:
    - adhere to steering and sailing rules including maintaining look-outs (e.g. visual, hearing, radar etc.), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar);
    - adhere to navigation light display requirements, including visibility, light position/shape appropriate to activity; and
    - adhere to navigation noise signals as required.
- The Shell Australia Marine Operation Manual is consistent with *Marine Order 21 (Safety of navigation and emergency procedures) 2012* which requires:
    - adherence to minimum safe manning levels;
    - maintenance of navigation equipment in efficient working order(compass/radar);
    - navigational systems and equipment required are those specified in Regulation 19 of Chapter V of SOLAS; and
    - AIS installed as required by vessel class in accordance with Regulation 19 of Chapter V of SOLAS.
- A 'Notice to Mariners' advising of the presence of the vessel will be issued through AMSA prior to the commencement of the activity. Ongoing communication with AFMA, and other commercial mariners such that that presence of vessel is widely communicated;
- Contractual requirement for support vessels to be equipped with Navigational Systems and equipment compliant with the latest rules and regulations (Class Rules per Shell approved Classification Societies). This is verified through an independent audit carried out on the vessels prior engagement;
- All the support vessels employed will be subjected to a stringent inspection prior engagement including independent audits to verify Vessels critical equipments as per the Oil Company International Marine Forum Offshore vessel Inspection Database (OCIMF OVID) Inspection Questionnaire;
- Vessel equipped with suitable navigation aids, navigational lighting and competent crew maintaining 24 hr visual, radio and radar watch for other vessels;
- Contractual requirement for vessels to be manned by competent crew, competency as recognised by AMSA including STCW 95 (Marine Engineer/ Marine Engine Driver) and IMCA M117 (Training and Experience Of Key DP Personnel); and
- The spill response measures are detailed in the OPEP (HSE_GEN_010428).
- Collision controls during any simultanesous operations will be in place such as: minimum requirement for dynamic positioning DP2 vessel and Permit To Work.
- Given the activity, the single Light Well Intervention Vessel will not be equipped with tracking buoys as part of the Monitor and Evaluate strategy as part of spill response. The nearest tracking bouy will be on vessels in the Prelude location.

Given the activities are in compliance with regulations, and that no adverse environmental effects are anticipated, the residual risk is considered to be acceptable. Concerns raised from the Department of Fisheries and the Department of Mines and Petroleum have been addressed through the provision of more information on the oil spill model, whether state managed lands or waters are likely to be impacted, Shell's oil spill response strategies for this activity and confirmation that Shell will notify the Department according to the Department's consultation guidance note and reflected in reporting requirements in Section 5.7.1. The residual risk is deemed to be managed to ALARP.

5.7. Oil Spill Response Strategies

This section describes the oil spill response strategies that may be enacted to deal with emergency events (Section 5.6), the environmental risk assessment of conducting the activities including the implementation of these responses to minimise the risk and impacts of emergency events.

Implementation of oil spill response strategies will take into account a range of considerations including the location, nature, and scale of a spill and the ecological and socioeconomic receptors that are at risk. The specific response strategies considered potentially suitable for the emergency events associated with the activity include:

- Monitor and Evaluate;
- Natural Recovery;
- Shoreline Clean-up;
- Oiled Wildlife Response; and
- Oil Spill Monitoring.

5.7.1. Overview of Response Strategies Risks Assessment

Typically, environmental risks that arise from conducting the spill response strategies are similar to those already described in Section 5.1-5.6, particularly for vessel related activities. Where additional risks exist, these are described in the following sections. Table 9 summarises the aspects generated by implementing the spill response activities. Where no materially different aspects are generated by a response strategy than presented in Section 5.1-5.6, this is highlighted in the table below to avoid repetition of information already presented in Sections 5.1-5.6.

Table 9: Spill Response Strategies Risk Assessment Overview – Aspects Generated

Response Activities	Atmospheric Emissions	Liquid Discharges	Disturbance to Ground	Disturbance to Seabed	Physical Presence	Noise	Light	Waste	Potential Spills
Monitor and Evaluate	No additional risks and impacts identified								
Natural Recovery	No additional risks and impacts identified								

Shoreline Clean-up[2]		x	x		x			x	
Oiled Wildlife Response[3]			x		x			x	
Oil Spill Monitoring	No additional risks and impacts identified								

5.7.2. Shoreline Clean-up

Activity

The objective of shoreline clean-up is to apply clean-up techniques that are appropriate to the shoreline type to remove as much oil as possible. Various techniques may be used alone or in combination to clean up oiled shorelines, including shoreline assessment (SCAT), natural recovery, absorbents, sediment reworking, manual and mechanical removal and washing, flooding, and flushing. Considerations for selecting and implementing shoreline clean-up techniques are included in the OPEP.

Assessment

The impacts associated with undertaking shoreline clean-up may be more than if the product was left in situ and remediated through natural processes. Shoreline natural recovery is a very common response option where continual human and vessel/vehicle traffic has the potential to generate greater impacts than the spilt hydrocarbon itself. This strategy has been implemented internationally including the Montara spill (where persistent components of the product were left to naturally breakdown in dense coastal mangroves) and the Macondo spill (where marshes and wetlands that had been impacted by weathered product were allowed to recover naturally). Where a smaller extent of shoreline is impacted, the impacts from a clean-up response activity may be lessened and more localised.

Shoreline clean-up is most likely proposed to be undertaken by responders with shovels at islands within the Browse Basin (e.g. Browse Island and Ashmore Island). No mechanical recovery equipment is anticipated to be able to be mobilised and used safely to reduce impacts to ALARP and acceptable levels. Given this low nature and scale of potential shoreline clean-up activities, there would be only minor impacts by people doing shoreline clean-up to sensitivities within the Commonwealth Marine Reserves and WA State Reserves. Shoreline clean-up will be managed to minimise impacts on turtles (nesting/hatchlings) and nesting seabirds, the key sensitivities of the reserves, through minimising disturbance to nest sites through awareness inductions delivered to responders before landing on the island. Responder transfer to shore would be on small boats or helicopters. Responders would be accommodated on medium sized vessels or facilities such as Prelude (if available). Given waste is likely to be contained small plastic bags, it may be feasible to move shoreline waste (and other waste) off islands via tenders used to transfer personnel. If this is found not to be feasible, waste is planned to be transported off islands via helicopter. Helicopter access routes will take account of seabird nest disturbance when planning approach paths and landing sites.

Where sediment washing is employed as a shoreline response, minor impacts from liquid discharges could be expected by remobilising minor amounts of oiled sediment

[2] Waste management as an aspect is addressed as apart of this response strategy.

[3] As above

into the surf zone to clean the sediment. The minor amount of oiled sediment taking this approach by nature has minor impact. An alternative is to remove oiled sediment which in some cases may be deemed to have a higher impact.

Some minor ground disturbance from response personnel walking on the island could be expected in the event of a response. Such impacts would be short term in nature and can be minimised through induction of response personnel with the key being, minimising trampling on island vegetation as far as possible.

The are no applicable codes and standards to this response. As administrative control, shoreline clean-up personnel will receive an induction which will contain information on minimising impacts conducting shoreline clean-up on remote Browse Basin islands. i.e. Avoid disturbing turtle nests or nesting birds where possible.

Management to ALARP and Acceptability

Relevant actions from the CMR Management Plan includes;

- Due to the risk of unexploded ordinances in a 10km radius around Cartier Island, no response activities are planned to occur in this area as outlined in the Ashmore Reef Nature Reserve and Cartier Island Marine Reserve Management Plans. This may be reconsidered if relevant advice (Department of Defence) suggests a safe response operation could be carried out in the area. Relevant approvals from the Director of National Parks will be required in such an event.
- Access beyond West Island at Ashmore reef will require permission from the Director of National Parks as outlined in the relevant Management Plan for Ashmore Reef.
- Cultural items shall be left in situ.
- All ‘taking’ of oiled fauna will be done so under relevant permits from the relevant regulator.

The induction of response personnel will assist in minimising residual risks from shoreline response on sensitivities such as commonwealth marine protected areas. Inductions will communicate information such that relevant sections of the Australian IUCN reserve management principles (Schedule 8 of the EPBC Regulations) will met. Relevant IUCN Category IA; reserve management principles for Ashmore and Cartier Islands include;

- Habitats, ecosystems and native species should be preserved in as undisturbed a state as possible.
- Established ecological processes should be maintained.
- Structural landscape features or rock exposures should be safeguarded.
- Disturbance should be minimised by careful planning and execution of research and other approved activities.

Relevant IUCN Category II; reserve management principles for Ashmore Island includes;

- Respect should be maintained for the ecological, geomorphologic, sacred and aesthetic attributes for which the reserve or zone was assigned to this category.

Relevant IUCN Category VI; reserve management principles for Kimberly Commonwealth Marine Reserve includes;

- The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term.

Given the appropriate education of response personnel, risks and impacts from implementing shoreline clean-up will be reduced to levels which are ALARP.

The risks and impacts from shoreline clean-up have been assessed. The proposed controls, which relate primarily to administrative procedures, are expected to manage the risks and impacts of shoreline clean-up to an acceptable level. Shoreline clean-up is an established technique with well understood risks and impacts and its use is in line with industry (IPIECA) standards and best-practice. Residual risks and impacts from implementing shoreline clean-up are consistent with the relevant IUCN management principles Therefore, the risk and impacts are considered acceptable.

5.7.3. Oiled Wildlife Response

Activity

The objective of an oiled wildlife response is to reduce damage to fauna threatened by a spill occurring as a result of the Prelude activities.

If oiled birds or non–avian wildlife were to be observed at sea, on-water collection should be considered for the effective capture of oiled animals before they become so debilitated that their chance of survival is severely affected (IPIECA, 2004).

Animals would be collected using nets or metallic cages (if possible) off the vessels, stored on a vessel and returned to shore for treatment. Onboard treatment may be considered if deemed more appropriate at the time of the spill. This would be outlined in the incident action plan at the time in consultation with DPAW.

Alternatively, hazing may be necessary to remove birds or non-avian fauna from the impacted zone and given the activity (aerial and vessel) likely to be occurring in the area, fauna is likely to practice avoidance of the zone in any case.

Assessment

The primary impacts and risks associated within implementing oiled wildlife repsonse for these activities are;

- Disturbance to ground;
- Physical presense; and
- Waste.

It is likely some minor disturbance to islands where oiled wilidife repsonse is carried out could occur. This is planned to be managed in the same way as that outlined in Section 5.7.2 (response personnel are accomodated on a nearby facility or vessel).

The presence of response personnel on islands carrying out oiled wildlife repsonse is likely to cause some behavioural disturbance to nesting turtles and/or seabirds which are key species within the CMR likely to be affected by the reponse. It is expected with implementation of controls as outlined in Section 5.7.2 that these would be minimised and of low magnitude. In addition, any hazing of fauna including seabirds, turtles or megafauna is likely to exhibit a behavioural response to the interaction. However, with tight controls on how it is implemented, as outlined in the WA Oiled Wildlife Response Plan (Section 4.5.1).

Waste from an oiled wildlife response, namely biological waste, will be managed as outlined in Section 5.7.2. Where possible, dead animals will be refrigerated onboard the vessel supporting oiled wildlife response.

Management to ALARP and Acceptability

Relevant actions from the CMR Management Plan includes;

- Due to the risk of unexploded ordinances in a 10km radius around Cartier Island, no response activities are planned to occur in this area as outlined in the Ashmore Reef Nature Reserve and Cartier Island Marine Reserve Management Plans. This may be reconsidered if relevant advice (Department of Defence) suggests a safe response operation could be carried out in the area. Relevant approvals from the Director of National Parks will be required in such an event.
- Access beyond West Island at Ashmore reef will require permission from the Director of National Parks as outlined in the relevant Management Plan for Ashmore Reef.
- Cultural items shall be left in situ.
- All 'taking' of oiled fauna will be done so under relevant permits from the relevant regulator.

The induction of response personnel will assist in minimising residual risks from oiled wildlife response on sensitivities such as commonwealth marine protected areas. Inductions will communicate information such that relevant sections of the Australian IUCN reserve management principles (Schedule 8 of the EPBC Regulations) will met. Relevant IUCN Category Ia; reserve management principles for Ashmore and Cartier Islands include;

- Habitats, ecosystems and native species should be preserved in as undisturbed a state as possible.
- Established ecological processes should be maintained.
- Structural landscape features or rock exposures should be safeguarded.
- Disturbance should be minimised by careful planning and execution of research and other approved activities.

Relevant IUCN Category II; reserve management principles for Ashmore Island includes;

- Respect should be maintained for the ecological, geomorphologic,sacred and aesthetic attributes for which the reserve or zone was assigned to this category.

Relevant IUCN Category VI; reserve management principles for Kimberly Commonwealth Marine Reserve includes;

- The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term.

Given the appropriate education of response personnel, risks and impacts from implementing oiled wildlife response will be reduced to levels which are ALARP.

Residual risks and impacts from oiled wildlife response are considered minor and consistent with the relevant IUCN management principles. Considering oiled wildlife response will be conducted in accordance with the WA Oiled Wildlife Response Plan and by doing so reduces risks to ALARP and acceptable levels.

6. Environmental Performance Outcomes and Standards

Shell's overarching environmental objective for the wellhead removal activity is to reduce environmental risks to as low as reasonably practicable (ALARP).

Specific objectives, standards and measurement criteria for each aspect of the proposed activity that has the potential to cause adverse environmental impact are detailed in Table . Compliance with Environmental Performance Outcomes is generally expected to be achieved by demonstrating compliance with all relevant environmental performance standards.

This Table includes a number of project specific and Shell Australia standards that have been set for the implementation of this EP, denoted 'EP standard', and the basis used to form each standard is provided where relevant. The Measurement Criteria are a number of records that will provide evidence of compliance with each standard.

A number of regular HSE checks are undertaken during the activity to ensure operating performance is maintained. Annual environmental performance review measures environmental performance against the outcomes and standards presented in this EP. Finally, Section 7.2 describes incident reporting and investigation and how non-conformances with the outcomes and standards in Table are addressed.

Where the term 'minimise' is used in the context of an Environmental Performance Outcome (EPO), it is Shell's intent that it is complied with through demonstration that all Environmental Performance Standards (EPS) associated with the EPO have been achieved.

Table 10: Environmental Performance Outcome, Standards and Measurement Criteria.

EPS	Hazard / Event	Performance Outcomes	Performance Standards	Measurement Criteria
1	Physical presence	Minimise interaction between operations and other vessel based activities (i.e. fishing)	Australian Hydrographic Service (AHS) will be given notification to enable a 'Notice to Mariners' is issued prior to the commencement of the activity. AMSA JRCC is notified 24-48 hours before the activity commences and within 48 hours of the activity being completed.	Records of notification to AHS and AMSA JRCC
2			The vessel is equipped with suitable navigation aids and regulatory equipment. Competent crew maintaining 24 hour visual, radio and automatic identification system (AIS).	Vessel OCIMF OVID Report
			The distance between the landout plate and the cutting nozzle shall be fixed thereby ensuring a fixed cut depth and that the cut will be made below the seabed	Records demonstrate (i.e. design drawings) that the landout plate and the cutting nozzle shall be fixed thereby ensuring a fixed cut depth and that the cut will be made below the seabed
2a		Demonstrate 'best endeavours' to remove wellheads and associated guide bases.	Demonstrate 'best endeavours' to remove wellheads and associated guide bases as per Light Well Intervention - WRA Well Program (30302-PR-50-G-0001).	Evidence of 'best endeavours' to remove wellheads and associated guide bases (e.g. operational reports).
2b			In the case wellheads or associated guide bases cannot be retrieved, NOPSEMA will be notified via the End of the Operation of an Environment Plan under Regulation 25A and through the annual environmental report under Regulation 26C.	End of the Operation of an Environment Plan under Regulation 25A and through the annual environmental report under Regulation 26C
3	Lighting	No adverse lighting impact on threatened fauna species as a result of the activity	Direction of temporary lighting on the vessel towards the sea will be minimised via communication through the Induction.	Vessel Induction – to include minimising temporary lighting directed towards the sea

EPS	Hazard / Event	Performance Outcomes	Performance Standards	Measurement Criteria
4	Noise generated	No threatened fauna species mortaility from noise impact as a result of the activity	Comply EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.04) Interacting with cetaceans, specifically: vessels will not travel greater than 6 knots within 300 m of a whale (caution zone) and not approach closer than 100 m from a whale; and a vessel will not approach closer than 50 m for a dolphin and/or 100 m for a whale (with the exception of animals bow riding). Requirements of EPBC Regulations Division 8.1 will be applied to whale sharks interactions. Comply with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.06) – Interacting with calves, which requires vessels to not approach closer than 300 m to a calf (whale or dolphin) (the caution zone). If a calf appears in the caution zone, then: • the vessel must be immediately stopped; and • must either o turn off the vessel's engines; or o disengage the gears; or o withdraw the vessel from the caution zone at a constant speed of less than 6 knots. Exception: The above requirement does not apply to the vessel operating under limited/constrained manoeuvrability, or in the event of an emergency.	Vessel logs – record sightings of cetaceans and show compliance with EPBC Regulations 2000 Part 8 and Australian National Guidelines for Whale and Dolphin Watching (Commonwealth Government of Australia 2005).
5	Seabed disturbance	To cause no permanent environmental impact to seabed as a result of the activity.	The wellhead removal activity was engineered to minimise seabed disturbance by cutting the wellhead from the inside, below the seabed (0.5-1.5m), aided by an ROV. All temporary equipment on the seabed will be retrieved. The footprint of the temporary equipment on the seabed will be recorded.	Record of the footprint of temporary equipment on the seabed (i.e. desktop foot print calculation based on equipment size or before and after seabed disturbance ROV surveys)
	Vessel collision with marine life	No fauna death or injury associated with vessel collisions with cetaceans or protected fauna.	Refer to EPS 4	Refer to EPS 4
6	Introduction of invasive marine spieces from the vessel	No introduction of invasive species attributable to the wellhead removal operations	Compliance with Shell Australia Marine Biosecurity Management Manual (HSE_GEN_005791). • Shell's biosecurity risk assessment process will be applied to vessels and submersible equipment planning to enter and operate within nearshore waters around Australia. • Only low risk vessels are allowed to mobilise to site (as defined in the *Biosecurity Act 2015*). Based on the outcomes of each biosecurity risk assessment, management measures commensurate with the risk will be implemented to minimise the likelihood of new invasive marine species being introduced, or established invasive marine species being spread within Australian waters.	Vessel IMS risk assessment Vessel OCIMF OVID Report Ballast water logs Other records of vessel compliance with Biosecurity Regulations (e.g. Quarantine reporting and inspections reports) Vessel antifouling /hull cleaning report (if required)

EPS	Hazard / Event	Performance Outcomes	Performance Standards	Measurement Criteria
7	Discharge of bilge and deck drainage into the sea	To cause no permanent environmental impact to surface water quality from the discharge of vessel bilge and deck drainage waters as a result of the activity.	Compliance with **Marine Order 91** (Marine pollution prevention – oil) 2006, requires, where applicable: • vessels hold a valid International Oil Pollution Prevention (IOPP) Certificate, as required by vessel class • equipment for the control of oil discharge from machinery space bilges and oil fuel tanks (e.g. oil separating/filtering equipment [15 ppm] and oil content meter) • oil residue holding tanks • standard discharge connections • Ship Oil/Marine Pollution Emergency Plan (SOPEP/SMPEP) Records of discharge or disposal of bilge water will be recorded in the vessel's Oil Record Book. Pollution drills will be carried out as per the Vessel SOPEP/SMPEP and recorded in the vessel log.	Valid International Oil Pollution Prevention Certificate Vessel Oil Record Book Vessel SOPEP/SMPEP Vessel log
8	Discharge of sewage, grey water and putrecible waste into the sea	To cause no permanent environmental impact to surface water quality from the discharge of putrecible wastes, sewage from vessels as a result of the activity.	Compliance with **Marine Order 97** (Pollution prevention – sewage), as required by vessel class: • a valid International Sewage Pollution Prevention (ISPP) Certificate • sewage treatment plant • sewage commuting and disinfecting system • sewage holding tank. Sewerage system shall be capable of servicing the full complement of crew on board the vessel and holding tanks shall be sized appropriately to contain all generated waste (black and grey water) for the necessary duration prior to planned and acceptable discharge operations.	Valid International Sewage Pollution Prevention Certificate
9			Compliance with **Marine Order 94 & 95** (pollution prevention – packaged harmful substances & garbage), as required by vessel class: • Putrescible waste and food scraps are passed through a macerator so that it is capable of passing through a screen with no opening wider than 25 mm. • All wastes (other than sewage, grey water and putrescible wastes) will be sent to shore for recycling, disposal or treatment.	Vessel Garbage Management Plan Vessel Garbage Record Book

EPS	Hazard / Event	Performance Outcomes	Performance Standards	Measurement Criteria
10	Use of wellhead cutting fluids	To cause no permanent environmental impact to surface water quality from the use of wellhead cutting fluids as a result of the activity.	Chemical Selection Process (Section 7) has been applied to Wellhead Cutting Fluids. The wellheads will be cut from inside the well below the seabed (nominally 0.5-1.5m). The quantities of Wellhead cutting fluids will be monitored and reported.	Record of application of Chemical Selection Process for Wellhead Cutting Fluids Records of use of wellhead cutting fluids
11	Atmospheric emissions from fuel combustion	To cause no permanent environmental impact to air quality from the discharge of combustion emissions as a result of the operations.	Compliance with **Marine Order 97** (marine pollution prevention – air pollution) vessels, where required by class will have: • a valid International Air Pollution Prevention Certificate • a the Ship Energy Efficiency Management Plan (SEEMP), where required by class • use of low sulphur fuel when available (3.5%). Fuel use of the vessel will be monitored and Greenhouse Gas emissions reported.	Valid International Air Pollution Prevention Certificate Bunker receipts – indicate sulphur content Fuel consumption logs and reports Vessel Ship Energy Efficiency Management Plan Fuel use records
	Accidental discharge of non- hazardous waste into the sea.	Minimise risk of non-compliant discharges into the ocean at anytime during the activity.	Refer to EPS 7, 8 and 9	Refer to EPS 7, 8 and 9
	Accidental discharge of hazardous waste or chemicals into the sea.	Minimise risk of non compliant discharges into the ocean at anytime during the activity.	Refer to EPS 7, 8 and 9	Refer to EPS 7, 8 and 9

EPS	Hazard / Event	Performance Outcomes	Performance Standards	Measurement Criteria
12	Hydrocarbon spill resulting from vessel collision	No vessel –vessel collisions. Note spill response dealt with separately below in 'Spill reaching the environment'.	Vessels compliant with **Marine Order 30** (Prevention of Collisions) 2009: • adhere to steering and sailing rules including maintaining look-outs (e.g. visual, hearing, radar etc.), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar) • adhere to navigation light display requirements, including visibility, light position/shape appropriate to activity • adhere to navigation noise signals as required. Vessels compliant with **Marine Order 21** (Safety of navigation and emergency procedures) 2012: • adherence to minimum safe manning levels • maintenance of navigation equipment in efficient working order (compass/radar) • navigational systems and equipment required are those specified in Regulation 19 of Chapter V of SOLAS • AIS installed as required by vessel class in accordance with Regulation 19 of Chapter V of SOLAS. The vessel shall be equipped with suitable Navigational Systems and critical equipment meets requirements under the OCIMF OVID. As determined through vessel contracting requirements outlined in Shell Australia Marine Operations Manual.	Records of notification to AMSA Vessel OCIMF OVID Report Vessel vetting records
13	Spill reaching the environment (Response Preparedness)	To be prepared for a spill response according to the following plans: Oil Pollution Emergency Plan *Note Prevention of spills is discussed above.*	The Wellhead Removal OPEP and implement Shell Australia Emergency Response Procedure in the event of an emergency as per the OPEP. Minimum training requirements for key oil spill response personnel include; IMO 3 (or equivalent) training: EIM's, and IMO 2 (or equivalent) training: IMT Section Unit Leads and Environment Unit Lead. Conduct oil spill response test and exercises in line with section 7.5.	Shell Australia Emergency Management Procedure Record of OPEP test Emergency training records

EPS	Hazard / Event	Performance Outcomes	Performance Standards	Measurement Criteria
14	Shoreline Clean-up	In the event of an emergency event – spill to water; minmise the potential environmental risk to the sensitive receptors within the zone of potential impact.	Relevant response personnel shall receive an induction outlining key controls to minimise disturbance to nesting turtles and/or seabirds prior to commencing relevant response activities. Key controls to be outlined in the induction include; • Measures to minimise disturbance to nesting seabirds and turtles from response personnel and helicopters; • Areas of the island to avoid and minimise assocaited ground disturbance from trampling etc; and • Waste management requirements	Induction records demonstrate it was completed before response activity commenced.
15			Implement shoreline clean-up strategy as outlined in OPEP Shoreline Response Guide and commencement and termination criteria outlined in the OPEP as relevant to the emergency event; DoT as control agency agree to commencing planned strategy through approval of relevant IAP. Conduct SCAT.	Records demonstrate shoreline clean-up strategy is implemented as outlined in OPEP Shoreline Response Guide and commencement and termination criteria outlined in the OPEP as relevant to the emergency event.
	Oiled Wildlife Response		EPS 14	
16	Oil Spill Monitoring	Determine the fate and ecological consequences of a Level 2 and 3 spills to enable environmental impacts and recovery to be measured.	Implement Shell Australia Oil Spill Monitoring Plan (HSE_PRE_000496)* as outlined in resources OSMP Table 4.1 and 4.2 as relevant to the emergency event.	Records demonstrate oil spill monitoring plan (HSE_PRE_000496) resources are implemented as outlined in OSMP Table 4.1 and 4.2 as relevant to the emergency event.
17			Implement oil spill monitoring plan (HSE_PRE_000496) maintenance and testing arrangements as outlined in Section 4.2.1 of the OSMP.	Records demonstrate oil spill monitoring plan (HSE_PRE_000496) maintenance and testing arrangements are implemented as outlined in Section 4.2.1 of the OSMP.

* Refer to Shell Australia Oil Spill Monitoring Plan (HSE_PRE_000496) submitted to NOPSEMA under the Prelude FLNG Environment Plan (2000-010-G000-GE00-G00000-HE-5880-00002).

7. Environmental Plan Implementation Strategy

The OPGGS (E) Regulations require an Implementation Strategy to be incorporated into the EP that includes:

- Measures and the systems, practices and to ensure that environmental risks continue to be identified and reduced to a level that is ALARP, mitigating measures are effective, and environmental performance outcomes and standards are met;
- Chain of Command;
- Measures to ensure workers are aware of their responsibilities;
- Monitoring and management;
- Records and reporting;
- Oil Pollution Emergency Plan (OPEP) provided as a separate document together with this EP submission; and
- Consultation.

7.1. Management Systems

The Shell Commitment and Policy on Health, Safety, Security, Environment and Social Performance (HSSE and SP) applies globally and documents Shell's commitment to protect people and the environment (Section 4).

This commitment is further supported by the Shell Group HSSE and SP Control Framework. The relevant environmental requirements from Shell's HSSE and SP Control Framework have been captured in this EP. This EP outlines how the aspects of the wellhead removal activity's associated environmental risks have been assessed and will be managed. Shell is responsible for assuring that the wellhead removal activity is managed in accordance with this EP.

Shell Australia's HSSE Management System (HSSE MS) provides a structured and documented framework for the effective management of HSSE risks, and demonstrates how the requirements of the Group HSSE and SP Control Framework are implemented throughout the business. Shell HSSE MS Manual consists of the following sections:

- Leadership & Commitment
- Policy & Objectives
- Organisation, Responsibility & Resources, Standard & Documents
- Risk Management
- Planning & Procedures
- Implementation, Monitoring & Reporting
- Assurance
- Management Review

The HSSE MS is subject to a continuous improvement 'plan, do, check, review' loop. Shell Australia's HSSE MS covers all operations within its business, including that of this wellhead removal activity.

7.2. Monitoring, Audits and Incident Investigation

This section of the EP outlines the measures undertaken by Shell to regularly monitor the management of environmental risks and impacts of the activity against the performance outcomes, standards and measurement criteria, with a view to continuous improvement of environmental performance.

7.2.1. Environmental Performance Monitoring

Monitoring and review of environmental performance of the activity is done to meet the requirements of the following:

- Shell Australia Environmental Reporting Manual (HSE_GEN_003179)
- Shell Australia Environmental Compliance Procedure (HSE_GEN_003177)

Emissions and discharges parameters which will be monitored from the activity are detailed in relevant parts of Section 5 and in the performance outcomes, standards and measurement criteria table in Section 6, and are summarised in Table 11. The following may be used for annual NGERS and NPI reporting.

Table 11: Sources of Emissions and Discharges for Monitoring

Source	Parameter to be Monitored	Monitoring Frequency	Monitoring Equipment/ Methodology*	Records	EP Reference
Discharge from bilge system	Oil Content Volume *As per IOPP Certificate	Per discharge	*As per IOPP Certificate	Maintenance Records of oily water separator Oil Record Book	Section 5.3.1
Discharge from the sewage and greywater	Quality Volume *As per ISPP Certificate	*As per ISPP Certificate	*As per ISPP Certificate	Maintenance Records of sewage treatment system	Section 5.3.2
Wellhead Cutting Fluids	Volume of flocculant and grit	End of campaign	Delivery certificates	Delivery certificates	Section 5.3.3
Ballast Water	Volume Location	As required / per exchange	Ballast Water log	Ballast Water log	Section 5.2.6
Atmospheric Emissions	Diesel sulfur content	As required (every delivery)	Delivery certificates	Delivery certificates	Section 5.4.1
	Diesel volume used	As required (every delivery)	Delivery certificates	Delivery certificates	
Non-hazardous wastes generated and disposed	Volume of wastes	As required (every delivery)	Garbage Record Book	Garbage Record Book	Section 5.5
Hazardous wastes generated and disposed	Volume of wastes	As required (every delivery)	Garbage Record Book	Garbage Record Book	Section 5.5
Accidental releases of hydrocarbons or chemicals	Type, volume and Concentrations of release Incidents	Per incident	Monthly incident reports and analysis. Volumes will be estimated based	Incident reports in Fountain Incident Management Monthly	Section 5.5.2

Source	Parameter to be Monitored	Monitoring Frequency	Monitoring Equipment/ Methodology*	Records	EP Reference
	reported in accordance with Shell and regulatory requirements.		on technical data and evaluations (e.g. duration of release and known inventory)	Environmental Incident Reports	

7.2.2. Marine Vessel Assurance

The vessel planned to be used on this wellhead removal activity is required to achieve "Positive Vetting" in accordance with the requirements specified in the HSSE & SP Control Framework – Transport Manual – Maritime Safety. The provisions of the Shell Australia Marine Vessels Assurance Control Procedures (OPS_PRE_000210) apply to all contractor vessel activities associated with Shell. They are assessed to be in compliance prior to mobilisation. Numerous stakeholders are required in order to assure a positive vetting, including Marine SME, Aviation SME and country security manager, Global Maritime Marine Warranty Surveyor and the project workstreams responsible for the particular activity to be conducted. The Marine Vessel Assurance process ensures that the physical safeguards are robust, including:

- Navigation Equipment and Aids;
- Communication Equipment ;
- Dynamic Positioning System;
- Lifting Equipment; and
- Emergency shut-down, alarm and lighting systems.

7.2.3. Environmental Audits and Assurance

Aside from the pre-qualification / premobilisation assurance, including the vessel compliance checks, no other audits are planned given the short duration and low nature and scale of the wellhead removal activity.

7.2.4. Management and Review of Environment Plan

The only planned review of the EP will be after the completion of the activity, once the environmental performance of the program has been assessed. The results of the review will be incorporated into future operations.

However, if any new or increased risks are identified during the activity, an assessment of the risk and review of the EP is undertaken and, if determined to be a significant new or significantly increased risk, the activity leading to the new risk will not continue until acceptance of the management approach to the new/ changed risks has been provided by NOPSEMA. A significant increase in risk would mean a change in the colour to a higher risk in the RAM (Figure 6).

This review process will work to make sure that the specified controls and environment plan are adequate to reduce the risks to ALARP and if the risk has changed, additional controls will need to be put in place, so that the risks can be continually reduced to ALARP.

7.2.5. Management of Incidents and Non-Conformances

All Health, Safety, Security and Environmental incidents and non-conformances are managed in accordance with the Shell Australia HSSE Incident Reporting, Investigation and Follow up Procedure (HSE_GEN_000027) that describes the process of reporting, classification, investigation, follow-up and close out. Non-conformances are treated in the same way as incidents and for the purposes of this document are referred to as incidents.

All incidents records are managed in an online electronic system called Fountain Incident Management (FIM). Below is the overview of the incident management process:

- The system allows incidents to be raised by any employee of the company including offshore personnel.
- The incident is then assigned to a Responsible Supervisor (Incident Owner) who then retains the ownership of the incident until closeout.
- The Responsible Supervisor initiates the Incident Investigation the depth of which depends on the actual and potential risk ranking of the incident.
- The recommendations of the investigation team are reviewed by the Incident Owner who then assigns the corrective and preventative actions to appropriate action party. Actions are tracked to closeout where the Incident Owner accepts that the remedial action is successfully completed based on the evidence recorded and logged in FIM.
- FIM provides functionality for automatic reminders for Incident Owner and Action Parties about the actions due. However, in addition reviews of outstanding actions are carried out both at asset/department level, and at the Shell Business Assurance Committee level at regular intervals to ensure timely closeout of actions.

In addition to the Incident Management Process outlined above, Shell also reports the number of non-compliances to the Shell Group on a quarterly basis, along with other HSE data in accordance with Shell Group Performance Monitoring and Reporting (PMR) standard. This information is reviewed in a dedicated HSE Business Performance Review where Shell Australia performance is reviewed by the Shell Group.

All employees or contracted staff are encouraged to submit incident reports to alert the organisation about the occurrence of an incident or non-conformance. Site HSSE Advisors or coordinators are responsible for making sure these reports are raised in the FIM system.

The incident investigation process works to understand the cause of an incident and the reason why a control/ mitigation measure has failed and to rectify the fault to prevent recurrence and the reporting process works to track performance and allows sharing of learnings. This process contributes to reducing the risks to ALARP.

7.3. Reportable and Recordable Incidents – External

7.3.1. Reportable Incidents

NOPSEMA will be notified of all reportable incidents under Regulation 26 of the OPGGS (E) Regulation within 2 hours of the incident and in writing with 3 days. Under the OPGGS (E) Regulations, **Reportable Incidents** are defined as *'an incident relating to the activity that has caused, or has the potential to cause, moderate to significant*

environmental damage'. The Shell Group Risk Assessment Matrix (refer to Section 5) uses severity levels 0 to 5 to define environmental consequences (no effect, slight effect, minor effect, moderate effect, major effect and massive effect'). All environmental effects with a severity 3 or greater (i.e. moderate to massive) are considered Reportable Incidents. Based on the risk assessment (Table 5), only one event is considered to be of moderate or higher consequence:

- Diesel spill resulting from a collision with another vessel.

Additional reportable incidents are also captured in Table 12. The reportable incident report contains all material facts and circumstances concerning the reportable incident, actions taken to avoid or mitigate any adverse impacts and corrective action taken. This report will be made to NOPSEMA (phone: +61 8646 17090, submissions@nopsema.gov.au). The NOPSEMA incident reporting guidance, plus the Incident Response Form (FORM FM0831 – Reportable Environmental Incident) can be located at http://www.nopsema.gov.au/environmental-management/notification-and-reporting/

Table 12: Externally Notafiable Incidents

Incident	Legislation	Timing of Notification with respect to the occurrence of the incident.	Contact Details
Uncontrolled release of petroleum liquids > 80 L.	OPGGS (Safety) Regs (Chapter 2, Part 4, Subregulation 2.41 (2)	ASAP and in writing within 3 days afterward.	NOPSEMA Incident Notification: (08) 6461 7090 Incident Reports submissions@nopsema.gov.au
Any spill to water	Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (2015).	ASAP once pollution has been confirmed	AMSA via Australian Search and Rescue (AusSAR)) Phone: 1800 641 792 or +61 2 6230 6811 Incident Reporting Requirements: http://www.amsa.gov.au/forms-and-publications/AMSA1522.pdf AMSA POLREP: https://www.amsa.gov.au/environment/maritime-environmental-emergencies/national-plan/Contingency/Oil/documents/
Any breach in the biosecurity regulations, including exchange of ballast water within the twelve nautical mile limit.	Biosecurity Act 2015; Australian Ballast Water Management Requirements 2011.	ASAP once the breach is confirmed.	DAWR Phone: **1800 798 636**. or online at: http://www.agriculture.gov.au/pests-diseases-weeds/report
Any known or suspected introduced marine pest species in Western Australian state waters.	Fish Resources Management Regulations 1995 r176(1)	Within 24 hours.	Dept of Fisheries FishWatch 1800 815 507 E: biosecurity@fish.wa.gov.au Biosecurity Unit ((08) 9482 7333)
Death or injury of threatened, migratory or cetacean species from collision with a vessel.	EPBC Act 1999, Chapter 5, Part 13, Division 3, subdivision C, 232 (2).	Within 7 days, including the time, place, circumstances, species affected and the consequences of the action.	The Secretary, DOE Phone: +61 2 6274 1111 Fax: +61 2 6274 1666 protected.species@environment.gov.au
Reportable incidents for this EP: 1) Diesel spill due to vessel collision*	OPGGS (E) Regulations 2009 Reg 26.	Verbally within 2hrs.	NOPSEMA Incident Notification: (08) 6461 7090
	Stakeholder request	Verbally within 24 hrs	Department of Fisheries Spill response officer: Phone: 0433 151 567 Email: environment@fish.wa.gov.au

Incident	Legislation	Timing of Notification with respect to the occurrence of the incident.	Contact Details
	OPGGS (E) Regulations 2009 Reg 26(6).	Written record of the verbal notification as soon as practical post the verbal notification.	NOPSEMA Incident Reports submissions@nopsema.gov.au DMP Email: webmaster@dmp.wa.gov.au Ph: +61 (08) 9222 3333 NOPTA Email: titles@nopta.gov.au Ph: +61 8 6424 5300
	OPGGS (E) Regulations 2009 Reg 26A.	Written incident report within 3 days. Form: N-03000-FM0831**.	NOPSEMA submissions@nopsema.gov.au Or via secure file transfer at: https://securefile.nopsema.gov.au/filedrop/submissions
	OPGGS (E) Regulations 2009 Reg 26A(5).	Copy of the written incident report within 7 days of giving the written report to NOPSEMA.	DMP Email: webmaster@dmp.wa.gov.au Ph: +61 (08) 9222 3333 NOPTA Email: titles@nopta.gov.au Ph: +61 8 6424 5300

* If in state waters, contact DoT (08 9480 9924), and DMP Petroleum Environment Duty Phone within 2hrs.
** Incident Response Form (FORM FM0831 – Reportable Environmental Incident) can be located at: http://www.nopsema.gov.au/environmental-management/notification-and-reporting.

7.3.2. Recordable Incidents

Recordable incidents in the OPGGS (E) Regulation are defined as 'an incident arising from the activity that *breaches a performance objective or standard in the Environment Plan that applies to the activity and is not a reportable incident*'. Performance outcomes and standards for the program are detailed in Section 6.

NOPSEMA will be notified of all **Recordable Incidents**, according to the requirements of Regulation 26B of the *OPGGS (E) Regulations*. A report of Recordable Incidents must be given to NOPSEMA *'as soon as practicable after the end of each calendar month, and in any case not later than 15 days after the end of the calendar month'.*

As per the OPGGS (E) Regulations, the report will comprise:

- *'A record of all Recordable Incidents that occurred during the calendar month;*
- *All material facts and circumstances concerning the Recordable Incidents that the operator knows or is able, by reasonable search or enquiry, to find out;*
- *Any action taken to avoid or mitigate any adverse environment impacts of the Recordable Incidents; and*
- *The corrective action that has been taken, or proposed to be taken, to prevent similar Recordable Incidents'.*

The Shell HSSE Advisor will email the report on a monthly basis to the NOPSEMA. Recordable incidents are captured in Table 13.

Table 13: Externally Recordable Incidents

Incident	Legislation	Timing of Notification	Contact Details
Breach of any performance standard or objective (Table) in this EP.	OPGGS (E) Regulations 2009 Reg 26B And Part 1 (4) Definition of "recordable incident".	As soon as practicable after the end of each calendar month and in any case not later than 15 days after the end of the calendar month. Form: N-03000-FM0928	Send completed form to: NOPSEMA submissions@nopsema.gov.au Or via secure file transfer at: https://securefile.nopsema.gov.au/filedrop/submissions

7.4. Reporting

Shell also has internal reporting requirements against environment parameters identified in the Shell Group Performance Monitoring and Reporting (PMR) standard. This data is used as the basis for an annual Shell Group external HSE report (Shell Sustainability Report), which is publicly and externally reported.

7.4.1. Notifications

Titleholders need to complete Forms 1405 and Form 1408 per outline below and submit them to NOPSEMA in any of the following ways:

- hard copy to: NOPSEMA, Level 8, 58 Mounts Bay Road, PERTH 6000, Western Australia
- Post to: Submissions, NOPSEMA, GPO Box 2568, PERTH 6001, Western Australia
- secure file transfer : https://securefile@nopsema.gov.au/filedrop/submissions
- email to: submissions@nopsema.gov.au

7.4.1.1. Start and end of an activity

Regulation 29 of the OPGGS(E) Regs 2009 requires that a titleholder must notify NOPSEMA using Form 1405 (located at: http://www.nopsema.gov.au/environmental-management/environmental-resources/ on NOPSEMA's website) that an activity:

- is to commence at least 10 days before the activity commences; and
- is completed within 10 days after the completion.

7.4.1.2. Notification of the end of the Environment Plan

Regulation 25A of the OPGGS (E) Regs 2009 requires the title holder to notify NOPSEMA using Form 1408 (located at: http://www.nopsema.gov.au/environmental-management/environmental-resources/ on NOPSEMA's website) that:

- the activity or activities to which the plan relates have ended; and
- all of the obligations under the environment plan have been completed.

7.4.1.3. Notification of details of titleholder and liaison person

The details of the contact persons for this EP are as follows:

Titleholder:
Shell Australia Pty. Ltd. (ACN/ABN: 009663576/14009663876)
GPO Box A47 CDC, Perth, WA 6000

Liaison person:
Kelly Lamperd
External Relations Advisor
Emal address: Kelly.Lamperd@shell.com
Contact numbers: +61 8 9338 6019

Should there be changes to the details of Shell's liaison person and titleholder of this EP, NOPSEMA shall be notified through email (submissions@nopsema.gov.au) and via written correspondence.

7.5. Maintenance and Testing of Emergency Response and Oil Pollution Emergency Plan

The Wellhead Removal Oil Pollution Emergency Plan (OPEP) (HSE_GEN_010428) is presented in a standalone document. It links to the Shell Australia Emergency Management Procedure (HSE_GEN_010996).

The OPEP will be tested prior to the commencement of the activity by way of a walkthrough by the ERT to test the communication, ERT functionality, Emergency Response Plans, and to ensure that the Emergency Response Team members are aware of their roles and responsibilities in the event of an incident. The plan will be retested annually for the duration of the activity and if there are any significant changes to the activity or response arrangements.

OPEP tests are critical to ensure there is appropriate level of response readiness should there be an incident and is an important part of continually managing the risks associated with an oil spill to ALARP from a response readiness perspective.

7.6. Stakeholder Consultation

As operator, Shell Australia has consulted with relevant persons in accordance with the NOPSEMA *Guidelines for Assessment of Environment Plans: Deciding on Consultation Requirements* (N-04750-GL1629) under the OPGGS (Environment) Regulations 2009 for this Wellhead Removal EP.

Shell has ensured that all relevant persons have been provided with sufficient information and had the opportunity to raise any objections or claims.

Shell has addressed objections and claims raised in relation to this EP and can demonstrate that the risk or impact in question has been reduced to ALARP and will be at an acceptable level.

7.6.1. Consultation Background

The wellhead removal activity spans across 3 Shell operated permits in the Browse Basin. Shell has operated in the basin for over a decade since the award of the F-Block WA-371-P exploration permit in 2006. Following a successful exploration campaign, the Prelude field was discovered and a production licence WA-44-L awarded. Consultation and stakeholder engagement on the proposed Prelude FLNG Project began when the gas field was first discovered in early 2007, and has been ongoing since the Final Investment Decision (FID) was taken in May 2011. Most recently Shell has undertaken extensive stakeholder engagement from March 2015 to August 2016 for the Installation and Operations EP. One wellhead will be removed from WA-44-L, one from WA-371-P, and one from WA-85-AA.

The other four wellheads will be removed from the Crux retention lease AC/RL9. Shell became operator of the Crux permit in 2012 and drilled the Auriga-1 exploration well in

2013. During this time Shell undertook extensive stakeholder consultation for the Auriga-1 well which has helped to inform the stakeholder identification process for the wellhead removal campaign.

7.6.1.1. Shell General Business Principles and Stakeholder Engagement

Shell Australia's consultation is undertaken in line with the Shell General Business Principles and relevant legislative requirements. Key to these principles is that Shell employees share a set of core values - honesty, integrity and respect for people. Key principles:

- Local Communities: Shell aims to be a good neighbour by continuously improving the ways in which we contribute directly or indirectly to the general wellbeing of the communities within which we work. We manage the social impacts of our business activities carefully and work with others to enhance the benefits to local communities, and mitigate any negative impacts from our activities. In addition, Shell companies take a constructive interest in societal matters, directly or indirectly related to our business.
- Communication and Engagement: Shell recognises that regular dialogue and engagement with our stakeholders is essential. In our interactions with local communities, we seek to listen and respond to them honestly and responsibly. Part of this commitment is ensuring those people and organisations that are impacted by our activities are engaged, and that their concerns are heard and responded to.

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7.6.1.2. Sufficient Information

Shell provided relevant persons with a letter outlining all the risks and mitigations extracted directly from the EP. This approach ensured that recipients had access to the risks outlined in the EP and the associated mitigations and could make their own assessment on the impact of the activity, thus removing potential for Shell to make any assumptions about what relevant persons would be interested or concerned about. The letter also contained contact details, location specifics, details of the activity and the response period of 30 days.
Given the nature and scale of this activity there was no requirement for face to face meetings. However follow up phone calls and emails were made to stakeholders that had expressed an interest or concern about the activity in the past. Shell received 2 requests for additional information, which were responded to via email.
NB: In 2015, in an effort to gather further and better contact details from the commercial fishers. Shell distributed a feedback form by mail, which gave the recipients the opportunity to respond with updated email or phone contact details to allow for consultation via these channels. Shell received no responses to this form and therefore has only mailing addresses available so consultation occurs via mail.

For details on each relevant person's consultation, please see the Consultation Summary Table (Table 15).

7.6.2. Assessment of merits of claims and objections

Shell Australia has a claims process managed by the Social Performance Team which guides our actions in response to complaints received from stakeholders. . Shell adapted this process for the EP to ensure it allowed for the efficient assessment of the merits of the claims and objections received.

Shell utilises relevant subject matter expertise to assess the merits of any claims and objections and to determine a response to the relevant person.

7.6.3. Ongoing Consultation

Upon acceptance of this EP, Shell will uphold its commitments to ensuring relevant persons continue to be consulted if there are changes in the scope of the activity or stakeholders have requested to be updated during the campaign.

Shell's internal management of change process will also ensure that any material changes to the activity scope will trigger engagement with those who may be impacted.

Table 14: Relevant Persons and Consultation Process Table

Category	Relevant Persons	Functions, Interests or Activities	Consultation Approach	Ongoing Consultation
Commonwealth Government	**Australian Border Force**	Maintains the integrity of Australia's international borders including customs and immigration Marine user / operator.	Letter via email	Only in the event of a major change in scope.
Commonwealth Government	**Australian Hydrographic Service (Department of Defence)**	The RAN Australian Hydrographic Service is the Commonwealth Government agency responsible for the publication and distribution of nautical charts and other information required for the safety of ships navigating in Australian waters. Issue notice to mariners and update nautical charts. Operate under the Australian Navigation Act 2012.	Letter via email	Only in the event of a major change in scope and/or when wellheads or associated guide bases had been left in-situ due to failure of removal despite 'best endeavours. This will be through a notice to mariners and consultation with potentially affected fisheries to be made in the event of unsuccessful structure removal as soon as possible but within 90 days of the completion of the activity.
Commonwealth Government	**Department of Foreign Affairs and Trade (DFAT)**	International relations with governments and other organisations. Specifically, DFAT will have functions relating to oil spills in international waters or foreign countries jurisdictions.	Letter via email	Only in the event of a major change in scope or spill that would impact Indonesian waters.

Commonwealth Government	**Department of the Environment and Energy**	Administers the EPBC Act. Main functions are associated with providing oiled wildlife advice in commonwealth waters during an Oil spill.	Letter via email	Only in the event of a major change in scope.
Fisheries	**Commonwealth Fishing Association**	Peak body representing the collective rights, responsibilities and interests of a diverse commercial fishing industry in Commonwealth regulated fisheries.	Letter via email	Only in the event of a major change in scope.
Fisheries	**Kimberley Professional Fisherman's Association**	Represent professional fishers in the Kimberley region. Represent the Northern Dermersal Scalefish Fishery.	Letter via email	Only in the event of a major change in scope.
Fisheries	**Mackeral Managed Fishery**	Activities exist in or in close proximity to the area of operation. Near-surface trawling activities near coastal areas primarily.	Letter via post	Only in the event of a major change in scope.
Fisheries	**North Coast Shark Fishery**	Activities exist in or in close proximity to area of operation. Primarily use demersal gillnets and longlines.	Letter via post	Only in the event of a major change in scope and/or when wellheads or associated guide bases had been left in-situ due to failure of removal despite 'best endeavours. This will be through a notice to mariners and consultation with potentially affected fisheries to be made in the event of unsuccessful structure removal as soon as possible but within 90 days of the completion of the activity.
Fisheries	**North West Slope Trawl Fishery**	Activities exist in or in close proximity to area of operation. Bottom trawl.	Letter via post	Only in the event of a major change in scope and/or when wellheads or associated guide bases had been left in-situ due to failure of removal despite 'best endeavours. This will be through a notice to mariners and consultation with

				potentially affected fisheries to be made in the event of unsuccessful structure removal as soon as possible but within 90 days of the completion of the activity.
Fisheries	**Northern Demersal Scalefish Fishery** **NB: Represented by the Kimberly Professional Fisherman's Association.**	Activities exist in close proximity to the area of operation, as confirmed by DoF and WAFIC. Primarily trap based fishery.	Letter via post Letter via email to Kimberley Professional Fisherman's Association	Only in the event of a major change in scope and/or when wellheads or associated guide bases had been left in-situ due to failure of removal despite 'best endeavours. This will be through a notice to mariners and consultation with potentially affected fisheries to be made in the event of unsuccessful structure removal as soon as possible but within 90 days of the completion of the activity.
Fisheries	**Pearl Oyster Fishery** **NB: Represented by the PPA**	Activities exist in or in close proximity to area of operation. Bottom drifting divers from Lacepede Islands south to Exmouth.	Letter via email	Only in the event of a major change in scope and/or when wellheads or associated guide bases had been left in-situ due to failure of removal despite 'best endeavours. This will be through a notice to mariners and consultation with potentially affected fisheries to be made in the event of unsuccessful structure removal as soon as possible but within 90 days of the completion of the activity.
Fisheries	**Pearl Producers Association (PPA)** **NB: Represents the Pearl Oyster Fishery.**	Peak industry representative body for the Pinctada maxima pearling industry licensees in Western Australia.	Letter via email	Only in the event of a major change in scope.
Fisheries	**RecFish**	Recfishwest is the peak body representing 740,000 recreational fishers in Western Australia.	Letter via email	Only in the event of a major change in scope.

Fisheries	**Southern Bluefin Tuna Fishery**	The Southern Bluefin Tuna Fishery covers the entire sea area around Australia, out to 200 nm from the coast. Pelagic long line and purse seine fishing gear is used.	Letter via post	Only in the event of a major change in scope.
Fisheries	**WAFIC**	Peak commercial fishing industry body to representing commercial fishers in WA.	Letter via email Follow up phone call	Only in the event of a major change in scope.
Fisheries	**West Coast Deep Sea Crustacean Fishery**	Activities exist in or in close proximity to WA-44-L, WA-371-P or AC/RL9. Baited pots >150m, mostly between 500m - 800m.	Letter via post	Only in the event of a major change in scope and/or when wellheads or associated guide bases had been left in-situ due to failure of removal despite 'best endeavours. This will be through a notice to mariners and consultation with potentially affected fisheries to be made in the event of unsuccessful structure removal as soon as possible but within 90 days of the completion of the activity.
Fisheries	**Western Tuna & Billfish Fishery**	Activities exist in or in close proximity to WA-44-L, WA-371-P or AC/RL9. Near surface longline and minor line gear used.	Letter via post	Only in the event of a major change in scope.
Government Agency	**Australian Fishery Management Authority (AFMA)**	The Australian Fisheries Management Authority (AFMA) is the Australian Government agency responsible for the efficient management and sustainable use of Commonwealth fish resources, in particular, Section 7 of the Fisheries Administration Act 1991.	Letter via email	Only in the event of a major change in scope.
Government Agency	**Australian Marine Safety Authority (AMSA) including AMSA RCC.**	The Australian Maritime Safety Authority (AMSA) is a statutory authority established under the Australian Maritime Safety Authority Act	Letter via email	Only in the event of a major change in scope and/or when wellheads or associated guide bases had been left in-situ due to failure of removal despite 'best

		1990 (the AMSA Act). AMSA are the responsible authority for the National Plan for maritime environmental emergencies. This power is provided under the AMSA act 1990 Regulator for the Australian Navigation Act 2012 and Protection of the Sea Act 1983.		endeavours. This will be through a notice to mariners and consultation with potentially affected fisheries to be made in the event of unsuccessful structure removal as soon as possible but within 90 days of the completion of the activity.
State Government	**Department of Environment Regulation (WA)**	Administers Section 72 EP act, reporting of Environmental Pollution. Have a role in the environmental management of WA state jurisdiction.	Letter via email	Only in the event of a major change in scope.
State Government	**Department of Mines and Petroleum (DMP)**	DMP is the responsible regulatory agency for offshore petroleum activities in Western Australian state territory and waters with reference to DMP Environment Division as the lead Western Australian agency for environmental issues associated with Petroleum exploration or production Noted that DMP is also the Joint Authority with the DMP Executive Director Petroleum Division being the Delegate of the State Member for the Joint Authority with responsibilities under the OPGGS Act.	Letter via email	Only in the event of a major change in scope. Provide project updates as part of normal half yearly Shell Offshore activity update.

State Government	**WA Department of Fisheries (DOF)**	The Department of Fisheries' cover policy development, licensing and legislation related to the State's commercial and recreational fisheries, pearling, aquaculture, the aquatic charter industry, customary fishing and protection of aquatic ecosystems, including safeguarding our aquatic biosecurity. They administer the Fish resources management Act 1984	Letter via email	Only in the event of a major change in scope and/or when wellheads or associated guide bases had been left in-situ due to failure of removal despite 'best endeavours. This will be through a notice to mariners and consultation with potentially affected fisheries to be made in the event of unsuccessful structure removal as soon as possible but within 90 days of the completion of the activity.
State Government	**WA Department of Parks and Wildlife (DPAW)**	The Department of Parks and Wildlife manage wildlife within state land and waters and WA state marine parks and reserves. They are the lead agency for oiled wildlife response during an oil spill. These powers are defined under the Wildlife Conservation Act 1950 and the Animal Welfare Act 2002.	Letter via email	Only in the event of a major change in scope.
State Government	**WA Department of Transport (DOT)**	DOT are responsible for managing oil spills in state waters under the Emergency Management Act 2005.	Letter via email	Only in the event of a major change in scope.

7.6.4. Conclusion

Shell's approach to consultation on the Wellhead Removal EP is one which is appropriate to the scale, low-risk, short term nature of the activity. It has resulted in transparent and collaborative discussions between Shell and the identified relevant persons during the preparation of this EP.

Shell is confident that the processes outlined in this EP have adequately afforded relevant persons a detailed understanding of the Wellhead Removal Campaign risks and potential impacts, as well as the opportunity to communicate claims or objections for Shell to address as appropriate.

Shell does not intend to provide further updates on the Campaign unless there are major changes in the scope and associated risks or the stakeholder has requested progress updates.

Table 15: Consultation Summary Table

Relevant Persons	Consultation Undertaken	Summary of Response	Stakeholder Objections and Claims	Assessment of Objections and Claims	Status
Commonwealth Government					
1. Australian Border Force	Consultation has been ongoing with the Australian Border Force for many years in relation to immigration and customs requirements for Prelude in WA-44-L. Correspondence on 7th October	During engagement for the Prelude project the Department advised not to expect a response from the Department regarding Environment Plans.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
2. Australian Hydrographic Service	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
3. Department of Foreign Affairs and Trade (DFAT)	Correspondence on 7th October	Based on previous engagements for the Prelude project, DFAT have requested that Shell contact the Directorate of Indonesia / East Timor in the event of an oil spill that would affect Indonesian territorial waters.		DFAT notification requirements incorporated in the EP.	Sufficient information supplied. Appropriate consultation completed.
Fisheries					
4. Commonwealth Fishing Association	Correspondence on 7th October	No response to date.	No claims or objections to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
5. Kimberley Professional Fisherman's Association (KPFA)	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
6. Northern Demersal Scalefish Fishery	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
7. Mackeral Managed Fishery	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
8. North Coast Shark Fishery	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
9. North West Slope Trawlery	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
10. Pearl Producers Association (PPA)	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.

Relevant Persons	Consultation Undertaken	Summary of Response	Stakeholder Objections and Claims	Assessment of Objections and Claims	Status
11. RecFish West	Correspondence on 7th October		No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
12. Southern Bluefin Tuna Fishery	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
13. WAFIC	Correspondence on 7th October	10th November – phone call to follow up.	WAFIC request that Shell direct engagement with licence holders. WAFIC request engagement with: Broome Prawn, Kimberley Prawn, West Coast Deep Sea Crab, North Coast Demersal Scalefish Zone 2, Mackerel and Pearling. For Commonwealth-managed fisheres, consult with AFMA.	Shell has directly provided engagment to individual fishing licence holders Shell confirms that letters were sent to North Coast Demersal Scalefish, Mackeral and Pearling. Furthermore, Commonwealth-managed fisheries were engaged through AFMA.	Sufficient information supplied. Appropriate consultation completed.
14. West Coast Deep Sea Fishery	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
15. Western Tuna & Billfish Fishery	Correspondence on 7th October	No response to date.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
Government Agencies					
16. Australian Marine Safety Authority (AMSA)	Consultation has been ongoing with AMSA for many years for compliance with the Navigation Act and POTS Act. In addition, AMSA have been engaged regarding their responsibilities and interface with Shell under the National Plan and AMSA Act 1990. Correspondence 7th October.	12th October – email received.	No objections or claims to date.	n/a	Sufficient information supplied. Fair consultation completed.
17. Australian Fishery Management Authority (AFMA)	Correspondence on 7th October	10th October – emailed received acknowledging receipt of information and requesting that all correspondence be sent to petroleum@afma.gov.au	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
State Government					
18. Department of Environment Regulation WA (DER)	Correspondence 7th October	7th October – email confirming receipt of information	No objections or claims to date.		Sufficient information supplied. Appropriate consultation completed.
19. Department of Mines and Petroleum (DMP)	Correspondence 7th October	14th October – Emailed received requesting further information on the description of the environment and potential impacts to State waters.	DMP request that Shell note the approval requirements for the use of dispersant in the event of an oil spill.	Shell confirms it will reflect the requirement in the EP.	Sufficient information supplied. Appropriate consultation completed. Accounted for in the Acceptability

Relevant Persons	Consultation Undertaken	Summary of Response	Stakeholder Objections and Claims	Assessment of Objections and Claims	Status
		1st November – Shell provided additional information 4th November – email received from DMP.			assessment of Section 5.6.1 – Hydrocarbon spill resulting from vessel collision
20. WA Department of Fisheries (DOF)	Correspondence 7th October	11th October – Email received requesting further information on the high pressure cutting and expected duration of turbidity. 1st November – Shell provided additional information. 3rd November – email confirming receipt of additional information. DoF indicated a formal response would be provided in the week commencing 7th November. 10th November – phone call to follow up. 15th November – formal advice received via email. 24th November - Shell provided additional information.	To ensure affected fishers are consulted prior to the commencement of the proposed activity, the Department recommends that Shell Australia initiate and maintain ongoing consultation with the Western Australian Fishing Industry Council, the Pearl Producers Association of WA, Recfishwest and directly with fishers (contact details of licensed fishers can be obtained through the Department's public register). The Department advises that the following commercial fishing interests exist in, or in close proximity to, the areas associated with the proposed activities: • Mackerel Managed Fishery • Joint Authority Northern Shark Fishery • Northern Demersal Scalefish Managed Fishery • West Coast Deep Sea Crustacean Managed Fishery In the event of an oil spill or discharge of any other pollutant into the environment, the Department requests that its spill response officer is contacted by phone (0433 151 567) and by email (environment@fish.wa.gov.au) within 24 hours of Shell Australia reporting the incident to the appropriate authority. For vessels moving into WA waters from overseas or interstate for this activity including WA-based support vessels servicing unmanaged offshore facilities like FPSOs and MODUs, the Department requests you use its new biofouling risk assessment tool Vessel Check (https://vesselcheck.fish.wa.gov.au) and complete the actions to manage any activity related vessels to a LOW / ACCEPTABLE risk rating. Alternatively, so Shell Australia can demonstrate the above, the Department requests the active use of a biofouling management plan and record book that meets all requirements under of the current edition of the International Maritime Organisation's Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species. The Department also requests that Shell	Shell confirms that all recommended stakeholders have been consulted on the activity. Shell confirms that notification to DoF is incorporated in the OPEP; consistent with regulatory requirements to notify Regulators and in accordance with the OPEP Shell Australia will notify DoF as soon as possible (within 24 hours) of a level 2 or 3 oil spill. Shell confirms managing its activities in accordance with the *International Maritime Organization (IMO) 2011 Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species* (aligned with the recommendation by DOF). Furthermore, the movements of the Light Well Intervention Vessel will be managed such that it will have LOW/ACCEPTABLE risk rating prior to entry to Australian territory and state waters. An Invasive Marine Species risk assessment will be done for the vessel which identifies the pre-voyage actions that are required per vessel. If the vessel has an overseas 'last port of call', a Pre-Arrival Report (Maritime Arrivals Reporting System (MARS)) will confirm	Sufficient information supplied. Appropriate consultation completed. Accounted for in the Acceptability assessment of Section 5.2.6 – Introduction of invasive marine species.

Relevant Persons	Consultation Undertaken	Summary of Response	Stakeholder Objections and Claims	Assessment of Objections and Claims	Status
			Australia plan how it intends to manage residual risk after arrival in WA waters. Where there is a possibility that microscopic marine pests have settled on a vessel (e.g. such as the vessel failing to depart from overseas or interstate for WA within seven days), the Department recommends that a follow-up marine pest inspection is conducted around 75 days later (if the vessel is in WA waters) to manage this residual risk. Any equipment coming from overseas or interstate for this activity should also be either new, or thoroughly cleaned, then dried for at least 24 hours and inspected for marine pests before use in WA waters. The Department requests that the presence of any suspected marine pest or disease be reported within 24 hours by email (biosecurity@fish.wa.gov.au) or telephone (FishWatch tel. 1800 815 507). This includes any organism listed in the Western Australian Prevention List for Introduced Marine Pests (see: http://www.fish.wa.gov.au/Documents/biosecurity/epa_introduced_ marine_pests.pdf), and any other non-endemic organism that demonstrates invasive characteristics. Please ensure the requests above are forwarded directly to all vessel operators associated with the project.	that the vessel meets ballast and quarantine requirements. The risk assessment will also determine if the residual risk requires any follow-up marine pest inspections to manage the residual risk of invasive marine species. While follow-up inspections are subject to the outcomes from risk assessment it is not our expectation that a follow-up inspection would occur. Shell confirms that the equipment used for the wellhead removal activity is currently based in Western Australia. Any other equipment which requires importing will have customs clearance, and comply with sections 176 (translocation of live non-endemic fish to WA) and 105 (bringing noxious fish into WA) of the Fish Resources Management Act 1994. Furthermore, the activity will meet the Department's requirements by following the Shell Australia Marine Biosecurity Management Manual. Shell confirms the plans to report any suspected detection of marine pests within 24 hours by email or telephone to the Department and this is reflected in the Wellhead Removal Environment Plan.	
21. WA Department of Parks and Wildlife (DPAW)	Correspondence 7th October	7th October – email received confirming receipt of information.	No objections or claims to date.	n/a	Sufficient information supplied. Appropriate consultation completed.
22. WA Department of Transport (DOT)	Correspondence 7th October	10th October – email received confirming receipt of information.	No objections or claims to date.		Sufficient information supplied. Appropriate consultation completed.

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