GREEN LIGHT ENVIRONMENTAL

BP Ironbark Small Scale Geotechnical and Geophysical Site Survey

Environment Plan Summary

Revision History

Rev	Issue Date	Revision summary	Originator	Reviewer	Approver
A	11/06/2019	Draft for BP review	C. Bateman	C. Weller	P. Raitt
B	17/06/2019	Draft for BP review	C. Bateman	C. Weller	P. Raitt
0	18/06/2019	Final for Submission to NOPSEMA	C. Bateman	P.Raitt	M. Kuijper

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1 Introduction

1.1 Overview

This Environment Plan (EP) summary has been prepared in accordance with the requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage Act 2006 and the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Environment Regulations).

This document summarises the BP Ironbark Small Scale Geotechnical and Geophysical Site Survey Environment Plan, which was accepted by the National Offshore Petroleum Safety Environment Management Authority (NOPSEMA) on 6 June 2019.

Excluded from the scope of this EP is the survey vessel transiting to or from the Operational Area. The survey vessel is deemed to be operating under the Commonwealth *Navigation Act 2012* and not performing a petroleum activity during transit.

1.2 Scope

BP is proposing to undertake a small scale geophysical and geotechnical survey (site survey) within Permit WA-359-P. This EP summary relates to the activities associated with the site survey in Commonwealth waters that occur within the Operational Area (as defined in Section 2 and depicted in Figure 1-1).

The primary objective for the site survey is the acquisition of site-specific geophysical and geotechnical data in WA-359-P. This activity will help identify surface and shallow subsurface characteristics of the site survey area, including the presence of potential geohazards and man-made seafloor hazards.

1.3 Titleholder Liaison

The titleholder liaison person for this petroleum activity is identified in Table 1-1.

Table 1-1 – Details of BP's Nominated Liaison Person

Company Name	Operator
Company Name	BP
Nominated Liaison Person	Tzila Katzel
Position	Director Environmental and Community Affairs
Business Address	Level 8, 250 St Georges Terrace, Perth, Western Australia, 6000
Telephone Number	08 9420 1828
Email Address	Tzila.Katzel@se1.bp.com

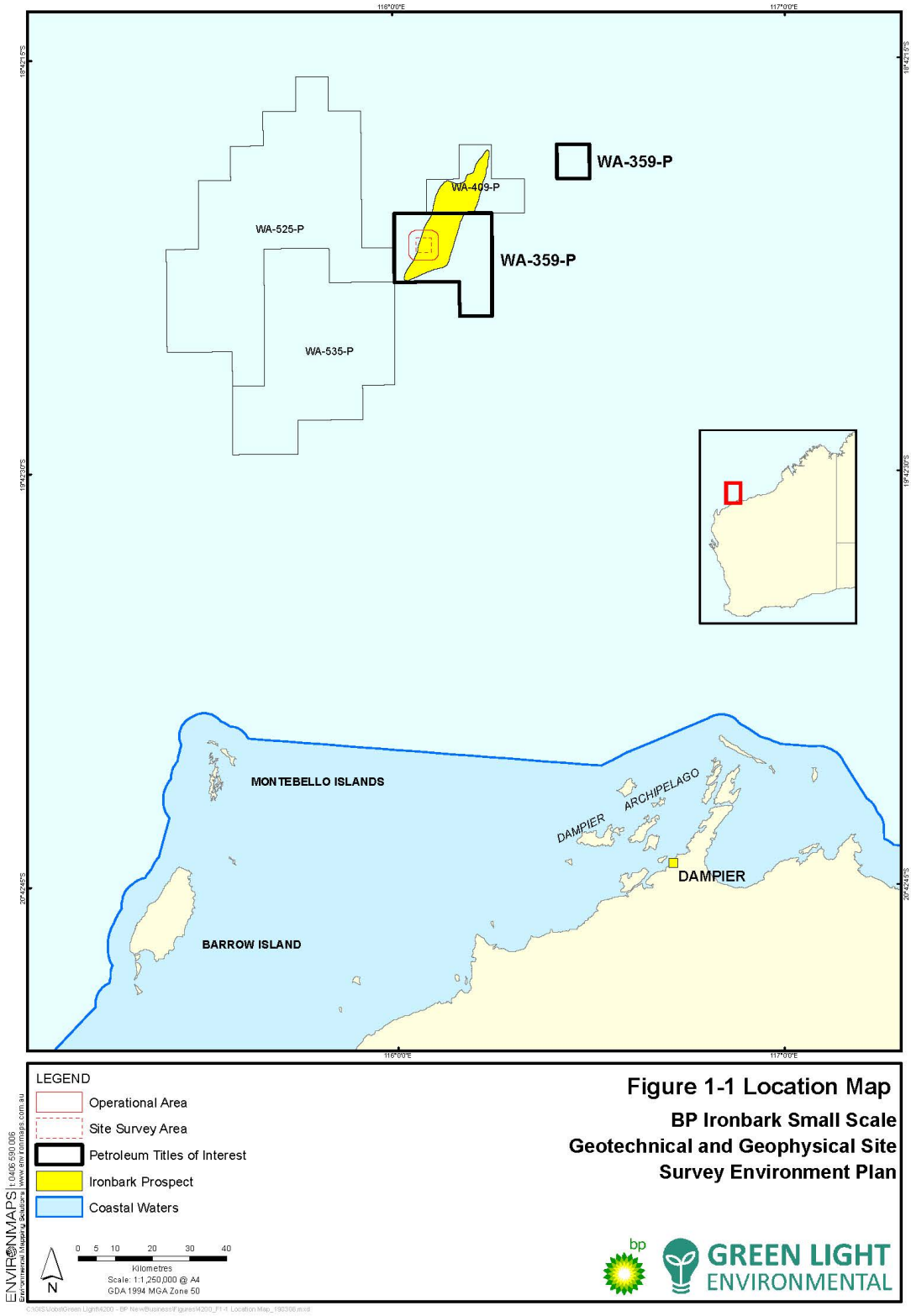

Figure 1-1 – Location of WA-359-P and Operational Area

2 Location of the activity

The site survey will be conducted over a 4 km x 4 km area located in offshore Commonwealth waters approximately 200 km north of the Dampier Archipelago. The Operational Area is defined as the site survey area plus a 2 km buffer for vessel manoeuvring, presented in Figure 1-1. Water depth in the Operational Area ranges from approximately 290 to 305 m. Coordinates for the Operational Area are provided in Table 2-1.

Table 2-1 – Geospatial Coordinates of the Operational Area (GDA94 * EPSG-Aus / MGA zone 50)

Latitude	Longitude
19° 07’ 23.22” S	116° 02’ 19.62” E
19° 07’ 24.60” S	116° 06’ 53.42” E
19° 11’ 43.43” S	116° 02’ 18.11” E
19° 11’ 44.81” S	116° 06’ 52.03” E

3 Description of the Environment

3.1 Environment that May be Affected

The environment that may be affected (EMBA) from the activity is associated with the maximum credible hydrocarbon spill event that may occur during petroleum activities. For the activities under this EP, the EMBA is based on hydrocarbon exposures above impact thresholds from a marine diesel oil (MDO) spill.

3.2 Regional Setting

The EMBA is in Commonwealth waters approximately 160 km north of the Dampier Archipelago. Water depths in the EMBA range from approximately 100 to 700 m. The EMBA, which encompasses the Operational Area, falls within the North West Shelf (NWS) province and North West Transition (NWT) bioregion of the North-west Marine Region (NWMR).

The NWT bioregion encompasses water depths from the shelf break (200 m depth) over the continental slope to depths of more than 1000 m (James et al. 2004 cited in DEWHA 2008). The NWS province is located primarily on the continental shelf, about half the bioregion has water depths of only 50-100 m, with maximum depths reaching only 200 m (DEWHA 2008).

Sediments in the EMBA are expected to be dominated by mud as is typical of the outer continental slope and continental shelf (Baker et al 2008). Sediments on the continental slope are expected to comprise very soft sandy clay/silt with the CAMRIS Marine Benthic Substrate Database indicating sediments are comprised of mud and calcareous clay (CSIRO 2017).

In the NWMR, water quality is regulated by the Indonesian Throughflow, which plays a key role in initiating the Leeuwin Current and brings warm, low-nutrient, low-salinity water to the NWMR (DEWHA 2008).

The EMBA is offshore and remote from urban or industrial areas. The EMBA is approximately 160 km from shore and from the town of Dampier (urban or industrial area) at its closest point (Figure 1-1). As such air quality is expected to be typical of an unpolluted tropical offshore environment and local light emissions via anthropogenic sources are limited to occasional vessels.

3.3 Ecological and Social Receptors

The following tables show the presence of ecological (Table 3-1) and social (Table 3-2) receptors that may occur within the EMBA. Examples of values and sensitivities associated with each of the ecological or social receptors have been included in the tables. These values and sensitivities have been identified based on:

- Presence of listed threatened or migratory species or threatened ecological communities identified in the Environment Protection and Biodiversity Conservation (EPBC) Protected Matter searches.
- Presence of Biologically Important Areas (BIAs) and habitats critical to the survival of the species.
- Presence of important behaviours (e.g. foraging, roosting or breeding) by fauna, including those identified in the EPBC Protected Matter searches.

- Their importance to other receptors (e.g. nursery habitat, food source, commercial species).
- Their importance to human activities (e.g. recreation and tourism, aesthetics, economy).

Table 3-3 shows the critical periods of seasonal receptors in the waters of the NWS.

Table 3-1 – Presence of Ecological Receptors within the EMBA

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	EMBA
Habitat	Soft Sediment	Predominantly unvegetated soft sediment substrates	Key habitat (e.g. benthic invertebrates)	Present The majority of the EMBA is located on the upper slope area (water depths of 225 – 500 m) of the continental slope. Studies completed within the region indicate that benthic composition in deep water habitats is generally lower in abundance than shallow water habitats of the region (DEWHA 2008). Gage (1996) reported that the density of benthic fauna tends to be lower in deep water sediments (>200 m) than in shallower coastal sediments, but the diversity of communities may be similar.
	Coral	Hard and soft coral communities	Nursery habitat (e.g. crustaceans, fish) Food source (e.g. fish)	Present Hard corals are generally found in shallower (<50 m) waters while the soft corals are found at most depths, particularly those below 50 m (Tzioumis and Keable 2007). Soft corals are likely to be found within the EMBA given soft corals can be found at most depths.
Marine Fauna	Plankton	Phytoplankton and zooplankton	Food Source (e.g. fish, whales, turtles)	Present Phytoplankton and zooplankton are widespread throughout oceanic environments and is expected to occur in the EMBA. Increased abundance and productivity can occur in areas of upwelling. Primary productivity of the NWMR is generally low and appears to be largely driven by offshore influences (Brewer et al., 2007 cited in DEWHA 2008).
	Seabirds and shorebirds	Birds that live or frequent the ocean	Threatened Species Listed Marine Species Listed Migratory	Present Nine seabird and shorebird species or species habitat may occur or are likely to occur within the EMBA. • Listed Threatened / Migratory Marine / Migratory Wetland Species: • Red Knot (Endangered) – may occur, • Eastern Curlew (Critically Endangered) – may occur. • Listed Migratory Marine Species: • Common Noddy – may occur, • Streaked Shearwater – likely to occur, • Lesser Frigatebird – likely to occur.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	EMBA
			Marine Species Listed Migratory Wetland Species	• Great Frigatebird – may occur, • Listed Migratory Wetlands Species: • Common Sandpiper – may occur, • Sharp-tailed Sandpiper – may occur, • Pectoral Sandpiper – may occur. No important behaviours (breeding, foraging and roosting) or BIAs were identified for seabird species within the EMBA in the EPBC Protected Matters search.
	Marine Invertebrates	Benthic and pelagic invertebrates	Food Source Commercial Species	Present Marine invertebrates may occur within the EMBA. The NWT bioregion is likely to support meiofauna (e.g. nematodes), larger infauna (e.g. polychaete worms and isopods) and sparsely distributed epibenthic communities (e.g. seapens) (Brewer et al. 2007 cited in DEWHA 2008). Mobile benthic species, such as deepwater sea cucumbers, crabs and polychaetes are likely to be associated with the seafloor (DEWHA 2008). In this generally low productivity environment, the dominant primary consumers are pelagic, vertically migrating zooplankton, such as crustaceans, larval molluscs and larval fish. These are preyed upon by larger crustaceans, jellyfish and squid (Brewer et al. 2007 cited in DEWHA 2008).
	Fish	Fish	Commercial Species	Present Commercial fish species are likely to occur within the EMBA. The upper slope (225-500 m depth) habitat of the NWT bioregion support rich and diverse demersal fish communities including commercial migratory pelagic species, such as juvenile southern bluefin tuna and billfish (DEWHA 2008).
		Sharks and Rays	Threatened Species	Present Eight shark and ray species or species habitat may occur, are likely to occur and are known to occur within the EMBA. • Listed Threatened / Migratory Marine Species:

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	EMBA
			Listed Migratory Marine Species BIA and habitat critical to the survival of the species	• Great White Shark (Vulnerable) – may occur, • Green Sawfish (Vulnerable) – known to occur, • Whale Shark (Vulnerable) – foraging, feeding or related behaviour known to occur. • Listed Migratory Marine Species: • Narrow Sawfish – may occur, • Shortfin Mako – likely to occur, • Longfin Mako – likely to occur, • Reef Manta Ray – likely to occur, • Giant Manta Ray – likely to occur. Important behaviours (foraging, feeding) is noted for the Whale Shark in the EPBC Protected Matters search. The EMBA overlaps a BIA for the Whale Shark. The Whale Shark BIA is associated with its foraging behaviours northward from Ningaloo along the 200 m isobath.
		Pipefish, Seahorse, Seadragons	Listed Marine Species	Present 26 syngnathid species or species habitat may occur within the EMBA. No important behaviours or BIAs have been identified. Almost all syngnathids live in nearshore or inner shelf habitats, usually in shallow, coastal waters, among seagrasses, mangroves, coral reefs, macroalgae-dominated reefs and sand or rubble habitats (Dawson 1985; Lourie et al 1999; Lourie et al. 2004; Vincent 1996). Two species have been identified in the NWMR in deeper waters (Winged Seahorse and the Western Pipehorse), these species were not identified by the EPBC Protected Matters search. Syngnathid species are not expected to be common in the EMBA because of the lack of appropriate habitat.
	Marine Reptiles	Marine Turtles	Threatened Species Listed Migratory Marine Species	Present Five marine turtle species or species habitat are likely to occur within the EMBA. • Listed Threatened / Migratory Marine Species: • Loggerhead Turtle (Endangered) – likely to occur, • Green Turtle (Vulnerable) – likely to occur, • Leatherback Turtle (Endangered) – likely to occur, • Hawksbill Turtle (Vulnerable) – likely to occur, • Flatback Turtle (Vulnerable) – likely to occur. No BIAs or habitat critical to the survival of the species occur within the EMBA.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	EMBA
		Seasnakes	Listed Marine Species	Present 13 species or species habitat may occur within the EMBA. No important behaviours or BIAs have been identified. Cogger (1975 and 2000) states that most seasnakes have shallow benthic feeding patterns and are rarely observed in water depths exceeding 30 m. As such, seasnakes are not expected to be common within the EMBA.
	Marine Mammals	Whales	Threatened Species Listed Migratory Marine Species Listed Marine Species	Present 15 whale species or species habitat may occur, likely occur or are known to occur within the EMBA. • Listed Threatened / Migratory Marine Species: • Sei Whale (Vulnerable) – likely to occur, • Blue Whale (Endangered) – known to occur, • Fin Whale (Vulnerable) – likely to occur, • Humpback Whale (Vulnerable) – known to occur. • Listed Migratory Marine Species: • Bryde's Whale – likely to occur, • Killer Whale – may occur, • Sperm Whale – may occur. • Listed Marine Species: • Pygmy Killer Whale – may occur, • Short-finned Pilot Whale – may occur, • Pygmy Sperm Whale – may occur, • Dwarf Sperm Whale – may occur, • Blainville's Beaked Whale – may occur, • Melon-headed Whale – may occur, • False Killer Whale – likely to occur, • Cuvier's Beaked Whale – may occur.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	EMBA
			BIA	There are no known feeding, calving and resting areas within the EMBA, most of these species are expected to be transient. The EMBA overlaps the migration route BIA for the Blue Whale and is in proximity to the Humpback Whale migration route BIA. Blue Whales are expected to migrate north through the EMBA from April to August and south from September to November (Double et al. 2015). Humpback Whales are expected to migrate north through the EMBA from July to August and south from August to October (DMP 2003).
		Dolphins	Listed Marine Species Listed Migratory Marine Species	Present 10 dolphin species or species habitat may occur within the EMBA. • Listed Migratory Marine Species: • Spotted Bottlenose Dolphin – may occur. • Listed Marine Species: • Common Dolphin – may occur, • Risso's Dolphin – may occur, • Fraser's Dolphin – may occur, • Spotted Dolphin – may occur, • Striped Dolphin – may occur, • Long-snouted Spinner Dolphin – may occur, • Rough-toothed Dolphin – may occur, • Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) – may occur, • Bottlenose Dolphin – may occur. No important behaviours or BIAs have been identified. Dolphin species are expected to be transient in the EMBA.

Note - Combination of an EPBC Protected Matters Search of the EMBA, and characteristics of the NWS province and NWT bioregion, have been used to describe ecological receptors that may occur within the EMBA.

Table 3-2 – Presence of Social Receptors within the EMBA

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	EMBA
Natural System	Commonwealth Marine Area	Key Ecological Features (KEF)	• High productivity • Aggregations of marine life	Present The EMBA intersects with the KEF Ancient coastline at 125 depth contour. The ancient coastline is a ledge of hard substrate on the seabed at 125 m water depth and is recognised its biodiversity values, including unique seabed. It is believed to be a possible navigation aid for whales, Whale Sharks, and other migratory pelagic species as they move through the region (DEWHA 2008).
Human System	Commercial Fisheries	Commonwealth Managed	• Economic benefit	Present Four Commonwealth-managed fisheries have management areas that intersect the EMBA: • North West Slope Trawl Fishery, • Southern Bluefin Tuna Fishery, • Western Skipjack Tuna Fishery, • Western Tuna and Billfish Fishery. The area is not noted to be of importance to the listed fisheries. Historic fishing effort in this area is low, and the EMBA only occupies a small proportion of the total area of the permitted fishery areas.
		State Managed	• Economic benefit	Present State-managed fisheries have management areas that intersect the EMBA: • Abalone, • Mackerel Managed, • Marine Aquarium, • Onslow Prawn, • Pilbara Fish Trawl, • Pilbara Trap, • South West Coast Salmon, • Specimen Shell, • West Coast Deep Sea Crustacean.

Receptor Group	Receptor Type	Receptor Description	Values and Sensitivities	EMBA
				The area is not noted to be of importance to the listed fisheries. Historic fishing effort in this area is low, and the EMBA only occupies a small proportion of the total area of the fishery permits.
	Industry	Shipping	• Community • Economic benefit	Present AMSA have advised that heavy vessel traffic, including tanker, cargo, support and passenger vessels, pass through the Operational Area based on the location of the chartered shipping fairway located west outside the EMBA and Operational Area (AMSA, personal communication, 19 March 2019). There are no channels or navigation hazards that restrict the bearing vessels could take around the Operational Area (AMSA 2019).

Note - Combination of an EPBC Protected Matters Search of the EMBA, and characteristics of the NWS province and NWT bioregion have been used to describe social receptors that may occur within the EMBA.

Table 3-3 – Critical Periods of Seasonal Receptors in Waters of the North West Shelf

Receptor	Event	January	February	March	April	May	June	July	August	September	October	November	December	Reference
Blue Whales	Northern Migration													Double et al. 2015
	Southern Migration													Double et al. 2015
Humpback Whales	Northern Migration													Jenner et al. 2001
	Southern Migration													Jenner et al. 2001
Loggerhead Turtle	Mating													Commonwealth of Australia 2017
	Nesting													Commonwealth of Australia 2017
	Hatching													Commonwealth of Australia 2017
Green Turtle	Mating													Commonwealth of Australia 2017
	Nesting													Commonwealth of Australia 2017
	Hatching													Commonwealth of Australia 2017

Receptor	Event	January	February	March	April	May	June	July	August	September	October	November	December	Reference
Hawksbill Turtle	Mating													Commonwealth of Australia 2017
	Nesting													Commonwealth of Australia 2017
	Hatching													Commonwealth of Australia 2017
Flatback Turtle	Mating													Commonwealth of Australia 2017
	Nesting													Commonwealth of Australia 2017
	Hatching													Commonwealth of Australia 2017
Mackerel Managed Fishery	Spawning - Spanish Mackerel													DoF 2013, Mackie et al. 2003
	Spawning - Grey Mackerel													Collette & Nauen 1983
North Coast Demersal Scalefish Managed Fishery Pilbara Sector	Spawning - Red Emperor													DoF 2013
	Spawning - Goldband Snapper													DoF 2013, Collette & Nauen 1983
	Spawning - Rankin Cod													DoF 2013
	Spawning - Bluespotted Emperor													Kailola et al. 1993
	Spawning - Saddletail Snapper													Allen 1985
	Spawning - Crimson Snapper													Kailola et al. 1993
	Spawning - Brownstripe Snapper													Davis & West 1993
	Spawning - Rosy Threadfin Bream													Russell 1990
Other	Spawning - Blacktip Sharks													DoF 2013
	Spawning - Pink Snapper													DoF 2013
Key		Low activity level in the North West Shelf												
		Peak activity level in the North West Shelf												
		Known activity period in the North West Shelf												

Note – Receptor list presented is not exhaustive, due to paucity of data relevant to the EMBA and/or waters of the North West Shelf available on critical periods for other migratory receptors listed in Table 3-1. Therefore, the seasonal presence of these receptors in the EMBA is currently unknown. However, for the purposes of this EP, it is assumed that they may be receptors to relevant impacts and risks of the site survey.

4 Description of the Activity

The activities undertaken as part of the site survey include:

- Geophysical survey program:
  - Multibeam (MBES)
  - Side-scan sonar (SSS),
  - Sub-bottom profiler (SBP),
  - Magnetometer,
  - High-resolution reflection imaging.
- Geotechnical survey program:
  - Piston or gravity coring technique,
  - Box core sampling technique,
  - Cone Penetration Test (CPT).
- Vessel and support operations.

4.1 Geophysical Survey Program

The geophysical survey program is expected to use MBES, SSS, SBP, magnetometry and high-resolution reflection imaging techniques. BP proposes to use pole mounted and towed sensors to conduct the survey.

It is anticipated that the seabed geophysical survey will be completed in a grid pattern. The main lines are expected to be spaced at 200 m intervals.

The magnetometer survey will only be conducted if the side-scan sonar survey results identify an anomaly such as metallic targets. No sound pulses are emitted from a magnetometer.

The MBES, SSS and SBP are conducted simultaneously. The duration of the MBES, SSS and SBP activity is likely to be in the order of two days excluding transit time. The High-resolution reflection imaging activity adds another two days to the geophysical program excluding transit time.

4.2 Geotechnical Survey Program

Geotechnical site investigations are performed utilising seabed sampling equipment deployed over the side of a vessel via a special deployment structure. Once the equipment is placed upon the seabed, the test is performed and/or the sample is collected.

The equipment that will be deployed to the sea floor for all sampling and testing techniques comprises a CPT, piston corer and box corer. The indicative footprint associated with each deployment of this equipment is expected to be up to approximately 1.3 m^2.

The geotechnical survey program will include recovery of sediment samples at locations within the Operational Area (Figure 1-1).

The overall duration of the geotechnical survey program is in the order of 4-6 days, excluding transit time.

4.3 Vessel Operations

The specific vessel that will complete the site survey is not yet known. Generally, site investigations are performed from a specialised vessel or a vessel of opportunity such as a drilling ship or supply vessel. The selected vessel is expected to support up to 35 personnel and will be compliant with MARPOL requirements as appropriate for the vessel. The vessel will use Marine Diesel Oil (MDO) and have a maximum tank size of 250 m^3. No refuelling is proposed at the location. Given the nature of activities described in this EP, the vessel is expected to be either slow moving (4-5 knots) during geophysical data acquisition, or stationary during soil sampling.

4.4 Timeframe

The site survey is aimed to be executed in the period of July-September 2019. The impact and risk evaluation was completed on the basis that the site survey could occur in any season in the event the proposed timeframe is changed.

5 Environmental Impact and Risk Evaluation

The environmental impact and risk assessment methodology presented below is based on BP's Environmental Impact Identification framework to evaluate the potential impacts and risks of a petroleum activity.

This framework supports the approach outlined in ISO 14001 (Environmental Management Systems), ISO 31000:2009 (Risk Management) and HB203:2012 (Environmental Risk Management – Principles and Process). Figure 5-1 illustrates this process, adopted for identifying and managing impacts and risks associated with BP's proposed Ironbark site survey.

Figure 5-1 – AS/NZS ISO 31000 – Risk Management Methodology

5.1 Impact and Risk Assessment Methodology

For the Ironbark site survey, environmental aspects, impacts and risks have been identified and assessed in accordance with BP's Environmental Impact Identification Workshop Process. This process is used within BP to:

a) Identify environmental and social aspects and impacts associated with planned activities and potential unplanned events, and for planned activities, assess the significance of the impacts, and for potential unplanned events, prioritise such that they can be further evaluated through the risk process.
b) Identify and validate safeguards that are in place at the time of the workshop.
c) Identify areas of design, processes and/or activities that can be changed or modified to eliminate or further mitigate environmental and social impacts.

d) Recommend actions (that can include actions to undertake further assessment) to eliminate or further mitigate impacts.

A key element of the approach is that impacts from planned activities and potential impacts (risks) associated with unplanned events are assessed using different criteria. 'Impact assessments' are concerned with events that are reasonably certain to occur, while 'environmental risk assessment' is concerned with events that may possibly occur. The approach is explained in the following subsections.

The impact and risk assessment process involves five key stages:

- Stage 1 – Activity definition (Section 5.1.1),
- Stage 2 – Aspect and impact identification (Section 5.1.2),
- Stage 3 – Identification of inherent / design control measures (Section 5.1.3),
- Stage 4 – Impact and risk evaluation (Section 5.1.4),
- Stage 5 – Identification of control measures and 'as low as reasonably practicable' (ALARP) (Section 5.1.5).

5.1.1 Stage 1 – Activity Definition

For the purposes of this EP, the defined scope for this petroleum activity is site survey activities. These scopes were then broken down to understand the relevant systems and system related activities. These then were evaluated to determine the operational condition and events that could arise from their implementation.

5.1.2 Stage 2 – Aspect and Impact Identification

Each activity was then screened to identify the environmental aspects and whether these resulted in either a planned impact or unplanned potential impact. Impacts are identified based on the aspect being considered, details of the source of the hazard, pathway and presence of sensitive receptors.

5.1.3 Stage 3 – Identification of Inherent / Design Control Measures

As per the methodology, once the environmental aspects and potential impacts were identified, control measures that were considered inherently part of the activity or program design were identified. Whilst identifying inherent or verified design control measures for this activity, BP also identified those Good Practice control measures that will apply (refer Section 5.1.5).

5.1.4 Stage 4 – Impact and Risk Evaluation

Impacts

For each planned impact arising from normal and abnormal operating conditions, an assessment of Impact Significance was undertaken. Impacts have been assessed based on the nature and magnitude of environmental and social impact (using a scale of 1-4) and duration (days to years)(using a scale of 1-4), resulting in four overall classifications of relative priority for impact management (impact significance of low, medium, high, very high).

Risks

An assessment of the risks for each unplanned aspect identified for the project was undertaken, considering the risk severity (using 8 categories from A-H, A being highest) against the likelihood of the risk event occurring (using 8 categories from remote possibility to common occurrence), resulting in four overall classifications of relative priority for risk management (risk levels of low, medium, high, very high).

Cumulative Impacts Assessment

As cumulative impacts are also required to be considered under the OPGGS(R), BP applies a cumulative assessment process consistent with the guidelines detailed in Hegmann et al (1999).

5.1.5 Stage 5 – Identification of Control Measures and ALARP

The process for identifying control measures depends on the 'as low as reasonably practicable' (ALARP) decision context set for that particular aspect. Regardless of the process, control measures are assigned according to defined environmental performance outcomes, with the objective to eliminate, prevent, reduce, or mitigate potential impacts associated with each identified environmental impact and risk.

In alignment with NOPSEMA's ALARP Guidance Note (GN0166), BP has adapted the approach developed by Oil and Gas UK (OGUK 2014) for use in an environmental context to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (Figure 5-2).

Specifically, the framework considers an 'ALARP Decision Context' as a function of impact severity and several guiding factors:

- Activity type,
- Risk and uncertainty, and
- Stakeholder influence.

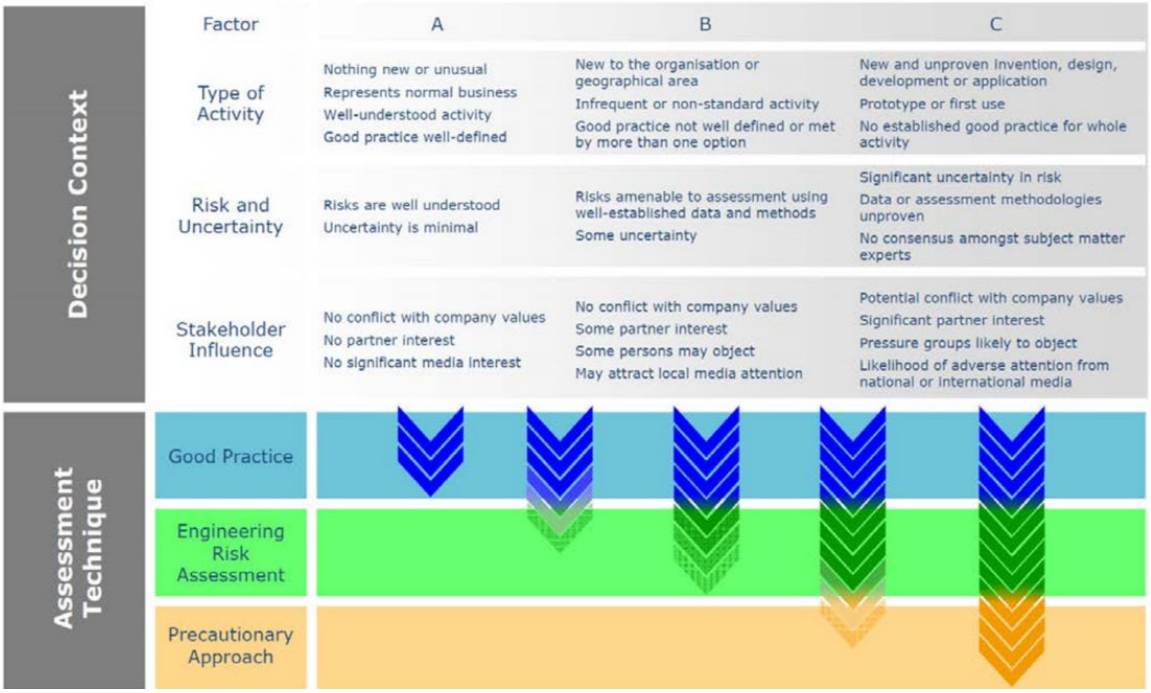

Figure 5-2 – ALARP decision support framework (NOPSEMA 2015)

In accordance with the regulatory requirement to demonstrate that environmental impacts and risks are ALARP, BP has considered the above decision context in determining the level of assessment required, and applied it to each aspect described in Section 5, in accordance with the definitions provided in Table 5-1.

Table 5-1 - BP's ALARP Decision Support Approach

ALARP Decision	Context	Impact or Risk Ranking Concordance
Type A decision	The impact or risk is relatively well understood, the impact or risk is **low**, activities are well practiced, and there is no significant stakeholder interest. However, if good practice is not sufficiently well-defined, additional assessment may be required	BP has assigned an impact management priority level of **Low** or **Medium** respectively. BP has assigned a risk management priority level of **Low** or **Medium** respectively.
Type B decision	There is greater uncertainty or complexity around the activity, impact and/or risk, the impact or risk is **moderate**, and the impact or risk generates several concerns from stakeholders. In this case, established good practice is not considered sufficient and further assessment	BP has assigned an impact management priority level of **High**. BP assigned a risk management priority level of **High**.

ALARP Decision	Context	Impact or Risk Ranking Concordance
	is required to support the decision and ensure the impact or risk is ALARP.	
Type C decision	There is sufficient complexity, the impact or risk is **high**, uncertainty, or stakeholder interest to require a precautionary approach. In this case, relevant good practice still has to be met, additional assessment is required, and the precautionary approach applied for those controls that only have a marginal cost benefit.	BP has assigned an impact management priority level of **Very High**. BP has assigned a risk management priority level of **Very High**.

The assessment techniques considered as part of the ALARP decision support framework include:

- Good practice,
- Engineering risk assessment,
- Precautionary approach.

5.1.6 Acceptability

In summary BP applies the following process in determining acceptability:

- Planned impacts and unplanned risks that are ranked as Decision Context A are considered inherently acceptable as it is assumed that ALARP has been achieved and no further evaluation is required.
- Planned impacts and unplanned risks that are ranked as Decision Context B or C are considered acceptable once impacts and risks are demonstrated to be reduced to ALARP (via the evaluation of additional control measures) and the following have been met:
  - Principles of ecologically sustainable development (ESD) (subsection below),
  - Legal and regulatory requirements,
  - Internal context, related to BP policies and standards,
  - External context, in particular whether stakeholder expectations have been addressed, and
  - Defined acceptable level of impact for planned aspects only (see subsection below).

This evaluation of acceptability generally aligns with guidance provided by NOPSEMA in demonstrating that impacts and risks will be of an acceptable level (NOPSEMA 2018). Further information regarding the application of the principles of ESD and defined level of acceptable level of impact is provided in the following subsections.

Principles of Ecologically Sustainable Development

Under the EPBC Act, considerations for approving taking of actions (or in this case a petroleum activity) in accordance with a plan includes considering the principles of ESD. A description of how BP have

considered the principles of ESD listed under the EPBC Act with regards to the site survey is provided in Table 5-2.

Table 5-2 –Consideration of Principles of ESD in Evaluation of Acceptability of Planned and Unplanned Aspects of the Site Survey

Principles of ESD	How They Have Been applied
(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social, and equitable considerations;	BP's impact and risk assessment process integrates long-term and short-term economic, environmental, social, and equitable considerations. This is demonstrated via Stage 4 – Impact and Risk Evaluation (Section 5.1.4), which includes provision for understanding the potential long-term and short-term impacts associated with its activities, and the ALARP process that balances the economic cost against environmental benefit. As this principle is inherently met through the application of the EP assessment process, this principle is not considered separately for each evaluation.
(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;	BP consider if there is the potential for serious or irreversible environmental damage when Impact Significance or Risk levels of "High" and above are identified . Where this was identified, BP is required to assess if there is significant lack of scientific certainty about the potential impacts of a planned activity or unplanned event.
(c) the principle of inter-generational equity—that the present generation should ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations;	BP's impact and risk assessment methodology ensures that potential impacts and risks are reduced to levels that are considered ALARP. If the potential impacts and risks are determined to be serious or irreversible, the precautionary principle is implemented with the intent that potential impacts and risks are managed, and that the environment is maintained for the benefit of future generations. The precautionary principle is applied for all impacts and risks that are assigned an ALARP Decision Context – C.
(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making;	BP evaluate if there is the potential to affect biological diversity and ecological integrity.
(E) improved valuation, pricing, and incentive mechanisms should be promoted.	Not considered relevant for petroleum activity acceptability demonstrations.

Defining an Acceptable Level of Impact

In alignment with NOPSEMA's Environment Plan Decision Making Guideline (2018), BP has used the EPBC Act Significant Impact Guidelines to support the definition of an acceptable level of impact.

The EPBC Act Significant Impact Guidelines 1.2 (DSEWPaC 2013) provide a definition of 'the severity of an impact on Commonwealth land that may persist long after an action ceases or that may be irreversible'. The general test for significance is whether an impact is 'important, notable or of consequence, having regard to its context of intensity'. The Significant Impact Guidelines 1.2 (DSEWPaC 2013) state that a severe impact:

> *generally, has two or more of the following characteristics: permanent/ irreversible; medium–large scale; moderate–high intensity.*

5.1.7 Environmental Performance Outcomes, Standards, and Measurement Criteria

Environmental performance outcomes, performance standards, and measurement criteria were defined to address the environmental impacts and risks identified during the impact and risk assessment.

BP is committed to conducting activities associated with the petroleum activity in an environmentally responsible manner and aims to implement best practice environmental management as part of a program of continual improvement to reduce impacts and risks to ALARP.

5.2 Activity – Aspect Relationships

An assessment of the petroleum activity was carried out to identify potential aspects. The outcomes of stakeholder consultation also contributed to aspect identification. The environmental aspects identified are displayed in Table 5-3.

Based upon an understanding of the environmental aspects, relevant planned impacts or unplanned risks were defined. Ecological and social receptors identified with the potential to be exposed to an aspect and subsequent impacts or risks were then assessed enabling a systematic evaluation to be undertaken.

A review of other activities likely to occur within the EMBA at the time of the site survey was undertaken, through stakeholder engagement as well as interrogation of the NOPSEMA's EP status search tool. No other activities were identified to have impacts and risks that have the potential to affect either cumulatively or in-combination the values and sensitivities identified to be relevant to the site survey. Based on this review, a cumulative impacts assessment was not developed further for this activity.

The impacts and risks associated with the petroleum activity appropriate to the nature and scale of each impact and risk and the control measures that are used to reduce the risks to ALARP are summarised in this section.

Table 5-3 – Activity – Aspect Relationships

	Aspects Relating to Planned Impacts										Aspects Relating to Unplanned Risks				
						Planned Discharges								Accidental release	
	Physical Presence – Displacement of other marine users	Seabed Disturbance	Light Emissions	Underwater Sound Emissions	Atmospheric Emissions	Subsea Operational Discharges	Cooling water and brine	Treated bilge	Sewage and greywater	Food waste	Introduction of IMS	Physical Presence – Fauna entanglement	Physical Presence – Collision with marine fauna	Waste	Loss of Containment (hydrocarbons or chemicals)
Geophysical															
Multibeam				x											
Side-scan Sonar				x											
Sub-bottom Profiler				x											
Magnetometer*															
High Resolution Reflective Imaging				x								x			
Geotechnical															
CPT or Piston Coring		x													
Box Core Sampling		x													
Vessel Operations															
Vessel Operations	x		x	x	x		x	x	x	x	x		x	x	x

*The use of a towed magnetometer does not have the potential to result in environmental aspects or hazards, leading to impacts on receptors outside of vessel operations, therefore will not be discussed further in this EP.

5.3 Physical Presence – Displacement of Other Marine Users

Activity

The following activity was identified as having the potential to displace other marine users:

- Vessel Operations

Planned Impacts associated with the Physical Presence – Displacement of Other Marine Users

The displacement of other marine users may impact commercial activities in the Operational Area. Several fisheries may have an active presence in the Operational Area however are known to fish in waters outside the EMBA and Operational Area. Current fishing effort data is not available but is expected to be low due to historical fishing effort and the lack of features within the Operational Area.

The exclusion of fisheries from around a single vessel and any towed equipment when undertaking survey activities will have a negligible consequence on fisheries catch as the area that is restricted is small in comparison to the area available for fishing (varying from the entire EEZ or between 114 °E to 125 °E of the EEZ) and the vessel is present for a period of days to weeks.

Vessel traffic exists within the EMBA, however there are no channels or navigation hazards which could limit movements of the survey vessel. The Operational Area does not cross any major shipping routes (AMSA 2019). The addition of a single vessel is not expected to impact the functions, interests or activities of other marine users (as confirmed from stakeholder consultation records).

The potential of localised consequences to marine users within the Operational Area, such as the exclusion of fishing and other marine users deviating around the survey vessel, is not expected to result in an impact to commercial operations via loss of catches or significant increase in travel time. The impact is considered to be minor with the potential for limited economic disturbance, therefore the social impact severity for this planned impact was assessed as Level 1.

Impact Evaluation

Environmental Impact Severity	Frequency/Duration	Significance of Impact
1	Due to the overall short duration of the survey, the frequency/duration rating was assessed as Level 2	Low

ALARP and Acceptability Assessment

ALARP Decision Context	A
Acceptability	Planned impacts associated with the displacement of other marine users due to physical presence are ranked as Decision Context A (refer to Figure 5.2), therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.4 Seabed Disturbance

Activity

The following activity was identified as having the potential to disturb the seabed:

- Geotechnical Survey

Planned Impacts associated with Seabed Disturbance

Seabed disturbance has the potential to alter benthic habitats. The indicative total footprint on the seabed associated with deployment of benthic sampling equipment (piston core, CPT and box core) to sample approximately 39 samples is expected to be limited to a total area of approximately 50 m^2.

Benthic habitats which could be impacted are expected to comprise soft sediment infauna communities, which are found in predominantly unvegetated soft sediment substrates (as described in Section 4). The Operational Area does not overlap

benthic habitats relied on by sensitive species or habitats designated as Key Ecological Features. However, the Operational Area has not been surveyed therefore hard substrate may occur in the area.

If soft sediment communities are impacted, any effects would be limited to incidental, temporary disturbance given the small footprint impacted by the deployment of benthic sampling equipment. Any impacted area is likely to be similar to the surrounding habitat. When the potential disturbance footprint of each geotechnical sample (approx. 1.3 m^2) is considered against the widespread distribution of soft sediment infauna communities, the potential disturbance is highly localised.

If hard substrate is encountered, any impacts to benthic communities will still be localised due to the limited footprint of the sampling technique. Given potential impacts are highly localised with limited local degradation of benthic habitat, the environmental impact severity was assessed to be Level 1.

Impact Evaluation

Environmental Impact Severity	Frequency/Duration	Significance of Impact
1	Due to very short duration of the geotechnical sampling activity (less than 2 days total), and the rapid contact between the equipment and the seabed (minutes), the frequency/duration rating was assessed as Level 1.	Low

ALARP and Acceptability Assessment

ALARP Decision Context	A
Acceptability	Planned impacts associated with seabed disturbance are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.5 Light Emissions

Activity

The following activity was identified to generate light emissions:

- Vessel Operations

Planned Impacts associated with Light Emissions

During the activity, the survey vessel will generate light while in the Operational Area. Lighting is used for marine safety to ensure clear identification of the survey vessel to other marine users and to allow activities to be undertaken safely 24 hours a day. Lighting will typically consist of bright white (i.e. metal halide, halogen, fluorescent) lights, and are not dissimilar to lights used for other offshore activities in the region, including fishing and shipping. No flaring is planned for the survey.

No evidence suggests that artificial light sources adversely affect the migratory, feeding, or breeding behaviours of cetaceans. Cetaceans predominantly use acoustic senses to monitor their environment rather than visual sources (Simmonds 2004), so light is not considered to be a significant factor in cetacean behaviour or survival.

Within the EMBA transient fish, reptiles and foraging seabirds are the only receptors with the potential to be exposed to light emissions.

Fishes will likely not be affected by navigational lighting for mariners (Morandi, 2018). However, other light emissions from the survey vessel (such as deck lights for survey requirements) in the operational area may result in localised aggregation of fish in the immediate vicinity of the vessel. This may result in an increase in predation on prey species aggregating in the area, or exclusion of nocturnal foragers/predators from the area (Marchesan et al. 2006). Artificial light can also influence dial vertical migration patterns of plankton (including planktonic life stages of some fish species) in the surface waters and lead to migrations that occur outside of the optimal window for that species (Gibson et al. 2001, cited in Morandi, 2018). The areas affected would be highly localised and short term due to the transient nature of the survey and limited to night-time operations.

Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Marquenie 2008) and that lighting can attract birds from large catchment areas (Wiese 2001). These studies indicate that migratory birds are attracted to lights on offshore platforms when travelling within a radius of 5 km from the light source and that outside this zone their migratory paths are unaffected (Shell 2010).

The EMBA is at its closest 120 km from coastal habitats. Ten threatened or migratory listed seabird and shorebird species are expected to occur in the EMBA – further details are provided in Section 4. It is not expected that light acting as an attractant to a small number of individual seabirds would result in any impact to the greater population.

Pendoley (2000) discovered that in the absence of illumination from the moon, glow from tower flares may influence the orientation of turtles at close range (30–100 m). Given that light emissions from this activity are limited to navigational lighting, exposure is expected to be much less than that associated with flaring. Based on findings from Pendoley (2000) and Hick (1995), it is expected that light emissions from this activity would result in a very small exposure area, which for this evaluation have been conservatively set to be within 100 m of the vessel.

Lighting emissions from this activity are only expected to result in small exposures, and thus the number of marine turtles exposed would be limited. The Recovery Plan for Marine Turtles in Australia (DotEE 2019) identifies light emissions as a key threat as it disrupts critical behaviours. However, it notes that critical behaviours are focused on nesting (nearshore) as well as disrupting hatchling orientation and sea finding behaviours of hatchlings. Given the distance offshore and limited exposure associated with this activity lighting emissions from the survey vessel is not expected to affect critical behaviours discussed in the aforementioned turtle recovery plan, and significantly alter sensitive behaviours that would lead to individual or greater population impacts.

Based on the distance to critical nesting habitats, limited sensitivities, and expected outcome that the limited exposure will not result in any impacts at an individual or population level, the environmental impact severity for this planned impact is Level 1.

Impact Evaluation

Environmental Impact Severity	Frequency/Duration	Significance of Impact
1	Due to the overall short duration of the survey, the frequency/duration rating was assessed as Level 2.	Low

ALARP and Acceptability Assessment

ALARP Decision Context	A
Acceptability	Planned impacts associated with light emissions are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.6 Underwater Sound Emissions

Activity

The following activities were identified to generate underwater sound emissions:

- Vessel Operations
- Geophysical Survey Techniques

Assessment Methodology

Available threshold criteria for impulsive and continuous sound exposure associated with behavioural changes, Temporary Threshold Shifts (TTS), Permanent Threshold Shifts (PTS), mortality or potential mortal injury for sound sensitive receptors (taken from NMFS 2018, NMFS 2013, Popper et al. 2014) were compared with sound levels over distance calculated using a spherical spreading model (Richardson et al. 1995). This analysis was then used to identify which sound sources may be heard by the various receptor groups and therefore may result in potential impacts.

Planned Impacts associated with Underwater Sound Emissions

LF and MF Cetaceans

PTS

The potential for PTS has been estimated to be within the following ranges based upon calculated sound levels versus threshold criteria:

- **Impulsive Source** - there is potential for PTS to occur where Low-frequency hearing (LF) and Medium-frequency hearing (MF) Cetaceans are present within 10 m from the source.

The likelihood a LF and MF cetacean to be within this range from the moving source and remain within this range for a significant duration is negligible. A behavioural response (startle and avoidance) is likely to occur prior to a marine mammal coming close to the vessel while undertaking the survey. It is therefore expected that marine mammals will not experience physical injury during the survey.

Behavioural changes / TTS

The potential for behavioural changes and TTS has been estimated to be within the following ranges based upon calculated sound levels versus threshold criteria:

- **Impulsive Source -** Potential TTS may occur where LF and MF Cetaceans are present within less than 50 m and less than 10 m of the impulsive source respectively. There is the potential for behavioural changes to LF and MF to be caused where LF and MF Cetaceans are present within 3 km of the impulsive source.
- **Continuous Source -** There is the potential for behavioural changes to LF and MF to be caused where LF and MF Cetaceans are present within 1.5 km of the continuous source.

The likelihood a LF and MF cetacean to be within close enough proximity to elicit TTS due to sound from the moving source and remain within this range for a significant duration is negligible. A behavioural response (avoidance) is likely to occur prior to a marine mammal coming close to the vessel while undertaking the survey. It is therefore expected that marine mammals will not experience TTS during the survey.

Although there is the potential for a larger number of cetaceans to be present during migration periods (Blue Whales and Humpback Whales) exposure to sound levels above the behavioural response thresholds for impulsive sound is not expected to significantly affect migration behaviours. Studies on the effect of a seismic surveys on Humpback Whales (McCauley et al, 1998; Dunlop et al. 2017) found that although no gross changes in migration paths were observed, behavioural and avoidance reactions to the sound source were documented. There is currently a lack of scientific evidence to validate potential behavioural impacts to Blue Whales from exposure to seismic sound sources (DoE 2015), however similar effects are anticipated. Parts of the Blue Whale and Humpback Whale migration pathways do not include narrow corridors or bottlenecks resulting from physical and other barriers (DoE 2015; TSSC 2015). The area affected by sound levels that may cause behavioural responses (approximately 3 km buffer around the impulsive source as inferred from calculated sound levels over distance vs threshold criteria), overlap parts of the Blue Whale and Humpback Whale migration pathways; however it is in open ocean with no obstacles to prevent movement of cetaceans transiting through or near the survey area. Therefore, potential behavioural responses from the short duration and moving seismic source are expected to be limited to temporary and insignificant avoidance reactions by migrating LF cetaceans.

Despite potential impacts being limited to temporary and insignificant avoidance reactions within tens of kilometres from the source, the assessed environmental impact severity for impulsive underwater sound emissions is Level 3 given the potential impact may be upon EPBC Act Listed Threatened / Migratory Marine Species.

Stakeholder consultation with AMSA determined that heavy vessel traffic, including tanker, cargo, support and passenger vessels, pass through the Operational Area based on the location of the chartered shipping fairway located west outside the EMBA and Operational Area (AMSA, personal communication, 19 March 2019). Given the high levels of existing vessel/shipping traffic in the area. Additional underwater sound being introduced by a single vessel operating in the area for a number of days is unlikely to contribute significantly to the overall levels of sound associated with existing vessel traffic and there are no obstacles to prevent movement of cetaceans transiting through the area. No further behavioural disturbance to cetaceans from continuous vessel sound is anticipated. Thus, any potential disturbance would result in short-term effects to species.

Therefore, the environmental impact severity for continuous underwater sound emissions is Level 1.

Fishes

Mortality, Potential Mortal Injury and TTS

Activities that generate impulsive and/or continuous sound within the estimated hearing frequencies of fishes such as geophysical survey sources and vessels, have the potential to cause mortality, potential mortal injury and TTS to fishes (Popper et al 2014). This study highlighted that the application of weighting requires reliable measures of hearing sensitivity vs frequency. The hearing sensitivity of fishes is only available for a few fishes and therefore the application of frequency weighting is deemed premature. Also sounds outside the hearing range of fishes, in particular high frequencies, may be capable of causing damage or exacerbate injury. For these reasons weighting to sounds for fishes requires further scientific validation. This assessment therefore utilises interim exposure guidelines defined for the function hearing categories:

- Fish with no swim bladder (such as sharks and rays),
- Fish where swim bladder is used in hearing (pelagic fish species, syngnathids).

The EMBA is likely to contain pelagic fish species (fish with swim bladders used for hearing), eight shark and ray (fish without swim bladders) and 26 syngnathid (fish with swim bladders used for hearing) species or habitats for those fish species. In terms of important behaviours, the EMBA overlaps the Whale Shark BIA for foraging behaviours along the 200 m isobath. However, the Approved Conservation Advice for the Whale Shark does not identify sound emissions as a threat (Table 3-1). There are no features within the EMBA where fishes are likely to be site-attached in large numbers.

The potential for Mortality, Potential Mortal Injury and TTS has been estimated to be within the following ranges based upon the calculated sound levels versus thresholds:

- **Impulsive Source** - there is potential for Mortality or Potential Mortal Injury to occur where fishes of all hearing sensitivities (with or without swim bladder) are present within less than 50 m of the impulsive source.
- **Continuous Source** - there is potential for Recoverable Injury to occur where hearing sensitive fishes (with swim bladder) are present within less than 10 m of the continuous source. There is potential for TTS to occur where hearing sensitive fishes (with swim bladder) are present within less than 50 m of the continuous source.

Potential for recoverable injury to fishes without a swim bladder from continuous sound from shipping is suggested to be of low risk while the potential for TTS has a moderate risk within tens of metres of the sound source as inferred from calculated sound levels over distance vs threshold criteria (Popper et al 2014). As there are no features within these ranges where fish are likely to be site-attached, only individual transient and foraging fish are expected to be near the survey vessel while it is undertaking geophysical data acquisition.

Studies to date have not shown fish mortality from exposure to seismic sound sources under field-operating conditions; though prolonged or extreme exposure to high-intensity, low-frequency sound, may lead to physical damage such as threshold shifts in hearing or barotraumatic ruptures (DFO 2004; Carroll et al. 2017). Prolonged exposure of wild, unrestrained, transient fish from the moving seismic vessel within close enough proximity for injury is considered negligible. It is therefore expected that fishes are unlikely to experience mortality, potential mortal injury and TTS from the survey.

Behavioural Responses

There are no quantitative criteria for behavioural responses of fish to impulsive sound. Popper et al. (2014) considered the likelihood of behavioural responses based as a function of distance between fishes and the sound source. Popper et al (2014) did not quantify distances because of insufficient data but suggests fishes are highly likely to exhibit a behavioural response to continuous sound within tens of metres of the sound source and impulsive sound within hundreds of metres from the sound source. Behavioural response (startle and avoidance) is therefore likely to occur prior to fish coming close to the vessel while undertaking the survey.

Seismic source discharges have been reported to elicit varying degrees of startle and alarm response in caged fish, however, studies on unrestrained fish are scarce (Carroll et al. 2017). Wardle et al. (2001) exposed free ranging marine fish inhabiting an inshore reef to sounds from a seismic source (195-218 dB re 1 µPa) found fish exhibited a startle response but no avoidance behaviour was observed. A study of captive marine fish exposed to a single sound source off the coast of Western Australia observed that fish returned to their pre-sound exposure position within 31 min after the final seismic signal for the study (Fewtrell and McCauley 2012).

In relation to continuous sound, changes to fish schooling patterns and distribution have been observed from the presence of commercial shipping, ferries and research vessels (McPherson et al. 2016).

Based on the observations of these studies, impulsive and continuous sound generated from the survey is likely to result in temporary and short-range displacement to transient and foraging fish. McCauley noted that the temporary, short-range displacement of pelagic or migratory fish populations may have insignificant repercussions at a population level (McCauley 1994). The area affected by sound levels that can cause behavioural responses (within hundreds of metres from the sound source) does not contain critical habitat or BIAs for fishes and is in open ocean where fish can move away from increased sound levels. Based on this assessment, it is anticipated that the potential sound generated behavioural effects on fishes unlikely to have a significant impact on individuals or at a population level.

Therefore, the assessed environmental impact severity for impulsive and continuous underwater sound emissions is Level 1 for fishes.

Sea Snakes and Marine Turtles

There is currently no scientific information on how or whether sea snakes use sound and therefore how susceptible they might be to underwater sound emissions. For this assessment, because snakes and turtles are both marine reptiles, it has been assumed that sea snakes are similarly or less sensitive to low level sounds than turtles. Therefore, the thresholds established and assessment of potential impacts for marine turtles are used as a proxy for sea snakes (McPherson et al. 2016). Popper et al (2014) extrapolated sea turtle hearing abilities and vulnerability to sound exposure from the fish function hearing category 'fish where swim bladder is used in hearing' i.e. the most sensitive fish hearing group.

Mortality and Potential Mortal Injury

Five marine turtle species (or species habitat) may occur within the EMBA. No BIAs or habitat critical to the survival of the species occur within the EMBA. Given the open ocean environment of the EMBA and lack of features where marine turtles are likely to accumulate, transient individuals are only expected to be within the area.

The potential for mortality or potential mortal injury has been estimated to be within the following ranges based upon the calculated sound levels versus thresholds:

- **Impulsive Source** - there is potential for mortality or potential mortal injury to occur where turtles are present within less than 50 m of the impulsive source.

Potential for recoverable injury and TTS to fishes without a swim bladder from continuous sound from shipping is suggested to be of low and moderate risk respectively within tens of metres of the sound source as inferred from calculated sound levels over distance versus thresholds criteria (Popper et al 2014). These ranges do not overlap any critical habitat or BIA for marine turtles. With only low numbers of individual marine turtles transiting the area, no population level effects would be expected.

A behavioural response (avoidance) is likely to occur prior to marine turtles coming close to the vessel while undertaking the survey. It is therefore expected that marine turtles will not experience mortality and potential mortal injury from the survey.

TTS and Behavioural Responses

Behavioural responses by marine turtles from impulsive sound, including rising to the surface and altered swimming patterns, have been elicited in caged animals exposed to a seismic sound source at received levels of 153 dB re 1 μPa^2s (McCauley et al. 2000), which is estimated to be within 1.5 km of the source as inferred from calculated sound levels over distance versus threshold criteria.

The area affected by sound levels that can cause behavioural responses does not contain critical habitat or BIAs for marine turtles and is in open ocean where marine turtles can move away from increased sound levels. It is anticipated that potential sound generated behavioural effects on marine turtles is unlikely to have a significant impact on individuals or at a population level.

Therefore, the assessed environmental impact severity for impulsive and continuous underwater sound emissions is Level 1 for marine reptiles.

Plankton

Based on scientific literature and underwater acoustic modelling (McCauley et al 2017, McPherson et al. 2016, Richardson et al 2017), planktonic organisms likely to be affected significantly by acoustic source discharges include eggs, larvae and other zooplanktonic organisms within 1.2 km of a sound source. No data is available for mortality or damage to eggs and larvae from sonar-like signals or shipping and continuous sound (Popper et al 2014). Therefore, an assessment on the

potential for high resolution reflective imaging operations to cause mortality in eggs, larvae and zooplanktonic organisms has been undertaken.

- **Impulsive Source -** there is potential for mortality or potential mortal injury to occur where plankton is present within less than 50 m of the impulsive source.

McCauley et al (2017 cited in Richardson 2017) conducted a study which observed the impact of seismic activity on zooplankton to be within 1.2 km of the sound source. Both ranges do not overlap fish spawning grounds, critical primary productive habitat such as coral reefs or the Whale Shark foraging behaviours BIA located northward from Ningaloo along the 200 m isobath. Primary productivity within the NWMR is generally low and this is also to be expected within the area with the potential to illicit injury to eggs and larvae.

Saetre and Ona (1996 cited in Popper et al 2014) concluded that mortality rates caused by exposure to seismic sounds are so low compared to natural mortality that the impact from seismic surveys must be regarded as insignificant. Based upon the understanding that:

- natural mortality of plankton (including fish larvae) is quite high, in the order of 21.3% per day (Houde and Zastrow 1993), and
- fast growth rates of zooplankton, and the dispersal and mixing of zooplankton from both inside and outside of the impacted region and therefore expected to rapidly recover (Richardson et al 2017),

impacts are expected to be localised to within close proximity of the sound source and temporary in nature as they recover rapidly. Findings of a study by Richardson et al (2017) concluded a substantial impact on zooplankton from seismic activity was identified on a local scale (within 15 km of the survey area), however on a regional scale the impacts were minimal. Over time zooplankton biomass recovered to pre-seismic survey conditions within 15 km of the survey area only 3 days following the completion of the survey. Consequently, potential impacts to planktonic organisms from the survey will not have a significant impact at a population level.

Therefore, the assessed environmental impact severity for impulsive and continuous underwater sound emissions is Level 1 for plankton.

Commercial Fisheries

Reduction in Catch Rates for Fishes

The potential impact assessment of underwater sound to fishes as described above indicated that fishes will generally avoid sound sources generated by the survey. The likely impacts on fishes are expected to be limited to short-term behavioural responses, including avoidance of the operating acoustic source. It is highly unlikely that underwater sound emissions would cause lethal and sub-lethal injuries, with no immediate and delayed mortality and physiological effects.

The potential impact assessment of fish eggs and larvae as previously described indicated that mortality rates by exposure to seismic sounds are so low compared to natural mortality it must be regarded as insignificant.

Cumulatively, the temporary avoidance of fish species and insignificant mortality of fish eggs and larvae within the Operational Area may have the potential to impact commercial fisheries through a reduction in catch rates. While commercial fishing licences overlap the Operational Area, high levels of fishing operations are unlikely based on the large size of the licence area, lack of sensitive or critical areas for these fisheries and the low current fishing effort and activity levels of these fisheries. It is therefore expected that a reduction in catch rates for fishes is not a credible impact as a result of the survey.

Reduction in Catch Rates for Benthic Invertebrates

McCauley (1994) advised that seismic surveys must be run in very shallow water to influence the hearing mechanisms of invertebrates. McCauley (1994) suggested zones of effect for invertebrates as follows:

- Audible zone - 20 m from the source,
- Response zone - 10 m from the source,
- Pathological zone - 2 m from the source.

A review by Moriyasu et al. (2004) indicated that behavioural responses such as startle response and rapid swimming have generally been observed for benthic invertebrates when exposed to seismic sources at close ranges. A few studies also generally found unaffected catch levels in fisheries targeting benthic crustaceans after exposure to seismic surveys (Andriguetto-Filho et al. 2005; Parry & Gason 2006; Day et al. 2016). These studies have indicated that only surveys occurring in very shallow water would have observed impacts to benthic invertebrates. A conservative figure for the

minimum depth for a response would be 15 m from the source (McCauley 1994). Application of this response range for geophysical surveys is therefore considered highly conservative. Water depth for survey acquisition will not occur in water shallower than 300 m, therefore benthic invertebrates are considered out of range to be potentially impacted.

Although fishing effort within the Operational Area was not confirmed during consultation with fishery licence owners, given the benthic invertebrates are out of range for potential impact, it was determined that the proposed activities are not expected to result in an impact to commercial operations (via loss of catches) of benthic invertebrates.

Impact Evaluation

Aspect	Environmental Impact Severity	Social Impact Severity	Frequency/ Duration	Significance of Impact
Impulsive underwater sound emissions	3	1	Due to the overall short duration of the geophysical data acquisition activity, the frequency/duration rating was assessed as Level 2.	Medium
Continuous underwater sound emissions	1	n/a	Due to the overall short duration of the survey, the frequency/duration rating was assessed as Level 2.	Low

ALARP and Acceptability Assessment

ALARP Decision Context	A
Acceptability	Planned impacts associated with underwater sound emissions are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.7 Atmospheric Emissions

Activity

The following activity was identified to generate atmospheric emissions:

- Vessel Operations

Planned Impacts associated with Atmospheric Emissions

Vessels and onboard machinery are typically powered by combustion engines using Marine Diesel Oil (MDO) resulting in exhaust fumes being released as part of routine operations It is expected that approximately 5,000 litres of MDO will be used daily on the survey vessel. Therefore a total of 50, 000 litres of MDO will be used for the site survey, based on an estimated maximum duration of 10 days.

Atmospheric emissions are likely to include greenhouse gases, including carbon dioxide (CO_2) and methane (CH_4), and other gases such as oxides of sulphur (SOx) and nitrogen (NOx), as well as particulate matter (PM) which have the potential to result in chronic effects to sensitive receptors from localised and temporary decrease in air quality.

The quantities of atmospheric emissions generated by the survey vessel, and related impacts, will be temporary and will be similar in nature to emissions generated by other vessels and helicopters operating in the NWMR.

As the EMBA, at its closest, is 120 km from coastline habitats, ten Threatened or Migratory listed seabird species would be expected to be present in this area, and no settlements or other offshore operations are expected to be exposed to any temporary incidental and very localised change in air quality.

Based on the distance to sensitive habitats, limited sensitivities, and expected outcome that limited exposure will not result in any impacts, the environmental impact severity was assessed to be Level 1.

Impact Evaluation

Environmental Impact Severity	Frequency/Duration	Significance of Impact
1	Due to the overall short duration of the survey, the frequency/duration rating was assessed as Level 2.	Low

ALARP and Acceptability Assessment	
ALARP Decision Context	A
Acceptability	Planned impacts associated with atmospheric emissions are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.8 Planned Discharge – Cooling Water and Brine

Activity

The following activity was identified to generate cooling water and brine discharges:

- Vessel Operations

Planned Impacts associated with Planned Discharge – Cooling Water and Brine

Cooling water will be used on the survey vessel as the medium in heat exchangers to manage temperature in the engines. Brine is a by-product of fresh water generation onboard the vessel, and volumes discharged are dependent on operational demands.

Planned discharge of cooling water and brine has the potential to result in effects to fauna through:

- Increased water temperature,
- Increased water salinity,
- Potential addition of chemicals to the water column.

Increased Temperature

In the absence of typical discharge and dispersion rates for cooling water from a survey vessel in transit, reference is made to modelling of continuous wastewater discharges (including cooling water) undertaken by Woodside for its Torosa South-1 drilling program in the Scott Reef complex (approximately 600 km northeast of the EMBA). The study found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being less than 1°C above ambient within 100 m (horizontally) of the discharge point, and 10 m vertically (Woodside 2014). Because the volumes of cooling water used for a MODU are expected to be larger than those used by a survey vessel, and the non-stationary nature of the survey activities with the vessel in motion for most of the time, and given the water depths associated with Torosa South-1 are comparable to this program (and subsequent dilution and dispersion efficacy is expected to be similar) the modelling is considered to provide a conservative indication of the extent of exposure from cooling water discharges. The potential values and sensitivities with the potential to be exposed to this discharge include:

- Blue Whale (migration)

Marine mammals passing through the area will be able to actively avoid entrainment in any heated plume (Langford 1990). Because marine mammals are not poikilothermic, they are less sensitive to slight changes in water temperature.

Given the open-waters of the receiving environment, the intermittent nature of the described petroleum activity, and the limited exposure to sensitive features, it was determined that a discharge of cooling water within the Operational Area was not expected to result in an impact to identified values and sensitivities. The environmental impact severity of this planned impact was therefore assessed to be Level 1.

Increased Salinity

Brine water will sink through the water column where it will be rapidly mixed with receiving waters and dispersed by ocean currents. Therefore, any potential impacts are expected to be limited to the area surrounding the source of the discharge where concentrations are highest. This is confirmed by studies that indicate effects from increased salinity on planktonic communities in areas of high mixing and dispersion are generally limited to the point of discharge only (Azis et al 2003).

The potential environmental receptors with the potential to be exposed to an increase in salinity are transient pelagic marine fauna including whales, sharks, fish, and reptiles found in surface waters around the survey and support vessels. Pelagic fauna species are mobile; at worst, it is expected that they would be subjected to slightly elevated salinity levels for a very short time.

It is expected that brine discharges could result in an increased salinity level ranging between 10-50% (Shell, 2009; Woodside, 2014), depending on the efficiency of the desalination system available onboard the survey vessel. Changes in salinity can affect the ecophysiology of marine organisms. Stenohaline marine animals (including marine fishes) generally react to salinity changes by exhibiting avoidance behaviours (Gunter et al. 1974). Whereas euryhaline marine animals (marine turtles) are able to adapt to a wide range of salinities from estuarine, brackish to marine waters (Kultz 2015). Migratory marine mammals and sharks are known migrate through varied temperatures and salinities of the east Indian Ocean (refer to Section 4). The salinity profile of the east Indian Ocean in terms of range (from Indonesian waters to Antarctic Waters) show high spatial variability of salinity (Purba et al. 2018). Salinity tends to decrease towards Indonesian Seas and increases towards Antarctic waters ranging from 25-34 PSU (Purba et al. 2018). It is anticipated that migratory marine mammals and sharks can tolerate changes in salinity of approximately 25%, which is greater than the potential elevated salinity levels from the discharge of brine water (10-15%).

Turtles are known to move between surface and deep waters with no impacts, as well as adapt to a wide range of salinities associated with their change in habitat through their lifecycle (Kultz 2015, Reina 2002). Salinity changes with water depth, where shallow waters are generally less saline than deepwater environments (DSEWPaC 2012). It is therefore reasonable to assume that exposure to a temporary change in salinity from brine discharge is not expected to result in an impact on sea turtles.

Given the open-waters of the receiving environment, the intermittent nature of the described petroleum activity, and the limited exposure to sensitive features, it was determined that a discharge of brine water within the Operational Area was not expected to result in an impact to identified values and sensitivities. The environmental impact severity of this planned impact was therefore assessed to be Level 1.

Potential Chemical Toxicity

Scale inhibitors and biocide are typically used in the heat exchange and desalination process to avoid fouling of pipework; however the cooling water discharge is expected to have negligible concentrations of the chemicals at the point of discharge. This is because they are usually consumed in the inhibition process with little or no residual chemical concentration remaining upon discharge.

Given the nature of this discharge, marine fauna most susceptible to toxicity impacts are mainly limited to less mobile fish embryo, larvae, and other plankton.

Larger pelagic species are mobile; at worst, it is expected they would be subjected to very low levels of chemicals for a very short time if they swim near the discharge plume. As transient species, they are not expected to remain long enough within the discharge plume to experience any chronic or acute effects.

Given the open-waters of the receiving environment, the intermittent nature of the described petroleum activity, and the lack of sensitive features that would result in sedentary behaviour, the environmental impact severity of this planned impact was assessed to be Level 1.

Impact Evaluation

Environmental Impact Severity	Frequency/Duration	Significance of Impact
1	Due to the overall short duration of the survey, the frequency/duration rating was assessed as Level 2.	Low

ALARP and Acceptability Assessment

ALARP Decision Context	A
Acceptability	Planned impacts associated with planned cooling water and brine discharges are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.9 Planned Discharge – Bilge

Activity

The following activity was identified to generate bilge discharges:

- Vessel Operations

Planned Impacts associated with Planned Discharge - Bilge

Bilge water consists of water, oily fluids, lubricants, cleaning fluids, and other similar wastes that have accumulated in the lowest part of the vessel (bilge space) typically from closed deck drainage and machinery spaces. Bilge water is either stored onboard for onshore disposal or treated so that oil content in the bilge water is less than 15 ppm in accordance with MARPOL requirements, before being discharged at sea. The discharge of bilge water has the potential to result in impacts to marine fauna via the potential addition of chemicals to the water column.

OSPAR (2014) indicates that the predicted no effect concentration (PNEC) for marine organisms exposed to dispersed oil is 70.5 ppb. It should be noted that this PNEC is based upon no observed effect concentrations (NOEC) after exposure to certain concentrations for an extended period that was greater than 7 days (OSPAR 2014).

A discharge of treated bilge at sea is non-continuous and infrequent, being driven by the holding capacity of the bilge space onboard the vessel. Modelling by Shell (2009) indicates that upon discharge, hydrocarbon and other chemical concentrations are rapidly diluted and expected to be below PNEC within a relatively short period of time, within less than 100 m of the discharge.

Given the significantly smaller volumes of the survey vessel's bilge discharge, marine fauna most susceptible to toxicity impacts are mainly limited to less mobile fish embryo, larvae, and other plankton. For example, copepods exposed to sublethal concentrations of hydrocarbons displayed decreased ingestion rates and decreased egg viability; however egg production rates were not reported to be significantly affected (Cowles and Remillard,1983).

Due to the overall short duration of the survey, there is also potential for short-term impacts to species that rely on plankton as a food source. Any impact to prey species due to the lower availability of their food source would be temporary as the duration of exposure would be limited, and fish larvae and other plankton stocks are expected to rapidly replenish as they are known to have high levels of natural mortality and a rapid replacement rate (UNEP, 1985).

Consequently, the environmental impact severity was assessed as Level 1.

Impact Evaluation

Environmental Impact Severity	Frequency/Duration	Significance of Impact
1	Due to the overall short duration of the survey, and intermittent and infrequent nature of bilge discharges, the frequency/duration rating was assessed as Level 2.	Low

ALARP and Acceptability Assessment

ALARP Decision Context	A
Acceptability	Planned impacts associated with planned bilge discharge are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.10 Planned Discharge – Sewage, Greywater and Putrescible Waste

Activity

The following activity was identified to generate bilge discharges:

- Vessel Operations

Planned Impacts associated with Planned Discharge – Sewage, Greywater and Putrescible Waste

Discharge of food waste and sewage results in potential impacts to marine fauna via:

- Changes to the water quality through nutrient enrichment and increased biological oxygen demand (BOD),
- Impact to predator–prey dynamics.

Changes to Water Quality through Nutrient Enrichment and Increased BOD

Sewage, greywater and putrescible waste discharges from vessels supporting the oil and gas industry typically ranges between 0.04 and 0.45 m^3 per day per person (depending on waste production rates and sewage systems available

onboard) (EMSA, 2016). It is expected that there will be no more than 35 personnel on board, and that the survey will last for no more than 10 days. Monitoring of sewage discharges for an offshore floating liquified natural gas (FLNG) project (Woodside 2014) determined that a 10 m^3 sewage discharge reduced to approximately 1% of its original concentration within 50 m of the discharge location. Further, monitoring at distances 50, 100, and 200 m downstream of the discharge location and at five different water depths confirmed that discharges were rapidly diluted and no elevations in water quality monitoring parameters (e.g. total nitrogen, total phosphorous, and selected metals) were recorded above background levels at any station. Given the water depths associated with the discharge location (shallowest discharge at 350 m depth) are comparable to this survey (and subsequent dilution and dispersion efficacy is expected to be similar) the modelling is considered to provide a suitable indication of the extent of exposure from this activity.

The values and sensitivities with the potential to be exposed to changes in surface water quality includes:

- Blue Whale (migration)

Studies into the effects of nutrient enrichment from offshore sewage discharges indicate that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed areas (McIntyre and Johnson 1975) and suggest that zooplankton composition and distribution in areas associated with sewage dumping grounds are not affected. Regardless of receptor sensitivity to BOD, the BOD of treated effluent is not expected to lead to oxygen depletion of the receiving waters (Black et al 1994).

Due the rapid mixing and dispersion rates identified during modelling of sewage releases (Woodside 2014), no values or sensitivities are expected to be impacted by this activity and consequently the environmental impact severity was assessed to be Level 1.

Changes to Predator-Prey Dynamics

The overboard discharge of sewage and macerated food wastes creates a localised and temporary food source and may attract scavenging marine fauna or seabirds to the survey vessel. This in turn can increase the food source for predatory species. It is expected that there will be rapid consumption of this food waste by scavenging fauna and degradation by physical and microbial processes. This is likely to limit the impacts of putrescible waste discharges to be localised and temporary in nature, with limited negative impacts on receptors in the water column.

The ecological receptors with the potential to be affected by changes in predator–prey dynamics include plankton and large pelagic fauna (e.g. marine mammals, fish and seabirds), found in the surface waters of the Operational Area.

The rapid consumption of this food waste by scavenging fauna, and physical and microbial breakdown, ensures that the impacts of food waste discharges are insignificant and temporary, and receptors that may potentially be in the water column are not impacted.

Although fish are likely to be attracted to these discharges, any attraction and consequent change to predator–prey dynamics is expected to be limited to close to the release and thus expected to result in localised impacts to species. Because it is not expected that any increased predation would result in more than a short-term localised impact on species, the environmental impact severity was assessed as Level 1.

Impact Evaluation		
Environmental Impact Severity	**Frequency/Duration**	**Significance of Impact**
1	Due to the overall short duration of the survey, and intermittent nature of sewage, greywater and putrescible waste, the frequency/duration rating was assessed as Level 2.	Low
ALARP and Acceptability Assessment		
ALARP Decision Context	A	
Acceptability	Planned impacts associated with planned sewage, greywater and putrescible waste discharge are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.	

5.11 Physical Presence – Collision with Marine Fauna

Activity

The following activity was identified to result in potential risk of collision with marine fauna:

- **Vessel Operations**

Unplanned Risk associated with Physical Presence – Collision with Marine Fauna

The presence of the moving or stationary survey vessel in the marine environment may result in interaction with marine fauna. Collisions between the survey vessel and marine fauna have the potential to result in injury or death of marine fauna. Surface-dwelling macrofauna are the species most at risk from this hazard and thus are the focus of this evaluation. As identified in Section 4, whale, sharks and rays, turtles, dolphin species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the Operational Area.

There is limited data on collisions with potential fauna such as turtles and Whale Sharks, possibly due to lack of collisions being noticed and lack of reporting; however, marks observed on animals show evidence of vessel strikes (Peel et al. 2016). There is limited information with respect to the frequency of vessel collisions and sea turtles. Sea turtles have been observed avoiding vessel (Hazel et al 2007) but speed plays a key role as turtles can only swim at certain speeds. In a field study examining behavioural effects of vessel speed on green sea turtles, Hazel et al (2007) demonstrated that the proportion of turtles that moved away to avoid the vessel decreased significant as vessel speed increases. Vessel strikes can be fatal for individual turtles; however it has not been shown to cause population-level declines (EA 2003).

Cetaceans are the focus of this evaluation, and are the representative case used to undertake a consequence evaluation. Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels and facilities. The reaction of whales to the approach of a vessel varies—some species remain motionless when close to a vessel, while others are known to be curious and often approach ships that have stopped or are slow moving; however, they generally do not approach, and sometimes avoid, faster moving ships (Richardson 1995).

Collisions between larger vessels with reduced manoeuvrability and large, slow-moving cetaceans occur more frequently where high vessel traffic and cetacean habitat overlap (WDCS 2006). Laist et al. (2001) identifies that larger vessels with reduced manoeuvrability moving in excess of 10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling faster than 14 knots.

There are recorded instances of cetacean deaths in Australian waters (e.g. a Bryde's Whale in Bass Strait in 1992) (Laist et al. 2001), though the data indicate these deaths are more likely to be associated with container ships and fast ferries. The Australian National Marine Safety Committee reports that during 2009, there was one report of a vessel collision with an animal (species not defined) (NMFS 2013). Mackay et al. (2015) report that four fatal and three non-fatal vessel collisions with Southern Right Whales have been recorded in Australian waters between 1950 and 2006, with one fatal and one non-fatal collision reported between 2007 and 2014.

The duration of exposure to physical presence is limited to the length of the site survey, which is based on the scope and estimated time frames described in Section 2.3. To complete the survey, vessels will either be travelling at low speeds (4-5 knots) or be stationary. Consequently, any fauna strike is expected to result in a recoverable injury, not death.

Any fauna strike during survey activities is most likely to result in a recoverable injury, not death, because of the survey vessel travelling at slow speeds. The national strategy for reducing vessel strikes on cetaceans and marine megafauna (Commonwealth of Australia 2017) reports on the link between vessel speed and the increase in occurrence and severity of collision with cetaceans, whereby slower moving vessels provide greater opportunity for both fauna and vessel to avoid collision. If a fauna strike occurred and resulted in death, considering the frequency at which such incidences have been reported in the past, and the recovery status of the west coast humpback whale population (Commonwealth of Australia 2017). it is not expected to have a detrimental effect on the overall population, suggesting this event would result in a limited short-term effect (expected impacts on an individual of a species listed as threatened and/or migratory under the EPBC Act) and not affect any populations. The environmental impact severity for this unplanned risk was assessed to be Level E.

Risk Evaluation

Environmental Impact Severity	Likelihood	Risk Level
E	Many marine vessels operate within Australian waters. The risks associated with fauna strike is well understood, and industry good practice control	Low

	measures are in place. Due to the nature and scale of this petroleum activity, the slow-moving nature of the survey vessel (4-5 knots), and the limited area and duration of operation, the likelihood of this unplanned risk was assessed as Level 2.	

ALARP and Acceptability Assessment	
ALARP Decision Context	A
Acceptability	Unplanned risks associated with a collision with marine fauna due to physical presence are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.12 Physical Presence – Marine Fauna Entanglement

Activity

The following activity was identified as having the potential to cause marine fauna entanglement:

- Geophysical Survey Techniques

Unplanned Risk associated with Physical Presence – Marine Fauna Entanglement

Entanglement of marine fauna from towed equipment such as streamers or tail buoy has the potential to result in injury or death of marine fauna. A review of literature regarding this type of interaction indicates that turtles may be more vulnerable to the risk of entanglement due to their mostly vertical movements (diving and surfacing) (García-Párraga et al., 2014, Parsons et al., 2009). As described in Section 4, there is no habitat or biologically important areas within the EMBA (and Operational Area) to indicate that large numbers of marine reptiles may be encountered.

Weir (2007) reports that in incidental surveys marine turtles have been known to become entrapped within some tailbuoy equipment leading to suffocation, however there have been no reported cases of marine fauna becoming entangled in tailbuoy equipment in Australian waters.

Close-range encounters with marine fauna are expected to be infrequent and limited to isolated individuals in the immediate vicinity of the survey vessel and towed array.

If marine fauna entanglement occurred and resulted in death, it is not expected to have a detrimental effect on the overall population, suggesting this event could have impacts on an individual of a species listed as threatened and/or migratory under the EPBC Act, but not affect any populations. The environmental impact severity for this unplanned risk was assessed to be Level E.

Risk Evaluation

Environmental Impact Severity	Likelihood	Risk Level
E	Many marine vessels operate within Australian waters. The risks associated with marine fauna entanglement is understood, with only a limited number of incidences of fauna entanglement that have been reported in the past, and industry good practice control measures are in place. Due to the nature and scale of this petroleum activity, the slow-moving nature of the survey vessel (4-5 knots), and the limited area and duration of operation, outside of habitat or biologically important areas that may result in increased aggregations of marine turtles, the likelihood of this unplanned risk was assessed as Level 3.	Low

ALARP and Acceptability Assessment	
ALARP Decision Context	A
Acceptability	Unplanned risks associated with marine fauna entanglement due to physical presence are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.13 Introduction of Invasive Marine Species (IMS)

Activity

The following activity was identified as having the potential to cause an introduction of an invasive marine species:

- Vessel Operations

Unplanned Risk associated with the Introduction of Invasive Marine Species

The introduction of an invasive marine species (IMS) has the potential to impact the ecology of marine habitats by outcompeting native species. IMS are marine plants or animals that have been introduced into a region beyond their natural range and can survive, reproduce and establish founder populations.

IMSs are likely to face little or no natural competition or predation and can potentially outcompete native species for food or space, prey on native species, or change the nature of the environment. It is estimated that Australia has more than 250 established marine pests, and it is estimated that approximately one in six introduced marine species becomes a pest (DoE 2015).

Change in Ecosystem Dynamics

The introduction of an IMS can potentially alter the ecosystem dynamics of an area. Predicting impacts associated with an IMS are difficult because of the complexity of ecosystems and interactions amongst biotic and abiotic receptors.

Values and sensitivities within the Operational Area with the potential to be impacted by the introduction of IMS is limited to soft sediment benthic habitats. Soft sediment benthic habitats include sediment infauna communities which are widespread and homogenous in the NWMR (as described in Section 4).

It has been found that highly disturbed nearshore environments containing hard substrates and artificial structures (such as marinas) are more susceptible to colonisation than open-water environments, where the number of dilutions and the degree of dispersal are high (Paulay et al. 2002).

The nature of the marine habitats near the Operational Area indicate that establishment would be difficult due to the water depths and dominant presence of soft sediment communities. If IMS were introduced and established founder populations, it could potentially result in widespread colonisation and subsequent destruction of marine habitat ecology, therefore the environmental impact severity was assessed as Level C.

Changes in the Functions, Interests or Activities of Other Users

IMS can have primary and/or secondary impacts on socio economic receptors. Primary impacts include direct damage to vessels, equipment and infrastructure which may then cause flow on effects and lead to a reduction in efficiency, productivity and profit. The presence of fouling organisms within a marine environment is likely to have the same or similar impacts to socio-economic receptors.

Secondarily, ecological impacts associated with IMS introduction may have an impact to socio economic receptors through reduction in ecological values. Marine pest species can deplete fishing grounds and aquaculture stock, with between 10% and 40% of Australia's fishing industry being potentially vulnerable to marine pest incursion. Therefore the environmental impact severity of this unplanned event was assessed as Level C.

Risk Evaluation

Environmental Impact Severity	Likelihood	Risk Level
C	There is no documented evidence of IMPs establishing in deep offshore waters. Given the nature and scale of this activity, expected absence of sensitive benthic habitats, water depth of the operational area, the likelihood of this event causing an impact with a severity of Level C was ranked as Level 1.	High
ALARP Decision Context		**Ranking**
The pathways for introducing IMS (e.g. planned release of ballast water or biofouling) are well understood and managed by both nationally and international regulations and industry guidance.		B

This risk has the potential for future impact with widespread damage to a non-sensitive environment, and has been assigned a relative priority for risk management of High. DPIRD was a stakeholder who identified an interest in impacts of the activities on fish stocks, marine habitats and fishing and requested additional information on controls BP will implement to demonstrate ALARP. We continue to engage with DPIRD on information requests, to date no objection or claim has been identified. Given the relative priority for risk management, and interest from a relevant stakeholder, BP believes that ALARP Decision Context B should apply.			
Additional Control Measures	**Benefit**	**Cost**	**Outcome**
Use only vessels currently operating in Commonwealth Waters to reduce the potential for introducing IMS	By using vessels already working in Commonwealth Waters, the likelihood of introducing an IMS can be reduced. However, because the risk of introducing an IMS in this location is already low, there is limited environmental benefit associated with implementing this response.	Using only vessels currently operating in Commonwealth Waters is impractical given the limited availability of specialised vessels for the activities. Limiting activities to vessels currently operating in Commonwealth waters could potentially pose a significant risk in terms of time and duration of sourcing a vessel, as well as the ability of the available vessels to perform the required tasks. This potential cost is grossly disproportionate to the minor environmental gain (of reducing the potential likelihood of IMS introduction) potentially achieved by using vessels currently operating in Commonwealth waters only, and is not reasonably practicable.	Not selected
Acceptability Assessment			
Principles of Ecologically Sustainable Development	The potential worst case impact associated with this aspect is a widespread and persistent change to benthic communities. Although the habitat that has the potential to be impacted is expected to comprise soft sediment communities, there is the potential for hard substrate communities to be exposed. Consequently, given the potential for irreversible impacts to ecologically important hard substrate communities, this aspect is considered as having the potential to affect biological diversity and ecological integrity. The environmental impact severity for this planned impact is Level C. Consequently, further evaluation against the remaining principles of ESD is required. Little scientific uncertainty is associated with this aspect. The activities are well known, the pathways for introducing an IMP are well understood, well regulated, and managed. Although there is limited uncertainty regarding the marine habitat within the Operational Area, this is not considered to be significant, given the information that is available for areas with similar bathymetry, water depths, and proximity to these locations. As this information can be applied, it is not considered that there is significant scientific uncertainty associated with this aspect. Therefore, the precautionary principle has not been applied.		
Relevant environmental legislation and other requirements	This legislation and other requirements are considered relevant control measures for this program: • Biosecurity Act 2015, • *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (enacted by AMSA Marine Order Part 98 [Marine pollution – anti-fouling systems]), • Australian Ballast Water Management Requirements (DAWR 2017).		

Internal Context	BP internal guidance recommends that projects should not deliberately introduce any alien species with a high risk of invasive behaviour or any known invasive species. Because any potential introduction of IMS through the site survey will be unintentional, this criterion would be met.
External Context	DPIRD was a stakeholder who identified an interest in impacts of the activities on fish stocks, marine habitats and fishing and requested additional information on controls BP will implement to demonstrate ALARP. We continue to engage with DPIRD on information requests, to date no objection or claim has been identified.
Defined Acceptable impact Level	Given that the introduction of an IMS is an unplanned risk, an assessment against the defined acceptable impact level is not required (Section 5.1.6). However, the activity is not considered to be inconsistent with the North-west Marine Bioregional Plan (DEWHA 2008) which does not identify the introduction of an IMS as a key threat to the nearest KEF, and states that: "Most actions occurring along the ancient coastline at the 125-metre depth contour are unlikely to impact adversely on the ecosystem functioning and integrity of this key ecological feature." The activity and risk are not inconsistent with any of the identified recovery plans, conservation advice or bioregional plans, and does not have the potential to result in a persistent reduction in ecosystem function on a landscape scale and with the control measures in place is very unlikely to occur. As such, BP considers the level of risk to be acceptable.

5.14 Accidental Release – Waste

Activity

The following activity was identified as having the potential to cause an accidental release of waste:

- Vessel Operations

Unplanned Risk associated with Accidental Release – Waste

Discharged overboard, non-hazardous wastes can cause injury or death to marine fauna or seabirds through ingestion or entanglement (e.g., plastics caught around the necks of seals or ingested by seabirds and fish). For example, DSEWPaC (2015) reported that there had been 104 records of cetaceans in Australian waters impacted by plastic debris through entanglement or ingestion since 1998 (humpback whales being the main species).

Fauna most at risk from marine pollution through ingestion or entanglement include marine reptiles and seabirds. The ingestion or entanglement of marine fauna has the potential to limit feeding / foraging behaviours and thus can result in individual deaths.

Within the Operational Area, the values and sensitivities with the potential to be exposed to marine pollution include individual transient marine mammals, reptiles and seabirds. Given the restricted exposures and limited quantity of marine pollution expected from this program, impacts are expected to be localised short-term impact to species/habitats of recognised conservation value but not affecting local ecosystem functioning. Therefore, impacts from marine pollution will result in an environmental impact severity of Level G.

Risk Evaluation

Environmental Impact Severity	Likelihood	Risk Level
G	Marine pollution from other activities has occurred previously in the industry, that is an accidental release of waste that caused death to individual fauna species. However, it is not expected to occur during these activities with the control measures in place. In the event that it did occur, the likelihood that values and sensitivities are impacted is small. Consequently, the likelihood has been ranked as a Level 3.	Low

ALARP and Acceptability Assessment

ALARP Decision Context	A

Acceptability	Unplanned risks associated with accidental release of waste are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.15 Accidental Release – Loss of Containment (Hydrocarbons or Chemicals)

Activity

The following activity was identified as having the potential to cause a hydrocarbon or chemical loss of containment event:

- Vessel Operations

The types of spill events that have the potential to occur under this EP include:

- loss of minor volumes of hydrocarbon or chemicals during use and storage on-board the vessel,
- loss of diesel via vessel collision during the site survey[1].

[1] Based upon the volumes of hydrocarbon and hazardous material types anticipated for utilisation for this activity; the impact evaluation is based upon a full release of a diesel tank (250 m³) being assessed as the worst credible environmental impact from an accidental release scenario for the planned activities relevant to this source assessment.

Unplanned Risks associated with Accidental Release – Loss of Containment

The major causes of a vessel collision were identified as:

- Loss of engine power causing a vessel to drift, or
- Navigational error.

A vessel collision resulting in the release of marine diesel oil (MDO) would affect water quality through surface and entrained hydrocarbon exposure, which could lead to toxic or smothering effects to sensitive environmental receptors.

To determine the extent of hydrocarbon exposure from an accidental release of MDO during the survey, oil weathering model ADIOS (Automated Data Inquiry for Oil Spills) was used to estimate how long an instantaneous release of 250 m³ of MDO will remain in the marine environment.

A volume of 250 m³ was selected for this analysis, which is considered conservative as the preferred vessel that BP is currently considering for completion of this activity is much smaller with a likely fuel inventory of 50 m³.

NERA Reference Case 2018:1003 identified ADIOS predictions show greater evaporation of hydrocarbons at higher seawater temperatures and high dispersion at high wind speeds. Therefore, to predict the greatest consequence extent using ADIOS, the low windspeed and low seawater temperature values representative of offshore Australian waters as defined by DNV's study for AMSA (DNV 2011) was used. Based on the parameters to predict the greatest consequence extent, ADIOS estimated that within 52 hours of an instantaneous release of 250 m³ diesel, no surface expression is expected as volatiles have evaporated, and the remaining components have entrained and dispersed into the water-column.

To calculate the extent of surface hydrocarbon exposures from this type of spill event, BP considered the influence of wind velocity on the surface slick as wind often determines the direction and speed with which a slick moves, with oil drift velocity about 3% of wind velocity (Lee 1980). The extent was then calculated using a velocity of 0.15 m/s (based upon 3% of 5 m/s, considered as calm weather conditions as used in the ADIOS model), which indicates that the horizontal extent of a surface slick associated with a 250 m³ MDO spill is limited to a 28 km horizontal buffer applied around the Operational Area for impact assessment purposes. The vertical extent of the spill within the water column is expected to be limited to the top 10 m of the water column (NERA Reference Case 2018:1003).

Therefore, the EMBA for a vessel collision resulting in a hydrocarbon spill is defined as within the top 10 m of the water column and a 28 km buffer around the Operational Area where marine receptors could be exposed to hydrocarbons through a surface, entrained or dissolved pathway.

Duration of exposure to hydrocarbons from this event would be limited with modelling indicating that following a 52-hour period, exposure is not expected to cause impacts to marine fauna.

Marine fauna with the potential to be exposed to hydrocarbons from this event include plankton and transient marine fauna and BIAs associated with the migrating Blue Whale and foraging Whale Shark were identified as intersecting the EMBA.

Surface Exposure

The extent of surface water hydrocarbon exposure has the potential to cause injury and mortality through toxicity poisoning to an intersecting individual marine receptor (such as seabirds, marine turtles or marine mammals):

- Seabirds dive in ocean waters to feed or rest at the surface. These seabird behaviours, within the spill EMBA, will oil feathers breaking down thermal insulation and buoyancy properties of seabird plumage which prevents them from feeding or flying (Crawford et al. 2000). Seabird preening of oiled feathers will result in oil ingestion and resultant gut damage (Crawford et al. 2000). Oiling of seabird feathers may result in mortal injury through starvation, cold and poisoning. The spill EMBA does not contain known offshore aggregation areas for seabirds.
- Marine turtles within the spill EMBA have the potential to ingest oil by surface breathing within the slick or consuming contaminated prey species. Ingestion of oil may result in mortal injury from damaged digestive function (Milton and Lutz 2010). The spill EMBA does not contain known offshore aggregation areas for marine turtles.
- Surfacing marine mammals such as Blue Whales migrating through the spill EMBA are susceptible to fume inhalation and oil absorption through the skin (Helm et al. 2015). Physical contact by individual whales of MDO is unlikely to lead to any long-term impacts (Fraker, 2013). Given the mobility and wide geographical distribution of whales on the NWS, only a small proportion of the population would be expected surface in the spill EMBA, resulting in short-term and localised consequences, with no long-term population viability effects (Helm et al. 2015). Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behaviour disturbance (including avoidance of the area) may occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may disrupt behaviours such as migration.

In-water Exposure

The extent of in-water hydrocarbon exposure has the potential to cause chronic impacts to planktonic organisms, pelagic fish and marine mammals that might move within the plume.

- Plankton are drifting organisms which includes eggs and larvae of fish and other animals. Plankton species are sensitive to toxic effects of oil at low concentrations and large numbers of planktonic organisms may be affected (ITOPF, 2011). Plankton are numerous and widespread but do act as the basis for the marine food web. However, any impact is expected to be localised and temporary, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have re-established, the plankton community may take weeks to months to recover (ITOPF, 2011). The potential impacts to plankton are expected to be short-term, localised, and not affecting local ecosystem functioning. No specific spawning locations within the EMBA have been identified.
- Pelagic free-swimming fish and sharks such as Whale Sharks foraging in the EMBA, are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2011). Subsurface hydrocarbons could potentially result in acute exposure to marine biota such as juvenile fish, larvae, and planktonic organisms, although impacts are not expected cause population-level impacts.
- Cetacean exposure to in-water hydrocarbons can occur via ingestion or physical coating (Geraci and St Aubin, 1988). The potential for environmental impacts would be limited to a relatively short period following the release and would need to coincide with a migration or aggregation event to result in exposure of a large number of individuals. However, such exposure is not anticipated to result in long-term population viability effects. A proportion of the migrating population of whales could be affected for a single migration event, which could result in temporary and localised consequences.

Given the spill EMBA is localised (within 28 km of the Operational Area), is relatively short-term (approximately 52 hours) and does not contain known offshore aggregation areas for seabirds, marine turtles and marine mammals, individual receptors may be exposed resulting in potential individual casualties. It is unlikely that many marine receptors will be exposed and therefore no receptor populations will be affected. In the event a vessel collision would result in the release of diesel, marine fauna casualties may result however would only occur at an individual level (given the limited duration and transient nature of receptors within the area) and would be unlikely to impact local populations. This event is expected to result in localised, short-term impacts to transient marine receptors. Therefore the environmental impact severity was assessed to be Level E.

Risk Evaluation

Environmental Impact Severity	Likelihood	Risk Level
E	During the site survey, the likelihood of a vessel collision will be low because only a single vessel is required, and control measures in place will reduce the chance of an interaction with a 3rd party vessel. The particular environmental	Low

	values and sensitivities with the potential to be exposed are limited, thus the likelihood of this event occurring that would then result in Level E environmental impacts was deemed to be a Level 3.	

ALARP and Acceptability Assessment	
ALARP Decision Context	A
Acceptability	Unplanned risks associated with an accidental release from a loss of containment are ranked as Decision Context A, therefore are considered inherently acceptable given that ALARP has been achieved and no further evaluation is required.

5.16 Summary of Control Measures

Activity	Aspect	Control Measures
Vessel Operations	**Physical presence – displacement of other marine users**	**Pre-start notifications** The Australian Hydrographic Service (AHS) will be notified no less than four working weeks before operations commence to enable Notices to Mariners to be published. AMSA's JRCC will be notified 24–48 hours before operations commence to enable AMSA to distribute an AUSCOAST warning. **Ongoing Consultation** In accordance with requests from relevant stakeholders during the consultation period, BP will implement the requirements as described in Section 6.
Geotechnical survey	**Seabed disturbance**	**Evaluate geophysical data before finalising geotechnical sampling locations** Geophysical data will be used to identify areas of hard substrate recognised for biodiversity values and finalise borehole / sampling locations prior to the geotechnical survey.
Vessel Operations	**Light emissions**	Lighting will be limited to that required for safe work/navigation
Geotechnical survey Vessel Operations	**Impulsive underwater sound emissions** **Continuous underwater sound emissions**	**Non-Dedicated Marine Fauna Observer (MFO) and Vessel Crew** During seabed surveys at least one vessel crew member and a non-dedicated person trained in marine fauna observation and mitigation measures will be on duty aboard the survey vessel. MFO will monitor the mitigation zone during the pre-start up visual, soft-start and line change procedures and the vessel master will implement mitigation measures as appropriate. **Vessel Master** Vessel master will be briefed on the mitigation zone, soft start and line changes control measures as defined in JNCC guidelines (JNCC 2017) and EPBC Act Policy Statement 2.1. **Vessel Crew** Vessel crew will be briefed on EPBC Act Policy Statement 2.1, and the environmental legal obligations for operating in Australian waters. Vessel crew will be trained in cetacean observation techniques and reporting requirements. Vessel crew will report all whale sightings to the Vessel Master who will maintain a record of all sightings for the project. **Vessel Maintenance**

Activity	Aspect	Control Measures
		Underwater sound radiated from vessels is reduced to as low as possible by ensuring engines and propulsion systems are maintained in accordance with manufacturer's specifications.
Vessel Operations	**Atmospheric emissions**	Only low-sulphur (<3.5% m/m) marine-grade diesel will be used in order to minimise SOx emissions. All combustion equipment is maintained in accordance with the PMS (or equivalent). Vessels with diesel engines>130 kW must be certified to emission standards (e.g. IAPP, EIAPP). Vessels implement their Ship Energy Efficiency Management Plan (SEEMP) to monitor and reduce air emissions (as appropriate to vessel class). Fuel consumption is monitored on vessels (and portable back-deck equipment) and abnormally high consumption investigated.
Vessel Operations	**Planned Discharge – Cooling water and Brine**	Cooling water and reverse osmosis (RO) systems are maintained in accordance with the facility PMS so that they are operating within accepted parameters.
Vessel Operations	**Planned Discharge – Bilge**	**Oily-water Separation Equipment** For vessels > 400 tonnes, bilge water passes through a MARPOL approved Oily Water Separator (OWS). **Criteria for approved discharge** For vessels < 400 tonnes treated bilge is discharged if: • Vessel is proceeding en-route; and • Approved treatment equipment ensures oil content less than 15 ppm. • If the above is not met the oil residue must be retained in on-board storage tanks for onshore disposal or further treatment. **OWS System Reliability** OWS and Oil Discharge Monitor Equipment (ODME) (appropriate to vessel size) are routinely maintained and system elements calibrated to ensure reliable discharge concentrations are being met. The residual oil from the OWS is pumped to storage tanks and disposed of onshore.
Vessel Operations	**Planned Discharge – Sewage, Greywater and Putrescible Waste**	**Food waste macerated** Discharge of food waste shall be controlled by macerating galley waste to ≤ 25 mm (using an on-board food macerator) before discharge. **Planned maintenance system (PMS)** The macerator will be maintained in accordance with the PMS. **MARPOL-discharge conditions** Sewage will be discharged in accordance with the following MARPOL conditions: • Sewage is treated via a STP before discharge (>3 nautical miles from land), • Proceeding en-route at a speed not less than 4 knots. or • Sewage remains untreated (>12 nautical miles from land),

Activity	Aspect	Control Measures
		• Proceeding en-route at a speed not less than 4 knots. **Planned maintenance system** If used for the activity, the sewage system will be maintained in accordance with the PMS
Vessel Operations	**Physical presence – collision with marine fauna**	**Vessel Master** The Vessel Master will be made aware of the Australian National Guidelines for Whale and Dolphin Watching (DEWHA 2005) before commencing operations. **Fauna interaction management actions** In accordance with the Australian National Guidelines for Whale and Dolphin Watching for seafaring activities, vessels will implement: • Caution zone (300 m either side of whales and 150 m either side of dolphins) – vessels must operate at no wake speed in this zone. • No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod. **Incident Reporting** Collisions with cetaceans will be reported to the Commonwealth Department of the Environment and Energy (DotEE) via the online National Ship Strike database* as soon as possible (but not later than 72 hours after the incident occurs). *https://data.marinemammals.gov.au/report/shipstrike
Vessel Operations	**Physical Presence - Marine Fauna Entanglement**	**Vessel Master** Vessel Master will be made aware of the EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans and its application to marine turtles and Whales Sharks before commencing operations. **Fauna interaction management actions** In accordance with the EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans, vessels will implement: • Caution zone (300 m either side of whales and 150 m either side of dolphins, marine turtles and Whale Sharks) – vessels must operate at no wake speed in this zone. • No approach zone (100 m either side of whales and 50 m either side of dolphins, marine turtles and Whale Sharks) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod. **Incident Reporting** Entanglements to megafauna will be reported to the Commonwealth Department of the Environment and Energy (DotEE) via the online National Ship Strike database* as soon as possible (but not later than 72 hours after the incident occurs). *https://data.marinemammals.gov.au/report/shipstrike

Activity	Aspect	Control Measures
Vessel Operations	**Introduction of Invasive Marine Species**	**Maritime Arrivals Reporting System (MARS)** If the survey vessel is mobilised from outside of Australian waters Commonwealth Department of Agriculture, Water and Resources (DAWR) clearance is obtained to enter Australian waters through pre-arrival information reported through MARS. **Exchange of survey vessel ballast water outside Australian waters** If the survey vessel is mobilised from outside of Australian waters, ballast water exchange will be undertaken in accordance with the requirements of the Australian Ballast Water Management Requirements (DAWR 2017) before entry into Commonwealth waters. **Report ballast water discharges** All ballast water discharges from the survey vessel will be reported. **Maintain a ballast water record system** A ballast water record system will be maintained by the survey vessel. **Antifouling certificate** The antifouling system certification is current in accordance with AMSA Marine Order Part 98 (Marine pollution – Anti-fouling systems). **Biofouling management plan** A biofouling management plan will be available for the survey vessel. **Biofouling record book** A biofouling record book will be maintained for the survey vessel. **Dry-store equipment during transit** In-sea equipment (specifically the geophysical and geotechnical survey systems will remain dry-stored during transit. **Biofouling inspection** In-sea equipment (specifically geophysical and geotechnical survey systems) will be inspected for biofouling before deployment.
Vessel Operations	**Accidental Release - Waste**	**Garbage / waste management plan** A Garbage Management Plan will be in place and implemented **Garbage record book** A garbage record book / log will be in place and maintained for the vessel **Waste management training / induction** All vessel crew will undertake site inductions that include a component on storing and handling hazardous materials and wastes **Accidental release / waste management training / induction** Prevent overboard discharge of hazardous liquid spills by storing hydrocarbons and hazardous liquids within secondary containment or purpose-built bulk tanks aboard the Vessel

Activity	Aspect	Control Measures
Vessel Operations	**Accidental Release – Loss of Containment (Hydrocarbons or Chemicals)**	**Vessel Crew and Navigational Equipment** Vessels will meet the crew competency, navigation equipment, and radar requirements of the Marine Safety Reliability and Efficiency (MSRE) process. **Stakeholder Consultation** Stakeholder consultation implemented to ensure other marine users are informed of vessel presence. **Pre-start Notifications** The AHS will be notified no less than four working weeks before operations commence to enable Notices to Mariners to be published. **Shipboard Oil Pollution Emergency Plan (SOPEP)** Emergency response activities will be implemented in accordance with the survey vessel SOPEP. BP will evaluate the relevant SOPEP against the impacts and risks identified in this EP prior to the survey commencing to ensure that response equipment is appropriate, the SOPEP is up to date and all reporting requirements and procedures for coordinating with local officials are correct. **Spill Response Arrangements** Prior to commencing the survey, response arrangements will be tested by conducting a desktop notification exercise to ensure SOPEP and potential Incident Management Team (IMT) activation along with AMSA notification requirements are understood. In the event of a vessel collision, external notifications will be conducted in accordance with Table 6-5. IMT will implement Monitoring Evaluation and Surveillance (MES) tactics in accordance with Section 6.4.3. **Operational and Scientific Monitoring Plan (OSMP)** Operational and scientific monitoring will be implemented in accordance with the OSMP.

6 Implementation Strategy

6.1 BP Operating Management System

BP's Operating Management System (OMS) provides a single framework for BP operations, covering people, plant, process, and performance and applies whenever BP carries out or uses a contractor to carry out operating activities.

The BP OMS defines a set of operating requirements and outlines a systematic way for businesses to deliver them. The requirements address eight focus areas - "the Elements of Operating" - under people, plant, process and performance. Element 3 (Risk) and Element 4 (Procedures) and Element 7 (Regulatory Compliance) of the OMS provides a framework for managing HSSE risks as described in this EP. These are summarised as:

- **Element 3 – Risk – Risk Assessment and Management**: BP's Risk Assessment and Management process is detailed under Element 3 of the BP OMS. This process supports the management of HSSE risks.
- **Element 4 – Procedures – Management of Change**: The BP MoC process aims to identify potential hazards and impacts when a permanent, temporary, or emergency change in 'people', 'plant', or 'process' is undertaken or a 'deviation' occurs. Based on this assessment, should the proposed change trigger a requirement to revise the EP and/or OPEP under the Regulations, the updated EP and/or OPEP will be submitted to NOPSEMA for acceptance.
- **Element 4 – Procedures – Incident Notification, Investigation and Reporting**: BP's incident notification process as applied to the site survey, describes how BP reports and investigates incidents. BP's database for incident action tracking (IRIS) will be used to progress reporting and escalation during the site survey.
- **Element 7 – Privilege to Operate – Regulatory Compliance:** BP's Regulatory Compliance process addresses the establishment of audit programs to verify the effectiveness of controls and the extent to which requirements are met. For this survey an audit will be performed of the vessel contractor prior to mobilisation in order to confirm the vessel meets HSE specifications and marine assurance requirements.
- **Element 7 – Privilege to Operate – Community and Stakeholder Relationships:** BP's Communities and Stakeholder Relationships process systematically identifies stakeholders and plans and executes engagement to foster mutual understanding, dialogue, and trust.
- **Element 8 – Results – Assessment and Audit:** BP's Assessment and Audit process is used if audit findings identify that activities in the scope of this EP are not being implemented in accordance with the control measures.

6.2 Contractor Management System

BP's OMS defines requirements and practices for working with contractors, in particular the requirement for contracts to include clear and consistent information, and specific details of BP's expectations. Contracts are awarded taking into account factors such as safety, technical quality and cost. Contractors and subcontractors shall be required to demonstrate conformance with the requirements that have been established, including HSSE standards and performance requirements. In particular, BP requires that contracted companies have in place a HSE management system that provides a systematic approach for controlling risk, complying with regulatory requirements and

continually improving HSE performance. Bridging documents are necessary in some cases to define how BP's safety management systems and those of BP's contractors will co-exist to manage impacts and risks of a project.

6.3 Emergency Response

Given that the site survey activities will involve a single contract vessel for a very limited timeframe, the vessel contractor will be the lead in managing an emergency response, as described within the vessel contractor's Shipboard Oil Pollution Emergency Plan (SOPEP) and similar emergency response plans. BP will review these vessel contractor plans to ensure that they are in place and address the range of potential emergency events that could occur. BP will also ensure that the vessel operator's notification procedures include a direct notification to BP of any emergency incidents. A notification exercise will be conducted prior to the commencement of operations of the survey in the Operational Area to validate the notification procedures are in place and accurate. Should an emergency incident occur, BP will be prepared to assist the contract vessel operator with any applicable resources available to BP. The primary roles in emergency response are outlined in Table 6-1 below.

Table 6-1 – Emergency Response Roles

Emergency Event Description	Primary Responsibility	Support Responsibility
General emergency on the survey vessel (fire, injury, accident, etc)	Contractor	BP
Oil or chemical spill on the survey vessel (contained inboard)	Contractor	BP
Oil or chemical spill event outboard to the ocean	Contractor	BP

Element 4 (Procedures) of the OMS requires that BP entities prepare for and respond promptly to crisis and emergency events threatening harm to BP employees and contractors, company assets and neighbouring communities and interruption in business operations. In the unlikely event that BP needs to establish an Incident Management Team (IMT), BP maintains in Perth a capability to stand up an IMT within an hour of call out. This team is staffed 24/7 and is drawn from a pool of staff from BP Upstream Australia, supported by staff from BP Downstream Australia. This includes the Kwinana Refinery, which has an established and experienced IMT. Furthermore, BP also has other experienced IMT staff within the Australian Downstream businesses outside of WA, who can support the response. Additionally, BP's Mutual Response Team (MRT), an international team of over 100 highly-trained response experts, can be mobilized to Australia within 24 hours of notification.

All BP IMTs and IMT members are trained in, and utilise, BP's Incident Management System. The BP Incident Management System is based on a tiered response structure.

The command structure hierarchy encompasses the internal BP teams that support an incident response which form BP Group's three escalation tiers of its Crisis Management Response System:

Tier 1. Incident Management Team (IMT),
Tier 2. Business Support Team (BST),
Tier 3. Executive Support Team (EST).

The EST and BST work with the Country Support Team (CST) to support the IMT in supporting the incident response, as needed.

6.4 Oil Pollution Emergency Plan

In the absence of a definition of potential emergency conditions under OPGGS(E)R, BP has defined an environmental emergency condition in Section 5 of the EP.

Based upon the potential aspects identified and impacts and risks evaluated, none of the activities were at risk of resulting in an accidental release or spill of oil or other hazardous materials that would result in an impact severity level greater than E. Therefore, there is not an oil pollution emergency event associated with this EP for which a standalone OPEP is required within the meaning of the OPPGGS(E)R.

Given the nature and scale of the potential spill risks associated with the site survey, any spills from the vessel would be sufficiently addressed by the contracted survey vessel's SOPEP. Regulation 14(8) is met by providing an AMSA-approved SOPEP under Regulation 23(2) of AMSA Marine Order Part 91 (Marine pollution prevention – oil) in addition to the arrangements described in the subsections below.

To prepare for a spill event, the SOPEP details:

- Response equipment available to control a spill event,
- Review cycle to ensure that the SOPEP is kept up-to-date, and
- Testing requirements, including the frequency and nature of these tests.

In the event of a spill, the SOPEP details:

- Reporting requirements and a list of authorities to be contacted,
- The activities to be undertaken to control the discharge of oil, and
- Procedures for coordinating with local officials.

BP will evaluate the relevant SOPEP against the impacts and risks identified in this EP prior to the survey commencing to ensure that response capability and procedures are appropriate, the SOPEP is up to date and all reporting requirements and procedures for coordinating with local officials are correct. BP will also ensure that the contract vessel operator's emergency notification procedures include notification to BP. BP will be available to support the contract vessel operator with any available and applicable resources. Examples of this support may include personnel to supplement the contractor's IMT, or accessing surveillance capabilities through BP's contracts with AMOSC or OSRL.

Not all response options and tactics are appropriate for every oil spill. The assessment of oil spill response options for a spill of MDO or equivalent from a vessel collision detailed in Table 6-2 shows that monitoring, evaluation and surveillance would be the only viable response strategy for the site survey based on location and oil type.

Table 6-2 – Suitability of Response Options for MDO or Equivalent

Response Option	Description	Vessel Collision (MDO or equivalent)	Viable Response?
Monitoring, Evaluation and Surveillance	Direct observation – Marine; Vector Calculations; Oil Spill Trajectory Modelling; Satellite Tracking Buoys	MDO spreads rapidly to thin layers (less than 10 µm). Various MES strategies may be suitable and can be deployed rapidly and are relatively intrusive.	✓

Response Option	Description	Vessel Collision (MDO or equivalent)	Viable Response?
	To maintain situational awareness, all monitor and evaluate options suitable.		
Dispersant Application	Breakdown surface spill & draw droplets into upper layers of water column. Increases biodegradation and weathering and provides benefit to sea-surface /air breathing animals.	MDO, while having a small persistent fraction, spreads rapidly to thin layers (less than 10 µm). This rapid spreading action can mean that there is insufficient time to respond using dispersants, as dispersant application is dependent on the presence of suitable surface thicknesses. Dispersant application can result in punch-through where dispersant passes into the water column without breaking oil layer down if surface layers are too thin. Application can contribute to water quality degradation through chemical application without removing surface oil. Dispersant application is not considered to add sufficient benefits for the management of a MDO spill.	**X**
Contain & Recover	Booms and skimmers to contain surface oil where there is a potential threat to environmental sensitivities.	MDO spread rapidly to less than 10 µm and suitable thicknesses for physical recovery would only be expected to be present for the first 36 hours of a large offshore MDO spill. There would be insufficient mobilisation time to capture residues. IPIECA (2015) indicates that when implemented, efficiency of at-sea containment and recovery operations can vary widely with recovery usually limited to between 5% and 20% of the initial spilled volume. Given the rapid spreading of MDO, it is expected that the encounter rate would be small thus efficiency of recovery would also be lower. In addition to this, containment and recovery creates significant levels of waste, requires significant manpower and suitable calm weather conditions to be deployed effectively.	**X**

Response Option	Description	Vessel Collision (MDO or equivalent)	Viable Response?
		Containment and recovery is not considered to add sufficient benefits for the management of a MDO spill.	
Protect & Deflect	Booms and skimmers deployed to protect environmental sensitivities.	MDO spread rapidly to less than 10 µm and suitable thicknesses for the deployment of booms and skimmers are only present for the first 36 hours for a large offshore spill. However no physical environmental sensitivities exist within the spill EMBA and protection and deflection is not considered to add sufficient benefits for the management of a MDO spill.	**X**
Shoreline Clean-up	Shoreline clean-up is a last response strategy due to the potential environmental impact.	The potential for shoreline exposure is dependent on the location of vessel collision with loss of fuel inventory if one was to occur. However given the site survey is located approximately 200 km from the closest shoreline, and as MDO is known to rapidly evaporate and entrain in the water column, no shoreline exposure wold be expected from a spill event covered under this EP. As no shorelines exist within the spill EMBA and as shoreline exposure is not expected from a spill event covered under this EP this response option has not been considered further.	**X**

6.4.1 Control Agencies

In the event of a hydrocarbon spill in Australia, the National Plan framework (AMSA 2014) establishes jurisdictional authority and clean-up responsibility. The National Plan defines that the role of the Control Agency is to control response activities to a maritime environmental emergency.

The following arrangements relevant to the site survey apply for spills in Western Australia:

- AMSA is the Control Agency for vessel (shipping) spills in Commonwealth Waters.
- BP is accountable for the first-strike response to be conducted by vessel contractor in the event of a spill during the site survey.
- First strike response to be undertaken by vessel contractor under the vessel's SOPEP.

IMT Activation Process

BP's incident response levels are described in Table 6-3 with details provided in Table 6-4. Given the nature and scope of site survey activities, any incident that might occur would most likely be a Level 1 or Level 2 event, as per the selection criteria below:

- Selection of any answer in Level 3 indicates a Level 3 response should be undertaken.
- Selection of any answer in Level 2, with no affirmative response in Level 3, indicates that Level 2 response options should be considered.
- A Level 1 response is considered appropriate only if no response options are selected in any other column.

Based on the nature of the petroleum activity being undertaken (vessel-based), a Level 1 or Level 2 spill incident would be managed by the contractor vessel operator, as per their emergency plans. As per BP's standards, BP's Incident Commander would be notified in the event of a spill incident and BP's IMT would be put on standby. The BP Environment Unit Lead would implement any required MES activities. However, should a Level 3 incident occur, BP would stand up an IMT in Perth, as per Section 6.3.

Table 6-3 – Overall Response Level Indication

Level 3	Level 2	Level 1
An incident likely to have a wide ranging impact on the public, the environment, and BP. A level 3 incident may require the mobilisation of external state, national or international resources to bring the situation under control.	An incident that cannot be controlled by the use of the vessel resources alone and requires external support and resources to combat the situation; or An incident that can be controlled by the vessel but which may have an adverse impact on the public or the environment.	An incident which is likely to have no adverse impact on the public or the environment. Control of the incident will be through the use of resources normally available at the vessel concerned without the need to mobilise the BP IMT or seek external assistance.

Table 6-4 – Specific Response Level Determination

Response Level Indication	Level 3	Level 2	Level 1
Spill Details			
Release Volume (guidance only – actual Level determined by potential impacts, not volume)	> 500 m^3	5 m^3 – 500 m^3	< 5 m^3
Continuous release	Yes	No	No
Hydrocarbon has high persistent component	Yes	Yes	No
Resolution likely to take	> 2 wks	48 hrs to 2 wks	< 48 hrs
Spill Impact			
Actual or potential threat to, or loss of, life	Yes	No	No
Adverse impact on public or environmental sensitivities	Yes	Possible	No
Oil will reach the shoreline	Yes	No	No
Media coverage likely	International	National	Local

Likely Resources Required			
International resources required, international agencies and government involved	Yes	Possibly	No
Regional/national (Australia wide) resources required, multiple agencies involved	Yes	Yes	No

Vessel Spills

AMSA is the Control Agency in Commonwealth Waters for all shipping (vessel) spills and spills that result from vessels undertaking offshore petroleum activities where the Commonwealth Navigation Act 1912 applies. The contract vessel operator will conduct the first-strike response (based on the requirements of the SOPEP) with the support of BP as required, until such time as AMSA or a nominated National Plan agency arrives to assume incident command. BP will support the contract vessel operator with any applicable resources at BP's disposal. The contract vessel operator will continue to implement the Monitoring, Evaluation and Surveillance (MES) activities outlined in Section 6.4.3 as deemed necessary by the Control Agency.

Multi-jurisdictional Incident Coordination

Incidents that are multi-jurisdictional (i.e. both a Commonwealth and State Waters Marine Oil Pollution (MOP) emergency resulting from the same incident) will be managed in accordance with the National Plan (AMSA 2014), WestPlan–MOP (DoT 2010), and the Offshore Petroleum Industry Guidance Note (OPIGN) issued by DoT(DoT 2017).

The coordination arrangements for multi-jurisdictional incident response will depend on the risk, severity, and impact of the incident for each jurisdictional and Control Agency area. These measures, based on the National Plan and OPIGN, may be considered as part of an agreed Incident Management Plan:

- Appointing a Lead Control Agency or Lead IMTs for particular response management functions;
- Establishing a Joint Strategic Coordination Committee to enable strategic direction, prioritisation, and conflict resolution;
- Transitioning control of the incident;
- Using a coordination plan to formalise the arrangements.

6.4.2 External Notification and Reporting

Table 6-5 lists the appropriate external notification and reporting requirements for incidents under this EP. Additional information in Table 6-5 for external notification and reporting includes the relevant legislation, the responsible party and links to spill notification and reporting forms.

Depending on the level of IMT activation, external notification should be undertaken by the Incident Commander (or delegate) in the IMT.

Table 6-5 – External Notification Requirements and Reporting Responsibilities

Agency or Authority	Legislation / Guidance	Notification Requirements	Responsibility and Timing	Links to Reporting Forms
All Marine Spills (Commonwealth and State Waters)				
AMSA	Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983 Commonwealth Navigation Act 2012 Marine Order 91 (Marine pollution prevention – oil) 2014 Marine Order 93 (Marine pollution prevention – noxious liquid substances) 2014	• All discharges /spills or probable discharges/spills to the marine environment of oil or oily mixtures, or noxious liquid substances in the marine environment from vessels. Note: Vessels transiting outside the Operational Area (Section 2.1) are outside the scope of this EP and the above reporting requirements do not apply.	• Immediate notification by the Vessel Master to AMSA. • Written Marine Pollution Report (POLREP) form submitted by the Vessel Master or BP Representative to AMSA; timing not specified.	If the ship is at sea, reports are to be made without delay to AMSA. • Ph: (02) 6230 6811 or 1800 641 792 • Email: rccaus@amsa.gov.au • Fax: (02) 6230 6868 • Reporting info: http://www.amsa.gov.au/forms-and-publications/AMSA1522.pdf • AMSA POLREP: https://amsa-forms.nogginoca.com/public/
Commonwealth Department of the Environment and Energy (DotEE)	Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	• Spill has potential to cause significant impact to a matter of national environmental significance (NES) • Death or injury of individual(s) from an EPBC Act Listed Species during the activity	Written notification submitted by the BP Representative to DotEE within: • 24 hours of detection / observation for death or injury of Listed Marine Fauna • 48 hours of detection / observation for unplanned impact on a matter of NES or death or injury of other (non-marine) Listed Species	• Phone: (02) 6274 1372 or free call 1800 110 395 • Email: compliance@environment.gov.au

Agency or Authority	Legislation / Guidance	Notification Requirements	Responsibility and Timing	Links to Reporting Forms
Commonwealth Waters				
NOPTA and **WA Department of Mines, Industry Regulation and Safety (DMIRS)**	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill to Commonwealth Waters that is reportable to NOPSEMA and DMIRS	BP Representative to provide a copy of the report provided to NOPSEMA, to both NOPTA and DMIRS, within 7 days of the initial report being submitted to NOPSEMA	Provide same written report as provided to NOPSEMA • Ph: 0419 960 621 • Email: petroleum.environment@dmirs.wa.gov.au • Email: resources@nopta.gov.au
NOPSEMA	Commonwealth Offshore Petroleum and Greenhouse Gas Storage Act 2006 OPGGS(E)R	A spill associated with the activity that has caused, or has the potential to cause, moderate to significant environmental damage.	• Notification by BP Representative to NOPSEMA, within 2 hours. • Written report submitted by the BP Representative to NOPSEMA, as soon as possible, within 3 days.	Incident Reporting requirements: http://www.nopsema.gov.au/assets/Guidance-notes/N-03000-GN0926-Notification-and-Reporting-of-Environmental-Incidents-Rev-4-February-2014.pdf
State Waters				
WA DoT	State Emergency Management Plan for Marine Oil Pollution (WestPlan–MOP) As per State legislation (i.e. Pollution of Waters by Oil and Noxious Substances Act 1987)	Spill to State Waters (including ports and inland waters) or with the potential to enter State Waters	• Immediate notification by Vessel Master to the DoT Oil Spill Response Coordination (OSRC) Unit. • Written POLREP submitted by Vessel Master to DoT as soon as practicable. • Written Situation Report (SITREP) submitted by the BP Representative within 24 hours of being directed by DoT.	DoT Oil Spill Response Coordination Unit: • Ph: (08) 9480 9924 (24 hours) • Email: marine.pollution@transport.wa.gov.au • WA DoT POLREP: http://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf • WA DoT SITREP: http://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
DMIRS	Petroleum and Geothermal Energy	A spill associated with the activity that has caused, or has the potential to cause,	• Written notification by BP Representative within 2 hours.	• Ph: 0419 960 621

Agency or Authority	Legislation / Guidance	Notification Requirements	Responsibility and Timing	Links to Reporting Forms
	Resources (Environment) Regulations 2012	moderate to significant environmental damage	• Written Environmental Incident Report submitted by BP Representative to DMIRS, within 3 days.	• Reportable Environmental Incident Report Form: http://www.dmp.wa.gov.au/documents/ENV-PEB-189.doc

6.4.3 Monitoring, Evaluation and Surveillance

Monitoring, Evaluation and Surveillance (MES) is important to gain, and maintain situational awareness, of the oil spill. To allow for the planning and execution of further oil spill response options, and when to cease the response. Collection of important data from a wide variety of sources, and their conversion into useful, well presented information enables informed decision making during the response.

In the event the SOPEP does not provide a MES strategy that meets BP's standards, BP will support the vessel contractor in implementing a surveillance strategy as soon as a notification of an incident is received. The first steps would include local assets providing the first visual observations from the vessel (if safe to do so), deployment of tracking buoys available on the vessel and trajectory modelling instigated via AMOSC and OSRL.

The combination of visual observation, tracking buoy deployment and satellite imagery would provide a comprehensive, 24-hour, reliable surveillance capability which could be scaled according to the needs of the response.

The Operational and Scientific Monitoring Plan (OSMP) (Section 6.5) would be triggered when initiation criteria for the various assessment components are met. MES tactics that are associated with protecting environmental receptors are addressed in the OSMP, and include:

- OMS1 Strategy: Forecast Modelling
- OMS2 Strategy: Surveillance and Tracking
- SMS1 Strategy: Hindcast Modelling

Initiation and termination triggers for those tactics are also provided in the OSMP.

6.4.4 Testing of Spill Response Arrangements

In accordance with Regulation 14(8C) of the OPGGS(E)R, the proposed schedule of tests for spill response arrangements applicable to the survey vessel is:

- when the response arrangements are introduced,
- when the response arrangements are significantly amended,
- testing the response arrangements no later than 12 months after the most recent test,
- if a new location for the activity is added to the environment plan after the response arrangements have been tested, and before the next test is conducted—testing the response arrangements in relation to the new location as soon as practicable after it is added to the plan.

Given the nature and scale of this activity, testing will be limited to conducting a desktop / notification exercise which will confirm test objectives that the notification requirements are understood. In particular, the exercise will test notification requirements between the vessel operator and BP in the event of a spill.

The outcomes of the test will be documented to assess the effectiveness of the exercise against its objectives and to record any lessons and actions. Any actions relevant to emergency preparedness for this survey will be completed prior to commencing activities under this plan and applied to future tests under this plan.

6.5 Operational Scientific Monitoring Program

6.5.1 Scope of the OSMP

The only hydrocarbon spill scenario for the site survey is a MDO release from a vessel collision. The risks of a hydrocarbon spill from a vessel collision, and the associated response activities are anticipated to be limited to Level 1 and 2 spill events with relevant response arrangements described in the OPEP.

The geographical scope of the OSMP is the EMBA which is wholly in offshore waters within a 28 km buffer of the Operational Area.

6.5.2 Objectives

In the event of a hydrocarbon spill incident, this OSMP Framework will be implemented to:

- Inform the vessel operator Incident Management Team (IMT) to plan appropriate response measures and to evaluate whether the environmental goals of the response strategies are being achieved (operational monitoring activities); and
- Determine whether their environmental goals have been met during and after a response (scientific monitoring activities).

Operational and scientific monitoring studies will be undertaken in the event of a Level 2 hydrocarbon spill incident at an appropriate scale, whereby:

- Operational monitoring studies (OMSs) during the spill response will support planning and operations through informing the IMT of the spill behaviour (e.g. trajectory, distribution in the water column, receptors that are impacted or at risk) and to track the effectiveness of the response measures (e.g. tracking buoys enabling spill behaviour information to be shared within the IMT); and
- Scientific monitoring studies (SMSs) will be used to characterise the short- (impact) and long- (recovery) term environmental effects from a hydrocarbon release incident. Scientific monitoring will also be used to assess if oil spill response measures have been effective in protecting and/or mitigating environmental sensitivities under threat from an incident.

6.5.3 Studies

In the event of a Level 2 hydrocarbon spill during this activity, the oil spill response, and evaluation of environmental impacts and recovery will be informed by OMSs and SMS including:

- **OMS1 – Forecast Modelling**: *To use numerical forecasting models to predict hydrocarbon spill movements to aid the identification of receptors at risk and thereby inform oil spill response strategies*
- **OMS2 – Surveillance and Tracking**: *To provide regular hydrocarbon spill surveillance post-release and during the response.*
- **SMS1 – Hindcast Modelling**: *To assess impacts from the spill and response activities with numerical modelling.*

The OMSs and SMS are based on the evaluation of the unplanned risks associated with the release of hydrocarbons and spill responses. Given the absence of coastal areas of importance, Australian Marine Parks, threatened ecological communities (TECs), wetlands of international importance ('Ramsar'

wetlands), nationally important wetlands, coastal protected areas, and state marine parks within the EMBA, scientific monitoring would be limited to hindcast modelling. Population level effects to receptors are not anticipated.

6.5.4 Resources

In order to lead and implement the OSMP, BP would be supported by third party service providers and supplemented by key Oil Spill Response Organisations (OSROs) as required.

6.6 Roles and Responsibilities

6.6.1 Chain of Command

A chain of command for the implementation of the site survey is outlined in Figure 6 1.

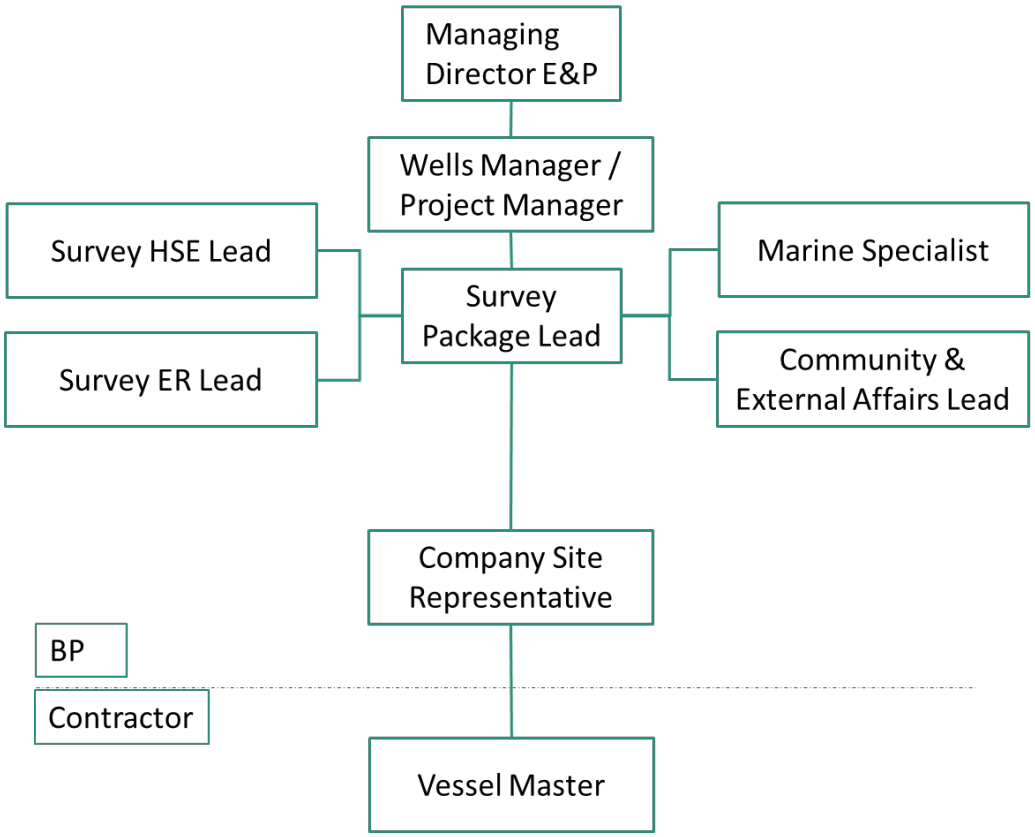

Figure 6-1 – Chain of Command

6.6.2 Roles and Responsibilities

Detailed roles and responsibilities are listed and described in Table 6-6.

Table 6-6 – Roles and Responsibilities

Role	Responsibilities
Managing Director E&P	Overall responsibility for Ironbark Site Survey

Wells Manager / Project Manager	Project manage and oversee the execution of the site survey
Survey Package Lead	Develop, prepare and execute scope of work for site survey
Survey HSE Lead	Input in EP Development and site survey contract
Survey ER Lead	Input in EP Development and ER/IMT accountability
Marine Specialist	Input in EP Development and site survey contract – vessel audit
Community & External Affairs Lead	Input in EP Development – Ongoing Stakeholder Consultation
Company Site Representative	Oversee implementation of site survey during pre-mobilisation, execution and de-mobilisation of site survey Onboard representative
Vessel Master	Vessel Contractor Representative / Execute Site Survey

6.6.3 Environmental Awareness

People who hold responsibilities relating to the implementation of this EP are hired by BP on the basis of their particular qualifications, experience, and competency.

The responsibilities identified in this EP are summarised in Table 6-6. Personnel with specific responsibilities under this EP were included during the internal review of this EP and are made aware of their role-specific responsibilities under this EP. Table 6-7 details the inductions required to be undertaken by responsible personnel.

Table 6-7 – Inductions

Induction	Required Personnel	Induction Scope
Environment Plan Roll-out	Personnel with specific responsibilities under this EP (Table 6-6)	Plan-specific environmental roll-out covering requirements in this EP, including roles and responsibilities outlined in Table 6-6.
Program Induction	Survey Personnel	All geophysical and geotechnical personnel, including subcontractors, will attend an induction that includes an overview of this EP. This induction fosters environmental stewardship amongst all personnel and ensures that they are aware of the control measures implemented to minimise the potential impact on the environment, before commencing operations. The induction will include: • Awareness of BP's Health, Safety, Security and Environment (HSSE) Policy, • An overview of environmental sensitivities, and key risks from the activity, • Cetacean Observation Techniques, • An outline of the control measures in this EP to achieve the environmental performance outcomes, • Incident reporting requirements, • Incident response arrangements.

6.7 Monitoring

Regulation 14(7) of the OPGGS(E)R requires that the implementation strategy provides for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges such that a record can be used to assess whether the environmental performance outcomes and standards in the EP are being met.

Planned emissions and discharges associated with this petroleum activity are assessed in Section 5 and includes requirements regarding environmental monitoring. Discharges and emissions are quantified wherever practicable and the relevant environmental performance outcomes and standards ensures continuous improvement is achieved. The impacts associated with discharges and emissions have Significance of Impact level of Low.

If a vessel collision results in a loss of containment event, BP will implement the OSMP. This OSMP is identified as a control measure in Section 5.16. The OSMP describes a program of monitoring, and is the principal tool for determining the extent, severity, and persistence of environmental impacts from an emergency condition and the emergency response activities to be undertaken by BP.

In addition to the results of environmental monitoring, all documents and records relating to the petroleum activity will be retained by BP for a minimum of five years in accordance with the BP document retention policy.

6.8 Recording and Reporting

6.8.1 Incident Reporting

Environmental incidents will be reported by BP in accordance with Table 6-8.

Table 6-8 – Incident Reporting

Recordable Incident Reporting – Regulation 26B	
Legislative definition of 'recordable incident': 'Recordable incident, for an activity, means a breach of an environmental performance objective or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident' Recordable incidents are breaches of environmental performance outcomes and standards.	
Reporting Requirements	**Report to / Timing**
Written notification to NOPSEMA by the 15th of each month As a minimum, the written incident report must describe: • The incidents and all material facts and circumstances concerning the incidents. • Any actions taken to avoid or mitigate any adverse environmental impacts. • Any corrective actions already taken, or that may be taken, to prevent a repeat of similar incidents. • If no recordable incidents occur during the reporting month, a 'nil report' will be submitted.	Submit written report to NOPSEMA by the 15th of each month.
Reportable Incident Reporting – Regulation 26, 26A and 26AA	

Legislative definition of 'reportable incident':

'Reportable incident, for an activity means an incident relating to an activity that has caused, or has the potential to cause an adverse environmental impact; and under the environmental risk assessment process the environmental impact is categorised as moderate or more serious than moderate.'

Therefore, reportable incidents under this EP are those events (not planned activities) that have a moderate or greater consequence (or risk) level.

Reporting Requirements	Report to / Timing
Verbal or written notification must be undertaken within two hours of the incident or as soon as practicable. This information is required: • The incident and all material facts and circumstances known at the time, • Any actions taken to avoid or mitigate any adverse environmental impacts.	Report verbally to NOPSEMA within two hours or as soon as practicable and provide written record of notification by email. Phone: (08) 6461 7090 Email: submissions@nopsema.gov.au
Verbal notifications must be followed by a written report as soon as practicable, and not later than 3 days following the incident. At a minimum, the written incident report will include: • The incident and all material facts and circumstances, • Actions taken to avoid or mitigate any adverse environmental impacts, • Any corrective actions already taken, or that may be taken, to prevent a recurrence. If the initial notification of the reportable incident was verbal, this information must be included in the written report.	Written report to be provided to NOPSEMA, the National Offshore Petroleum Titles Authority, and the WA Department of Mines, Industry Regulation and Safety. Email: submissions@nopsema.gov.au Email: info@nopta.gov.au Email: petroleum.environment@dmp.wa.gov.au
Additional Reporting Requirements	
Reporting Requirements	**Report to**
Death or injury to individual(s) from an EPBC Act Listed Species as a result of the petroleum activities	Report injury to or mortality of EPBC Act Listed Threatened or Migratory species within seven business days of observation to DotEE or equivalent: Phone: +61 2 6274 1111 Email: EPBC.Permits@environment.gov.au
Vessel collision with marine mammals (whales)	Reported as soon as practicable. https://data.marinemammals.gov.au/report/shipstrike
Presence of any suspected marine pest or disease within 24 hours	DPIRD by email (mailto:biosecurity@fish.wa.gov.au) or phone via the FishWatch 24 hour hotline on 1800 815 507.
Identification of any historic shipwrecks or relics	Written notification provided to the Western Australian Museum – Maritime Archaeology Department, within one week. Email: reception@museum.wa.gov.au

6.8.2 Routine Reporting

Reporting of environmental performance of this EP is described in Table 6-9.

Table 6-9 – Routine External Reporting Requirements

Reporting Requirement	Description	Reporting to	Timing
Environmental performance reporting (annual)	A report detailing environmental performance of the activity detailed in this EP	NOPSEMA submissions@nopsema.gov.au Phone: +61 8 6461 7090	Annually from commencement of activities.
Notification of start and end of activity	BP shall complete Form (FM1405) and submit to NOPSEMA 10 days before activity commencement	NOPSEMA Submissions NOPSEMA GPO Box 2568 PERTH 6001 Western Australia https://securefile@nopsema.gov.au/filedrop/submissions	One-off (10 days before activity commencement)
End of EP Notification	BP shall complete Form (FM1405) and submit to NOPSEMA within 10 days of activity completion		One-off (10 days after activity completion)

6.9 Environment Plan Review

Revisions and/or resubmission of this EP to NOPSEMA will be undertaken in accordance with Regulation 17 of the OPGGS(E)R. The decision to revise or resubmit the EP will be made in accordance with BP's OMS, particularly Element 4 (Procedures) sub-element Management of Change.

In addition to this, the oil spill response arrangements will be subject to review where learnings arise from the exercise completed under this plan, or any other exercise conducted by BP over the course of this activity where learnings are deemed relevant.

The Description of Environment will be reviewed annually to include any relevant changes to source documents, which may include State/Federal Management Plans, Recovery Plans, EPBC status or new published research, in case of a delayed start of the site survey. Any suggested changes to the description of environment or risk assessment arising from this review will be subject to a management of change.

6.10 Stakeholder Engagement

6.10.1 Provision of Sufficient Information to Stakeholders

To ensure that sufficient information was provided to relevant stakeholders, an email detailing specific information regarding the activities covered under this EP was sent out between 18 February and 17 March 2019, which summarised the activity, impacts and risks, and the proposed control measures to manage these impacts and risks. Following this fact sheet, additional information has been provided based upon comments, objections and claims from relevant stakeholders.

6.10.2 Assessment of Merit of any Objections or Claims

Table 6-10 summarises the objections and claims made by relevant stakeholders, assesses their merits, and describes how each objection or claim is managed in this EP.

6.10.3 Provision of Response to Objections or Claims

Based on the outcomes of the merit assessments, responses to objections and claims (where relevant) were provided to stakeholders.

A record of all consultation undertaken specifically for this activity is included in Table 6-10.

6.10.4 Ongoing Consultation

From the stakeholder consultation undertaken, the notifications and ongoing consultation required for this activity is captured in Table 6-11. If any additional information is identified that results in a significant change to environmental impacts or risks or is considered a material change to information previously provided to stakeholders identified as relevant to this activity, additional consultation will be sought.

Table 6-10 – Record of consultation undertaken

Stakeholder	Date	Objection or Claim	Assessment of Merits	BP Response
Australian Maritime Safety Authority (AMSA)	17/03/2019	Please have the Master of the survey vessel (semi-submersible or jack-up rig) should notify AMSA's Joint Rescue Coordination Centre (JRCC) through rccaus@amsa.gov.au<mailto:rccaus@amsa.gov.au> (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. AMSA's JRCC will require the vessel details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels, and need to be advised when operations start and end. Please contact the Australian Hydrographic Office at datacentre@hydro.gov.au<mailto:datacentre@hydro.gov.au> no less than four working weeks before operations with the details related to the operations. The AHO will promulgate the appropriate Notice to Mariners (NTM), which will ensure other vessels are informed of your activities.	Requested control measure were deemed appropriate as AMSA is responsible, on behalf of the Commonwealth Government of Australia, for the regulation and safety oversight of Australia's shipping fleet and management of Australia's international maritime obligations.	BP noted triggers for ongoing consultation with both the JRCC and AHS in (Section 5.3) of this EP as control measures. BP has included safety control measures to prevent a vessel collision (in Section 5.15 of this EP). In addition to this, the chartered shipping fairway location is described in Table 4-2 of this EP.
Australian Marine Oil Spill Centre (AMOSC)	14/03/2019	No objections or claims were noted.	-	-
Department of Transport – Marine Safety	11/03/2019	No objections or claims were noted.	-	-
Australian Fisheries Management Authority (AFMA)	17/03/2019	Follow up on request for coordinates and updated information.	Requested information was deemed appropriate as AFMA is the peak representative body for Commonwealth fisheries, identified as a receptor	BP provided coordinates to AFMA on 14 Mar 2019

Stakeholder	Date	Objection or Claim	Assessment of Merits	BP Response
WA Department of Primary Industries and Regional Development (DPIRD)	18/02/2019	Request a summary of how the proposed activities will impact on fish stocks, marine habitats and fishers as well as the controls BP will implement to demonstrate ALARP.	Applicable aspects associated with this activity and information regarding the evaluation of potential impact to commercial fisheries is appropriate for this stakeholder given they are the government agency for this industry. Given that DPIRD are the governmental body responsible for the implementation of the Fish Resources Management Act 1994 and as the associated regulations indicate transferring live non-endemic or noxious fish (including marine pests) into WA waters is an offense this a relevant claim.	Additional information on impacts and control measures for requested receptors sent to DPIRD on 2 Apr 2019.
	10/04/2019	Request further consultation with relevant fishing representative bodies and OPEP notification.		Confirmation that the EP provides evidence of consultation with relevant persons and OPEP notification as requested by DPIRD sent to DPIRD on 15 May 2019.
Commonwealth Fisheries Association (CFA)	21/02/2019	No objections or claims were noted.	-	-

Stakeholder	Date	Objection or Claim	Assessment of Merits	BP Response
Western Australian Fishing Industry Council (WAFIC)	18/02/2019	No objections or claims were noted.	-	-
Pearl Producers Association	07/03/2019	No objections or claims were noted.	-	-
Australian Southern Bluefin Tuna Association (ASBTIA)	17/03/2019	No objections or claims were noted.	-	-
Raptis Fishing Licenses	07/03/2019	No objections or claims were noted.	-	-
Seafresh holdings	07/03/2019	No objections or claims were noted.	-	-
WA Seafood Exporters	07/03/2019	No objections or claims were noted.	-	-
Australian Hydrographic Office (AHO) / Commonwealth Department of Defence (DoD)	18/02/2019	No objections or claims were noted.	-	-

Stakeholder	Date	Objection or Claim	Assessment of Merits	BP Response
Woodside	27/02/2019	No objections or claims were noted.	-	-
Chevron	27/02/2019	No objections or claims were noted.	-	-
RecFishWest	18/02/2019	No objections or claims were noted.	-	-
Australian Petroleum Production and Exploration Association (APPEA)	27/02/2019	No objections or claims were noted.	-	-
International Fund for Animal Welfare	20/02/2019	No objections or claims were noted.	-	-

Table 6-11 - Routine External Reporting Requirements

Date	Stakeholder	Objection or Claim	Assessment of Merits	Additional Actions
17/02/2019	Australian Maritime Safety Authority (AMSA)	Please have the Master of the survey vessel (semi-submersible or jack-up rig) should notify AMSA's Joint Rescue Coordination Centre (JRCC) through rccaus@amsa.gov.au<mailto:rccaus@amsa.gov.au> (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. AMSA's JRCC will require the vessel details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels, and need to be advised when operations start and end. Please contact the Australian Hydrographic Office at datacentre@hydro.gov.au<mailto:datacentre@hydro.gov.au> no less than four working weeks before operations with the details related to the operations. The AHO will promulgate the appropriate Notice to Mariners (NTM), which will ensure other vessels are informed of your activities.	Requested control measure were deemed appropriate as AMSA is responsible, on behalf of the Commonwealth Government of Australia, for the regulation and safety oversight of Australia's shipping fleet and management of Australia's international maritime obligations.	BP noted triggers for ongoing consultation with both the JRCC and AHS in (Section 5.3) of this EP as control measures. BP has included safety control measures to prevent a vessel collision (in Section 5.15 of this EP). In addition to this, the chartered shipping fairway location is described in Table 4-2 of this EP.
17/02/2019	Australian Fisheries Management Authority (AFMA)	Follow up on request for coordinates and issue of updated activity information (duration / timing of site survey)	Requested information was deemed appropriate as AFMA is the peak representative body for Commonwealth fisheries, identified as a receptor	BP provided coordinates and updated activity information to AFMA on 14 Mar 2019
18/02/2019	WA Department of Primary Industries and Regional Development (DPIRD)	Request a summary of how the proposed activities will impact on fish stocks, marine habitats and fishers as well as the controls BP will implement to demonstrate ALARP.	Applicable aspects associated with this activity and information regarding the evaluation of potential impact to commercial fisheries is appropriate for this stakeholder given they are the government agency for this industry. Given that DPIRD are the governmental body responsible for the implementation of the Fish Resources Management Act 1994 and as the associated regulations indicate transferring live non-endemic or noxious fish (including marine pests) into WA waters is an offense this a relevant claim.	Additional information on impacts and control measures for requested receptors sent to DPIRD on 2 Apr 2019.
10/04/2019	WA Department of Primary Industries and Regional Development (DPIRD)	Request further consultation with relevant fishing representative bodies and OPEP notification.		Confirmation that the EP provides evidence of consultation with relevant persons and OPEP notification as requested by DPIRD sent to DPIRD on 15 May 2019.

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