GREATER PÍNA COLADA

MULTICLIENT MARINE SEISMIC SURVEY

ENVIRONMENT PLAN - PUBLIC SUMMARY

DOLPHIN GEOPHYSICAL Ltd

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Rev 1

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1. INTRODUCTION

The geophysical company Dolphin Geophysical Ltd (Dolphin) proposes to acquire multi-client (MC) three-dimensional (3D) marine seismic surveys (MSS), within the Roebuck Basin offshore from Western Australia (WA). The Greater Pĩna Colada (GPC) MC MSS will comprise acquisition of approximately 5,000 km^2 of 3D seismic data in Exploration Permits WA-466-P, WA-479-P, WA-487-P and a very small portion of adjacent open acreage for the purposes of acquiring sufficient data to fully-image the prospects on the titles (**Figure 1.1**).

The GPC MC MSS polygon (hereafter known as the GPC MC MSS) is approximately 4 km from Mermaid Reef Commonwealth Marine Reserve (see **Figure 1.2**) and ~33 km Rowley Shoals Marine Park and is at its closest point ~9 km from the 250 m contour of Mermaid Reef, at which point, maximum received SEL are well below those purported to have an impact on marine fauna, including site attached species.

This Environment Plan (EP) for the GPC MC MSS has the objective of covering MC3D over the specific petroleum titles and adjacent vacant acreage within the Roebuck Basin over a period of up to 6 months between July and December 2015. The survey will take ~2-3 months to complete.

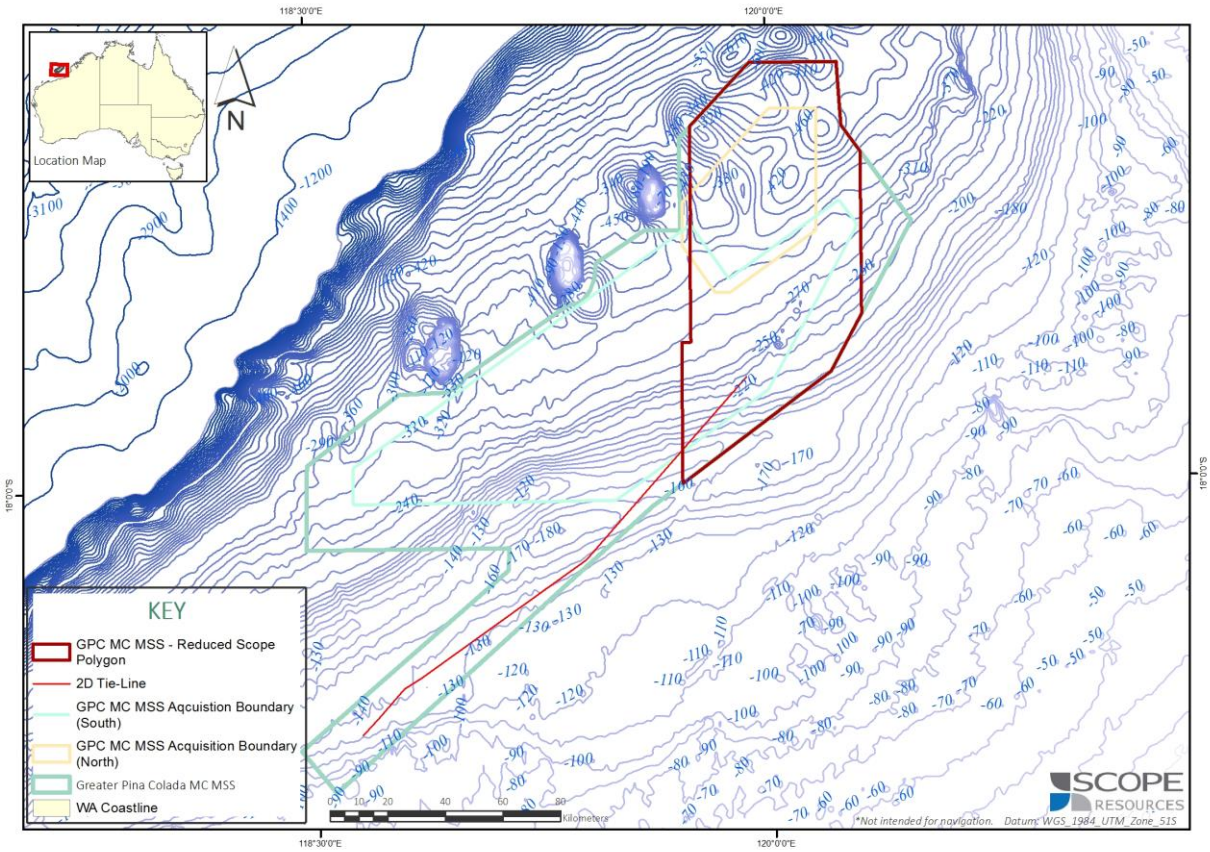


Figure 1.1 - GPC MC MSS location map

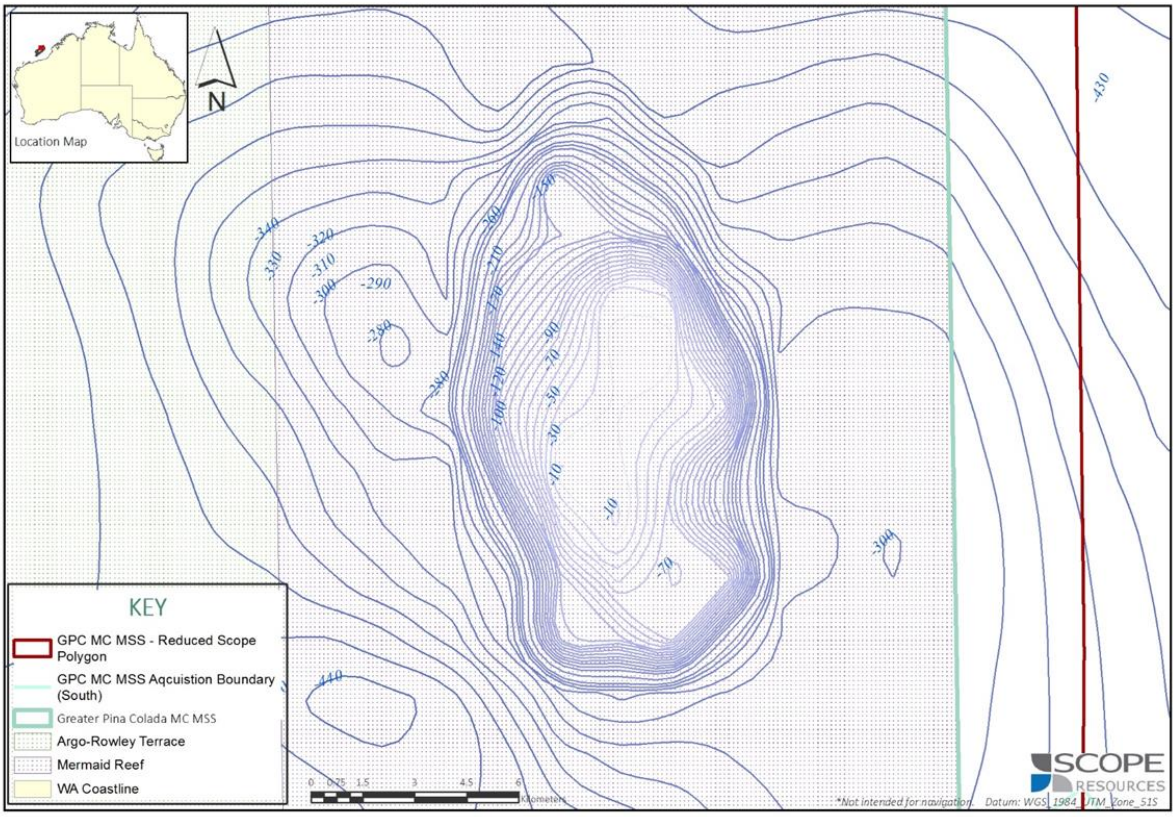


Figure 1.2 - GPC MC MSS polygon boundary relative to Mermaid Reef Commonwealth Marine Reserve

1.1. LOCATION OF THE ACTIVITY

The GPC MC MSS polygon lies entirely in Commonwealth waters within the Northwest Marine Region (NWMR). The polygon incorporates Exploration Permits WA-466-P, WA-479-P, WA-487-P and adjacent open acreage areas (**Figure 1.1**) and a very small portion of adjacent open acreage for the purposes of acquiring sufficient data to fully-image the prospects on the titles. The Greater Pĩna Colada (GPC) MC MSS will comprise acquisition of approximately 5,000 km^2 of 3D seismic data.

The GPC MC MSS is located offshore from the Pilbara region between Onslow and Broome. The GPC MC MSS is located ~190 km from Coulomb Point on the mainland coast of WA, with the southern corner of the polygon located ~270 km from Port Hedland and the eastern boundary ~220 km west of Broome. The Mermaid Reef CMR is ~4 km from the boundary of the polygon. Water depths across the polygon range from ~160 - 440 m (see **Figure 1.1**) with the shallowest waters encountered to the south. Waters along the western boundary, closest to Mermaid Reef are minimum ~330 m.

1.2. COORDINATES OF THE PROPOSED ACTIVITY

Boundary coordinates for the GPC MC MSS are as follows:

Table 1.1 - GPC MC MSS polygon coordinates

Latitude (S) Decimal Degrees	Longitude (E) Decimal Degrees
-16.69515099	119.9476046
-16.69746426	120.2322939
-16.89584109	120.2452516
-16.97835435	120.3071086
-17.48626471	120.3045103
-17.66599456	120.2019646
-18.00980924	119.7117143
-17.56977069	119.7166693
-17.56738929	119.7454565
-17.25698747	119.7488889
-17.16530353	119.7512867
-16.89420129	119.7524359
-16.69515099	119.9476046

Datum: WGS84

2. DESCRIPTION OF THE RECEIVING ENVIRONMENT

In accordance with Regulation 13(2) of the Environment Regulations, a description of the existing environment that may potentially be affected by planned and unplanned activities relating to the Greater Pina Colada MC MSS is presented in this section. It includes a description of relevant natural, cultural and socio-economic aspects of the environment, as well as details of relevant values and sensitivities.

2.1. PHYSICAL SETTING

The GPC MC MSS polygon lies entirely within Commonwealth marine waters of the North-west Marine Region (NWMR) which extends from offshore Kalbarri in Western Australia (WA) to the Western Australia / Northern Territory (NT) border.

The region is generally characterised by two seasons: winter (May to August) and summer (September to April). The Kimberley system is subject to episodic offshore cyclonic activity. On average, two to three tropical cyclones occur during each tropical cyclone season, primarily in the December to April period, though cyclones have been recorded as late as June (BoM, 2015).

Depth is the primary driver in the differences between inshore and offshore waters. Overall, the NWMR is relatively shallow with more than 50% of the region at depths <500 m; therefore, surface currents exert a strong influence over the region's biophysical and ecological processes (DEWHA, 2008a). Oceanographic processes are also a key driver, particularly the composition of each water mass, such as its physical and chemical composition and temperature. Currents are the agents for movements of the differing water masses and therefore provide the link between systems.

2.2. BIOLOGICAL ENVIRONMENT

2.2.1. BIOLOGICAL COMMUNITIES

Most of the NWMR species are tropical and are also found in other parts of the Indian and western Pacific oceans. The NWMR has high species diversity said to be associated with the diversity of habitats available. These include hard seafloor areas (e.g., limestone pavements on the NWS), submerged cliffs and coral reefs of the Kimberley, and atolls and reefs on the edge of the shelf. These habitats support a high diversity of benthic filter feeders and producers. Fish spawning in summer/autumn in the Kimberley is thought to correspond with peaks in production and current movements. There is a strong delineation in demersal slope fish communities in the Kimberley in comparison to systems further south.

The NWMR supports internationally important breeding and feeding grounds for a number of threatened and migratory marine species that transit through the bioregion, including humpback whales. Significant turtle rookeries are found on coastal beaches and offshore islands and the surrounding waters provide important resting and internesting (i.e. in between egg laying periods) habitats (DEWHA, 2007; DEWHA, 2008a).

Significant areas of coral reefs within the NWMR include the Rowley Shoals, which is adjacent to the GPC MC MSS polygon. The Rowley Shoals are a hotspot for biodiversity in this bioregion and contain intertidal and sub-tidal coral reefs. These reefs support a diverse marine fauna typical of oceanic coral reef communities of the Indo-west Pacific. The reefs are important stepping-stones in the maintenance of gene flow among the northwest Australian coral reefs. Biological surveys of the reefs have identified 184 species of corals, 264 species of molluscs, 82 species of echinoderms and 389 species of finfish (DEWHA, 2008a). Sponge diversity in the Rowley Shoals is unique and has no similarity with any other locality.

The NWMR is thought to contain a high diversity of crustaceans with dominant species groups including copepods, prawns, scampi and crabs. The North West Slope Trawl Fishery (NWSTF) targets scampi in the NWMR. Data from the fishery suggests that muddy sediments support significant populations of crustaceans (Fletcher and Santoro, 2014).

Approximately 81 different species of cephalopod are believed to occur in the NWMR.

The NWMR supports a diverse assemblage of fish, particularly in shallow water near the mainland and around islands. Most fish have tropical distributions and are well distributed throughout the Indo-west Pacific region. The NWMR also supports large populations of cartilaginous fish such as sharks and rays; which are typically higher order predators and perform an important ecological role through the regulation of prey species. Sharks are found in considerable numbers on the Rowley Shoals, particularly the grey reef shark, the whitetip reef shark, and the silvertip whaler.

The Rowley Shoals have over 500 species of fish inhabitants, including many species not found on nearshore coral reefs. Giant potato cod, Maori wrasse, reef fish, trevally, mackerel and tuna are known to occur. As well as being inhabited by a number of species not recorded from other WA coral reefs, the coral and fish communities of the Rowley Shoals are unique in their composition, and in the relative abundance of species (DEC, 2007). The marine communities of the Rowley Shoals are more characteristic of south-east Asia than any other WA reefs. In relation to the proposed GPC MC MSS reduced, site-attached fish are only located around the reefs of the Rowley Shoals.

2.2.2. PROTECTED MARINE FAUNA

The Protected Matters Search Tool (PMST) from the DoE was used to determine whether matters of national environmental significance (NES) or other matters protected by the EPBC Act were likely to occur in the GPC MC MSS polygon. Nine (9) listed Threatened species may occur, or relate to, the GPC MC MSS polygon:

1. the blue whale
2. the humpback whale
3. the loggerhead turtle
4. the green turtle
5. the leatherback turtle
6. the hawksbill turtle
7. the flatback turtle
8. the great white shark
9. the whale shark

The GPC MC MSS polygon is not considered a habitat that is critical to the survival of any listed species. Similarly, there are no EPBC Act-listed threatened ecological communities (TEC) or critical habitats within the vicinity of the GPC MC MSS polygon.

The PMST report identified two Key Ecological Features (KEF) within or adjacent to the GPC MC MSS-Reduced Scope Polygon:

- the Ancient coastline at 125 m depth contour; and
- the Mermaid Reef and Commonwealth waters around Rowley Shoals.

The BIA that overlap the GPC MC MSS polygon are as follows:

- migration area (north and south) for the pygmy blue whale;
- foraging area for the whale shark; and
- breeding and foraging area for the white-tailed tropicbird.

The BIA for particular marine species are presented in **Appendix 1**.

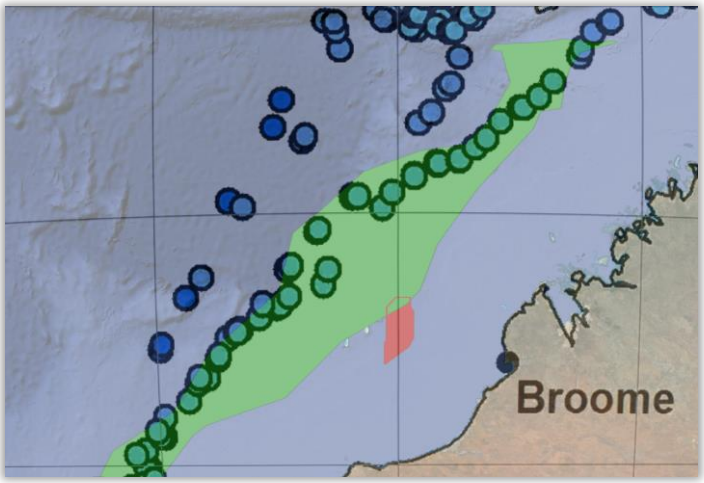
There is one (1) additional BIA that is adjacent to the GPC MC MSS – Reduced Scope Polygon:

- resting area for the little tern;

2.2.2.1. CETACEANS

The EPBC Act database (DoE, 2015a) lists 24 cetacean species that may occur within the GPC MC MSS polygon, all of which are protected under the Act; one of which is also classified as Endangered, one as Vulnerable and seven as Migratory. The pygmy blue whale is listed as Endangered and Migratory and the humpback whale is listed as Vulnerable and Migratory.

2.2.2.1.1. Pygmy blue whales



Source: Modified from Double (2014)

Figure 2.1 - Satellite tracking of 11 blue whales in 2009 & 2011 vs GPC MC MSS - Reduced Scope Polygon

In the NWMR, pygmy blue whales (*Balaenoptera musculus brevicauda*) migrate offshore Augusta (southwest WA) to Derby (northern WA) approximately along the 500 m to 1,000 m contour.

The GPC MC MSS overlaps a small portion of the pygmy blue whale BIA (migration area) (see **Appendix 1**) encroaching ~10 km into the BIA at a point where the migration route is 250 km wide. Migrating pygmy blue whales are expected to have passed the GPC MC MSS Polygon on their northbound migration by end of June (before the commencement of the survey) but may be encountered in the deeper waters of the northern part of the GPC MC MSS during their southbound migration from October to November (**Figure 2.1**). However, the deepest waters of the polygon are ~440 m and the pygmy blue whale migration is centered on the 500 m contour and significant numbers of individuals are unlikely to be encountered in the 160-440 depth range (**Figure 2.1**). Northbound animals are thought to be heading to calving areas in the Banda Sea, therefore once animals have rounded the Northwest Cape the shortest route is via Scott Reef (an 'en-route' opportunistic feeding location) and remaining on the 500 m contour which is to the north of the GPC MC MSS. **Figure 2-1** shows the location of the GPC MC MSS in relation to the satellite tagging data and pygmy blue whale BIA.

2.2.2.1.2. Humpback whales

The humpback whale is the most commonly sighted whale in WA waters.

The GPC MC MSS may start as early as July 2015 coinciding with the humpback whale migration season. However, given that the GPC MC MSS is located more than 100 km from the identified humpback whale migration BIA, the distance offshore (closest point ~200 km), and the water depths over the polygon (~160-440 m), it is unlikely that significant numbers of humpback whales will be encountered. Individuals that are present within the GPC MC MSS are likely to be transient only. Nevertheless, adaptive management of impacts from seismic acoustic emissions on humpback whales have been considered and adopted (**Section 5**).

2.2.2.1.3. Dolphins

Dolphins are relatively common in the waters of the NWS. Species known to occur in this region include the common, bottlenose and Risso's dolphins. The GPC MC MSS polygon does not contain any critical habitats or feeding grounds for these dolphin species (DSEWPAC, 2012).

2.2.2.1.4. Marine Reptiles

The PMST identified five (5) species that may occur within or in the waters surrounding the GPC MC MSS polygon; the green, hawksbill and flatback turtles (all listed as Vulnerable and Migratory); and the loggerhead and leatherback turtles (both listed as Endangered, and Migratory). The closest marine reptile BIA is located more than ~100 km from the southern boundary of the GPC MC MSS polygon, this being the 80 km internesting buffer for flatback turtles.

Turtles do occur within the Rowley Shoals Marine Park (DEC, 2007) and around Mermaid Reef (DNP, 2013); however, these reefs are not considered critical habitats for marine reptiles. There are no known significant breeding sites for marine turtles in the Rowley Shoals Marine Park.

2.2.2.1.5. Sea Snakes

There are 14 protected species of sea snakes listed as marine species under the EPBC Act that may occur within or adjacent to the GPC MC MSS polygon. However, given the water depths within the polygon (~160-440 m) it is unlikely that large numbers of sea snakes will be encountered during the survey.

2.2.2.1.6. Sharks and Ray-finned Fishes

EPBC Act protected marine species that may occur within the GPC MC MSS polygon and surrounding waters include the great white shark, shortfin mako, longfin mako shark and various species of pipefishes and seahorses (Family Syngnathidae). Information regarding the habitat, species numbers or life cycles of species from this family on the NWS is limited (DSEWPaC, 2012); however, it is understood most syngnathid species prefer complex shallow water habitats including seagrass and reefs.

2.2.2.1.7. Whale Shark

The whale shark is listed as Vulnerable and Migratory under the EPBC Act and is also classified as Vulnerable on the World Conservation Union's Red List of Threatened Species (IUCN, 2015). In WA, they are known to aggregate in the reef front waters of Ningaloo Reef from March to July, and northward of the Ningaloo Marine Park along the 200 m contour from July to November. However, the timing is variable and individual whale sharks have been recorded at other times of the year, (Wilson *et al.,* 2001). Based on information a likely 'peak migration' period (sensitive period) for whale sharks through the GPC MC MSS Polygon is from 1 August - 31 October.

A BIA (foraging area) for the whale shark overlaps the GPC MC MSS polygon and so it is possible that whale sharks may be encountered during the survey. However, due to the low numbers of the animals and their irregular movements, it is not expected that whale sharks will be encountered in significant numbers and those individuals that are encountered are likely to be transient.

2.2.2.1.8. Seabirds

The EPBC Protected Matters database search listed five (5) migratory bird species that may occur within the GPC MC MSS polygon: the lesser frigatebird, little tern, streaked shearwater (two species), and the white-tailed tropicbird.

The nearest emergent land features to the GPC MC MSS polygon are the Rowley Shoals. Bedwell Island (connected to Clerke Reef), is recognised as a BIA (breeding area and foraging) for the white-tailed tropicbird (a Listed migratory CAMBA, JAMBA). The species nests in hollows and has been known to construct experimental artificial stone structures for nesting. Red-tailed tropic birds nest in the autumn months, which also corresponds with the peak Rowley Shoals visitor season, so there is a potential for human nature-based activities on the islands to affect breeding birds (DEC, 2007). Tropicbirds are predominantly pelagic species, rarely coming to shore except to breed. The white-tailed tropicbird forages in warm waters and over long distances, they have been known to forage up to 1,500 kilometres from breeding sites on fish and cephalopods by plunge-diving (DSEWPaC, 2012). Bedwell Island and Cunningham Island (connected to Imperieuse Reef) are also identified as a BIA (resting) for the little tern which is widespread in Australia.

Based on the ecology and habits of the species that may be present, the GPC MC MSS polygon activity is unlikely to have significant impact on seabird populations.

2.3. SOCIO-ECOMOMIC ENVIRONMENT

2.3.1. COMMERCIAL FISHERIES

The GPC MC MSS has the potential to interact with Commonwealth and State-managed fisheries. The following section details the commercial fisheries that may be operating within, or adjacent to, the operational area.

State fisheries administered by the Department of Fisheries (DoF) that can operate in the proposed GPC MC MSS polygon include the following:

- Mackerel Managed Fishery (MMF);
- Pilbara Demersal Scalefish Fisheries (PDSF);
    - Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)*;
    - Pilbara Trap Managed Fishery (PTMF);
    - Pilbara Line Fishery (PLF);
- Northern Demersal Scalefish Managed Fishery (NDSF);
- Pearl Oyster Managed Fishery (POMF);
- North Coast Prawn Managed Fishery (NCPMF)*;
- Broome Prawn Managed Fishery (BPMF)*;
- West Coast Deep Sea Crustacean Managed Fishery (WCDSCF).

Commercial fisheries managed by the Australian Fisheries Management Authority (AFMA) that can operate in the GPC MC MSS polygon include the following:

- North West Slope Trawl Fishery (NWSTF);
- Western Skipjack Tuna Fishery (WSTF)*; and
- Western Tuna and Billfish Fishery (WTBF)*.

*It should be noted that various state and commonwealth managed fisheries were not included in the stakeholder consultation plan for the GPC MC MSS as their recognised fishing area did not overlap the polygon, and so therefore it was deemed that their interestets or activities would not be affected by the survey.

2.3.2. PETROLEUM EXPLORATION AND PRODUCTION

The GPC MC MSS overlaps Exploration Permits WA-466-P, WA-479-P, WA-487-P, and adjacent open acreage areas. There are no petroleum production facilities or pipelines within the polygon, however, there is one (1) petroleum well. Therefore, there is no emergent infrastructure within the GPC MC MSS – Reduced Scope Polygon.

2.3.3. COMMERCIAL SHIPPING

Major shipping routes in the vicinity of the GPC MC MSS polygon are associated with entry to the Port of Dampier, Port Hedland and Barrow Island with less traffic through the Port of Broome. The Australian Maritime Safety Authority (AMSA) was identified as a stakeholder and contacted regarding the proposed GPC MC MSS and subsequently supplied details of the location of shipping fairways that overlap and are adjacent to the polygon. Consultation with AMSA will be ongoing prior to, and throughout the duration of the survey.

2.3.4. TOURISM AND RECREATION

The Rowley Shoals have limited visitation, with the major activities in the area being nature-based tourism and recreational fishing; primarily by charter vessel and mostly occurring between September and December. Nature-based tourism is based on the Department of Parks and Wildlife (DPaW) licensed charter boat operators who take passengers to the Rowley Shoals on trips of up to 10 days in duration (DEC, 2007). The shallow sheltered lagoons provide ideal conditions for snorkelling, while SCUBA divers can experience lagoon, channel, and wall dives. The zoning scheme provides diving locations free from conflicting uses such as fishing in all the major habitats found in the Park (DEC 2007).

2.3.4.1. SNORKELLING AND DIVING

Mermaid Reef is the least visited reef in the Rowley Shoals and is visited primarily for SCUBA divingneither within the lagoon and outer reef (DEC 2007). Recreational diving is depth-limited to 40 m (www.padi.com). Physical interaction with divers and dive boats is unlikely as the seismic vessels will not enter state waters and will be located ~4 km from the edge of the Mermaid Reef Nature Reserve and more than 10 km from any credible divesite at Mermaid Reef as the distance to the 40 m contour is ~11 km. Furthermore, based on noise modelling, received SEL to divers who are restricted to the atolls will be minimal. At the 250 m contour, seismic acoustic emissions are reduced to SEL of ~142 dB re 1 μPa^2.s and is anticipated to be less than ~140 dB re 1 μPa^2.s at 11 km's distance. Further, reefs are known to be noisy places due to increased biotic activity and noise from SCUBA diving equipment is known to emit higher sound levels than what is anticipated from the proposed sound source at the reef (Anthony *et al.* 2009).

2.3.4.2. RECREATIONAL FISHING

The Rowley Shoals have had a relatively low level of fishing effort, primarily due to their isolation from major population centres. There has been a prohibition on commercial fishing and a ban on the take of key demersal fish by recreational fishers since 1987, with a proposal to extend this ban to more species of fish, and extending it out to 3 nm of the reef perimeter (align with the extent of the WA State waters limit (Dec, 2007).

At its closest point, the GPC MC MSS polygon is located ~210 km from Broome. Recfishwest suggests that recreational fishing activities mostly occur within a 40 nm radius of townships and that there are only a few select charter boat operators that make the trip out to the Rowley Shoals (Ms Eileen Smith and Matt Gillet, Recfishwest, pers. comm email, March 2014 and March 2015). Therefore, considering that the polygon is located more than 200 km from the nearest town site, recreational fishing activities are not likely to been encountered in great numbers. Those that are encountered are likely to be transiting through the area en route to and from the Rowley Shoals and / or Mermaid Reef.

2.3.4.3. CHARTER BOAT OPERATORS

Charter Boats in the Rowley Shoals region primarily visit Clerke Reef as it provides easy access into the lagoon and a protected mooring / anchorage site. The Department of Parks and Wildlife (DPaW) manage access and licencing arrangements for the Rowley Shoals Marine Park. Because of their remote location, most visitors go to the Rowley Shoals Marine Park and Mermaid Reef Marine National Nature Reserve by charter boat, and trips are generally a minimum of five days. The boat trip to the Rowley Shoals takes about 12 hours. Charter operators usually depart from Broome at sunset and arrive at the shoals at about midday. Mermaid and Clerke reefs are the most visited sites. Most operators visit the shoals from September to December and vessels operate out of Broome (DEC, 2007). Consultation has been undertaken with Commercial Tour Operators that hold a current licence to operate and conduct tours at the Rowley Shoals (Section 8). One stakeholder requested clarification on whether there will be impacts to diving tours, divers and marine life, to which Dolphin has responded to on the 10th May 2015. Another tour operator identified that they forsee no impacts to their operations as long as the vessel remained more than 500 m away from their diving location whilst tours were underway.

In the Pilbara area, there are 13 charter vessels, five of which have commercial fishing boat licenses and target demersal scalefish (Fletcher and Santoro, 2014). Therefore, it is possible that fishing charter boats may be encountered within or adjacent to the polygon (Ryan and Wise *et al.,* 2013).

2.3.5. CULTURAL HERITAGE

There are no Native Title Determination Areas overlapping or in the vicinity of the GPC MC MSS polygon. Under the *Historic Shipwrecks Act 1976* (Commonwealth), all historic wrecks and associated relics older than 75 years are protected if located in waters from the Low Water Mark (LWM) out to the continental shelf edge (DoE, 2015c). A search of the National Shipwrecks Database (DoE, 2015d) indicates that there is one shipwreck located in the vicinity of the GPC MC MSS polygon. The *Lively*, a 240 ton sailing vessel, wrecked near Mermaid Reef in 1810, is ~12 km from the western boundary of the GPC MC MSS polygon (DoE, 2015d).

2.3.6. NATIONAL HERITAGE

There are no Commonwealth Heritage Places or National Heritage Places within the GPC MC MSS polygon. The following places are listed on the Commonwealth Heritage List and are adjacent to the GPC MC MSS - Reduced Scope Polygon:

- Mermaid Reef - Rowley Shoals, ~4 km from GPC MC MSS – Reduced Scope Polygon:
  - Listed Place (22/06/2004) Place ID 105255, Place File No 5/09/210/0033.

The following places are listed on the Register of the National Estate (non-statutory archive) and are adjacent to the GPC MC MSS polygon:

- Clerke Reef - Rowley Shoals ~33 km from GPC MC MSS - Reduced Scope Polygon:
  - Registered (24/06/1997) Place ID 100378, Place File No 5/09/210/0033.
- Imperieuse Reef - Rowley Shoals, ~73 km from GPC MC MSS - Reduced Scope Polygon:
  - Registered (24/06/1997), Place ID 100377, Place File No 5/09/210/0033.
- Mermaid Reef - Rowley Shoals, ~4 km from GPC MC MSS - Reduced Scope Polygon:
  - Registered (24/06/1997), Place ID 100376, Place File No 5/09/210/0033.

2.3.7. MARINE PARKS AND RESERVES

The GPC MC MSS polygon abuts the following Commonwealth Marine Reserve (CMR) and WA State marine parks:

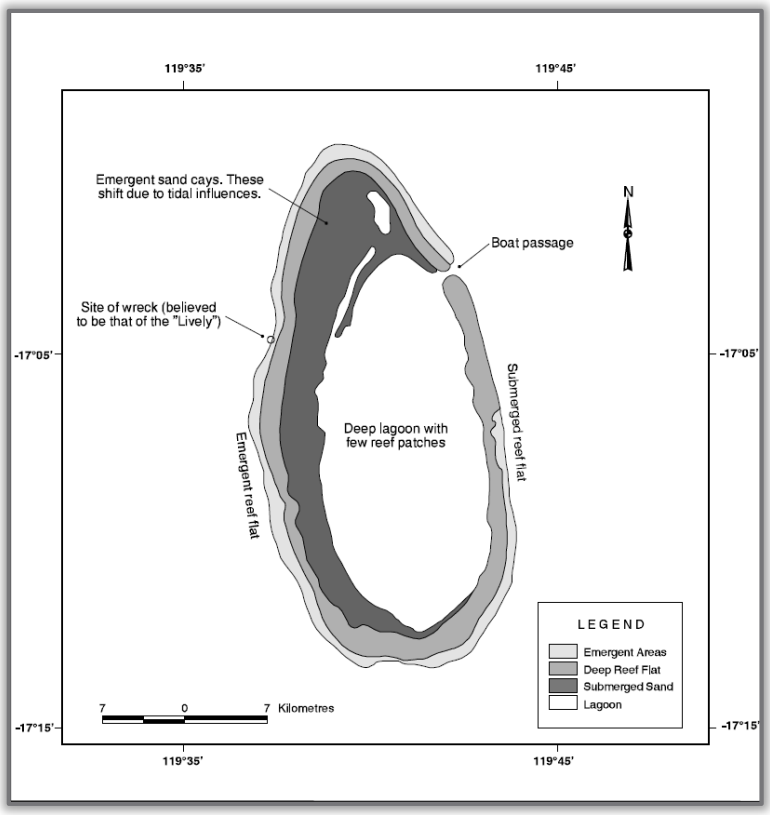
- Rowley Shoals Marine Park
- Argo Rowley Terrace CMR*
  - Multiple Use Zone - IUCN Category VI
- Mermaid Reef CMR
  - Strict Nature Reserve - IUCN Category Ia

2.3.8. COMMONWEALTH MARINE RESERVES

Mermaid Reef has national and international significance due to its pristine character, coral formations, geomorphic features and diverse marine life. The environmental values are its biodiversity; the marine ecosystems on which this biodiversity depends; and the high water quality which is a key feature of the reserve's marine habitat (DNP, 2013). To preserve Mermaid reef's pristine condition it is essential to maintain its natural water quality.

The major marine habitats of Mermaid Reef have been mapped and classified as sand cay, lagoon, submerged sand, deep reef flat, and emergent areas. The coral communities are one of the special values of Mermaid Reef and can exist over a great range of depth due to the clear waters. Other benthic groups include sponges, bryozoans, ascidians (sea squirts), polychaetes, molluscs such as cones, cowries, thaids, mitres and giant clams, echinoderms, crustaceans and cnidarians. The corals, other benthic groups and site attached species associated with all areas of the reef, including the submerged reef flat (as indicated in **Figure 2.2**) and outer reef slope which, at its closest point, is more than 9 km from the outer boundary of the proposed GPC MC MSS.

Nine (9) km marks the closest distance between the GPC MC MSS polygon and the 250 m contour surrounding Mermaid Reef and the distance between the GPC MC MSS polygon and the outer edge of the reef flat is ~11.5 km.



Source: DNP 2000

Figure 2.2 - Mermaid Reef Marine Habitats

The strategic objectives for managing Mermaid Reef are in line with the reserves IUCN 1a category and the relevant management principles set out in Schedule 8 of the EPBC Regulations, which means that it is a protected area managed primarily for scientific research and environmental monitoring.

As outlined in the Mermaid Reef Marine National Nature Reserve Plan of Management 2000-2007 (DNP, 2000), the strategic objectives for Mermaid Reef Marine National Nature Reserve are:

- to manage the area as part of a comprehensive, adequate and representative system of marine protected areas to contribute to the long-term ecological viability of marine and estuarine systems;
- to ensure the preservation of Mermaid Reef in its natural condition and the protection of its special features, including objects and sites of biological, historical, paleontological, archaeological, geological and geographical interest;
- to protect, conserve and manage the wildlife in the Marine National Nature Reserve;
- to protect the Marine National Nature Reserve against damage; and
- to encourage and regulate the appropriate use, appreciation and enjoyment of the Marine National Nature Reserve.

To attain these objectives, the main management goals for the reserve include, relevant to the GPC MC MSS, include:

- maintain the current high water quality;
- minimise damage to coral and other features from boating and recreational activities;
- To protect the diversity, distribution, abundance and community structure of fish and other vertebrate fauna
- educate visitors about the conservation values and significance of the Marine National Nature Reserve;
- minimise potential impacts from exploration and extractive operations such as those for petroleum (oil and gas).

Major ecological values of the Reserve include:

- Best geological example of shelf atolls

- Water quality
- Rich and diverse marine communities/habitats (biodiversity)
- Pristine, undisturbed marine communities and habitats, e.g. corals.
- High abundance of marine fauna, e.g. fishes.
- Wilderness character
- Cultural Heritage: Shipwreck – Lively

Dolphin recognises the values of the Reserve and to help meet the objectives shall not tow deployed equipment through, or undertake seismic acquisition activities within, the Reserve. Based on noise modelling results outlined in **Section 3.2**, it is not anticipated that received levels will have significant impacts on fauna or benthic communities within the Reserve. **Table 2.1** outlines specific values and goals as outlined in the Mermaid Reef Marine National Nature Reserve Plan of Management.

Table 2.1 - Mermaid Reef Nature Reserve – applicable values and goals

Value	Management Goal	Survey commitment
Water quality	Maintain the current high water quality, especially in the lagoon	All discharges to be in accordance with MARPOL. No discharges within the Reserve Survey vessels will not enter Reserve
physical damage from boating and recreational activities	To minimise damage to corals and other benthic organisms.	No activities, including the deployment of streamers, will occur within the Reserve No anchoring within the Reserve Survey vessels will not enter Reserve
Illegal collecting and fishing	To protect the diversity, distribution, abundance and Community structure of fish and other vertebrate fauna.	No activities will occur within the Reserve No fishing will be allowed within the Reserve Survey vessels will not enter Reserve
Cultural heritage	To preserve the remains of the wreck in situ.	No activities will occur within the Reserve Survey vessels will not enter Reserve
Petroleum and mineral exploration and extraction	To ensure that there is no damage to the natural physical and biological features of Reserve from exploration and extraction activities within the Reserve. To minimise damage to the natural physical and biological features of the Reserve from exploration and extraction activities in the vicinity of the Rowley Shoals.	No activities within the Reserve Noise impacts within the Park where site-attached fish occur will be below those that may cause mortality, permanent injury or TTS. Noise impacts within the general waters around the atoll will be below those that may cause mortality and permanent injury. Pelagic fish can swim away from a sound Survey vessels will not enter Reserve Environment Australia were contacted and they provided advice on the seismic activity adjacent to the Reserve.

With proposed discharge control measures in place; vessel separation distances from the reef and CMR waters boundary; received noise levels at the reef predicted to be below those produced by visiting charter boats or dolphin clicks; and mitigation to reduce likelihood of hydrocarbon spills, Dolphin believe that the impact of their activities on the reef are light and will have minimal disturbance on individual species, populations or ecosystems.

2.3.9. WA State Marine Reserves

The Rowley Shoals Marine Park is characterised by intertidal and sub tidal coral reefs, diverse marine fauna and high water quality. These attributes and the low level of use of the area contribute to the park's unique wilderness qualities, which are a significant draw card for visitors.

A strategic objective of the Rowley Shoals Marin Park Management Plan in relation to conservation, is to maintain the marine biodiversity of the Marine Park and to maintain its ecological integrity and social values. To help achieve this, the Park has been zoned based on a number of key principles including:

- the value of the Shoals as an international coral reef reference site; and
- recognition that a key value of the Shoals is wilderness and it relies on the area having a high degree of naturalness (e.g. presence of large fish)

In particular, sanctuary zones have been established to provide the highest level of protection for vulnerable or specially protected species and to protect representative habitats from human disturbance so that marine life can be seen and studied in an undisturbed or largely undisturbed state. Based on modelling results, due to the distance of the MSS from the sanctuary zones, species will not experience noise levels that could adversely affect the environment. The Rowley Shoals Marine Park is located more than 30 km from the GPC MC MSS polygon and so impacts from GPC MC MSS activities are expected to be negligible.

The Rowley Shoals MP Management Plan (2007-2017) (DEC 2007) further highlights specific Ecological and social values and related objectives as outlined in **Table 2.2**.

Table 2.2 - Rowley Shoals Marine Park – applicable ecological values

Value	Management Objective	Target	Survey commitment
Geology and Geomorphology	To ensure the structural complexity of the Park's geomorphology is not significantly affected by human activities.	No change of seabed structural complexity as a result of human activity in the Park.	No anchoring within the Marine Park
Water Quality	To ensure that the water quality of the Marine Park is not significantly impacted by sewage discharge from boats.	No change in water quality of all Park waters from background levels as a result of human activity in the Park.	All discharges to be in accordance with MARPOL. No discharges within the Marine Park
Intertidal coral reef communities:	To ensure species diversity and abundance of marine flora and fauna on the intertidal coral reef communities of the Park are not significantly impacted by reef-walking and collecting activities.	No loss of intertidal coral reef community diversity as a result of human activity in the Park. No loss of living intertidal coral reef community abundance* as a result of human activity in the Park.	No activities shall occur within the Marine Park
Subtidal coral reef communities:	To reduce damage to coral communities caused by mooring and anchoring activities.	No loss of subtidal coral reef community diversity as a result of human activity in the Park. No loss of living subtidal coral community abundance* as a result of human activity in the Park.	No anchoring or mooring within the Marine Park
Invertebrates (excluding corals)	To ensure that invertebrate diversity and abundance are not significantly impacted by recreational fishing and from illegal fishing activities in the Park.	No loss of invertebrate species diversity as a result of human activity in the Park. No loss of protected invertebrate species abundance* as a result of human activity in the Park. Abundance and size composition of invertebrate species in sanctuary zones to be at natural# levels. Management targets for abundance of targeted invertebrate species in all other areas to be determined in consultation with DoF and peak bodies.	No activities, including fishing, within the Marine Park. Noise impacts within the Park where invertebrates will mostly occur (reef areas) will be below those that may cause mortality, permanent injury or TTS.

Value	Management Objective	Target	Survey commitment
Finfish	To develop an understanding of the finfish diversity and abundance in the Park.	No loss of finfish species diversity as a result of human activity in the Park. No loss of protected finfish species abundance* as a result of human activity in the Park. Abundance and size composition of finfish species in sanctuary zones to be at natural# levels Management targets for abundance of targeted finfish species in all other areas to be determined in consultation with DoF and peak bodies.	No activities, including fishing, within the Marine Park. Noise impacts within the Park where site-attached fish occur will be below those that may cause mortality, permanent injury or TTS. Noise impacts within the general use area of the Park will be below those that may cause mortality and permanent injury. Pelagic fish can swim away from a sound source so TTS is not anticipated.
Turtles	To gain an increased understanding of the importance of habitats within the Park for turtles.	No loss of turtle diversity as a result of human activity in the Park. No loss in turtle abundance* as a result of human activity in the Park.	No activities within the Marine Park. Noise impacts within the Park where turtles will mostly occur (reef areas) will be below those that may cause mortality, permanent injury or TTS.
Seabirds	To ensure that breeding red–tailed tropic birds on Bedwell Island are not significantly disturbed by human activity.	No loss of seabird diversity as a result of human activity in the Park. No loss of seabird abundance* as a result of human activity in the Park.	No activities within the Marine Park.
Cetaceans	To gain an increased understanding of the use of the Park by cetaceans.	No loss of cetacean diversity as a result of human activity in Park. No loss of cetacean abundance* as a result of human activity in the Park.	No activities within the Marine Park.

*In this context a loss or change in “abundance” or “biomass” excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, turtles and cetaceans where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).
“Natural” in this case refers to the abundance that would occur in areas that are undisturbed and/or unexploited by human activities.

2.3.10. Other Protected Areas

There are no World Heritage Properties (WHP) or Ramsar Wetlands of International Importance located within the GPC MC MSS polygon (DOE, 2015j; DOE, 2015k). The nearest WHP is the Ningaloo Coast, which is located approximately 750 km from the survey polygon. The nearest RAMSAR Wetland is ~250 km from the survey polygon.

2.3.11. Defence Activities

There are no defence activities overlapping the GPC MC MSS polygon (AMSIS, 2015)

3. DESCRIPTION OF ACTIVITY

3.1. SURVEY PARAMETERS

The MSS proposed is a typical 3D survey similar to most others conducted in Australian marine waters (in terms of technical methods and procedures). No unique or unusual equipment or operations are proposed. The surveys will be conducted using a purpose-built seismic survey vessel. Neither vessels nor equipment shall enter the Mermaid Reef CMR at any time.

During the activities, the survey vessel will traverse a series of pre-determined sail lines within the polygon at a speed of ~8-9 km/hr. As the vessel travels along the survey lines a series of noise pulses (every 7-8 seconds) will be directed down through the water column and seabed. The seismic array will comprise of twelve (12) solid streamers, with a maximum length of ~8,100 m. Streamer spacing will be ~120 m, and sail line spacing will be ~720 m. The total size of the towed array is ~1,550 m wide and 8,100 m long. The source (airgun array) tow depth will be 6 m (+/- 1 m) and the streamer tow depth will be 18 to 25 m. The operating pressure for the airgun array will be ~2,000 psi. The airgun array will consist of two sub-arrays, each with a maximum volume of ~4,100 in^3. These sub-arrays will be fired alternately, with a shotpoint interval of ~25 m horizontal distance, and will produce at source (i.e. within a few metres of the airguns) sound pulses in the order of 220 dB re 1μPa^2 s (Sound Exposure Level - SEL), at frequencies extending up to approximately 200 Hz.

The size of the source has been selected as low as reasonably possible to work in water depths from ~160-440 m, and to ensure the geophysical targets below the sea surface are imaged to an acceptable level. As the surveys will be conducted in water depths greater than 160 m it is unlikely and operationally/ecologically undesirable, that any of the towed equipment will make contact with the seabed or benthic communities.

The volume of the source that has been chosen is as low as reasonably practicable (ALARP) when considering the geological target being aimed for. Dolphin has designed the 4,100 in^3 source array to meet several criteria regarding operational stability, predictable behaviour, and fit-for-purpose subsurface seismic imaging.

3.2. ACOUSTIC MODELLING

Source modelling was used to calculate sound levels within the water column, both vertically and up to several kilometres away from the source, using the sound exposure level (SEL) and sound pressure level (SPL) units of measurement suggested by Southall *et al.* (2007) (and further refined by NOAA (2013) and Popper *et al.* (2014) to evaluate the effect of seismic noise on the receiving environment.

Sound levels have been calculated within the water column over a grid of locations around the array up to 20 km distance from the seismic source at a depth of 10 m below the sea surface. The calculations of SEL and SPL have been made according to the methods suggested by Southall *et al.* (2007) to calculate the sound field emitted by the seismic source.

3.2.1. HORIZONTAL MODELLING

The horizontal modelling indicates the un-weighted SEL values at 500 m are a maximum of 179 dB re 1 μPa^2 s; at 1 km a maximum of 171 dB re 1 μPa^2 .s; at 3 km a maximum of 157 dB re 1 μPa^2 s; at 4 km a maximum of 153 dB re 1 μPa^2 s all in the crossline direction.

These results are in line with empirical measurements from a number of seismic airgun sources in western and southern Australian waters (Dr Rob McCauley, CMST Curtin University, pers. comm., June 2009), in which a 4,000 in^3 airgun array is expected to decrease to SEL in the order of 165 to 175 dB re 1μPa^2.s within 1 km of the source.

On this basis, and as required by the EPBC Policy Statement 2.1, the following precaution zones will be applied for the GPC MC MSS – Reduced Scope Polygon:

- Observation zone: 3+ km horizontal radius from the acoustic source.
- Low power zone: 2 km horizontal radius from the acoustic source.
- Shut-down zone: 500 m horizontal radius from the acoustic source.

3.2.2. RECEIVED SEL AT VARIOUS SENSITIVE LOCATIONS

Based on horizontal modelling, **Table 3.1** shows expected SEL at various locations where sensitivities may be located adjacent to the GPC MC MSS – Reduced Scope Polygon.

At the closest point, the edge of the polygon is ~9 km from the 250 m contour around Mermaid Reef (approximate start of the steep reef incline) and ~37 km from the 250 m contour around Clerke Reef. At this distance, received SEL values are 142 dB re 1 µPa2.s and <131 dB re 1 µPa2.s, respectively. Shallower waters within the CMR and Marine Park where site attached species associated with reef communities occur are further away again, and so will experience reduced SEL.

Table 3.1 - Proposed Sound levels for various locations relative to the GPC MC MSS – Reduced Scope Polygon

Parameter	Distance between Marine Park/ CMR boundary and seismic acquisition area		polygon edge to 250m isobath at atoll	
	Distance (km)	SEL (dB re1µPa2.s)	Distance (km)	SEL (dB re 1µPa2.s)
Mermaid Reef	~4 km	153	~9 km	142
Clerke Reef	~33 km	< 131 (@20km)	~37 km	< 131 (@20km)
Imperieuse Reef	~73 km	< 131 (@20 km)	~77 km	< 131 (@20 km)

3.2.3. VERTICAL MODELLING

Vertical modelling was undertaken to show received SEL directly below the sound source. The results of the modelling indicates that 150 m directly under the sound source (160 m water depth and shallowest in the survey polygon) SEL levels are reduced to 191 dB.

3.2.4. TTS AND PTS THRESHOLD LEVELS

Temporary Threshold Shift (TTS) is the limit at which the onset of reversible hearing loss occurs in marine fauna including mammals, turtles, fish and larvae. Permanent Threshold Shift (PTS) is the estimated level at which the onset of irreversible hearing loss occurs.

Table 3.2 shows the summary of the draft US (NOAA) weighted and un-weighted threshold levels for TTS and PTS onset for low-frequency (LF) cetaceans (baleen whales), mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales) and high-frequency (HF) cetaceans (true porpoises, pygmy and dwarf sperm whales, cephalorhynchid dolphins, Peale's dolphin and hourglass dolphin) for impulsive sources of noise such as seismic airgun arrays (NOAA, 2013).

Table 3.2 - Summary of draft NOAA un-weighted and weighted threshold levels for TTS and PTS onset for LF, MF and HF cetaceans

Functional Hearing Group	PTS Onset (Received Level)	TTS Onset (Received Level)
LF Cetaceans	230 dB_{peak} & 187 dB SEL_{cum}	224 dB_{peak} & 172 dB SEL_{cum}
MF Cetaceans	230 dB_{peak} & 187 dB SEL_{cum*} 204 dB SEL_{cum**}	224 dB_{peak} & 172 dB SEL_{cum*} 189 dB SEL_{cum**}
HF Cetaceans	201 dB_{peak} & 161 dB SEL_{cum*} 180 dB SEL_{cum**}	195 dB_{peak} & 146 dB SEL_{cum*} 165 dB SEL_{cum**}

Peak levels are same for weighted and un-weighted levels
* weighted levels
** Un-weighted levels
Source: extract from Table B1 and B2, NOAA (2013).

Modelling indicates that the SEL at 500 m from the source is a maximum of 179 dB re 1 μPa^2 s, which is below the defined threshold level for PTS onset in LF and MF cetaceans (187 dB re 1 μPa^2 s). This means that the application of a 500 m shut-down zone, as required under the EPBC Policy Statement 2.1 is an appropriate and effective mitigation measure in this case to minimise the risk of irreversible hearing loss in any LF and MF cetaceans that could approach the operating airgun array.

It is not anticipated that significant numbers of any HF cetacean species will be encountered within the GPC MC MSS polygon as there are no applicable identified BIA for these species (only BIA are for the LF pygmy blue whale) overlapping or adjacent to the polygon: any animals within the area would be limited to transiting individuals.

Table 3.3 - Proposed Sound levels for Mortality and Impairment in Fishes and Turtles

Type of animal	Mortality or potential mortal injury	Impairment	
		Recoverable injury	TTS
Fish: no swim bladder	>219 dB SELcum or >213 dB peak	>216 dB SELcum or >213 dB peak	>186 dB SELcum
Fish: swim bladder but not involved in hearing	>210 dB SELcum or >207 dB peak	>203 dB SELcum or >207 dB peak	>186 dB SELcum
Fish: swim bladder involved in hearing	>207 dB SELcum or >207 dB peak	>203 dB SELcum or >207 dB peak	>186 dB SELcum
Sea Turtles	>210 dB SELcum or >207 dB peak	-	-
Eggs and Larvae	>210 dB SELcum or >207 dB peak	-	-

From the vertical modelling results the SEL at 150 m below the source is a maximum of 191 dB re 1 μPa^2 s, which is below the defined threshold level for recoverable injury and mortality or potential mortal injury in various fish, turtles and larvae (Popper *et al.,* 2014). However it is above levels that may induce TTS for various fish. The waters with minimum depth (160 m) are located in the south of the polygon in open waters and well away from any areas of significant site-attached species.

The waters where the polygon is closest to Mermaid Reef CMR are ~ 330 m deep, at which point the SEL on benthic communities directly under the sound source will be ~184 dB. As the Mermaid Reef CMR outer boundary is ~ 4 km from the polygon, and the 250m reef contour is ~9 km from the polygon edge, vertical modelling results are deemed not applicable to species associated with the reef.

3.3. SEISMIC SURVEY VESSELS

Dolphin proposes to conduct the GPC MC MSS using a purpose-built seismic survey vessel similar to the MV *Sanco Swift*, which is owned and managed by Sanco Shipping AS and operated by Dolphin. Any survey vessel used for the GPC MC MSS polygon will have all necessary certification/registration and be fully compliant with all relevant MARPOL and SOLAS convention requirements specific for the vessels' size and purpose. The seismic survey vessel will have an implemented and tested Shipboard Oil Pollution Emergency Plan (SOPEP), in accordance with Regulation 37 of Annex I of MARPOL 73/78. The vessel will travel within the GPC MC MSS polygon at an average speed of 4.5 knots (~8.3 km per hour).

3.3.1. SUPPORT / GUARD VESSEL(S)

Dolphin proposes to use two support / guard vessel(s) that will accompany the seismic survey vessel to maintain a safe distance between the survey array and other vessels, and assist in managing interactions with shipping vessels and fishing activities if required. If required (i.e. for vessels over 400 GRT) the support / guard vessel(s) will have an implemented and tested SOPEP.

The GPC MC MSS is expected to have an acquisition period of ~2-3 months. It is likely that the survey vessel will be refuelled at sea using the support / guard vessel(s) either within or immediately adjacent to the polygon. At sea refuelling will only take place during daylight hours, and will not take place within a distance of 25 km from any emergent land or shallow water features (<20 m water depth). Dolphin at sea refuelling procedures are outlined in **Section 5.4.5.5** of the EP.

4. DETAILS OF ENVIRONMENTAL IMPACTS AND RISKS

4.1. ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY

An Environmental Risk Assessment (ERA) of the proposed GPC MC MSS has been undertaken to understand and manage the environmental risks associated with the activity to a level that minimises impacts on the environment and meets the objectives of the proposed survey.

The ERA methodology applied is consistent with the *Australian/New Zealand Standard AS/NZS ISO 31000:2009 Risk management–Principles and guidelines*, *Handbook HB 203:2012 Managing environment-related risk*, and *Handbook HB 89-2012 Risk management - Guidelines on risk assessment techniques*. The risk assessment has been undertaken to identify the sources of risk (aspects) and potential environmental impacts associated with the activity and to assign a level of significance or risk to each impact. This subsequently assists in prioritising mitigation measures to ensure that the environmental impacts are managed to ALARP.

The environmental risks associated with the proposed marine seismic survey have been assessed by a methodology that:

- identifies the activities and the environmental aspects associated with them;
- identifies the values/attributes at risk within and adjacent to the polygon;
- defines the potential environmental effects of the activities;
- identifies the likelihood of occurrence and potential consequences; and
- determines overall environmental risk levels using a likelihood and consequence matrix.

The Environmental Risk Assessment process identified, assessed and ranked the risks associated with each environmental hazard in accordance with the environmetal risk matrix (**Table 4-1**).

Table 4.1 - Environmental event potential matrix

CONSQUENCE LEVEL	LIKELIHOOD LEVEL					
	Remote	Highly Unlikely	Unlikely	Possible	Likely	Highly Likely
Catastrophic	2	2	1	1	1	1
Massive	3	2	2	1	1	1
Major	3	3	2	2	1	1
Moderate	4	3	3	2	2	1
Minor	4	4	3	3	2	2
Slight	4	4	4	3	3	2

Operational Risk Levels

Risk Level 1: **SEVERE** risk, apply strict Precautionary Principle.
Risk Level 2: **HIGH** risk, apply industry best practice to reduce to ALARP.
Risk Level 3: **MEDIUM** risk, apply standard cost-benefit approach to reduce risk to ALARP.
Risk Level 4: **LOW** risk, apply normal business management practice to avoid impact.

4.2. RISK EVALUATION

Environmental risks cover a wider range of issues, multiple species, persistence, reversibility, resilience, cumulative effects and variability in severity. The degree of environmental risk and the corresponding threshold for acceptability has been adapted to include principles of ecological sustainability (given as an objective in the Environment Regulations and defined in the EPBC Act), the Precautionary Principle and the corresponding environmental risk threshold decision-making principles used to determine acceptability.

4.2.1. DEMONSTRATION OF ALARP

Impacts and risks are reduced to ALARP where:

- The residual risk is **LOW**:
  - good industry practice or comparable standards have been applied to control the risk, because any further effort towards risk reduction is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.
- The residual risk is **MEDIUM** or **HIGH**:
  - good industry practice is applied for the situation/ risk; or
  - alternatives have been identified and the control measures selected to reduce the impacts and risks to ALARP. This may require assessment of Company and industry benchmarking, review of local and international codes and standards, consultation with stakeholders etc.

4.2.2. DEMONSTRATION OF ACCEPTABILITY

The following process has been applied to demonstrate acceptability.

- **LOW** residual risks are 'Broadly Acceptable', if they meet legislative requirements, industry codes and standards, regulator expectations, Dolphin's HSE Policy and industry guidelines.
- **MEDIUM** and **HIGH** residual risks are 'Broadly Acceptable' if ALARP can be demonstrated using good industry practice, risk based analysis, if societal concerns are accounted for and the alternative control measures are disproportionate to the benefit gained.
- **SEVERE** residual risks are 'Intolerable' and therefore 'Unacceptable'. Risks will require further investigation and mitigation to reduce the risk to a lower and more acceptable level. If after further investigation the risk remains in the severe category, the risk requires appropriate business sign-off to accept the risk.

4.3. IDENTIFICATION OF RISKS AND IMPACTS

The risks identified during the ERA process (including Decision Type, residual risk level and acceptability of residual risk) have been divided into two broad categories: Planned (routine and non-routine); and Unplanned (accidents or incidents) activities. Both of these categories have then been further divided into impact assessment groupings based on stressor type e.g. noise, equipment loss etc.

4.3.1. ENVIRONMENTAL ASPECTS

A summary of the key sources of environmental risk (aspects) for planned (routine and non-routine) activities include:

- Vessel noise emissions (excluding seismic acoustic emissions)
- Vessel light emissions*
- Deployment and retrieval of anchors*
- Interaction with commercial fisheries and tourism activities including recreational fishing, shipping and petroleum service vessels
- Interaction with defence activities*
- Biofouling of vessel hull, other niches and immersible equipment
- Underwater noise emissions from discharge of airgun array
- Emissions from fuel consumption and waste combustion
- Discharge of ballast water
- Discharge of bilge water, sewage, grey water and food wastes

A summary of the key sources of environmental risk (aspects) for unplanned (accidents and incidents) activities include:

- Collision between survey vessels / towed array and marine fauna
- Vessel grounding*
- Equipment dragging or loss
- Accidental release of hazardous or non-hazardous waste
- Hydrocarbon release caused by topsides (vessel) loss of containment
- Refuelling of survey vessel
- Hydrocarbon release caused by loss of structural integrity from vessel collision between survey vessel and third-party vessel

* Deemed not credible and so not assessed any further

4.3.2. ENVIRONMENTAL IMPACTS

A summary of the potential environmental impacts associated with the sources of environmental risk for planned (routine and non-routine) activities listed above include:

- Short-term localised disturbance to marine fauna, such as alteration of behaviours and localised displacement
- Localised physical damage to benthic habitats
- Disruption to fishing vessels
- Potential direct and indirect noise impacts on target species
- Restriction of access to fishing grounds, loss/damage to gear
- Recreational take of finfish
- Temporary disruption / exclusion of shipping traffic
- Temporary disruption of aircraft activities in military exercise areas from helicopter operations
- Introduction and establishment of IMS and displacement of native marine species
- Disturbance to marine fauna, particularly whales, marine turtles and whale sharks, involving potential physiological and behavioural effects
- Introduction and establishment of IMS and displacement of native marine species
- Localised eutrophication of the water column; and localised adverse effect to marine biota

A summary of the potential environmental impacts associated with the sources of environmental risk for unplanned (accidents and incidents) activities listed above include:

- Injury or fatality to protected marine fauna (cetaceans, marine turtles and whale sharks)
- Localised physical damage to benthic habitats
- Pollution and contamination of the environment and secondary impacts of marine fauna (e.g. ingestion, entanglement)
- Localised and temporary reduction in water quality due to hydrocarbon contamination
- Toxic effects on marine fauna and flora
- Localised and temporary reduction in water quality
- Direct and indirect effects on commercial and recreational fisheries

4.4. ASSESSMENT OF ENVIRONMENTAL IMPACTS AND RISKS

This section briefly describes the potential risks and impacts that could occur as a result of the proposed activity. **Section 4** details the risk assessment and **Section 6** summarises the control measures that will be implemented to minimise impacts to receptors described herein.

4.4.1. VESSEL NOISE EMISSIONS (EXCLUDING SEISMIC ACOUSTIC EMISSIONS)

Noise emitted from the survey vessel and support / guard vessel(s) (i.e. engines, propellers, hull flow noise - excluding noise generated by the seismic acoustic source) within the GPC MC MSS polygon may result in incidental changes in behaviour of marine fauna (primarily cetaceans, whale sharks and marine turtles), such as disturbance, avoidance or attraction. However, these impacts are likely to be localized and temporary. Furthermore, underwater noise from the survey vessel is transient, in that the vessel will be moving across large areas rather than concentrating activities in a small area, and the type of noise is no different to that emitted by the commercial shipping traffic and fishing vessels operating in these areas.

4.4.2. INTERACTION WITH COMMERCIAL FISHERIES, RECREATIONAL FISHERS, TOURISM, SHIPPING AND PETROLEUM SERVICE VESSELS

There are a number of commercial fisheries operating within the area of the GPC MC MSS, as well as significant commercial shipping activity associated with entry to the Port of Dampier, Port Hedland and Barrow Island (**Section 2.4.3**). The Rowley Shoals (including Mermaid Reef) are a known tourist destination associated with diving, eco-tourism and fishing. There is the possibility that fishing, tourism and commercial activities will be disrupted by the physical presence of the seismic and support / guard vessel(s).

Commercial and Recreational Fisheries

Disruption to fisheries in the area could result from:

- direct effects of underwater noise disturbance on target fish populations;
- indirect effects of underwater noise disturbance on fish prey species;
- restriction of access to fishing grounds due to vessel movements and operations;
- seismic equipment loss and subsequent interference with fishing gear (entanglement);
- loss of fishing gear e.g. buoyed fish traps, cray pots; and
- recreational take of finfish species from the survey vessel and support / guard vessel(s).

The MMF, NDSF, PLF, PTMF, WCDSCF and NWSTF may be actively fishing in, or adjacent to the polygon. However, an analysis of the current fishery closures, depth range of activity, historical fishing effort data, fishing methods (as outlined in **Section 2.4.1.3** and based on consultation feedback (see **Section 8**) has revealed that although there is a potential for interaction with commercial fisheries, with proposed mitigation including ongoing consultation, the potential for interaction is **low**.

Due to its distance offshore, recreational fishers to the area generally visit through charter boat operators offering live aboard packages. The main targeted species are marlin and sailfish, as well as tuna, mackerel and trevally. The best fishing for most species is between August and March. Although charters may be available all year, the majority commence in September during the best fishing and weather periods. There is the possibility of interaction with charter operated fishing vessels. However, as the numbers will be limited and likely contained to the waters

immediately around the Rowley Shoals; with proposed mitigation including ongoing consultation, the potential for interaction is **low**.

Tourism Operations

Disruption to tourism operations in the area could result from:

- direct effects of underwater noise disturbance on divers;
- disruption to 'wilderness character' of Mermaid Reef and therefore diver/snorkler visual or auditory experience;
- restriction of access to tourism locations due to vessel movements and operations; and
- divers exposed to high levels of underwater sound can suffer from dizziness, hearing damage or other injuries to other sensitive organs, depending on the frequency and intensity of the sound.

The majority of vessels visiting the Rowley Shoals are Charter Boat Operators supporting various activities such as eco-tourism, diving and recreational fishing and will generally be limited to the waters around the atolls of the Rowley Shoals, including Mermaid Reef. As seismic activities will be limited to the waters outside the Marine Park and Mermaid Nature Reserve (a minimum 4 km separation distance) any interaction would likely be limited to vessels transiting between the shoals and the mainland. Marine Fauna Observers (MFO) as part of general fauna observations shall look for diving/charter vessels, and survey support/guard vessel(s) shall be used to manage interactions.

Predicted received SEL at the 250 m contour at Mermaid Reef (~9 km from seismic source) is ~142 dB re 1uPa^2.s, which is less than noise associated with many powerboats (Anthony *et al.* 2009) or snapping shrimp and is well below those recommended for recreational and commercial diving:

- Recreational divers: 154 dB (600 - 2500 Hz);
- DMAC commercial diver guidelines: 191 dB; and

Predicted received SEL at the Mermaid Reef CMR boundary, which is 4 km from the GPC MC MSS operational area, is ~153 dB. Diving and snorkling is most likely to be undertaken in shallow water on the reef with the view of observing predominantly site-attached wildlife and experiencing the 'wilderness character' of Mermaid Reef. Consultation with charter boat stakeholders also suggest that no bluewater diving is planned and that maximum dive depths is 40 m for exceptionally experienced divers (**Section 8**). Recreational diving is therefore usually conducted in shallow waters of 40 m or less as this is the depth limit that standard recreational dive certification allow (www.padi.com). The 40 m contour surrounding Mermaid Reef is more than 11 km from the GPC MC MSS operational area and noise levels here are predicted to reach ~140 dB re 1uPa^2.s.

In the event that seismic operations look to extend into the diving season (1 September to 30 November) then a risk assessment shall be undertaken jointly and SIMOPS plan developed jointly, if required, with individual operators present on Mermaid Reef. The Diving Medical Advisory Committee guidelines on Safe Diving Distance from Seismic Surveying Operations have been developed for commercial dive operations that can use underwater audio communications equipment and that have the potential to come closer than 10 km of a seismic survey. Recreational divers do not use underwater audio communication equipment and will not come closer than 11 km of the survey given the distance between the 40 m contour and the GPC MC MSS operational area. Nevertheless, the guidelines will be adopted for recreational diving.

At any point in time a dive operator can request that the sound source is shut down immediately before and during dives/snorkel activities if they perceive that the risk to the visual/audio experience of divers will be compromised and the survey vessel will comply with such a request. Dolphin believes that the negative interaction with tourism from the GPC MC MSS activity will be managed to ALARP and acceptable levels given the above information and controls outlined.

Shipping

The survey vessel and towed array represent a potential navigational hazard and other vessels will need to avoid the survey vessel to prevent vessel collisions, entanglement of/damage to the streamer and other components of the towed array, and other incidents. The highest potential risk will be during slow speed turning of the survey vessel during line changes, or when it is moving perpendicular to the normal passage of commercial shipping.

A Safe Navigation Area (SNA) will be in place for the duration of the GPC MC MSS. The extent of this SNA will be specific to the survey vessel and extent of the towed array. The SNA will cover ~10 km radius from the survey vessel, to account for the length of the towed streamer array (8,100 m). A support / guard vessel(s) will be used to implement the SNA if approaching vessels fail to heed navigational warnings (NAVAREA X warnings, Notices to Mariners [NTM], beacons, lights, radio contact etc.).

4.4.3. BIOFOULING OF VESSEL HULL, OTHER NICHES AND IMMERSIBLE EQUIPMENT

Invasive Marine Species (IMS) are marine plants or animals that have been introduced into a region beyond their natural range and have the ability to survive, reproduce and establish founder populations. In the case of Dolphin's proposed activities during the GPC MC MSS, the key vectors requiring management attention include:

- discharge of high risk ballast water taken up at international or domestic sources;
- biofouling on vessel hulls and other external niches (e.g. propulsion units, steering gear and thruster tunnels);
- biofouling of vessel internal niches (e.g. sea chests, strainers, seawater pipe work, anchor cable lockers and bilge spaces etc.); and
- biofouling on equipment that routinely becomes immersed in water.

Once introduced IMS can cause serious environmental, social and economic impacts through predation or displacement of native species. These direct or indirect impacts have the potential to threaten a range of sectors including commercial fisheries and aquaculture, the tourism industry, human health, shipping and infrastructure

Ballast Water

The Department of Agriculture (DoA) has introduced the mandatory Australian Ballast Water Management Requirements (DoA, 2008) that are enforced under the *Quarantine Act 1908*. Under these arrangements all vessels that have travelled from international waters are obligated to assess and manage their ballast water in accordance with the AQIS requirements. These arrangements prohibit the discharge of high-risk ballast water within Australian territorial seas (within 12 nautical miles of Australian territories) including Australian ports. It is also recommended by AQIS that ballast exchanges be conducted as far as possible away from shore and in water at least 200 m deep.

Biofouling

Under the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia, 2009) a risk assessment approach is recommended to manage biofouling. All vessels contracted for the GPC MC MSS will have an IMS Risk assessment done prior to arriving in Australia, and all of the necessary clearances to operate within Australia waters, as required. This includes meeting the biosecurity standards of DAFF and the DoF, who have significant powers to prevent the arrival and establishment of IMS of concern.

Any vessel or marine infrastructure destined for WA waters is required to meet the aquatic biosecurity standards set out under the *Fisheries Resources Management Act 1994*, including a Marine Biosecurity Inspection for the presence of known and potential IMS to ensure compliance with Regulation 176. Vessels will be coated in an appropriate antifouling system that is considered suitable for both coastal and deep sea vessels and is compliant with the International Convention on the Control of Harmful Anti-Fouling Systems on Ships (IMO document AFS/CONF/26).

4.4.4. UNDERWATER NOISE EMISSIONS FROM DISCHARGE OF AIRGUN ARRAY

Studies relating to the environmental effect of marine seismic surveys have largely focused on the potential effects to fish stocks and marine mammals from the sound waves associated with the seismic energy source. Concerns have included:

- pathological effects (lethal and sub-lethal injuries) - immediate and delayed mortality and physiological effects to nearby marine organisms;
- behavioural change to populations;

- disruptions to feeding, mating, breeding or nursery activities of marine organisms in such a way as to affect the vitality or abundance of populations;
- disruptions to the abundance and behaviour of prey species for marine mammals, seabirds and fish; and
- changed behaviour or breeding patterns of commercially targeted marine species, either directly, or indirectly, in such a way that commercial or recreational fishing activities are compromised.

In relation to cumulative noise levels, an environmental review recently published by the Bureau of Ocean Energy Management (BOEM 2014) indicated a typical radius for a 160-dB threshold for a large airgun array was no more than 10 km (BOEM, 2014). Consequently, the implementation of a 40 km geographic spacing between survey vessels working simultaneously is a very conservative approach, as this would leave a potential 20 km 'corridor' between vessels, rather than the 10 km 'corridor' as stated in the BOEM environmental review (BOEM, 2014).

Disturbance to Benthic Invertebrates

Few marine invertebrates have sensory organs that can perceive sound pressure, but many have organs or elaborate arrays of tactile 'hairs' that are sensitive to hydro-acoustic disturbances (McCauley, 1994). These sensory hairs or organs are collectively known as mechanoreceptors, and crustaceans are particularly well endowed with them. Close to a seismic source, the mechano-sensory system of many benthic crustaceans will perceive the 'sound' of airgun pulses, but for most species such stimulation would only occur within the near-field or closer, perhaps within distances of several metres from the source (McCauley, 1994).

A summary of impacts of seismic airguns on marine invertebrates based on literature reviews concludes that "very limited numbers of experiments were scientifically and reasonably conducted" but the results of nine quantitative studies showed five cases of immediate (lethal or physical) impacts of seismic airguns on invertebrate species and four cases of no impacts. One study showed physiological impacts and another showed no physiological impact. Three cases showed behavioural impacts and one study showed no impact on behaviour.

Disturbance to Bivalve Molluscs

A review of studies (Parry *et al.* 2002) suggested that molluscs are at risk of damage from seismic airgun noise only when they are closer than 1-2 m. However, previous studies have also suggested that most effects on invertebrates without gas-filled cavities are likely to be too subtle to be measured in the field. It would appear that significant impacts on bivalve molluscs, such as the pearl oyster, from airgun noise emissions will only occur within very short distances from the source. A conservative estimate for a minimum distance beyond which significant effects are unlikely, is approximately 10 m, but this will depend on the source dynamics and propagation characteristics of the area. Benthic environments that may support bivalve molluscs are mostly limited to the reefal areas within the Rowley Shoals, which are more than 4 km away.

Disturbance to Planktonic Organisms

Except for fish eggs, larvae and other minute planktonic organisms within a few meters of an airgun, no planktonic organisms are likely to be affected significantly by airgun array discharges (McCauley, 1994). Sound exposure guidelines published by Popper *et al.* in 2014 have indicated that for eggs and larvae, SEL (cum) levels >210 dB or peak > 207 dB may incur mortality or potential mortal injury while animals near have a moderate risk of recoverable injury or TTS. These predictions are based on work by Bolle *et al*. (2012) as cited in Popper *et al* 2014) on pile driving signals. Modelled SEL levels undertaken by Dolphin are below those purported to induce mortality or potential mortal injury in eggs or larvae (Popper *et al* 2014) at the 250m contour and the edge of the Mermaid Reef CMR.

Disturbance to Fish

Potential impacts on fish species related to the operation of survey airgun arrays include behavioural avoidance of seismic sound sources, temporary threshold shifts (TTS) and pathological trauma or mortality. Indirect effects may include reduced catches resulting from changes in feeding behaviour and vertical/horizontal distribution (Skalski *et al.* 1992).

Behavioural responses to sounds are variable but include:

- leaving the area of the noise source (avoidance);
- startle/ alarm responses;
- spatial changes in schooling behaviour/ swimming patterns; and

- changes in depth/ vertical distribution.

These effects are expected to be short-lived, with duration of effect less than or equal to the duration of exposure, are expected to vary between species and individuals, and be dependent on the properties of received sound (DFO 2004). The ecological significance of such effects is expected to be low, except where they influence reproductive activity.

Based on existing information, impacts on fish populations (as opposed to individuals) resulting from seismic survey noise are likely to be restricted to the following:

- surveys that take place over protracted periods close to areas important for the purposes of feeding, spawning or breeding;
- surveys that take place over protracted periods close to areas that constitute narrow, restricted migratory paths; or
- populations that cannot move away from operating arrays (e.g., site-attached reef species that experience short ranges and high sound intensities).

Considering the distribution range of key species in this area, adequate spawning biomass levels, that migratory routes are not restricted, and distance from any area associated with site-attached species, the impact on fish populations is considered to be low.

The potential effects of marine seismic surveys have been summarised as part of a detailed environmental assessment of geophysical exploration for mineral resources on the Gulf of Mexico outer continental shelf (MMS 2004). This assessment concluded that negligible to potentially adverse effects on fish may occur from seismic surveys. However, these effects were not considered biologically significant due to the following factors:

- seismic survey noise may disturb fish and may produce temporary or permanent hearing impairment in some individuals, but it is unlikely to cause death or life-threatening injury;
- seismic surveys are not expected to cause long term or permanent displacement of any listed species from critical/preferred habitat; and
- seismic surveys are not expected to result in destruction or adverse modification of critical or essential fish habitat.

Dolphin has undertaken vertical acoustic modelling to assess the impacts of the acoustic source on demersal species or benthic organisms that may habitat the shallower waters of the GPC MC MSS, which has a minimum depth of 160 m. The received SEL will be ~190 dB re 1µPa^2.s. This level is below the limits Popper *et al*. (2014) state could result in recoverable injury or mortality, or potential mortal injury to fish.

Based on the available information regarding active fisheries in the area of the proposed GPC MC MSS, the proposed survey will have minimal effect on long-term fish abundances. Short-term commercial fish catches may decline in the exclusion area, but this represents only a small percentage of the total fishing area available, and stocks are anticipated to return within days. Considering the uncertainty in times and locations of fish spawning areas, and the limited time of the proposed survey, no additional controls will be implemented to reduce the impacts and risks to fish stocks during the GPC 3D MSS.

Based on the depths of the waters that the survey is being undertaken; the distance from the polygon boundary to locations of site-attached species and benthic communities; that pelagic species can swim way from the sound source; that the sound source is continually moving and the predicted minimal received SEL; the proposed survey will have minimal effect on individual species or long-term fish abundances. Therefore Dolphin believes that the impacts to site attached species associated with Mermaid Reef, demersal species that may habitat the shallowest waters in the survey area (160 m), and pelagic species within and adjacent to the polygon are ALARP and acceptable.

Disturbance to Sharks and Whale Sharks

The available evidence indicates sharks will generally avoid seismic sources and the likely impacts on sharks are expected to be limited to short-term behavioural responses, possibly including avoidance of the operating airgun

array. These behavioural responses are unlikely to be significant at a population level (see *Spatial and Temporal Overlap with Critical Habitat and Peak Periods of Activity for Protected Marine Fauna* below). It is highly unlikely that the underwater noise emissions from the airgun array would cause any pathological effects (lethal and sub-lethal injuries), resulting in immediate and delayed mortality and physiological effects on sharks. It is expected that the potential effects to whale sharks (*Rhincodon typus*) associated with acoustic noise will be the same as for other pelagic fish species, resulting in minor and temporary behavioural change (such as avoidance).

Disturbance to Baleen whales (Mysticetes)

Physical damage to the auditory system of cetaceans may occur at noise levels of about 230 to 240 dB re 1µPa (Gausland, 2000), which is equivalent to a distance of about 1-2 m from the energy source. Because of the good swimming abilities of marine mammals and their avoidance of either the vessel or the airgun array, it is highly unlikely that any marine mammals will be exposed to levels likely to cause pathological damage (McCauley, 1994).

Noise associated with airguns used during seismic surveys can cause significant behavioural changes in whales. With regards to avoidance behaviour by baleen whales, it is known that baleen whales will avoid operating seismic vessels and the distance over which the avoidance occurs seems to be highly variable between species and even within species. It is considered that this avoidance behaviour represents only a minor effect on either the individual or the species unless avoidance results in displacement of whales from nursery, resting or feeding areas, at an important period for the species. Approximately 100 km² only of the GPC MC MSS polygon operational area overlaps blue pygmy whale migration BIA, but it is not considered a critical habitat (feeding, breeding, calving, resting aggregation, narrow/restricted migratory pathway). The polygon overlaps no other recognised cetacean BIA.

Disturbance to Toothed Whales (Odontocetes)

The frequency range of toothed whale sounds excluding echo location clicks are mostly <20 kHz with most of the energy typically around 10 kHz, although some calls may be as low as 100 to 900 Hz. Source levels range from 100 to 180 dB re 1 µPa (Richardson et al., 1995).

There is little systematic data on the behavioural response of toothed whales to seismic surveys. Richardson et al., (1995) reports that sperm whales appeared to react by moving away from surveys and ceasing to call even at great distances from a survey. However, in a 2003 study supported by the US Minerals Management Service (Jochens and Biggs, 2003), two controlled exposure experiments were carried out (including one with three simultaneously tagged whales) to monitor the response of sperm whales to seismic source. The whales were exposed to a maximum received level of 148 dB re 1µPa. There was no indication that the whales showed horizontal avoidance of the seismic vessel nor was there any detected change in feeding rates of the tagged sperm whales.

The hearing capability of larger toothed whales (such as the killer whale) is unknown, but it is possible that they can hear better in the lower frequencies than the smaller toothed cetaceans. If this is the case, in lieu of any other information, their reactions to seismic survey vessels may be akin to those of the baleen whales. It is considered that the potential adverse effect on toothed whales would only occur if the whale is within close range (i.e. less than a few hundred metres).

Disturbance to Marine Turtles

Electro-physical studies have indicated that the best hearing range for marine turtles is in the range 100 to 700 Hz, which overlaps with the frequency range of maximum energy in the horizontally propagating component of a seismic array 'shot' (McCauley, 1994). Studies indicate that marine turtles may begin to show behavioural responses to an approaching seismic array at received sound levels of ~166 dB re 1 µPa (rms), and avoidance at around 175 dB re 1 µPa (rms; McCauley *et al.,* 2003). This corresponds to behavioural changes at approximately two kilometres, and avoidance from approximately one (1) km.

Marine turtles may possibly be exposed to noise levels sufficient to cause physical damage if airgun arrays start suddenly with turtles nearby (less than 30 m). In circumstances where arrays are already operating, (i.e., as a vessel moves along an acquisition line) individuals would be expected to implement avoidance measures before entering ranges at which physical damage might take place.

The GPC MC MSS polygon does not overlap any marine turtle biologically important areas, i.e. nesting, foraging or internesting buffers.

4.4.5. DISCHARGE OF BILGE WATER, SEWAGE, GREY WATER AND FOOD WASTES

Routine discharge of bile water, sewage and food wastes to the ocean will cause a negligible and localised and temporary increase in nutrient concentrations and reduction in water quality. The total nutrient loading from vessel operations during surveys in the GPC MC MSS polygon will be insignificant in comparison to the natural daily nutrient flux that occurs in marine waters within the region. No significant impacts are anticipated because of the minor quantities involved, localised area of impact, high level of dilution into deep oceanic waters and high biodegradability/low persistence of the wastes.

4.4.6. COLLISION BETWEEN SURVEY VESSELS / TOWED ARRAY AND MARINE FAUNA

The survey and support / guard vessel(s) may present a potential physical hazard (e.g. animal displacement or vessel strike) to marine fauna including cetaceans, turtles and whale sharks. Additionally, the tail buoys that are attached to the end of seismic streamers can represent an entanglement risk for turtles. The impact from vessel interactions with marine fauna can be as minimal as behavioural changes by the marine fauna to severe impacts such as mortality resulting from vessel strikes. Support vessel-marine fauna interaction procedures have been prepared to ensure any interactions between the support vessel and cetaceans, whale sharks and turtles are managed in accordance with EPBC Regulations 2000. Given the slow operating speed of the survey and support / guard vessel(s) (unless in an emergency) and the low likelihood of large numbers of animals being present, the potential for vessel strike to impact significantly on cetacean, whale shark or turtle populations in the polygon is assessed to be low.

4.4.7. EQUIPMENT DRAGGING OR LOSS

The accidental dragging or loss of seismic streamer equipment or vessel grounding has the potential to cause minor physical damage to benthic habitats and biological communities. However, soft sediment benthic areas relatively devoid of sensitive habitats and consisting of sandy /silt substrate is the predominant benthic receiving environment within, and adjacent to, the GPC MC MSS area. The surveys will be operating at depths and distances from emergent land that preclude any possible contact i.e. vessel is at least 9 km from nearest emergent land, and minimum 160 m water depth.

In the unlikely event of damage to or loss of a solid seismic streamer, potential environmental effects will be limited to physical impacts on benthic communities arising from the cable and associated equipment sinking to the seabed. Seismic streamers and vanes are fitted with pressure-activated, self-inflating buoys that are designed to bring the equipment to the surface if lost accidentally during a survey. As the equipment sinks it passes a certain water depth at which point the buoys inflate and bring the equipment back to the surface where it can be retrieved by the support / guard vessel(s) or survey vessel workboats.

Dragging of the streamer along the seabed may result in localised physical disturbance of substrates, benthic habitats and communities. However, given the water depth range across the GPC MC MSS polygon (~160-440 m) and the absence of any shallow waters (<20 m depth) or any emergent features within the polygon, the risk of significant impacts resulting from equipment dragging or loss is considered to be low. The survey vessel will not transit the Mermaid Reef CMR or the Rowley Shoals MP with the seismic equipment deployed, as per the Mermaid Reef CMR transitional management arrangements (DNP, 2000).

4.4.8. ACCIDENTAL RELEASE OF HAZARDOUS OR NON-HAZARDOUS WASTE

The survey and support / guard vessel(s) will store and use a variety of hazardous materials such as paints, cleaning chemicals and batteries. Both vessels will also produce a variety of other non-hazardous solid and liquid wastes, including packaging and domestic wastes, such as aluminium cans, bottles, paper and cardboard.

Hazardous Materials

These materials have the potential to adversely impact the marine environment if accidentally released in significant quantities. Chemicals e.g. solvents and detergents will typically be stored in small containers of 5-25 L capacity and

stored / used in internal areas where any leak or spill would be retained on board and cleaned up in accordance with the Shipboard Oil Pollution Emergency Plan (SOPEP) and associated spill clean-up procedures. The realistic worst case volume would be 25 L.

Non-hazardous Materials

These materials could potentially impact the marine environment if accidentally released in significant quantities resulting in a reduction in water quality and physical impacts on marine fauna, such as becoming entangled in waste plastics.

4.4.9. HYDROCARBON RELEASE CAUSED BY TOPSIDES (VESSEL) LOSS OF CONTAINMENT

The survey and support / guard vessel(s) store and use small quantities of lubricating oils and hydraulic fluid, which have the potential to spill if not appropriately managed. Hydraulic fluid may also potentially be spilled from a leak in hoses or lines on hydraulic equipment such as cranes or winches. The size of potential spills to deck of these substances are likely to be between 50 and 200 L (0.05 m³ and 0.2 m³) based on expected volumes of fluids available on deck typically stored in 50 to 200 L steel drums. Storage of these substances aboard the survey vessel would typically be within a designated storage room or a contained (bunded) area on deck.

In the event a loss to sea does occur, impacts to the marine environment would be minimal, due to the small potential volumes released, and the fact that spilt hydrocarbons will rapidly evaporate, disperse and weather.

4.4.10. HYDROCARBON RELEASE CAUSED BY VESSEL COLLISION OR AT-SEA REFUELLING

The hazards associated with hydrocarbon spills during the GPC MC MSS (that are considered most credible) are:

- on-deck leak or spill of small quantities (between 50 and 200 L) of lubricating oils or hydraulic fluids;
- loss of up to 648 L of diesel during at sea refuelling operations, as a result of hose failure;
- larger volume (up to 135 m^3) loss of diesel from a ruptured fuel storage tank, resulting from vessel-to-vessel collision.

The accidental discharge of diesel has the potential to cause toxic effects on marine fauna and flora and a localised reduction in water quality. Potentially affected biota includes seabirds, cetaceans, turtles and whale sharks that may come into contact with a surface hydrocarbon slicks. If surface slicks or entrained diesel were to contact shallow waters or emergent features adjacent to the survey polygon, then a range of benthic habitats and communities could be at risk of impacts. Commercial fishing activities and shipping in the area could also be impacted in the event of a major diesel spill.

The fuel that will be used during the GPC MC MSS is MGO (marine diesel). All fuel oil tanks are located in the interior of the vessel, and are separated from the hull either by void spaces (empty tanks) or by tanks for other fluids (fresh water, water ballast). The largest fuel oil tanks on the *Sanco Swift* that are closest to the side of the hull have a maximum capacity of 149.5 m^3. In accordance with Sanco Shipping and Dolphin vessel refuelling procedures, these tanks are never filled to 100% of their capacity—instead they are filled to 90% capacity.

Therefore, in the extremely unlikely (improbable) event of a ruptured fuel oil tank as a result of collision, the maximum spill size possible would be in the order of ~135 m^3 of MGO. However, this could only occur in the event of a rupture of one of the vessels largest MGO tanks and complete loss of all of its contents. The ADIOS2 model was run using the worst case scenario for an oil spill of MGO (Diesel Fuel Oil, API 37.2) from the largest tank at maximum capacity of 135 m^3 (90% full). Based on the ADIOS2 modelling output, ~99% of the slick will have dispersed and evaporated within about 10 hours, with a potential radius of 14.4 km if occurring in the winter months and ~ 19 hours with a potential radius of 9.1 km if occurring in the summer months.

Mermaid Reef has an outer reef rim, which fully encloses an inner lagoon. Mermaid Reef has no landforms above high water mark. The reef platform and small sandbank at the northern end of the lagoon are both completely covered at high water, the latter being dry for only about 1.5 hours either side of low water (DEC / MPRA, 2007).

The small sandbank at the northern end of the lagoon of Mermaid Reef is located within the ZPI for a spill at location A. Clerke Reef and Imperieuse Reef are too far away to be impacted and so shall not be discussed further.

The ZPI's for a 135 m^3 diesel spill in winter (circle with a radius of 14.4 km) and summer (circle with a radius of 19.1 km) for the GPC MC MSS polygon does not overlap islands that represent defined BIA for any turtle species in the region - i.e. the emergent features within Mermaid, Clerke and Imperieuse Reefs do not represent a critical habitat for large numbers of turtles.

Although the northern part of the survey polygon overlaps the edge of the defined BIA (migration) for pygmy blue whales, and the survey period overlaps the timing of the northward migration of this species in the region, it is unlikely that significant numbers of animals would be exposed to surface diesel slicks in the event of a major diesel spill within the very short timeframe prior to natural weathering of these slicks (~99% of the slick will have dispersed and evaporated within about 10 hours in winter and 19 hours in summer).

Given the proximity of the survey polygon to the Rowley Shoals, there is the possibility of some impacts from a major diesel spill if surface slicks were to contact the waters surrounding the reefs, and enter the lagoons within the reefs, during periods when charter vessels are visiting the area for fishing, diving and snorkelling activities. Exclusion zones surrounding spills will reduce access for recreational fishing and snorkelling/diving on intertidal and sub tidal reefs. Stranding of oil on sandy beaches may impact some tourism activities.

The Rowley Shoals are not known to be key habitat for pearl oysters so any significant presence in the shallower waters of the Rowley Shoals is not anticipated. Any presence at the Rowley Shoals of adult Pearl Oysters is not likely to result in viable or significant recruitment from a September spawning event to the nearest active fishing ground given the distance to Compass Rose (~170 km) and the likely maximu drift distance for the duration of the larval phase being <30km (Hart *et al.,* 2010). Overall, impacts to the POMF are unlikely and minor.

4.5. SUMMARY OF ENVIRONMENTAL RISK ASSESSMENT RESULTS

The Environmental Risk Assessment (ERA) for the GPC MC MSS indicates that the residual environmental impacts and risks associated with the activity will be reduced to ALARP and are of an acceptable level. The ERA identified 13 sources of environmental risk, seven planned and six unplanned types, which are all assessed as having a **Low** or **Medium** residual risk following implementation of identified control measures.

Table 4.2 presents a summary of the assessed level of residual (post-mitigation) environmental risk associated with the proposed seismic survey. The environmental aspects of the survey that have the potential to cause significant environmental effects (Medium or High risk levels) have been determined through an evaluation of the proposed activity, the surrounding environment, including specific sensitivities and values, and legislative requirements. These environmental aspects are:

- Interaction with commercial fisheries and tourism activities including recreational fishing
- Interaction with shipping
- Refuelling of survey vessel
- Hydrocarbon release caused by loss of structural integrity from vessel collision between survey vessel and third-party vessel

In this case a number of additional control measures were also assessed, and were found to be not practicable—i.e., the cost, time and effort required to implement the measure is grossly disproportionate to the benefit gained. A summary of the control measures that will be implemented are shown in **Section 5.**

Table 4.2 -Summary of Environment Risk Assessment for GPC MC MSS

Source of Risk	Key Potential Environmental Impacts	Risk Rating		
		Consequence	Likelihood	Residual Risk
Vessel noise emissions (excluding seismic acoustic emissions)	Short-term localised disturbance to marine fauna, such as alteration of behaviours and localised displacement	Slight	Unlikely	**Low**
Vessel light emissions	Short-term localised disturbance to marine fauna, such as alteration of behaviour and localised displacement	Slight	Highly Unlikely	**Low**
Deployment and retrieval of anchors	Localised physical damage to benthic habitats	Slight	Unlikely	**Low**
Interaction with commercial fisheries and tourism activities including recreational fishing	Disruption to fishing vessels Potential direct and indirect noise impacts on target species Restriction of access to fishing grounds, loss/damage to gear Recreational take of finfish	Minor	Possible	**Medium**
Interaction with shipping	Temporary disruption / exclusion of shipping traffic	Minor	Possible	**Medium**
Interaction with defence activities	Temporary disruption of aircraft activities in military exercise areas from helicopter operations	Minor	Remote	**Low**
Biofouling of vessel hull, other niches and immersible equipment	Introduction and establishment of IMS and displacement of native marine species	Slight	Highly Unlikely	**Low**
Underwater noise emissions from discharge of airgun array	Disturbance to marine fauna, particularly whales, marine turtles and whale sharks, involving potential physiological and behavioural effects	Slight	Possible	**Low**
Emissions from fuel consumption and waste combustion	Localised reduction in air quality Greenhouse gas emissions	Slight	Highly Unlikely	**Low**
Discharge of ballast water	Introduction and establishment of IMS and displacement of native marine species	Slight	Highly Unlikely	**Low**
Discharge of bilge water, sewage, grey water and food wastes	Localised eutrophication of the water column; and localised adverse effect to marine biota	Slight	Unlikely	**Low**
Collision between survey vessels / towed array and marine fauna	Injury or fatality to protected marine fauna (cetaceans, marine turtles and whale sharks)	Minor	Highly Unlikely	**Low**
Vessel grounding	Localised physical damage to benthic habitats	Minor	Highly Unlikely	**Low**
Equipment dragging or loss	Localised physical damage to benthic habitats	Slight	Unlikely	**Low**
Accidental release of hazardous or non-hazardous waste	Pollution and contamination of the environment and secondary impacts of marine fauna (e.g. ingestion, entanglement)	Slight	Unlikely	**Low**
Hydrocarbon release caused by topsides (vessel) loss of containment	Localised and temporary reduction in water quality due to hydrocarbon contamination	Slight	Unlikely	**Low**
Refuelling of survey vessel	Toxic effects on marine fauna and flora Localised and temporary reduction in water quality Direct and indirect effects on commercial and recreational fisheries	Minor	Unlikely	**Medium**

Source of Risk	Key Potential Environmental Impacts	Risk Rating		
		Consequence	Likelihood	Residual Risk
Hydrocarbon release caused by loss of structural integrity from vessel collision between survey vessel and third-party vessel	Toxic effects on marine fauna and flora Localised and temporary reduction in water quality Direct and indirect effects on commercial and recreational fisheries	Moderate	Highly Unlikely	**Medium**

5. SUMMARY OF THE CONTROL MEASURES

Table 5.1 - Summary of the Controls and Mitigation Measures

Potential Impacts	Control and Mitigation Measures
Prevent adverse impacts from survey and support / guard vessel noise emissions on cetaceans, marine turtles and whale sharks	Interaction between the survey and support / guard vessel(s) and cetaceans, turtles and whale sharks within the polygon will be consistent with EPBC Regulations 2000 - Part 8 Division 8.1 (Regulation 8.05) - Interacting with cetaceans: • during periods when the survey vessel is transiting the polygon without the seismic array deployed, or during the process of deployment or retrieval of the array, the vessel will not travel at speeds greater than 6 knots within 300 m of a cetacean, turtle or whale shark or 150 m of a dolphin (caution zone); and will not approach closer than 100 m from an animal (with the exception of animals bow riding).
	Interaction between vessels (not including a vessel that is towing or retrieving/deploying a seismic array) and cetaceans, turtles and whale sharks within the polygon will be consistent with the vessel fauna interaction procedure flowchart (Figure 5.2): vessel will not travel at speeds greater than 6 knots within 300 m of a cetacean, turtle or whale shark
Zero incidents of interference and negative interactions with commercial or recreational fishers, tourism or shipping occur during the survey	Operations of the survey vessel must comply with the following: • International Regulations for Preventing Collisions at Sea 1972 (COLREG); • Standards of Training, Certification & Watchkeeping (STCW) Convention; and • *Navigation Act 2012*: Marine Order 21 (Safety of navigation and emergency procedures) 2012; • Marine Order 30 (Prevention of collisions) 2009; • Marine Order 59 (Offshore industry vessel operations) 2011; and • Marine Order 28 (Operations standards and procedures) 2012, specifically: ○ standard maritime safety procedures (including radar watch, radio contact, display of navigational beacons and lights) ○ standards for watchkeeping
	Operations of the survey vessel will be in accordance with Marine Notice 21/2013: Sound navigational practices; and with Marine Notice 4/2012: Safety of Fishing Vessels.
	The Australian Maritime Safety Authority (AMSA) Rescue Coordination Centre (RCC) will be advised of the survey details (survey vessel, location, timing etc.) prior to mobilisation to ensure NAVAREA X warnings can be issued and kept up to date. AMSA RCC will also be notified of survey completion.
	The Australian Hydrographic Service (AHS) will be advised of the survey details (survey vessel, location, timing etc.) not less than two weeks prior to mobilisation for the promulgation of a Notice to Mariners (NTM) broadcast.
	The survey vessel will have an Automatic Identification System (AIS) tracking device installed and operating to aid identification by other vessels.

	Mariners will be alerted of survey vessels' presence and extent of towed array. This includes the display of navigational beacons and lights to indicate that the vessel has restricted manoeuvrability and the implementation of the Dolphin Geophysical Vessel Communications Protocol (see Appendix K).
	Notification of activity details to relevant stakeholders prior to the survey commencing, including the offer of a seven (7) to ten (10) day forecast of operations and the promulgation of a Dolphin Geophysical 'fact sheet' (minimum one week) prior to the survey commencing containing specific information of the survey vessels and contact information.
	Use of a dedicated guard vessel to manage interactions with stakeholders including commercial fishing vessels, charter vessels and shipping, during seismic acquisition operations including implementation of the Safe Navigational Area (SNA). The SNA is likely to cover at least a 10 km radius from the survey vessel, to account for the length of the towed streamer spread.
	Use of the smallest possible seismic source - lowest possible total capacity for the airgun array and sail lines in North/South racetrack configuration.
	Lost towed equipment will be relocated and recovered where safe and practicable to do so.
	Recreational fishing from the survey vessel will be prohibited.
	MFO's will conduct a pre-start observation (as used for cetaceans, turtles and whale sharks) will include observations for charter vessels particularly with the aim of determining if there are divers or small boats in the water on the outside of the reef.
	If seismic operations occur between 1 September and 30 November and charter vessel operated dive/snorkling tours occur within Mermaid Reef Nature Reserve during this time, Dolphin will undertake a joint risk assessment and, if required, jointly develop and implement a SIMOPS plan in consultation with Dive Charter Vessel Operators. The SIMOPS plan will adopt the DMAC guidance including stopping seismic acquisition all together immediately before and when divers are in the water if requested by the charter operator.
	DPaW will be provided a pre-start fact sheet 1 week prior to activities commencing, and a daily seven (7) to ten (10) day forecast of operations to disseminate to charter boat operators (covering diving and fishing activities) and visitors to the Rowley Shoals.
Zero incidents of introduction of IMS from ballast water exchange during the survey	Ballast water discharges for the survey and support / guard vessel(s) must comply with the requirements of the Australian Ballast Water Management Requirements (as enforced under the *Quarantine Act 1908* [Section 27A]; and Quarantine Regulations 2000): • no discharge of high-risk ballast water within Australian territorial seas (within 12 nautical miles of WA coastline) including any ports; and • completion of Department of Agriculture Ballast Water Management Summary (BWMS) forms for any ballast water discharge in Australian waters.
	The Ballast Water Management Plan for the survey and support / guard vessel(s) must comply with: • Regulation B-1 of the International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 and should have been prepared in accordance with: • the IMO Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (IMO Resolution MEPC.127(53)

	Whilst in Australian waters, the survey and support / guard vessel(s) must operate in accordance with the conditions detailed in the "Approval to Berth" issued by DoA, and submitted a Quarantine Pre-arrival Report (QPAR).
Zero incidents of introduction of IMS from biofouling of survey vessel hull, other niches and immersible equipment during the survey	The risks of introducing IMS via biofouling into WA waters and ports must be managed in accordance with marine pest management guidelines (as enforced under the WA *Fish Resources Management Act 1994*; and Fish Resources Management Regulations 1995) for the survey and support / guard vessel(s): • immersible equipment and the survey vessel hull, sea chests and other niches must be 'clean' before the survey vessel enters WA waters and ports • The suspected or confirmed presence of any marine pests or disease must be reported within 24 hours by email (biosecurity@fish.gov.au) or telephone (FishWatch tel: 1800 815 507). ○ This includes any organism listed on the WA Prevention List of Introduced Marine Pests, and any other non-indigenous organism, that demonstrates invasive characteristics
	Application of DoA guideline that ballast exchanges be conducted as far as possible away from shore and in water at least 200 m deep for the survey and support / guard vessel(s).
	Application of guidelines detailed in the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry, and in the IMO Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species for the survey and support / guard vessel(s).
	The survey and support / guard vessel(s) will have had a recent dry dock, IMS inspection or antifoulant application prior to mobilising to Australian waters.
	If the survey vessel and / or support / guard vessel(s) (s) has to leave Australian waters before completion of the survey, they will be required to undergo a further IMS inspection and cleaning (if required), prior to re-entering Australian waters to complete the survey.
Prevent adverse noise impacts on whales, turtles, and whale sharks from discharge of the airgun array	Operation of the seismic source at all times during the survey must comply with all requirements of the EPBC Act Policy Statement 2.1 - Interactions between offshore seismic activities and whales Part A Standard Management Procedures (DEWHA 2008b & 2008c), including: • precaution zones (Observation zone: 3 km+; Low power zone: 2 km; and Shut-down zone: 500 m) • all of the Part A Standard Management Procedures will be applied for whale sharks as well as for whales.
	Operation of the seismic source within the polygon at all times will comply with the following EPBC Act Policy Statement 2.1 Part B Additional Management Procedures: • two dedicated Marine Fauna Observers (MFO) on the survey vessel for duration of the survey
	Operation of the seismic source within the biologically important areas during the peak periods for migration of pygmy blue whales: • northbound 1 May to 30 June, and • southbound 1 October to 15 December Must comply with the following EPBC Act Policy Statement 2.1 Part B Additional Management Procedures: • application of increased precaution zones (Observation zone: >3 km; Shut-down zone: 2 km) • application of an increased Pre Start-up Visual Observation of 45 minutes, rather than 30 minutes.

	The increased pre start-up visual observation period is to allow for the possibility of longer dive times for whales, i.e. the time between surfacing events is longer for animals that have longer down times or could be potentially be feeding
	For pygmy blue whales, if during operation of the seismic source: • outside of the migration BIA; or • outside the abovementioned pygmy blue whale peak periods, there have been 3 or more whale instigated power-downs or shut-downs in the preceding 48 hour period then the following measures shall be implemented: • increased precaution zones (Observation zone: >3 km; Shut-down zone: 2 km); and • increased Pre Start-up Visual Observation of 45 minutes
	For humpback whales, if during operation of the seismic source there have been 3 or more humpback whale instigated power-downs or shut-downs in the preceding 48 hour period then the following measures shall be implemented: • increased precaution zones (Observation zone: >3 km; Shut-down zone: 2 km); and • increased Pre Start-up Visual Observation of 45 minutes
	Operation of the seismic source within the whale shark BIA (1 August - 31 October) must comply with the following: • two dedicated Marine Fauna Observers (MFO) on the survey vessel for duration of the survey • undertake visual observations for whale sharks at least 10 minutes before the commencement of soft start procedures; and • application of a 500 m shut-down zone for whale sharks
	Use of the smallest possible seismic source - 4,100 in^3 - lowest possible total capacity for the airgun array (EPS #11).
	Survey vessel personnel (marine and seismic) provided with pre-survey induction on EPBC Act Policy Statement 2.1 requirements.
	Communication with any geophysical contractors planned or proposed to operate concurrently in the vicinity of the GPC MC MSS to agree upon, and implement, a minimum separation distance of 40 km between their survey vessel and the MV *Sanco Swift*.
	Pre-survey and during survey (as part of auditing arrangements) review of the NOPSEMA submissions website and available and contemporary data on whales will be undertaken prior to activities commencing
	No vessel or equipment shall enter the waters of the Mermaid Reef CMR or Rowley Shoals Marine Park
	All activities that fall within the scope of this EP shall be limited to the GPC – Reduced Scope Polygon
Zero incidents of non-compliant discharges of bilge water, sewage and food wastes within the polygon during the survey	Bilge water discharges (machinery space bilges) from the survey and support / guard vessel(s) must comply with the requirements of: • MARPOL Annex I - Oil • *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 9 Survey vessel - bilge water discharges can occur only if: • the vessel has an IMO approved / MARPOL compliant oily water separator (International Oil Pollution Prevention Certificate [IOPPC]) • the vessel is proceeding en route (i.e. is not stationary); and • oil content less than 15 parts per million (ppm); and • oil discharge monitoring and control system and oil filtering equipment are operating

	Support vessel(s): • oil and all oily mixtures must be retained aboard for onshore disposal • or: - the vessel is proceeding en route; and has in operation an IMO approved / MARPOL compliant oily water separator that ensures oil content less than 15 ppm All bilge water contaminated with chemicals must be contained and disposed of onshore, except if the chemical is demonstrated to have a low toxicity (as determined by the relevant Material Safety Data Sheet; MSDS)
	Sewage discharges from the survey and support / guard vessel must comply with the requirements of: • MARPOL Annex IV - Sewage • Protection of the Sea (Prevention of Pollution from Ships) Act 1983 - Section 26D • Marine Order 96 (Marine pollution prevention — sewage) 2013 Comminuted and disinfected sewage can be using an IMO approved / MARPOL compliant sewage treatment plant (International Sewage Pollution Prevention Certificate [ISPPC]) can be discharged if: • the vessel is >3 nm from nearest land; and • sewage originating from holding tanks is discharged at a moderate rate (as defined in Marine Order 96) while the vessel is proceeding en route at a speed not less than 4 knots Sewage that is not comminuted or disinfected can be discharged if: • the vessel is >12 nm from nearest land; and • sewage originating from holding tanks is discharged at a moderate rate (as defined in Marine Order 96) while the vessel is proceeding en route at a speed not less than 4 knots
	Food waste discharges from vessels must comply with the requirements of: • MARPOL Annex V - Garbage • Protection of the Sea (Prevention of Pollution from Ships) Act 1983 - Section 26F • Marine Order 95 (Marine pollution prevention - garbage) 2013 Food wastes can be discharged from the survey and support / guard vessel(s) if: • it is comminuted or ground to a particle size <25 mm • the vessel is en route • the discharge takes place as far as practicable from the nearest land, but in any case, ≥ 3 nm from the nearest land Food wastes that are not comminuted or ground can be discharged if: • the vessel is en route • the discharge takes place as far as practicable from the nearest land, but in any case, ≥ 12 nm from the nearest land
	Operations of the survey and support / guard vessel will be in accordance with Marine Notice 6/2012: Revised Garbage Discharge Regulations for Ships
	Compliance will be in accordance with Marine Notice 6/2012: Revised Garbage Discharge Regulations for Ships.

Collision between Survey Vessels / Towed Array and Marine Fauna	Any incidents of vessel or towed array collision with cetaceans, turtles and whale sharks must be reported as reportable incidents for the activity, in accordance with: • Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 - Regulation 26 (see **Section 7.3.3**)
	Interaction with marine fauna: • measures to minimise the likelihood of vessel collision with marine fauna: see EPS # 2
	Operations of the survey and support / guard vessel(s) will be in accordance with Marine Notice 12/2011: Minimising the risk of ships colliding with cetaceans, specifically that any incident of collision shall be reported to DoE
	Streamer tail buoys either of a design that does not represent a turtle entrapment threat, or fitted with turtle guards
Zero incidents of physical damage to benthic habitats and communities from vessel grounding, dragging or loss of the streamer and associated equipment	No vessel or equipment shall enter the waters of the Mermaid Reef CMR or Rowley Shoals Marine Park
	Vessels will use approved navigation systems and depth sounders.
	Streamers equipped with pressure-activated, self-inflating buoys designed to bring the equipment to the surface if lost accidentally.
	Use of solid streamers, rather than fluid-filled streamers.
	Steamers and associated equipment shall be checked/inspected prior to use.
	Lost towed equipment will be relocated and recovered where safe and practicable to do so.
Zero incidents of accidental release of hazardous or non-hazardous material to the sea from the survey and support / guard vessel(s)	Handling of hazardous wastes aboard the survey and support / guard vessel(s) must comply with the requirements of: • MARPOL Annex III - Noxious Liquid Substances • Protection of the Sea (Prevention of Pollution from Ships) Act 1983 - Section 26AB • Marine Order 94 (Marine pollution prevention - packaged harmful substances) 2014 • Marine Order 95 (Marine pollution prevention - garbage) 2013
	Handling of non-hazardous wastes (garbage) aboard the survey and support / guard vessel(s) must comply with the requirements of: • MARPOL Annex V - Garbage • *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 26F • Marine Order 95 (Marine pollution prevention - garbage) 2013
	Operations of the survey and support / guard vessel(s) will be in accordance with Marine Notice 6/2012: Revised Garbage Discharge Regulations for Ships.
	Application of garbage, solid and liquid wastes handling and disposal requirements: • No discharge of plastics or plastic products of any kind from survey or support / guard vessel • No discharge of domestic wastes or maintenance wastes from survey or support / guard vessel • All waste receptacles aboard survey and support / guard vessel covered with tightly fitting, secure lids to prevent any solid wastes from blowing overboard • All solid, liquid and hazardous wastes (other than bilge water, sewage and food wastes) will be incinerated or compacted (if possible) and stored in designated areas and sent ashore for recycling, disposal or treatment

	• Hydrocarbons located above deck stored with some form of secondary containment to contain leaks or spills (e.g. bund, containment pallet, transport packs) • Correct segregation of solid and hazardous wastes
Zero incidents of release of hydrocarbons to the marine environment resulting from spill to deck.	Control measures to prevent the release of hydrocarbons to the sea resulting from spill to deck aboard the survey and support / guard vessels must comply with the requirements of: • MARPOL Annex I - Oil • Protection *of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 9 • Marine Order 91 (Marine pollution prevention — oil) 2014
	The survey vessel must have a Shipboard Oil Pollution Emergency Plan (SOPEP) in place that complies with the requirements of: • Regulation 37 of MARPOL Annex I • Marine Order 91 (Marine pollution prevention — oil) 2014
	The survey vessel must have a valid International Oil Pollution Prevention Certificate (IOPPC]) applicable to vessel class
	<u>Storage:</u> • Any hydrocarbon storage on deck of the survey vessel must be designed and maintained to have at least one barrier (i.e. form of bunding) to contain and prevent deck spills entering the sea. This can include containment lips on deck (primary bunding) and/or secondary containment measures (bunding, containment pallet, transport packs, absorbent pad barriers) in place
	<u>Equipment:</u> • Equipment located on deck utilising hydrocarbons (e.g. cranes, winches or other hydraulic equipment) will have as a minimum primary bunding (i.e. deck edge lips or up-stands) to prevent loss of hydrocarbons to the sea • Equipment located on deck utilising hydrocarbons (e.g. cranes, winches or other hydraulic equipment) will be maintained to reduce risk of loss of hydrocarbon containment to the sea. Ongoing maintenance will be accordance with the planned maintenance system (PMS) for the survey vessel. • Fuel day tank fitted with an overflow routed to a containment tank to prevent spills if overfilled. • Remote manually operated shut-down devices for pumps; mechanical closure devices are fitted to vents.
	<u>Spill Response:</u> • The survey vessel SOPEP will be in the prescribed the format described in Guidelines for the Development of Shipboard Oil Pollution Emergency Plans, adopted by IMO as Resolution MEPC.54(32) • A SOPEP drill will be conducted in Australian waters between the survey vessel's arrival off the WA coastline and the commencement of the GPC MC MSS • A further two SOPEP drills will be conducted during the course of the survey • All drills will be reported as per MARPOL Annex I (Regulation 15) requirements (see Appendix C) and reviewed as part of the ongoing monitoring and improvement of emergency control measures • Spill response bins/kits are maintained and located in close proximity to hydrocarbon storage areas and deck equipment / bunkering areas for use to contain and recover deck spills

	<u>SOPEP / OPEP:</u> • In the event of any fuel or oil spills to sea SOPEP / OPEP procedures will be followed for notification and consultation with AMSA and DoT, to ensure prompt and appropriate mobilisation of NATPLAN or WestPlan-MOP / WA DoT OSCP as appropriate • SOPEP implemented and tested (see EPS #50)
	<u>Reporting:</u> • When a fuel/oil spill to sea occurs the survey vessel Master will inform the RCC Australia using a POLREP form (AMSA 197 [MO 91/2]). RCC Australia, in turn, will notify AMSA and/or WA DoT. • Any diesel spills to sea >80 L will be reported to NOPSEMA and WA DMP as reportable incidents (see **Section 8**)
Zero incidents of release of hydrocarbons to the marine environment resulting from vessel collision or fuelling	Operations of the survey vessel must comply with the International Regulations for Preventing Collisions at Sea 1972 (COLREG); the Standards of Training, Certification & Watchkeeping (STCW) Convention; Marine Orders Part 21 (Safety of navigation and emergency procedures) 2012; Marine Orders Part 30 (Prevention of collisions) 2009; Marine Order 28 (Operations standards and procedures) 2012, specifically: • standard maritime safety procedures (including radar watch, radio contact, display of navigational beacons and lights) • standards for watchkeeping
	The survey vessel must have a Shipboard Oil Pollution Emergency Plan (SOPEP) in place that complies with the requirements of: • Regulation 37 of MARPOL Annex I • Marine Order 91 (Marine pollution prevention — oil) 2014
	Reporting of any spills of hydrocarbons to the sea from the survey vessel must comply with the requirements of: • Marine Order 91 (Marine pollution prevention — oil) 2014
	<u>Prevention of vessel collisions:</u> Good industry practice measures to minimise the likelihood of vessel collision, as described in **Section 5.3.2**: • see EPS #4, 5, 6, 7, 8, 9, 10 and 12.
	Refuelling at sea will be subject to Dolphin standard operating procedures, plus the following additional measures: • AMSA will be notified prior to any refuelling taking place; • at sea refuelling will not take place within a distance of 25 km of any emergent land or shallow water features (20 m or less depth); • refuelling of vessels will be undertaken under favourable wind and sea conditions as determined by the vessel Masters; • refuelling will take place during daylight hours only; • Job Hazard Analysis (JHA) or equivalent in place and reviewed before each fuel transfer; • all valves and flexible transfer hoses checked for integrity prior to use and certified; and • dry break couplings (or similar) in place for all flexible hydrocarbon transfer hoses.
	<u>Immediate actions:</u> • In the event of a vessel-to-vessel collision, implementation of measures described in the Dolphin Emergency Contingency Manual (ECM). • Notify AMSA • Commence spill monitoring and supply real-time information to control agency as soon as it is safe and practicable to do so

	<u>SOPEP / OPEP:</u> • See EPS # 51
	<u>Reporting:</u> • See EPS # 52
	<u>Response strategy:</u> The primary response strategy in the event of a diesel spill to sea from the survey vessel will be to: • Immediate notification to RCC Australia • Allow small diesel spills to disperse and evaporate naturally, and monitor position and trajectory of any surface slicks
	<u>Spill monitoring:</u> • In the event of a major diesel spill from the survey vessel to the sea, Dolphin will implement relevant Type I "Operational Monitoring" implemented for spill surveillance and tracking • If there is a likelihood of a diesel spill impacting any protected areas (e.g. Rowley Shoals MP; Mermaid Reef CMR) Dolphin will: ○ Notify DPaW and / or DoE • implement the appropriate Type II "Scientific Monitoring" to understand the effects of the spill and any response activities on the marine environment
	<u>Stakeholder consultation:</u> • Pre-survey consultation with AMSA and DoT to ensure agreement in place for SOPEP interface with NATPLAN, WestPlan-MOP and WA DoT OSCP • Consultation in the event of a major diesel spill - relevant stakeholders (apart from Combat Agencies) will be contacted in the event of a large diesel spill occurring in the GPC MC MSS - Reduced Scope Polygon
	<u>Insurances:</u> Dolphin has public liability insurance that covers any pollution that could result in environmental damage. As such, this insurance would cover the cost of environmental monitoring or clean-up post spill
	Dolphin will have an agreement in place with a third party provider to undertake scientific monitoring appropriate to the nature and scale of the spill prior to commencing activities

6. SUMMARY OF THE RESPONSE ARRANGEMENTS IN THE OIL POLLUTION EMERGENCY PLAN

6.1. OIL POLLUTION EMERGENCY PLAN

The Oil Pollution Emergency Plan (OPEP) for the proposed GPC MC MSS, taking into account the nature and scale of the activity and the potential spill risks involved (see above) comprises components of the survey vessel SOPEP that manage the environmental impacts of a spill, supported as required by applicable established, statutory OPEPs (e.g. NATPLAN, WestPlan MOP, WA DoT OSCP). In summary, the following plans are in place as a contingency in the unlikely event of an oil spill, which as a whole, represent the OPEP for this activity:

- Survey vessel SOPEP - deals with spills which are either contained on the vessel or which can be dealt with from / by the vessel.
- National Plan for Maritime Emergencies (NATPLAN): Australian Maritime Safety Authority (AMSA) - is the Jurisdictional Authority (JA) and Control Agency (CA) for spills from vessel which affect Commonwealth waters, i.e. outside of 3 nm from the coast (AMSA, 2014b).
- WA State Emergency Management Plan for Marine Oil Pollution (WestPlan-MOP) and Department of Transport (DoT) Oil Spill Contingency Plan (OSCP) - deals with spills from the vessels which affect WA State waters (AMSA, 2011).

6.2. VESSEL SOPEP

The survey vessels' Shipboard Marine Pollution Emergency Plan Manual (SMPEP) plan constitutes the vessels' SOPEP, which has been prepared in accordance with the IMO guidelines for the development of shipboard oil pollution emergency plans (resolution MEPC.54(32) as amended by resolution MEPC.86(44)), includes emergency response arrangements and provisions for testing the SOPEP (oil pollution emergency drills), as required under Regulations 14(8AA), 14(8A) and 14(8B) to 14(8E) of the Environment Regulations

6.2.1. DRILLS AND TRAINING

A test of the oil spill emergency response arrangements will be conducted prior to commencement of survey activities. A Standard Operating Procedure (SOP) for the survey vessel is to undertake a minimum of four scheduled drills per annum. If response arrangements are significantly amended, testing of the updated response arrangements shall occur. The components of the *Sanco Swift* SOPEP for managing environmental impacts of a spill are included in **Appendix C** of the EP.

All drill tests will be reported as per MARPOL Annex I (Regulation 15) requirements and reviewed after each drill as part of the ongoing monitoring and improvement of emergency control measures. Identified improvements or recommendations shall be addressed as outlined in **Section 7**. The objective of testing is to ensure that the vessel SOPEP is current and applicable (including contact details) for dealing with a spill specific to the nature and location associated with the GPC MC MSS - Reduced Scope Polygon.

In compliance with Regulation 14(4) and 14(5) a designated Oil Pollution Prevention Team (OPPT) will be trained to ensure they are familiar with their tasks and the equipment in the event of an oil spill.

Implementation and testing of the survey vessels' SOPEP, plus adherence to the additional spill response and reporting measures will enable Dolphin to demonstrate that environmental risks from fuel and oil spills during the proposed survey have been reduced to ALARP.

6.3. EMERGENCY RESPONSE ARRANGEMENTS

The survey vessel Master will initiate the vessel SOPEP and first strike actions as outlined within it.

Due to the nature and scale of the activity, credible spill scenarios and characteristics of diesel, the initial response to any spill will be to monitor and evaluate. The preferred strategy for diesel spills will be to allow small spills to disperse and evaporate naturally, and monitor the position and trajectory of any surface slicks. Physical break up (using prop wash from the support / guard vessel(s)) by repeated transits through the slick may be considered for larger slicks (following consultation with the Combat Agency - AMSA or DoT).

Priority actions in the event of a fuel or oil spill are to make the area safe and to stop the leak and ensure that further spillage is not possible. All deck spills aboard vessel(s) will be cleaned-up immediately, using appropriate equipment from the on board spill response kits (e.g., absorbent materials etc.) to minimise any likelihood of discharge of spilt hydrocarbons or chemicals to the sea. A planned maintenance system (PMS) will be implemented on the survey vessel, to ensure that all equipment used during operations is in full working order, and does not represent a hydrocarbon spill risk.

6.3.1. COMMONWEALTH WATERS

For Commonwealth waters, initial actions will be undertaken by the survey vessel with subsequent actions determined in consultation with the regulatory authorities (AMSA) under NATPLAN, having regard to the potential impacts posed by the spill. AMSA has indicated that it does not require titleholders to directly consult on OPEPs for seismic surveys or those addressing the operations of offshore supply vessels (AMSA, 2014a). Such operations are already covered by existing NATPLAN arrangements. AMSA is the responsible Combat Agency (CA) for oil spills from vessels within the Commonwealth jurisdiction and will respond in accordance with its Marine Pollution Response Plan as approved by the AMSA Executive. Upon notification of an incident, AMSA will assume control of the incident (AMSA, 2014b).

6.3.2. STATE WATERS

If surface slicks appear likely to enter WA State waters (i.e. adjacent to the Rowley Shoals) then subsequent actions will be determined in consultation with the DoT under WestPlan-MOP and the OSCP. The DoT is the designated Hazard Management Agency (HMA) for oil spills from vessels within the WA State jurisdiction.

6.3.3. TYPE 1 OPERATIONAL MONITORING

In the event of an accidental event that resulted in a diesel spill to the waters surrounding the survey or support / guard vessel(s), Dolphin will be responsible for undertaking Type I “Operational Monitoring” (unless AMSA as control agency directs otherwise) that would have the primary objective of spill surveillance and tracking. This monitoring will be implemented to:

- determine the extent and character of a spill;
- track the movement and trajectory of surface diesel slicks;
- identify areas/ resources potentially affected by surface slicks; and
- determine sea conditions/ other constraints.

This monitoring will enable the survey Vessel Master to provide the necessary information to the relevant Combat Agency (AMSA or DoT) via a POLREP form to determine and plan appropriate response actions under NATPLAN (if this plan is activated). Operational monitoring and observation in the event of a spill will inform an adaptive spill response and scientific monitoring of relevant key sensitive receptors. In addition, provisions for real-time oil spill monitoring can be undertaken by a third party provider such as RPS- Applied Science Associates or Cardno, or by AMSA.

This Type I monitoring will be restricted to daylight hours only, when surface slicks will be visible from the vessel(s), (or via aerial surveillance if available). The information gathered from this monitoring will be passed on to AMSA, via

the POLREP form, but also via ongoing SITREP reports following the initial spill notification to RCC Australia. Dolphin believe that the arrangements in place are ALARP and acceptable.

6.3.4. TYPE II SCIENTIFIC MONITORING

ADIOS2 spill modelling indicates that surface slicks, and possibly entrained oil, from an MGO spill of 135 m^3 may contact Bedwell and Cunningham islands and associated shallow water environments within the Rowley Shoals Marine Park. However, if this scenario occurs, Dolphin will work with the relevant stakeholders to develop and implement appropriate Type II "Scientific Monitoring" to understand the effects of the spill and any response activities on the marine environment. This scientific monitoring will have a focus on relevant environmental and social values and sensitive receptors.

Relevant stakeholders may include, but not be limited to, the following:

- Combat Agency (WA DoT);
- WA Environmental Protection Authority (EPA);
- WA Conservation and Parks Commission (CPC);
- WA Department of Parks and Wildlife (DPaW);
- NOPSEMA;
- appropriate marine research and monitoring organisations, such as:
  - WA Marine Science Institution (WAMSI);
  - Australian Institute of Marine Science (AIMS);
  - UWA Oceans Institute; and
  - environmental consultancy companies with appropriate expertise and experience in hydrocarbon spill monitoring
- marine contractors able to provide appropriate vessels for inshore/shallow water work in the Rowley Shoals; and
- key marine users in these protected areas.

This scientific monitoring will focus on a number of key environmental and social values and sensitive receptors, including (but not limited to):

- sediment and water quality, particularly for the pristine waters of the Rowley Shoals and Mermaid Reef;
- benthic primary producer habitat (BPPH):
  - coral reef communities;
  - macroalgal and seagrass communities; and
- rocky shore/intertidal reef platform communities;
- sub tidal soft-bottom communities;
- whales;
- whale sharks;
- turtles
- seabirds;
- finfish;
- benthic invertebrates;
- commercial and recreational fishing; and
- tourism.

Dolphin has financial assurance policies in place. Such as, Protection and Indemnity (P&I) insurance which is subject to the GARD Club rules covering environmental liability. i.e. the costs of any Type I operational monitoring and Type II scientific monitoring required in the event of a large hydrocarbon spill resulting from its' activities, or required to cover the costs of any clean-up or remediation activities following a spill. These policies cover activities in Australian Commonwealth and State/Territory waters, including the GPC MC MSS.

6.3.5. REPORTING, MAINTENANCE AND REVIEW

Any fuel or oil spills aboard either the survey or support / guard vessel(s) must be reported to Dolphin via the internal Dolphin Event Reporting Management. In the event of spillage of any oil or diesel spills to the sea, AMSA or DoT will be notified by the survey vessel Master immediately (via RCC Australia using a POLREP form) to ensure prompt and appropriate mobilisation of relevant response plans. Any significant spills (greater than 80 L) will be reported to NOPSEMA by Dolphin, as reportable incidents.

A planned maintenance system (PMS) will be implemented on the survey and support / guard vessel(s), to ensure that all equipment used during operations is in full working order, and does not represent a hydrocarbon spill risk. Stocks of absorbent materials aboard the survey vessel will be checked for their adequacy and replenished as necessary prior to the commencement of activities.

The OPEP will be regularly reviewed to ensure it is appropriate to the nature and scale of the activities within its scope and to ensure maintenance of the response capability and the operator's preparedness. In compliance with Regulation 14(8AA) the OPEP will be continuously reviewed and kept up-to-date to ensure new information or improved technology can be incorporated as specifies in the SOPEP.

7. SUMMARY OF THE ARRANGEMENTS FOR ONGOING MONITORING OF THE TITLEHOLDERS PERFORMANCE

The following arrangements will be established to review environmental performance of the activity:

- A summary of the EPO, EPS and MC for the activity (ECR) will be distributed aboard the survey vessel. These will be monitored on a regular basis, by the SEA via mechanisms such as:
- Pre-start vessel inspection will be undertaken at the project mobilisation stage by the SEA. If a support / guard vessel(s) is mobilised from another port, an environmental advisor will visit the vessel prior to the survey start to conduct the initial inspection.
- Weekly inspections completed by SEA. Support / guard vessel(s) will be visited when possible at crew changes or via small boat transfers in the operational area. The SEA will check the NOPSEMA website for new surveys as per environmental performance standard #66.
- An inspection(s) of the vessels will be carried out before or during the activity to ensure that procedures and equipment for managing routine discharges and emissions are in place to ensure compliance with the EP.
- A test of the oil spill emergency response arrangements will be conducted during the mobilisation phase of the survey (unless a test has already been undertaken in Australian waters within a month prior to mobilisation) to ensure vessel SOPEP is current and applicable.

Any non-conformances shall be reported, tracked and closed-out.

Dolphin Management will review environmental performance upon completion of the activity. The results of the review and any identified improvements or recommendations will be incorporated into processes and procedures for future surveys to help facilitate continuous improvement.

Management of changes to scope (e.g. timing, location or survey details described in this EP) are the responsibility of the Dolphin VOM. The scope of this EP covers MC3D surveys over specific petroleum titles and adjacent vacant acreage within the GPC MC MSS polygon over a period of up to 6 months (July to December 2015).

Notification to other government authorities, where required, will be undertaken by the TGS Vessel Operations Manager. Notifications will include details of the change and procedures that will be put in place for managing or mitigating the additional or modified risks.

8. DETAILS OF CONSULTATION ALREADY UNDERTAKEN, AND PLANS FOR ONGOING CONSULTATION

Consultation with stakeholder groups, primarily within the commercial fishing industry, concerning the proposed GPC MC MSS has taken place prior to, and during the preparation of this EP. The stakeholder consultation will be undertaken in phases as described below:

- Phase 1: Preparatory Consultation:
  - Stakeholders notified of the proposed GPC MC MSS.
- Phase 2: Ongoing Consultation:
  - Relevant key stakeholders (e.g. commercial fisheries and shipping stakeholders) informed of further details of the proposed activity (e.g. start date, vessel communication information, extent of towed array etc.).
- Phase 3: Post-survey Notifications:
  - Includes complying with requests from stakeholders for notification of the completion of the survey.

The following fisheries bodies and organisations were originally informed of the survey, via letters or emails sent on 12 January 2015 as part of Phase 1: Preparatory Consultation.

- Australian Fisheries Management Authority (AFMA)
  - Represents all Commonwealth fisheries licence holders: the North West Slope Trawl Fishery (NWSTF); Western Skipjack Tuna Fishery (WSTF); and Western Tuna and Billfish Fishery (WTBF).
- Australian Recreational Fishing Foundation (ARFF)
- Broome Fishing Club
- Commonwealth Fisheries Association (CFA)
  - Represents all Commonwealth fisheries licence holders.
- Kimberley Professional Fishermen's Association (KPFA)
- Mary Island Fishing Club (Derby)
- MG Kailis Group
- Northern Wildcatch Seafood Australia (NWSA)
  - Represents WA State fishery licence holders in the Northern Demersal Scalefish Fishery (NDSF)
- Recfishwest
  - Represents recreational fishers, divers / snorkelers, spear fishers and charter boat operators.
- WA Department of Fisheries (DoF)
- WA Fishing Industry Council (WAFIC)
  - Represents all State Fishery Licence holders & North West Slope Trawl and Western Deepwater Trawl licence holders
- Westmore Seafoods
  - Represents Commonwealth fishery licence holders in the North West Slope Trawl Fishery (NWST)

- Mackerel Managed Fishery (MMF);
- Northern Demersal Scalefish Managed Fishery (NDSF);
- Pilbara Trap Managed Fishery (PTMF);
- Pilbara Line Fishery (PLF); and
- West Coast Deep Sea Crustacean (Interim) Managed Fishery (WCDSCF)

Eighty six (86) separate individuals or entities holding licences were identified across the seven WA State-managed fisheries. These individuals or entities will often hold more than one licence either within a fishery or across multiple fisheries. Stakeholder letters were sent on 12 February 2015 to all licence-holding individuals or entities, informing them of the proposed activities.

In addition, the following government departments and agencies were informed of the proposed activities, via letters or emails sent on 12 February 2015.

- Australian Hydrographic Service (AHS)
- Australian Maritime Safety Authority (AMSA)
- Department of the Environment - including the Commonwealth Marine Reserves Branch (CMRB)
- Department of Defence (DoD)
- WA Department of Environment Regulation (DER)
- WA Department of Mines and Petroleum (DMP)
- WA Department of Parks and Wildlife (DPaW)
- WA Department of Transport (DoT)
- International Fund for Animal Welfare (IFAW)
- Centre for Whale Research (CWR)

Department of Fisheries (DoF) was contacted on 24th March 2015 after it became apparent that they had not received an initial notification.

The letter provides information concerning the location, timing and nature of the proposed activities, and provides contact details should stakeholders wish to seek further information.

Charter Boat Operators' that are licensed to visit Rowley Shoals were contacted on 19th May 2015 after DPaW notified Dolphin they were unable to supply information to them on Dolphins behalf. This letter is a similar format as the initial letter but showing the reduced polygon as was sent to:

- Odyssey Expeditions
- Absolute Ocean Charters
- Reel Teasers
- Lindblad Expeditions
- Sealife Charters
- The Great Escape Charter Company
- K20 Kimberley To Ocean
- Kimberley Expeditions
- True North
- Kimberley Quest
- Blue Sun2
- Kimberley Boat Cruises

8.1. PHASE 2 - PRE-SURVEY CONSULTATION

At least three (3) weeks prior to commencing the GPC MC MSS, Dolphin will contact relevant stakeholders to provide detailed information for the proposed activity, location and geographical coordinates for the polygon, timing and duration, parameters for the towed seismic array (airgun array, towed streamer equipment, tail buoy etc.), and details of the survey vessel and support / guard vessel(s). At this point, stakeholders will have a further opportunity to raise any specific concerns or issues with Dolphin, regarding the proposed survey.

Pre-start notifications were sent out to all stakeholders on 8th May 2015 in anticipation of mobilisation for the end of May/ beginning of June. Three replies have been received: AHS, AMSA and DPaW.

As a change of scope, being a large reduction in the size of the polygon and its movement away from sensitive environments of the Rowley Shoals and Mermaid Reef, resulted in no new or increased risk but a reduction of risk, stakeholders were not be notified of the change. This is also to minimise stakeholder fatigue as individuals and entities in the area have been inundated with stakeholder letters over recent months due to increased seismic activity in the North West Shelf.

Prior to the commencement of the proposed survey, Dolphin will consult with the offshore E&P industry to determine if other seismic operations may be in tha area.

Recfishwest, relevant recreational fishing groups/organisations and commercial fishers (as requested) will be issued a 7-10 day forecast prior to activities commencing. DPaW will receive notification one (1) week prior to activities commencing as well as the 7-10 day forecast for dissemination to Charter Boat Operators and tourists accessing Rowley Shoals. Individual Charter Vessel Operators that have been contacted through pre-survey consultation will be contacted directly.

8.1.1. PHASE 3 - ONGOING CONSULTATION AND PHASE 4 - POST SURVEY NOTIFICATION

Consultation with stakeholders will be ongoing throughout the period the GPC MC MSS EP is valid. Dolphin will comply with requests by stakeholders for additional information and requests for updates during activities undertaken within the GPC MC MSS.

As required under sub regulation 16(b), Dolphin will assess the merits of any new claims or objections made by a stakeholder whereby they believe the activity may have adverse impacts upon their interest or activities. If the claim has merit, where appropriate, Dolphin shall modify management of the activity.

If a significant new or increased impact or risk is identified, as required under subregulation 17 (6), and it is not already appropriately covered under the EP, Dolphin shall submit a proposed revision to the EP. Dolphin shall determine at the time of the assessment, whether a risk or impact is considered 'significant' based on information available at that time.

On completion of the survey, a notification will be sent to the relevant stakeholders or those that request post-survey notification.

8.2. MERITS OF THE STAKEHOLDER OBJECTIONS AND CLAIMS

An assessment of the merits of objections or claims about the adverse impact of the GPCMC MSS was made, and where practicable those with merit were incorporated into the survey design. The following objections and claims were identified (note where possible these have been grouped into common themes):

Common Theme	Stakeholder Concern Raised	Dolphin Assessment of Merits and Comments
Fisheries	• Consultation advice from AFMA: • Consultation with relevant fisheries licence holders is being undertaken.	• Dolphin has begun consultation with the relevant fisheries licence holders and other fishery organisations and representative bodies that have interests in the area within and adjacent to the polygon. • Consultation with stakeholders will be ongoing throughout the period the GPC MC MSS Environment Plan is valid. • Dolphin will continue to liaise with AFMA via stakeholder consultation updates and notifications.

	• Consultation advice from DoF:
	  ▪ Identified fisheries licence holders in the area
	  ▪ fish spawning times; and
	  ▪ requirements for biosecurity.
		• 1. Consultation
		  ▪ Department of Parks and Wildlife, Commonwealth Department of Environment - Marine Reserves Branch, WAFIC and Recfishwest were consulted as part of the preparatory consultation during preparation of the Environment Plan (EP) for the proposed activity.
		  ▪ Dolphin obtained extracts from the Public Register held by the WA Department of Fisheries (DoF) for the relevant State-managed fisheries that can operate in the waters overlapped by the GPC MC MSS.
		  ▪ Dolphin thanked DoF for bringing to our attention to consult with individual licence holders in the Pearl Oyster Managed Fishery (POMF) via the peak industry body for this fishery – Pearl Producer Association (PPA). The PPA has previously advised Scope Resources that they wish to be considered a 'relevant persons' for seismic surveys that are located within the 100 m contour, in particular those adjacent to Eighty Mile Beach. As the majority of the GPC MC MSS polygon (as defined in Rev0 of this

Common Theme	Stakeholder Concern Raised	Dolphin Assessment of Merits and Comments
		submission) is located beyond the 100 m contour, i.e. less than 0.2% of the polygon lies in water depths 90-100 m (see Appendix I - 8a), the PPA was not deemed a 'relevant persons' for this project. ▪ Forty-three separate individuals or entities holding (86) licences were identified across the different fisheries, and informed of the proposed activities on 12 February 2015 via email and posted letters. ▪ Dolphin has not received any responses from individual licence holders contacted during the Phase 1 stakeholder consultation period, which has now been more than 60 days. ▪ Prior to the commencement of the GPC MC MSS, Dolphin will undertake further consultation with the DoF and other stakeholders. This additional consultation will take place a minimum of three weeks prior to the planned commencement of the GPC MC MSS, and will include all of the stakeholders (i.e. WAFIC, Recfishwest, individual licence holders etc.) contacted as part of the preparatory consultation process. • 2. Fisheries Licences ▪ Dolphin and Scope Resources has conducted an analysis of the State and Commonwealth-managed commercial fisheries licence areas that overlap the GPC MC MSS, and has determined which of these fisheries may be directly or indirectly affected by the survey. An assessment has also been undertaken regarding potential recreational fisheries and charter companies that may operate in the vicinity of the GPC MC MSS polygon (as defined in Rev0 of this submission). This information has been included in the EP. ▪ Scope Resources contacted DoF Aboriginal liaison officer on the 13 April 2015, and confirmed that Aboriginal customary fishing activities are not conducted within or immediately adjacent to the GPC MC MSS polygon (as defined in Rev0 of this submission). Customary fishing activities in this region tend to be focussed on the intertidal zone adjacent to Eighty Mile Beach. • 3. Fish spawning ▪ Specific control/mitigation measures have been included in the EP to minimise the potential impacts of the proposed seismic survey on fish spawning. This includes: ▪ the use of the smallest possible seismic source; and ▪ the use of soft starts of the seismic source. • 4. Biosecurity ▪ The EP outlines management strategies to minimise the likelihood of introducing marine pests or disease including inspection and cleaning of the survey vessel hull, other niches, and immersible towed equipment (e.g. airgun array, streamer and tail buoy) prior to entry into WA waters and ports. As required by the Department's policy, the suspected or confirmed presence of any marine pest or disease will be reported within 24 hours by email or telephone, and this requirement will be communicated directly to the operator of the survey vessel (Dolphin).
Marine Safety	• Consultation advice from AMSA: • Concerns raised about shipping safety and interaction with fishing and shipping vessels • Requests were made from AMSA: ▪ Upon completion of the survey, feedback on the operations and the interaction with commercial shipping at the time of the survey. ▪ Lessons learnt with regard to the amount and type of vessels sighted in the area of operations. ▪ Requests for the 7 - 10 day forecasts were made	• Dolphin are committed to prioritising the health and safety of every person involved in our operations and will therefore: ▪ Inform all GPC MC MSS vessel operators of: ▪ AMSA spatial website; ▪ GIS spatial data downloads available; and ▪ Online monthly shipping traffic updates. ▪ Continue to liaise with AMSA's Nautical Advice department via stakeholder consultation updates and notifications. ▪ Consult with AMSA RCC to for NAVAREAX warnings broadcasts before any operations commence. ▪ Consult with AHS for the promulgation of the NTM. ▪ Actively communicate with commercial shipping in the area and keep records of these interactions in order to provide AMSA with meaningful feedback after the completion of the survey.

Common Theme	Stakeholder Concern Raised	Dolphin Assessment of Merits and Comments
		▪ Display appropriate daytime warning beacons and appropriate night-time lighting in order to alert vessels in the area that the vessel is towing equipment and is restricted in manoeuvrability. ▪ Maintain visual and radar watches at all times in accordance with the *Navigation Act 2012*. • Dolphin will provide ASMA with Lessons learnt and information regarding interactions with fishing and shipping vessels • Dolphin will provide the 7-10 day forecasts to stakeholders as requested
EPBC Protected Matters Impacts	• Concerns were raised by Centre for Whale Research regarding the survey timing (commencing in May 2015 for 3.5 months): ▪ it will directly impact northbound humpback whales en route to their calving grounds in the Kimberley. ▪ potential to block the calving grounds for pregnant females unwilling to pass your vessel, and at the very last would result in numerous shutdowns for the ship. ▪ Recommend that the survey be completed by July 15 at the latest when the majority of the pregnant females in this population are likely to be approaching the Kimberley.	• The GPC MC MSS polygon (as defined in Rev0 of this submission) is not in the middle of the main northern migratory corridor. • It is possible that some humpbacks could be encountered during surveys in the period May to mid-July 2015, but these encounters are likely to be limited to activities in the south-eastern part of the polygon that overlaps shelf waters <200 m in depth. • Given the separation distance between the polygon and parts of the migratory pathway where the majority of animals are likely to be moving, it is unlikely that there will be a significant number of encounters. • The operational area is not in the middle of the main northern migratory corridor. It is possible that some humpbacks could be encountered during surveys in the period May to mid-July 2015, but these encounters are likely to be limited to activities in the south-eastern part of the operational area that overlaps shelf waters <200 m in depth. Given the separation distance between the operational area and parts of the migratory pathway where the majority of animals are likely to be moving, it is unlikely that there will be a significant number of encounters. • The location of the defined BIA and the movements of humpbacks during the northern migration has been further confirmed by recent satellite tagging and tracking work. The results described in the Double *et al.,* (2012) report indicated that, for the 2011 season, the whales tended to be within 50 km of the coast in the region between North-west Cape and Camden Sound. This report also concluded that "*The width of the migratory corridor revealed by the tagged whales was frequently less than 60 km. There was little evidence that the whales tended to venture further from shore and into deeper water at any point on their northward migration.*" • The following control measures will be implemented to minimise potential impacts on humpback whales: ▪ Operation of the seismic source within the GPC MC MSS polygon (as defined in Rev0 of this submission) at all times during the survey must comply with all requirements of the EPBC Act Policy Statement 2.1 - Part A Standard Management Procedures, including: ▪ Precaution zones (Observation zone: 3 km+; Low power zone: 2 km; and Shut-down zone: 500 m); and ▪ if the acoustic source is required to power-down / shutdown three or more times during the preceding 24-hour period as a result of sighting pygmy blue whales, then the seismic operations must not be undertaken thereafter at night-time or during low visibility conditions. Seismic operations cannot resume at night-time or during low visibility conditions, until there has been a 24-hour period, which included seismic operations during good visibility conditions, during which no power-downs / shut-downs have occurred for pygmy blue whale sightings. • The following Part B Additional Management Procedures will also be implemented: ▪ Two dedicated Marine Fauna Observer (MFO) on the survey vessel for entire duration of the survey. • During the peak northbound migration period for humpback whales in the region (1 July to 31 August): ▪ application of increased precaution zones (Observation zone: >3 km; Shut-down zone: 2 km); and ▪ application of an increased Pre Start-up Visual Observation of 45 minutes, rather than 30 minutes. The increased pre start-up

Common Theme	Stakeholder Concern Raised	Dolphin Assessment of Merits and Comments
		visual observation period is to allow for the possibility of longer dive times for humpback whales.
	• Concerns were raised by IFAW regarding Dolphins considerations of cumulative impacts. • Given the overlap with biologically important area for pygmy blue whale, concerns were raised regarding: ▪ What information Dolphin is using to determine which cetacean species may be present ▪ What data gaps have been identified ▪ What Dolphin is doing to address data gaps ▪ How Dolphin is ensuring the best possible change of detecting cetacean during the survey ▪ What measures Dolphin will take to minimse risk to cetaceans ▪ What methods Dolphin has used to estimate the level of risk reduction that these measures provide.	• Dolphin recognises that deterioration of 'acoustic habitat' is affected by shipping and not only seismic noise. ▪ Dolphin will implement a 40 km separation to other seismic surveys, which is supported by an environmental review by BOEM. This will provide a corridor for transit of migrating cetaceans within which adverse affects are not anticipated. ▪ Any concurrent or sequenctial surveys will be short-term and not cause population-level effects further supported by the fact that the migration pathway is not narrow or constitutes 'critical habitat. ▪ Over the past 30-40 years there has been seismic surveying on the north west shelf but no records of population level effect. Humpback whales population continues to increase by 11-12% per year. ▪ Proposed surveys accepted by NOPSEMA may not eventuate as seismic proponents seek to obtain environmental approval in the hope of attracting the underlying titleholder as a client. • Dolphin will use all relevant sources of public information to determine cetacean diversity and prevalence of sensitive areas. • Primary knowledge gap relates to the movement of pygmy blue whales which is limited by small sample sizes and limited understanding of Browse Cliffs feaures which could be a key habitat for pygmy blue whales. • Dolphin support research initiatives through the peak industry bodies such as APPEA and will employ MFOs on board the survey vessel which will facilitate reporting of cetacean sightings to the DoE. • Two MFOs will be used on board the survey to implement EPBC Act Policy Statement 2.1 Part A as well as Part B when overlapping the pygmy blue whale BIA. Further adaptive management will be implemented where cetacean sighting are greater than anticipated.
Adherence to Marine Park Management Plans	• Dolphin contacted the Commonwealth Marine Reserves Branch on the 30 January 2015 requesting clarification as to whether the seismic vessel whilst towing seismic equipment is permitted to transit the Mermaid Reef CMR. • CMRB responded on the 30 January 2015 with the following advice: ▪ As you may be aware the definition of mining operations in the EPBC Act is broad – see section 355(3). A seismic survey vessel towing a seismic array would be regarded as engaged in a mining operation, and therefore not permitted under Mermaid Reef CMR's transitional management arrangements.	• Dolphin acknowledge that the seismic vessel is not permitted to transit the Mermaid Reef CMR whilst the seismic equipment is deployed and in tow and has incorporated this into the EP (see EPS # 36).

Common Theme	Stakeholder Concern Raised	Dolphin Assessment of Merits and Comments
	• DPaW have requested Dolphin to acquire and interpret the following information to assist with the assessment of the survey: ▪ an inventory, relevant to the survey period, of species that may occur within Rowley Shoals Marine Park and are specially protected under the Wildlife Conservation Act 1950; ▪ maximum received sound exposure levels (SELs) within Rowley Shoals Marine Park; ▪ a comparison between the received SELs in Rowley Shoals Marine Park and levels likely to trigger the behavioural disturbance of specially protected species that may be present in the marine park during the proposed seismic survey; ▪ survey design and operational management procedures that will be implemented in order to avoid, or minimise impacts on protected wildlife and marine park values; ▪ clarification regarding the footprint of seismic data acquisition and any additional areas required for proposed operations, in particular whether access to the marine park is proposed for vessel turns (guns off, or powered down) or any other commercial purpose associated with the proposed survey.	• Dolphin has acquired and undertaken all of the information requests as suggested by the DPaW and incorporated the findings into the GPC MC MSS Environment Plan. • Acoustic modelling has been undertaken for the proposed acoustic source size for the survey. • Source levels and sound propagation comparisons have been assessed for the survey parameters. • Dolphin sent a reply to DPaW on the 9 March 2015. Dolphin also included the acoustic modelling results undertaken for the survey in the response
Adherence to WA State water Regulations	• DMP requested additional information from Dolphin: ▪ Does the boundary shown in the maps provided account for line run outs/vessel turns and soft start procedures? ▪ How close will the vessel acquire to the Mermaid Reef Marine Park and the Rowley Shoals Marine Park? How have impacts been determined to be ALARP? ▪ The notification states that 'at sea refuelling will only take place during daylight hours and will not take place within a distance of 25 km from any emergent land or shallow water feature – does this include Clerke, Imperieuse and Mermaid reefs? ▪ The survey is planned to commence in May for a duration of 3.5 months. How will Dolphin Geophysical ensure that impacts to migrating whales will be managed to ALARP? ▪ Has Dolphin Geophysical consulted recreational dive charters that operate at the Rowley Shoals?	• Yes the polygon includes line run outs/vessel turns and soft start, • The polygon is 4 km from the Mermaid Reef and 33km from Rowley Shoals • Provide an overview of Dolphins risk assessment process and how risks are determined to be ALARP, with detail provided for impacts relating to noise and hydrocarbon spills (Information taken directly from EP) • That at-sea refuelling will only take place during the day and more than 25 km from Mermaid and Rowley Reefs (being counted as emergent) • Proposed mitigation, including implementation of Policy 2.1, to ensure impacts to migrating whales are ALARP. • Yes, Dolphin will / has consulted with dive charter boats
Diving and Fishing	• Concerns raisedby Odeyssey Expeditions if survey is within 500m of the eastern and northern edge of Clerke and Mermaid Reef. No blue water dives are proposed.	• Dolphin explained (via phone conversation) that the seismic vessel would be located more than 10 km from proposed dive sites at Mermaid Reef.

Common Theme	Stakeholder Concern Raised	Dolphin Assessment of Merits and Comments
Commercial Tour Operators	• Tour operator has experienced a seismic survey at Scott Reef and they worked out a plan without disruption to either party.	
	• Concerns raised by True North regarding ▪ noise pollution for divers and snorklers whilst they are in the water. ▪ what will the effect be on flora and fauna. ▪ Polarcus will be conducting seismic surveys in the area during the same timeframe.	• Dolphin responded 10th June 2015 outlining the distance between identified dive sites and the noise levels predicted at Mermaid reef, which are anticipated to be well below thresholds that induce startle responses in marine fauna. The response further outlined that SCUBA equipment is expected to yield greater noise levels than the seismic noise at the distances involved. Dolphin further highlighted that True North will be included in pre-mobilisation consultation and if they require can be issued with a 7-10 day forecast. • Dolphin outlined the strategies adopted to mitigate impacts to diver experience including a joint risk assessment which could result in a SIMOPS plan being developed. Further Dolphin informed stakeholder that they may request that seismic acquisition is stopped immediately prior to and while divers/snorkelers are in the water if they perceive that the diver experience is compromised. • Dolphin further highlighted strategies to maintain awareness of other survey going at the same time as the GPC MC MSS and would maintain a minimum separation distance of 40 km. In the case of Capreolus, the distance between the two would be more than 140 km and that therefore the two surveys would not have additive effects on Mermaid or Clerke Reef.

9. DETAILS OF THE TITLEHOLDER AND LIAISON PERSON

As required under Regulation 15, details for Dolphin as the Titleholder and nominated liaison person for the GPC MC MSS EP are as follows:

Nominated liaison person:	Ian Edwards
Name:	Dolphin Geophysical
Business address:	Brockbourne House 77 Mount Ephraim Tunbridge Wells Kent TN4 8GN
Telephone:	+44 (0) 1892 701 015
Email address:	ian.edwards@dolphingeo.com
ABN:	95 585 497 039

The Regulator will be notified according to the requirements of Regulation 15(3), of changes to the titleholder or nominated liaison. Dolphin will submit in writing to the Regulator; within 30 days of the change, information regarding a change in:

- the titleholder;
- the titleholder's nominated liaison person;
- contact details for the titleholder; and
- contact details for the liaison person.

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11. APPENDIX 1 - BIOLOGICALLY IMPORTANT AREAS IN RELATION TO THE GREATER PINA COLADA MC MSS - REDUCED SCOPE POLYGON

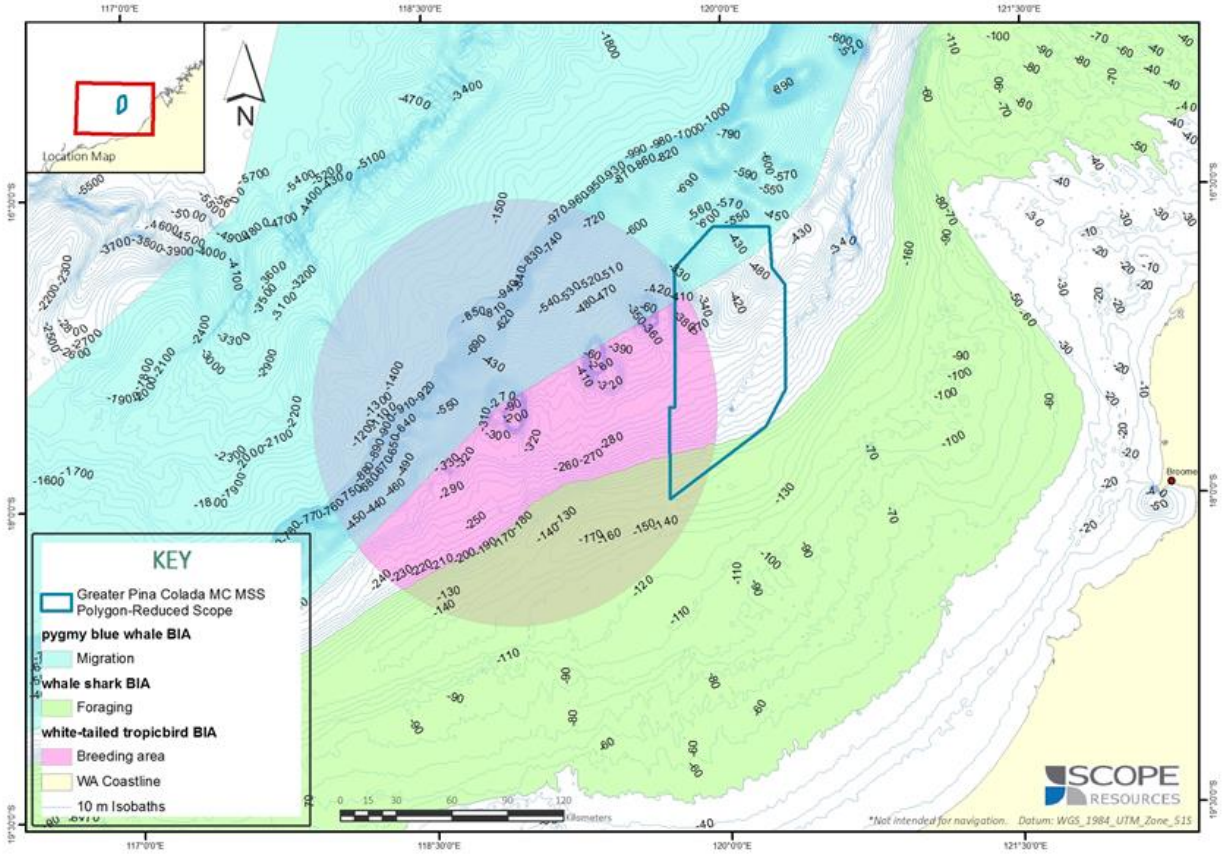

Figure A - BIA for the pygmy blue whale, whale shark and white-tailed tropic bird