



# Rocket Multi-Client 2D Marine Seismic Survey

## Environment Plan Summary

Spectrum Geo Pty Ltd

Revision 3

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# 1 INTRODUCTION

## 1.1 OVERVIEW

Spectrum Geo Pty Ltd (Spectrum) proposes to acquire a multi-client two-dimensional (MC2D) marine seismic survey (Rocket MC2D MSS) within the Houtman Sub-basin offshore from Western Australia (WA), between late August and the end of October 2015. The survey will comprise acquisition of approximately (~) 6,885 line kilometres (km) of 2D seismic data.

## 1.2 LOCATION

The survey will be divided into two separate phases – Phase 1 and Phase 2, and acquisition will occur within defined operational areas that are located entirely in Commonwealth waters. The Phase 1 operational area, which is located offshore from Gascoyne region between Ningaloo Reef and Shark Bay, incorporates the majority of the WA-492-P permit, 100% of the WA-493-P permit, and adjacent open acreage areas (see **Figure 1–1**). The Phase 2 operational area, which incorporates the entirety of the WA-512-P permit and the north-western part of the W13-20 Release Area, is located offshore from Kalbarri, between Shark Bay and the Houtman Abrolhos Islands (see **Figure 1–2**). The Phase 2 operational area excludes the Abrolhos Islands.

The areas defined as the Phase 1 and Phase 2 operational areas are the physical areas used for full power data acquisition along the sail lines, plus an additional area for line run-outs (required to obtain full fold coverage), line turns, line run-ins, soft-start procedures and vessel maneuvering.

Water depths in both the Phase 1 and Phase 2 operational areas range from >50 m to ~4,000 m, with the deepest water depths occurring along the western edges of both operational areas.

Boundary coordinates for the Phase 1 and Phase 2 operational areas are provided in **Table 1-1**.

**Table 1-1 - Rocket MC2D MSS Phase 1 and Phase 2 operational areas – boundary coordinates**

Phase 1 Operational Area		Phase 2 Operational Area	
Latitude	Longitude	Latitude	Longitude
Decimal degrees	Decimal degrees	Decimal degrees	Decimal degrees
-22.61667	110.66667	-26.97021	110.43102
-27.23964	110.66699	-29.02520	111.99787
-27.24001	113.59001	-27.84660	113.98540
-25.41794	112.66886	-27.53538	113.91193
-24.42917	112.66886	-26.16293	112.97257
-23.76554	113.33333	-25.64510	112.75364
-23.58333	113.33333		
-23.58336	113.41150		
-23.27128	113.41173		
-23.27170	113.44094		
-23.13988	113.44245		
-22.92743	113.41199		
-22.62130	113.41222		

Datum: WGS84

Figure 1-1 - Rocket MC2D MSS – Phase 1 operational area

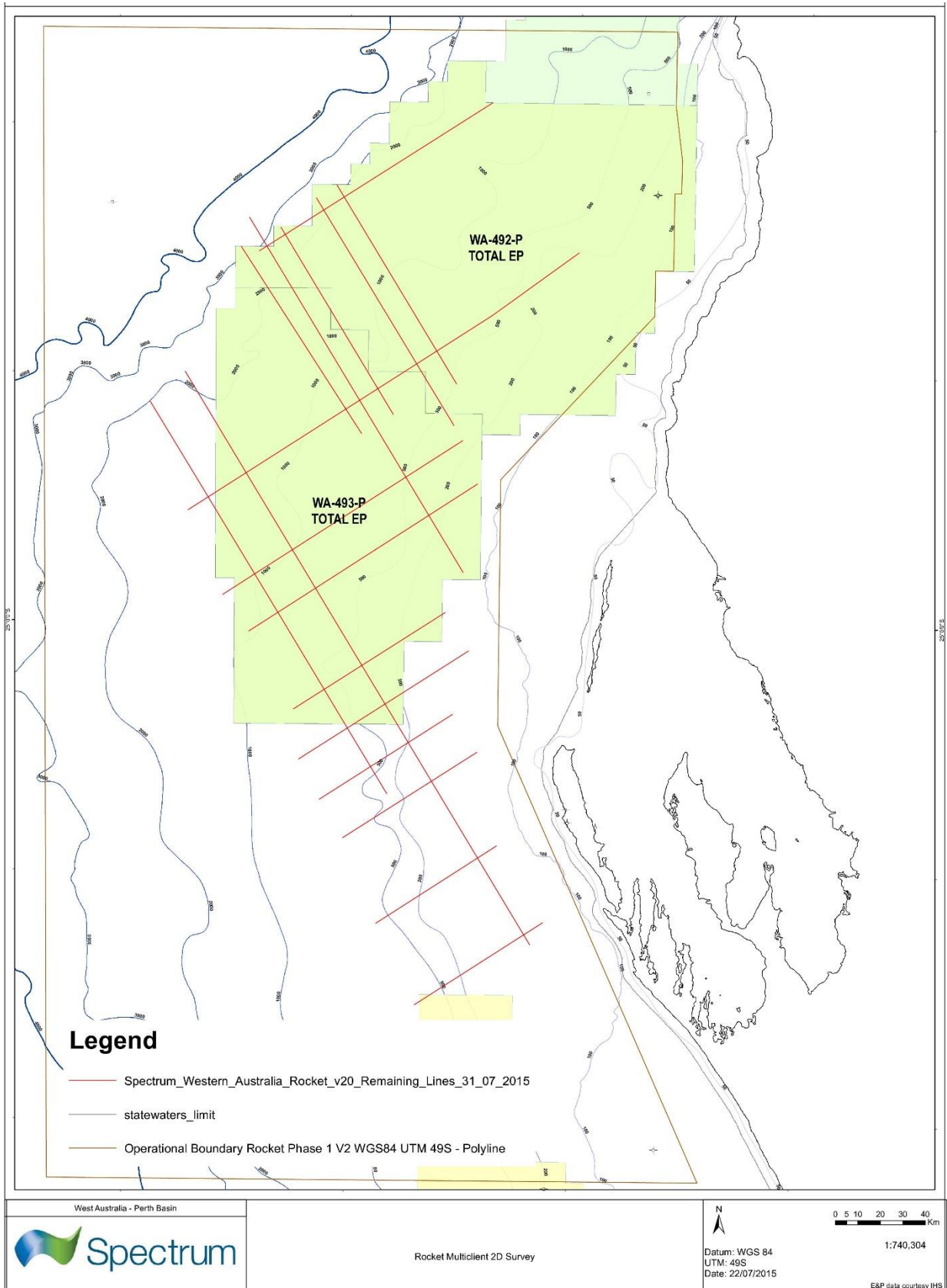
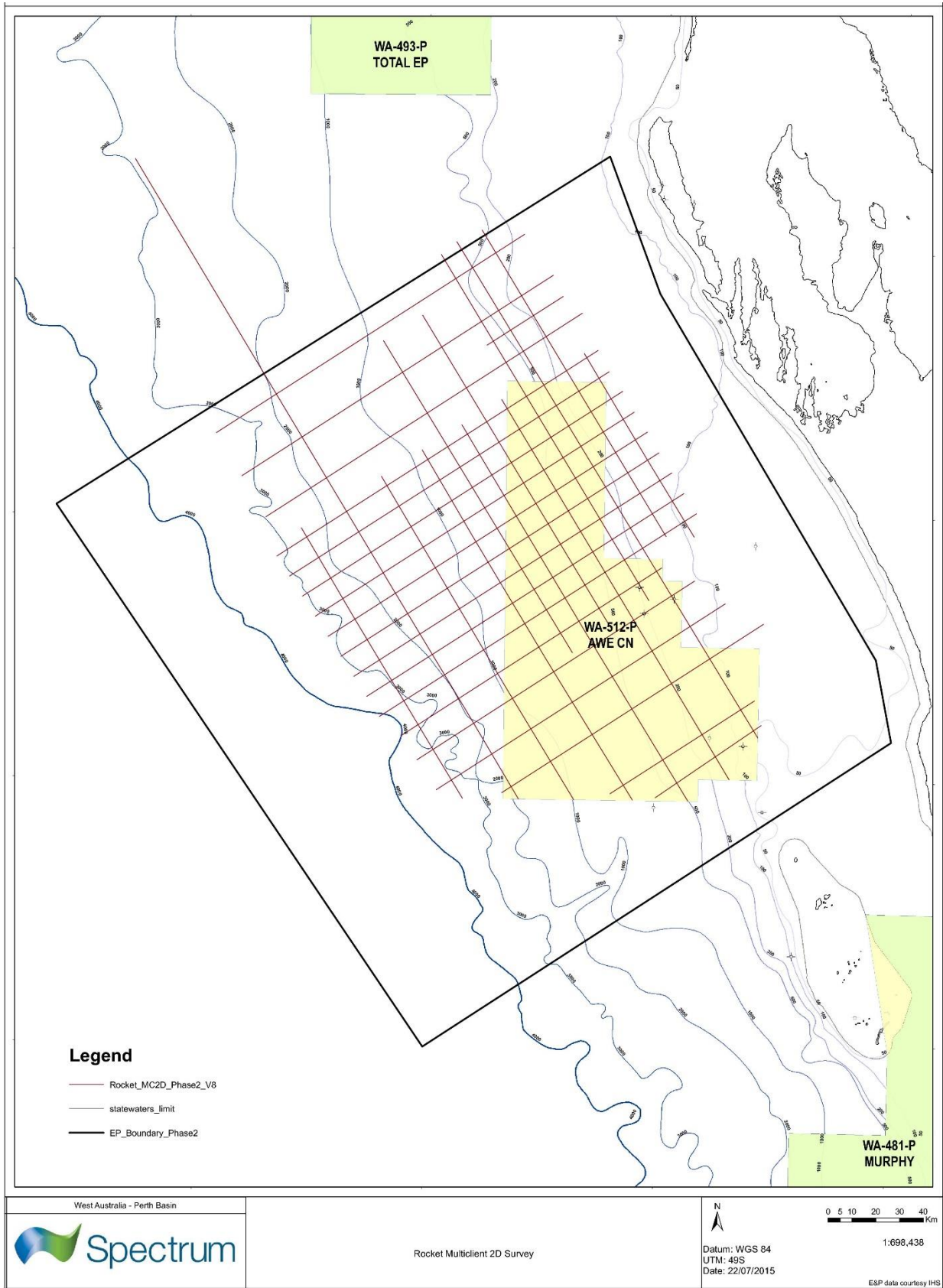


Figure 1-2 - Rocket MC2D MSS – Phase 2 operational area



## 2 EXISTING ENVIRONMENT

### 2.1 REGIONAL SETTING

The Rocket MC2D MSS Phase 1 and Phase 2 operational areas cover a large area of Commonwealth waters off WA. The polygons extend from the North-west Marine Region (NWMR) adjacent to Point Cloates, WA to the northern portion of the South-west Marine Region (SWMR) offshore from Geraldton. The NWMR and SWMR include Commonwealth waters, between the WA State waters boundary (3 nm from the territorial baseline) and the Australian Exclusive Economic Zone boundary (200 nm from the low water mark).

### 2.2 CLIMATE AND METEOROLOGY

The Phase 1 operational area lies mostly in the NWMR and is described as having a monsoonal climatic pattern, characterised by a distinct cyclone season from December-March. The Phase 2 operational area lies mostly in the SWMR and is described as having a Mediterranean climate, characterised by warm dry summers and cool wet winters. Lower rainfall and humidity are typically associated with the Southeast Monsoon, in contrast to the high levels of rainfall and humidity associated with the Northwest Monsoon.

The Phase 1 operational area is predicted to receive wind speeds of ~10-20 knots from a north-westerly direction in summer (January) and ~8-10 knots from a south-westerly direction in winter (July). The Phase 2 operational area is expected to receive wind speeds of ~10-15 knots from a north north-easterly direction in summer, and ~10-20 knots from a south south-easterly direction in winter.

The NWMR has a very high cyclone incidence and these occur primarily between December and March. Typically, cyclones move south-west across the Arafura and Timor Seas. Gale to hurricane force winds are likely to be encountered over an area between 32 km and 240 km wide.

### 2.3 OCEANOGRAPHY

#### 2.3.1 Currents of the NWMR and Phase 1 Operational Area

Currents within the NWMR include the South Equatorial Current; the Indonesian Throughflow (ITF); the Eastern Gyral Current, and the Leeuwin Current. Seasonal surface currents in the region are the Ningaloo Current, the Holloway Current, the Shark Bay Outflow and the Capes Current. The South Equatorial Current and Eastern Gyral Current intensify during July-September. Similarly, the Leeuwin Current is strongest in autumn, and diminishes during the Northwest Monsoon in summer (December-March). This complex system of ocean currents change between seasons and between years, generally resulting in the surface waters being warm, nutrient poor and of low salinity.

During the southeast tradewinds (April-September), the predominant direction of the ocean current is west-southwest. In the monsoon season (December-March), winds come from the northwest or west, and the direction of the ocean current reverses, becoming east-northeast. The dominant tidal current flows in the NWMR in summer are east-northeast and west-southwest, with speeds generally ranging from 0.1-0.3 m/s.

The region typically receives a persistent swell of around 2 m, generated by low-pressure systems in southern latitudes during winter; strong easterly winds can also generate 2 m seas. Both swell and seas tend to be smaller during summer. Tropical cyclones generate waves propagating out in a radial direction from the storm centre, and generate swells from any direction, with wave heights between 0.5 and 9.0 m.

#### 2.3.2 Currents of the SWMR and Phase 2 Operational Area

The three dominant currents in the SWMR are; the Leeuwin Current, the Leeuwin Undercurrent and the Capes Current. The Leeuwin Current forms near the North West Shelf and transports warm, nutrient deficient waters south along the continental shelf break. The current is approximately 100 km wide and 300 m deep with dimensions differentiating over the seasons. The strength of the current is also seasonal with a weaker summer flow than winter. The flow of the Leeuwin Current is slowed during summer months as it has prevailing southerly winds moving against it. In winter the speed of the current picks up so much that it extends around the west coast of WA and continues to move east along Southern Australia.



Eddies are another component of the Leeuwin Current that are a significant feature of this region. Meso-scale eddies peel off the Leeuwin Current in predictable locations along the shelf break are hundreds of kilometres in diameter, move in an anti-clockwise direction (e.g. off Shark Bay, Abrolhos Islands, Jurien Bay and Rottnest Island). The Capes Current is a cold water surface current that flows north inside the Leeuwin Current. This coastal current is present mainly during summer months between Cape Leeuwin and Shark Bay. Its cold waters are driven north by strong southerly winds that prevail between December and March. It is thought that the mixing of the Leeuwin Current, the Leeuwin Undercurrent and the Capes Current increases productivity in the SWMR.

### 2.3.3 Water Temperatures

Historical sea surface temperatures for the Phase 1 operational area in summer are predicted to be from ~24°C-26°C and winter sea surface temperatures to be from ~22°C-24°C. Whereas, the Phase 2 operational area summer sea surface temperatures are predicted to be from ~22°C-24°C and winter sea surface temperatures to be from ~20°C-22°C.

## 2.4 BIOLOGICAL ENVIRONMENT

### 2.4.1 Biological Communities

#### Corals

Coral communities, including patch or fringing reefs occur in shallow water, sub-tidal environments of the NWMR and SWMR as well as around intertidal areas adjacent to islands and other emergent features. Coral reefs are areas of especially high species diversity. Located 60 km offshore from Geraldton at the edge of the continental shelf are the coral reefs of the Abrolhos Islands, which are high-latitude coral reefs and host a diverse mix of temperate and tropical fish, corals and molluscs.

#### Crustaceans

The NWMR is thought to contain a high diversity of crustaceans across a range of habitats, from intertidal sites to the deeper waters of the slope and the abyss. Dominant species groups include copepods, prawns, scampi and crabs. In the SWMR western rock lobsters can be found north of Cape Leeuwin to a depth of 150 m. The summer hatching of western rock lobster coincides with maximal wind generated offshore transport vectors, dispersing the animals into the Indian Ocean and beyond the influence of the Leeuwin Current. During the next twelve months the larvae actively swim across shelf waters and settle in shallow inshore reefs where spend a considerable period (3-4 years) of its lifecycle on the reef as a juvenile, before migrating to deeper offshore waters to spawn as sub-adults and complete the lifecycle. During the inshore reef period western rock lobster are important prey for a range of commercially and recreational species such as octopus, cuttlefish, baldchin groper, blue groper, dhufish, pink snapper, wirrah cod, breaksea cod and Australian sea lion.

#### Macroalgae

In the NWMR algae are dominant on shallow sandbars, platforms, reefs and ridges and are thought to be the major primary producer in this system, followed by mangroves and corals in isolated areas. Macroalgae occurs predominantly in the intertidal and shallow sub-tidal waters on hard substrates, inshore of the Phase 1 operational area. In the SWMR, distinct ridges of limestone reefs support diverse communities of macroalgae, with a high species richness and endemism (over 1,000 species of macroalgae are known), many species are also found at much greater depths than usual, for instance some species are far at depths of 120 m. Macroalgae communities (including epiphytic algae) provide foraging areas for the commercially and recreationally important abalone and many other reef species. Macroalgae occurs predominantly in the intertidal and shallow sub-tidal waters on hard substrates, on the reefs of the Abrolhos Islands and inshore of the Phase 2 operational area.

#### Mangroves

Mangroves are recognised significant habitats as they are productive coastal forest systems, providing habitat and shelter for birds, fish and other marine species and are important nursery sites for juvenile fish, lobsters and prawns. The only significant area of mangroves adjacent to the operational areas are found on the western side of the Cape Range Peninsula (Mangrove Bay) ~90 km inshore from the Phase 1 operational area.

## Seagrasses

Seagrass beds are said to provide critical habitats for fish and dugongs and are important for sustaining many of the fish populations of the North West Shelf. Seagrasses are predominantly found in WA State waters inshore of the Phase 1 and Phase 2 operational areas. In the SWMR, species diversity and endemism of seagrasses is the highest in the world, with fourteen species occurring in water depths of up to 50 m in some parts of the region. Seagrass meadows occur in cooler waters in the SWMR in areas with less exposure and in protected lagoon areas or deep waters between the Abrolhos Islands. The Abrolhos Island lagoons are important areas for benthic productivity and are dominated by seagrasses and epiphytic algae, the meadows provide a sheltered habitat and a breeding and nursery aggregations for many temperate and tropical marine species and epiphytes are one of the main food sources in the lagoonal system.

### 2.4.2 Key Ecological Features

Six Key Ecological Features (KEF) within the Rocket MC2D MSS operational areas were identified by a search of the EPBC Act Protected Matters database.

**Table 2-1** identifies the KEFs that overlap the Phase 1 and Phase 2 operational areas.

**Table 2-1 - KEF vs Rocket MC2D MSS Phase 1 and Phase 2 operational area**

No.	Key Ecological Feature	Operational Area
1	Ancient coastline at 90-120m depth	2
2	Commonwealth marine environment surrounding the Houtman Abrolhos Islands	2
3	Meso-scale eddies	1, 2
4	Perth Canyon and adjacent shelf break, and other west coast canyons	2
5	Western demersal slope and associated fish communities	1, 2
6	Western rock lobster	2

### 2.4.1 Biologically Important Areas

There are a number of Biologically Important Areas (BIAs; e.g. breeding, nesting, foraging areas; **Tables 2-2 and 2-3**) for EPBC Act-listed species of marine fauna that overlap the Rocket MC2D MSS operational areas, with seven BIAs overlapping the Phase 1 operational area and 10 BIAs overlapping the Phase 2 operational area.

**Table 2-2 - BIA overlapping the Phase 1 operational area**

Common Name	Behaviour
Humpback whale	Migration (north and south)
Roseate tern	Breeding area, Foraging
Wedge-tailed shearwater	Breeding area, Foraging
Wedge-tailed shearwater	Foraging (in high numbers)
Sooty tern	Foraging
Bridled tern	Foraging (in high numbers)
Pygmy blue whale	Migration

**Table 2-3 - BIA overlapping the Phase 2 operational area**

Common Name	Behaviour
Bridled tern	Foraging (in high numbers)
Caspian tern	Foraging (provisioning young)
Common noddy	Foraging (provisioning young)
Fairy tern	Foraging (in high numbers)
Humpback whale	Migration (north and south), Resting,
Little shearwater	Foraging (in high numbers)
Pygmy blue whale	Migration
Roseate tern	Foraging (provisioning young)
Sooty tern	Foraging
Wedge-tailed shearwater	Breeding area, Foraging, Foraging (in high numbers)

## 2.4.2 Protected Marine Fauna

The Protected Matters Search Tool (PMST) from the Commonwealth Department of the Environment was used to determine whether matters of national environmental significance or other matters protected by the EPBC Act were likely to occur in the Rocket MC2D MSS Phase 1 and Phase 2 operational areas. The 30 listed threatened species that may occur, or relate to, the Phase 1 and Phase 2 operational areas are:

- |                                  |  |
|----------------------------------|--|
| 1. the sei whale;                | 17. the southern royal albatross;      |
| 2. the blue whale;               | 18. the northern royal albatross       |
| 3. the fin whale;                | 19. the Amsterdam albatross;           |
| 4. the southern right whale;     | 20. the Tristan albatross;             |
| 5. the humpback whale;           | 21. the wandering albatross;           |
| 6. the Australian sea-lion;      | 22. the southern giant-petrel;         |
| 7. the short-nose seasnake;      | 23. the northern giant-petrel;         |
| 8. the loggerhead turtle;        | 24. the soft-plumaged petrel;          |
| 9. the green turtle;             | 25. the Australian fairy tern;         |
| 10. the leatherback turtle;      | 26. the Indian yellow-nosed albatross; |
| 11. the hawksbill turtle;        | 27. the shy albatross;                 |
| 12. the flatback turtle;         | 28. the white-capped albatross;        |
| 13. the grey nurse shark;        | 29. black-browed albatross; and        |
| 14. the great white shark;       | 30. Campbell albatross.                |
| 15. the whale shark;             |  |
| 16. the Australian lesser noddy; |  |

### Humpback Whale

Humpback whales are listed as Vulnerable and Migratory under the EPBC Act and are the most commonly sighted whale in northern WA waters. The Phase 1 and Phase 2 operational areas overlap the BIA for migrating humpback whales. Humpback whale migration in the region is characterised by three distinct directional phases:

- Northbound phase - starts June, peaks July and tapers off by August. Around the Geraldton to Point Cloates area, northerly migrating humpback whale numbers peak during July, and are generally confined to continental shelf waters out to the 200 m depth contour.
- Transitional phase - between August and early September. Peak numbers are expected to be in the calving grounds off the west Kimberley coastline during this period.
- Southbound phase – usually occurring in mid to late September in the region between Point Cloates and Geraldton, although smaller numbers may occur until early November. This phase of

migration is segmented by 2–3 week delay in appearance of peak numbers of cow/calf pods after the main migratory body has passed. Consequently, the southbound peak of cow/calf pairs in the region between Point Cloates and Geraldton usually occurs between mid-October and early November. Southerly migration in this area is contracted in a narrower band than the northerly migration route, generally occurring closer to the coast in waters less than 100 m deep.

#### Pygmy Blue Whale

The blue whale is listed as Endangered and Migratory, and may be present in, or adjacent to, the Phase 1 and Phase 2 operational areas. Their migration paths are widespread and do not clearly follow coastlines or particular oceanographic features. The blue whale is rarely present in large numbers outside recognised aggregation areas. In the NWMR, pygmy blue whales migrate along the 500 m to 1,000 m depth contour on the edge of the slope, and are likely to be feeding on ephemeral krill aggregations. The northbound component of this migration takes place from May to mid-August, with a peak in July–August, and the southbound component occurs from late October to November–December, with a few isolated individuals moving south in January. The migration appears to be centred on the 500 m depth contour.

The operational areas overlap the BIA for pygmy blue whales. Consequently, there is the possibility that migrating (and possibly feeding) pygmy blue whales may be encountered in the deeper waters of both the Phase 1 and Phase 2 operational areas.

#### Fin Whales

Fin whale distribution is known primarily from stranding events and whaling records, and is thought to occur along the west coast of Australia to New South Wales. The migration routes and location of winter breeding grounds are uncertain but their presence in Victorian and southern WA waters has also been detected in summer and autumn months. Fin whales may be present in the Phase 1 and Phase 2 operational areas, however, it is unlikely that they will be present in significant numbers.

#### Southern Right Whale

Southern right whales are large whales that are known to occur on a seasonal basis within the coastal waters of Australia. Major calving areas are generally restricted to coastal, inshore waters off the southern coastline of WA (east of Albany), South Australia and Victoria. No specific feeding areas are known for southern right whales, as they generally depend on variable prey distribution and abundance and will migrate according to prey location. Although the species is known from nearshore coastal waters in Australia, it is possible for this species to occur within the Phase 1 and Phase 2 operational areas. However, given that major calving areas and aggregations occur in WA in proximity to the Great Australian Bight, southern right whales are unlikely to be present in high numbers within the operational areas.

#### Sei Whale

The sei whale is a cosmopolitan species, ranging from polar waters to the tropics. They tend to be sighted more frequently from offshore waters in comparison to other species of whales, but the species is not commonly recorded in Australian waters. The species is migratory, moving between Australian waters and Antarctic feeding areas, however their movements are unpredictable and not well documented. Additionally, there are no known mating or calving areas in Australian waters. Sei whales may be present in the deeper waters of the Phase 1 and Phase 2 operational areas, however, it is unlikely that they will be present in significant numbers.

#### Dugong

There is a BIA for foraging dugong within Shark Bay adjacent to the Phase 1 and Phase 2 operational areas. The Shark Bay dugong population has estimated numbers of ~10,000 individuals. Dugong feed on shallow seagrass habitat and it is unlikely that dugong will be present within the operational areas.

#### Australian Sea Lion

The Australian sea lion is listed as Vulnerable under the EPBC Act. A BIA for foraging male and female Australian sea lions is located around the Houtman Abrolhos Islands and along the coastline south of Geraldton. The Phase 2 operational area does not overlap this BIA. The species has also been recorded at Shark Bay. The Australian sea lion exhibits high site fidelity with little movement of females between colonies has been observed. There is little or no interchange of females between breeding colonies, even between those separated by short distances. Australian sea lions may be present in the Phase 1 and Phase 2 operational areas, however, it is unlikely that they will be present in significant numbers.

### Marine Reptiles

The PMST identified five species of marine turtle that may occur within, or in the waters surrounding, the Phase 1 and Phase 2 operational areas, including the flatback, green and hawksbill turtle, (all listed as Vulnerable and Migratory) and the leatherback and loggerhead turtle (listed as Endangered and Migratory). There is a BIA (internesting buffer) for loggerhead turtles around Point Cloates in the southern part of Ningaloo Reef, at Cape Farquhar south of Gnarloo, and around the northern end of Dirk Hartog Island within Shark Bay. Loggerhead turtles may be present in Phase 1 and Phase 2 operational areas, however, it is unlikely that they will be present in significant numbers.

The short-nosed seasnake is listed as Critically Endangered under the EPBC Act. The species prefers the reef flats or shallow waters along the outer reef edge in water depths to 10 m. It has been reported short-nosed seasnakes tend not move more than 50 m away from reef flats. There are no shallow areas or reefs within the Phase 1 and Phase 2 operational areas, and since the species is not likely to move far from shallow waters or reefs it is not likely to be encountered during the survey.

### Whale Shark

The whale shark is listed as Vulnerable and Migratory under the EPBC Act. This species is normally oceanic and cosmopolitan in their distribution occurring in both tropical and temperate waters. They are known to aggregate in the reef front waters adjacent to the Ningaloo Reef between March and July. Preliminary research on the migration patterns of whale sharks has shown that after departing Ningaloo Reef they head north through the NWMR with some individuals passing Scott and Ashmore Reefs. Short-term tags have indicated whale sharks move northwest into the Indian Ocean but may also move directly north towards Sumatra and Java.

The Phase 1 operational area does not represent any critically important areas (migration, breeding or foraging areas) for the whale shark. It is possible that whale sharks may be encountered during the operations within the Phase 1 operational area. However, it is not expected that whale sharks will be encountered in significant numbers and those individuals that are encountered are likely to be transient.

### White Shark

There is a BIA for foraging great white sharks around the Houtman Abrolhos Islands, which correlates with the Australian sea lion BIA (sea lions being a key prey species for great white sharks). Great white sharks are listed as Vulnerable under the EPBC Act. The Phase 2 operational area does not overlap the BIA for foraging great white sharks.

### Seabirds

A search of the EPBC Protected Matters database listed 26 species of seabird that may occur in the Phase 1 and Phase 2 operational areas. Of these, 11 species are classified as Vulnerable and four are classified as Endangered. There are a number of BIA for breeding and foraging on and surrounding the Houtman Abrolhos Islands. **Tables 2-2** and **2-3** identify the BIA for individual seabird species that overlap the Phase 1 and Phase 2 operational areas.

## **2.5 SOCIO-ECONOMIC ENVIRONMENT**

### **2.5.1 Commercial Fisheries**

State fisheries administered by the WA Department of Fisheries (DoF) that can operate in the Rocket MC2D Phase 1 and Phase 2 operational areas include:

- Roe's Abalone Fishery;
- Abrolhos Islands and Mid West Trawl Managed Fishery;
- West Coast Purse Seine Fishery;
- Gascoyne Demersal Scalefish Fishery;
- Shark Bay Prawn Fishery\*;
- Shark Bay Scallop Fishery\*;
- Mackerel Managed Fishery;
- West Coast Rock Lobster Fishery;
- West Coast Deep Sea Crustacean Managed Fishery; and
- West Coast Demersal Scalefish Resource.

*\*Note: Current fishing effort of these fisheries does not overlap the Phase 1 and Phase 2 operational areas.*

Commonwealth fisheries administered by the Australian Fisheries Management Authority (AFMA) that can operate in the Rocket MC2D Phase 1 and Phase 2 operational areas include:

- Southern Bluefin Tuna Fishery;
- Western Deepwater Trawl Fishery;
- Western Skipjack Fishery; and
- Western Tuna and Billfish Fishery.

#### State Administered Fisheries

##### **Roe's Abalone Fishery**

The Phase 1 and Phase 2 operational areas overlap Area 8 of the Roe's abalone fishery area. However, the Roe's abalone fishery is a dive and wade fishery, operating in shallow coastal waters along WA's western and southern coasts. The fishery harvest method is a single diver working off a 'hookah' (surface-supplied breathing apparatus) using an abalone 'iron' to prise the shellfish off rocks. It is therefore unlikely that abalone diving would take place within the Phase 1 and Phase 2 operational areas.

##### **Abrolhos Islands and Mid West Trawl Managed Fishery**

The Abrolhos Islands and Mid West Trawl Managed Fishery is based on the take of saucer scallops, with a small component targeting the western king prawn in the Port Gregory area. The fishery operates between 27°51' south latitude and 29°03' south latitude on the landward side of the 200 m isobath. No scallop fishing occurred in this fishery during 2012 because the annual scallop survey showed scallop abundance below the limit level to commence fishing. The Phase 2 operational area excludes the Abrolhos Islands but overlaps a small part of the area for this fishery.

##### **West Coast Purse Seine Fishery**

The West Coast Purse Seine Fishery mainly captures pilchards and the tropical sardine (or scaly mackerel; referred to as sardinella) by purse seine in the West Coast Bioregion. Smaller catches of Perth herring, yellowtail scad, Australian anchovy, maray and other species are also reported. There are three defined fisheries: the Perth metropolitan fishery operates between 31° S and 33° S latitude; the Southern Development Zone covers waters between 33° S and Cape Leeuwin; and the Northern Development Zone covers waters between 22° S and 31° S. The Phase 1 and Phase 2 operational areas fall within the Northern Development Zone of the fishery.

##### **Gascoyne Demersal Scalefish Fishery**

The Gascoyne Demersal Scalefish Fishery includes both commercial and recreational (line) fishing for demersal scalefish species in continental shelf waters. Commercial vessels historically focused on the pink snapper oceanic stock. Licensed vessels fish year-round with mechanised handlines and target a number of other demersal species along with pink snapper, such as; goldband snapper, rosy snapper, ruby snapper, red emperor, emperors, cods, pearl perch, mulloway, amberjack and trevallies. The fishery operates in the waters of the Indian Ocean and Shark Bay between latitudes 23°07'30"S and 26°30'S. There are also a limited number of licensed charter vessels and a large number of recreational vessels that fish out of Denham, Carnarvon and around the Ningaloo area (Coral Bay, Tantabiddi and Exmouth). Recreational fishers are managed using maximum and minimum legal lengths, daily bag and possession limits, and limitations on the use of certain fishing gears.

The Phase 1 and Phase 2 operational areas overlap this fishery. Therefore, it is possible that vessels fishing in this fishery could operate in the vicinity of the survey vessel during the survey.

##### **Mackerel Managed Fishery**

The Mackerel Managed Fishery uses near-surface trolling gear from small vessels in coastal areas around reefs, shoals and headlands to target Spanish mackerel. Jig fishing is also used to capture grey mackerel, with other species from other genera also contributing to commercial catches. Permit holders may only fish for mackerel by trolling or handline. The fishery extends from the West Coast Bioregion to the WA/NT border, with most effort and catches recorded north of Geraldton, especially from the Kimberley and Pilbara coasts. The Phase 1 and Phase 2 operational areas overlap Areas 3 (Gascoyne/West Coast) of

the fishery. Therefore, it is possible that vessels fishing in this area could operate in the vicinity of the survey vessel during the survey.

#### **West Coast Rock Lobster Fishery**

The West Coast Rock Lobster Managed Fishery targets the western rock lobster, on the west coast of WA between Shark Bay and Cape Leeuwin, using baited traps (pots) between Latitudes 21°44' to 34°24' S. The fishery is managed in three zones: Zone A – Abrolhos Islands, north of latitude 30° S excluding the Abrolhos Islands (Zone B) and south of latitude 30° S (Zone C). With annual production historically averaging about 11,000 t this has been Australia's most valuable single species wild capture fishery and was the first fishery in the world to achieve Marine Stewardship Council certification.

The Phase 1 operational area overlaps Zone B and the Phase 2 operational area overlaps Zones A and C. Therefore, it is possible that vessels fishing in these areas could operate in the vicinity of proposed survey operations.

#### **West Coast Deep Sea Crustacean Managed Fishery**

The boundaries of the West Coast Deep Sea Crab Managed Fishery include all the waters lying north of latitude 34°24'S (Cape Leeuwin) and west of the Northern Territory (NT) border on the seaward side of the 150 m isobath out to the extent of the Australian Fishing Zone. This fishery targets crystal (snow) crabs, giant (king) crabs and champagne (spiny) crabs using baited pots operated in a long-line formation in the shelf edge waters (>150 m) of the West Coast. The fishery is a quota based 'pot' fishery that operates mainly in depths of 500-800 m. No fishing is permitted in depths <150 m, with the only allowable method for capture being baited pots ('traps').

The Phase 1 and Phase 2 operational areas overlap this fishery. Optimal fishing effort occurs in deep offshore waters between 500 and 1,000 m, most of the commercial crystal crab catch is taken in depths between 500 to 800 m on the continental shelf slope. Therefore, it is possible that vessels fishing in these areas could operate in the vicinity of proposed survey operations.

#### **West Coast Demersal Scalefish Resource**

The West Coast Demersal Scalefish Resource comprises inshore and offshore suites of demersal scalefish species that are exploited by different commercial fisheries and recreational and charter fishers that operate in the West Coast Bioregion. The West Coast Inshore Demersal suite occurs in waters 20-250 m deep with approximately 100 species of this suite caught by these fisheries. The most important species are the WA dhufish and pink snapper with other species captured including redthroat emperor, bight redfish and baldchin groper. The West Coast Offshore Demersal suite, which occurs in waters >250 m deep, includes eightbar grouper, hapuku, blue-eye trevalla and ruby snapper. The fishery is managed as the West Coast Demersal Scalefish (Interim) Managed Fishery and encompasses the waters of the Indian Ocean just south of Shark Bay (at 26°30'S) to just east of Augusta (at 115°30'E) and extends seaward to the 200 nm boundary of the Australian Fishing Zone. The Phase 1 and Phase 2 operational areas overlap the area of this fishery.

#### Commonwealth Administered Fisheries

##### **Western Deepwater Trawl Fishery**

The Western Deepwater Trawl Fishery operations in WA extend from 115°08' E in the south to 114° E in the north. The fishery catches more than 50 species in waters exceeding 200 m depth in habitats ranging from temperate-subtropical in the southern region to tropical in the north region. Catches in the fishery were dominated historically by six main commercial finfish species including orange roughy, oreos, boarfish, eteline snapper, apsiline snapper and sea bream. Between 2000 and 2005, deepwater bugs emerged as the most important target species. However, there has been a large reduction in effort and catch over the past three years. The Phase 1 and Phase 2 operational areas overlap the area of this fishery, therefore, it is possible that vessels fishing in these areas could operate in the vicinity of proposed survey operations.

##### **Southern Bluefin Tuna Fishery**

The Southern Bluefin Tuna Fishery targets juvenile southern bluefin tuna (2–3 years old) in the Great Australian Bight using purse-seine gear, mainly from December to April. These operations are concentrated in shelf and upper slope waters of the eastern Bight, with the maximum fishing intensity in 2012 being concentrated on a relatively small area just north of the shelf break. Throughout the rest of its range, southern bluefin tuna is targeted by pelagic longliners, with the focus being on domestic longliners operating along Australia's east coast. Although the fishery area covers the Phase 1 and Phase 2

operational areas, activities in the fishery are primarily confined to the waters off South Australia with smaller areas along the south east coastline, such as northeast of Eden in New South Wales. Therefore, activity in this fishery does not overlap the operational areas.

### **Western Skipjack Tuna Fishery**

The Western Skipjack Tuna Fishery is not active in continental shelf waters of the Carnarvon Basin. The skipjack tuna is the only target species in the fishery and in recent years, activities in the fishery have largely been confined to waters in the Great Australian Bight and northeast of Eden in New South Wales. Therefore, activity in this fishery does not overlap the Phase 1 and Phase 2 operational areas.

### **Western Tuna and Billfish Fishery**

The Western Tuna and Billfish Fishery extends from Cape York westwards around the NT and WA coast and across to the Great Australian Bight, out to the limit of the Australian Fishing Zone. The fishery primary targets broadbill swordfish, yellowfin tuna, bigeye tuna and albacore tuna. The majority of catch and effort in the fishery occurs in Commonwealth waters off the central west coast of WA, with fishing effort in the northwest located north of Broome in the Kimberley, west of Scott Reef with the majority of effort concentrated south of Geraldton (~30°S) and there was no activity at all in the fishery during the 2010-2011 season. Activity in this fishery is unlikely to overlap the Phase 1 and Phase 2 operational areas to any substantial extent.

## **2.5.2 Petroleum Exploration and Production**

The Rocket MC2D MSS operational areas overlap exploration permits WA-492-P and WA-493-P, (operated by Total E & P Australia), exploration permit WA-512-P (operated by AWE (Offshore PB) Pty Ltd), and the north-west part of the 2013 Round 2 Acreage Releases W13-20 (see **Figures 1-1** and **1-2**). There are a number of petroleum wells within the Rocket MC2D MSS operational areas. There are four abandoned wells within the Phase 1 operational area, and seven in the Phase 2 operational area. There are no petroleum production facilities or pipelines within the Rocket MC2D MSS operational areas.

## **2.5.3 Commercial Shipping**

There is significant amount of commercial shipping activity within the Phase 1 and Phase 2 operational areas. The main commercial shipping traffic route for the west coast of WA is located within the operational areas, and is associated with entry to the Port of Geraldton and the Port of Fremantle. Therefore, heavy commercial bulk shipping traffic will be encountered within the operational areas, as follows:

- international bulk freighters/tankers arriving and departing from Port of Geraldton and Port of Fremantle, including mineral ore, hydrocarbons (LNG, liquefied petroleum gas, condensate) and salt carriers;
- commercial fishing vessels;
- construction vessels/barges/dredges; and
- offshore survey vessels.

## **2.5.4 Tourism and Recreation**

There are a number of recreational activities, such as recreational fishing, boating, diving and marine-based tourism, which occur near the coast and the islands off Ningaloo Reef, and from Shark Bay to Geraldton and the Abrolhos Islands. However, the Abrolhos Islands (located in an exclusion zone within the Phase 2 operational area) do have limited visitation, with the most visits occurring between the months of August and November.

A range of fishing activities are available to recreational fishers in the Gascoyne and West Coast bioregions regions of WA. In the Gascoyne bioregion, most of the recreational boat fishing is undertaken in embayments and shallow-water boat angling in Shark Bay, Exmouth Gulf and Ningaloo lagoons. Offshore boat angling for demersal and larger pelagic species is undertaken offshore from Ningaloo and Exmouth. The West Coast bioregion contains the State's major population centres and therefore is the most heavily used recreational fishing area. Recreational boat fishing opportunities occur mostly in either in estuaries and embayments or offshore for demersal and pelagic/game species often around islands and out to the edge of the continental shelf.

The Abrolhos Islands also attracts seasonal marine-based tourism attractions that offer interactions with marine wildlife, including whale watching with humpback whales, Australian sea lion encounters and fishing charter expeditions.



### 2.5.5 Cultural Heritage

There are no current or pending Native Title Determinations for the waters and seabed within or immediately adjacent to the Phase 1 and Phase 2 operational areas.

A search of the National Shipwrecks Database indicates that there are forty-three listed historic shipwrecks located within and in the vicinity of the Phase 1 and Phase 2 operational areas, with the majority of these located around the Abrolhos Islands.

The wreck sites of HMAS *Sydney II* and HSK *Kormoran* (located ~22 km apart at a distance of ~280 km west south-west of Carnarvon) were wrecked after a battle in 1941 during Second World War. Both shipwreck sites are protected and are located within the Phase 1 operational area, ~52 km from the western boundary. Both wreck sites have a protected or no-entry zone with a radius of 800 m around the location. One of the 2D lines in the Phase 2 component of the survey is located ~5 km from the wreck site of HMAS *Sydney II*.

### 2.5.6 National Heritage

There is one heritage place listed on the Commonwealth Heritage List and the National Heritage List within the Phase 1 operational area—the HMAS *Sydney II* and HSK *Kormoran* Shipwreck Sites – Carnarvon. The *Batavia* Shipwreck Site and Survivor Camps Area 1629 - Houtman Abrolhos national heritage site is located in the Abrolhos Islands to the south-east of the Phase 2 operational area.

### 2.5.7 Marine Parks and Reserves

The Phase 1 and Phase 2 operational areas overlap the following proposed Commonwealth Marine Reserves (CMR) (**Figure 2-1**):

#### Phase 1 Operational Area

- Carnarvon Canyon CMR\*
  - Habitat Protection Zone (IUCN IV)
- Gascoyne CMR\*
  - Habitat Protection Zone (IUCN IV)
  - Marine National Park Zone (IUCN II)
  - Multiple Use Zone (IUCN VI)
- Shark Bay CMR\*
  - Multiple Use Zone (IUCN VI)
- Abrolhos CMR\*
  - Marine National Park Zone (IUCN II)
  - Multiple Use Zone (IUCN VI)

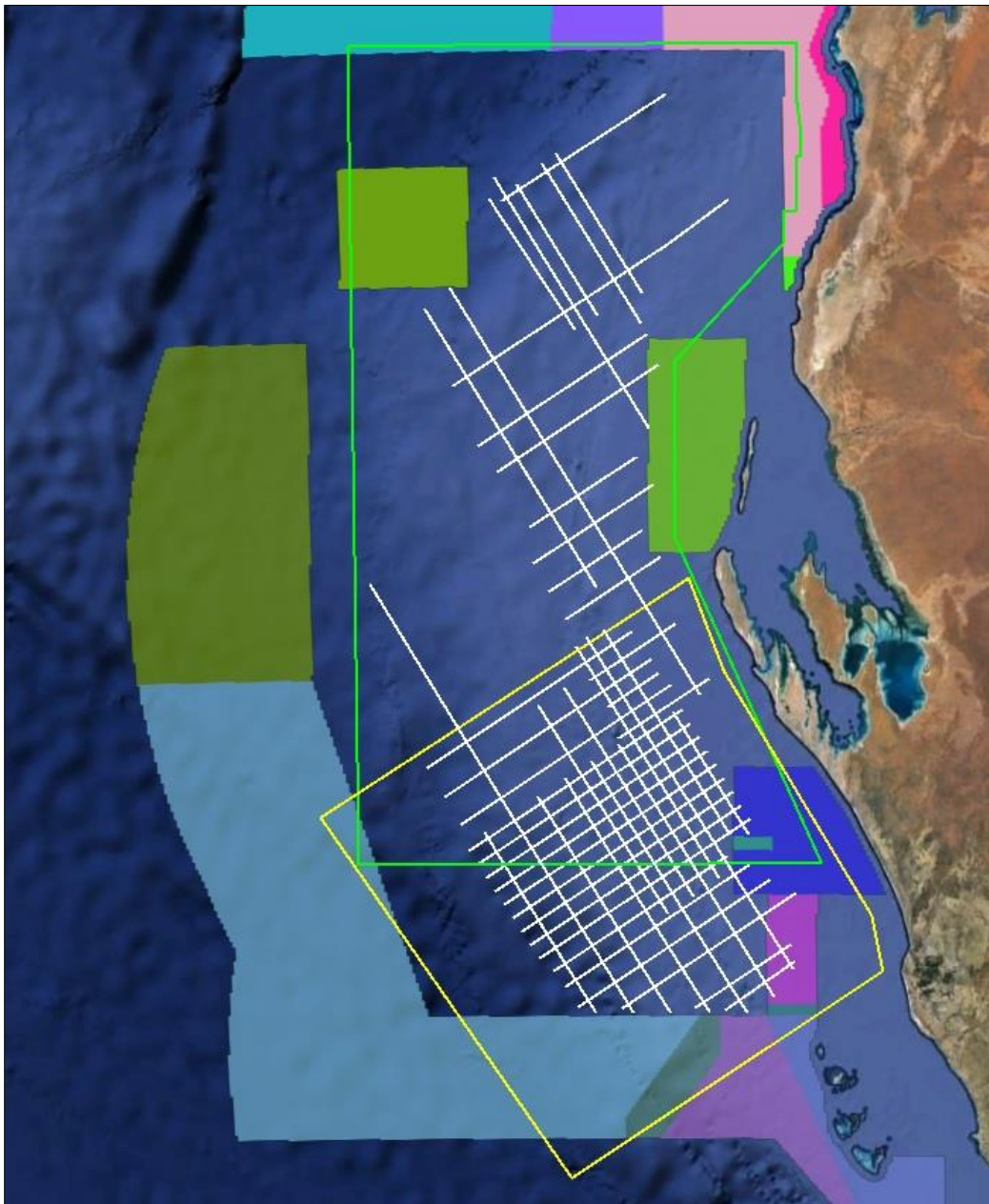
#### Phase 2 Operational Area

- Abrolhos CMR\*
  - Marine National Park Zone (IUCN II)
  - Multiple Use Zone (IUCN VI)
  - Special Purpose Zone (IUCN VI)

None of the 2D lines in the Phase 1 or the Phase 2 operational areas overlap the Marine National Park Zones in either the Gascoyne CMR or the Abrolhos CMR—i.e. there is no overlap between seismic acquisition and areas designated as IUCN category II reserves within the proposed CMR (see **Figure 2-1**).

Several line ends in the Phase 2 operational area overlap the Multiple Use Zone (MUZ) component of the Shark Bay CMR, to the west of Bernier and Dorrier Islands (see **Figure 2-1**). Parts of several lines in the Phase 2 operational area overlap the MUZ and Special Purpose Zone (SPZ) of the Abrolhos CMR, to the north of the Abrolhos Islands (see **Figure 2-1**). As stated above, there is no overlap between lines in the Phase 2 operational area and the Marine National Park Zones (MNPZ) of the Abrolhos CMR, to the north and west of the Abrolhos Islands, nor between lines in the Phase 1 operational area and the MNPZ of the Gascoyne CMR (see **Figure 2-1**).

**Figure 2-1 – Overlap between Rocket MC2D MSS operational areas and 2D lines with Commonwealth marine reserves**



Existing and proposed CMR are subject to the Australian IUCN reserve management principles as presented in Schedule 8 of the EPBC Regulations. Until management plans come into effect for the new proposed CMR in the NWMR and SWMR (which was scheduled to occur in July 2014 but did not take place) transitional arrangements apply and there are no changes on the water for users of the new proposed reserves - i.e. seismic surveys are permitted to take place within any zone of the proposed CMR.

Spectrum shall ensure that activities within the Abrolhos CMR will not result in unacceptable impacts to the environment or matters protected under Part 3 within this reserves, will have regard to the Marine Bioregional Plans for the NWMR and SWMR, and will not act inconsistently with the draft plan of management for the CMR.

By implementing this EP and the controls and mitigation measures within it, impacts to the environment, including the values, sensitivities and management principles of the Abrolhos CMR, are considered ALARP and acceptable.

### 2.5.8 Other Protected Areas

There are no World Heritage Properties (WHP) or Ramsar Wetlands of International Importance located within the Phase 1 and Phase 2 operational areas or immediate vicinity. The nearest WHP to the operational areas are the Ningaloo Coast WHP and the Shark Bay WHP. At the closest points, the eastern boundary of the Phase 1 operational area is located ~7.5 km from the boundary of the Ningaloo Coast WHP offshore from Point Cloates, and ~5 km from the boundary of the Shark Bay WHP, offshore from Dirk Hartog Island.

The Phase 2 operational area excludes WA State waters around the Abrolhos Islands and the FHPA - the boundary of which is contiguous with the WA State waters boundary around the islands. At the closest point the south-east boundary of the operational area is located ~10 km from the boundary of the FHPA, just to the north of North Island.

### 2.5.9 Defence Activities

The RAAF Learmonth Airspace R859A, R859B, R859C, R860A, R860B, R860C, R861A, R861B, R862A and R862B components are located adjacent to the northern boundary of the Phase 1 operational area. These components make up the Learmonth Air Weapons Range. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to low altitudes including sea level.

## 3 DESCRIPTION OF THE ACTIVITY

### 3.1 LOCATION

The Rocket MC2D MSS Phase 1 and Phase 2 operational areas lie entirely in Commonwealth waters within the southern part of the NWMR and the northern part of the SWMR. The Phase 1 operational area, which is located offshore from Gascoyne region between Ningaloo Reef and Shark Bay, incorporates the majority of the WA-492-P permit, 100% of the WA-493-P permit, and adjacent open acreage areas (**Figure 1-1**), and the Phase 2 operational area, which incorporates the entirety of the WA-512-P permit and the north-western part of the W13-20 Release Area, is located offshore from Kalbarri, between Shark Bay and the Houtman Abrolhos Islands (**Figure 1-2**). Boundary coordinates for the Phase 1 and Phase 2 operational areas are provided in **Table 1-1**.

At the closest points, the eastern boundary of the Phase 1 operational area is located ~7.5 km from the boundary of the Ningaloo Coast World Heritage Property (WHP) offshore from Point Cloates, and ~5 km from the boundary of the Shark Bay WHP, offshore from Dirk Hartog Island. The minimum separation distance from the boundary of the Phase 1 operational area and the nearest land is ~10 km, at Steep Point (**Figure 1-1**). The eastern ends of the 2D lines are separated from the boundaries of the Ningaloo Coast WHP and the Shark Bay WHP by a buffer zone of at least 20 km, ensuring that during line run-outs and line turns neither the survey vessel nor any part of the towed array will enter either the Ningaloo Coast or Shark Bay WHP. Similarly, during line run-outs and line turns along the eastern side of the Phase 1 operational area neither the survey vessel nor any part of the towed array will enter WA State waters.

The Phase 2 operational area is located north-west of the Houtman Abrolhos Islands (**Figure 1-2**). At the closest point, the south-east boundary of the Phase 2 operational area is located ~19 km from the North Island in the Abrolhos. The ends of the 2D lines in the area to the north-west of the Abrolhos are located at least 43 km from North Island, ensuring that during line run-outs and line turns neither the survey vessel nor any part of the towed array will enter WA State waters or the Abrolhos Islands Fish Habitat Protection Area (FHPA). The Phase 2 operational area does not overlap the Abrolhos Islands FHPA—at the closest point the south-east boundary of the operational area is located ~10 km from the boundary of the FHPA, just to the north of North Island.

Water depths in both the Phase 1 and Phase 2 operational areas range from >50 m to ~4,000 m, with the deepest water depths occurring along the western edges of both operational areas.

### 3.2 TIMING

The Rocket MC2D MSS is planned to commence in late August 2015, dependent on the availability of the survey vessel for conducting the survey, client data requirements, fair sea state conditions suitable for marine seismic acquisition, and granting of approvals from the appropriate government bodies. The survey

is planned to have a maximum duration of ~53 days, and acquisition will be divided into two separate phases—Phase 1, which has a scheduled duration of ~18 days, and Phase 2, which has a scheduled duration of ~35 days. The operational areas for Phases 1 and 2 of the Rocket MC2D MSS are shown in **Figures 1-1** and **1-2**, respectively. Phase 2 (4,750 line km of 2D acquisition) will commence after the completion of Phase 1 (2,135 line km of 2D acquisition) of the survey, and all seismic acquisition will be completed by the end of October 2015.

### 3.3 SEISMIC PROGRAMME

#### 3.3.1 Survey Parameters

The marine seismic survey proposed is a typical 2D 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 survey will be conducted using a purpose-built seismic survey vessel.

During the proposed activities, the survey vessel will traverse a series of pre-determined sail lines within the Phase 1 and Phase 2 operational areas at a speed of ~8-9 km/hour (~4.5 knots). As the vessel travels along the survey lines a series of noise pulses (every 8-12 seconds) will be directed down through the water column and seabed. The released sound is attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones arranged along a single hydrophone cable (streamer) towed behind the survey vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed in an attempt to identify hydrocarbon reservoirs.

There are a total of 17 lines in the Phase 1 operational area, with a total length of 2,135 line km, a minimum separation distance of ~6 km and a maximum separation distance of ~80 km (**Figure 1-1**). There are a total of 31 lines in the Phase 2 operational area, with a total length of 4,750 line km, a minimum separation distance of ~8 km and a maximum separation distance of ~25 km (**Figure 1-2**).

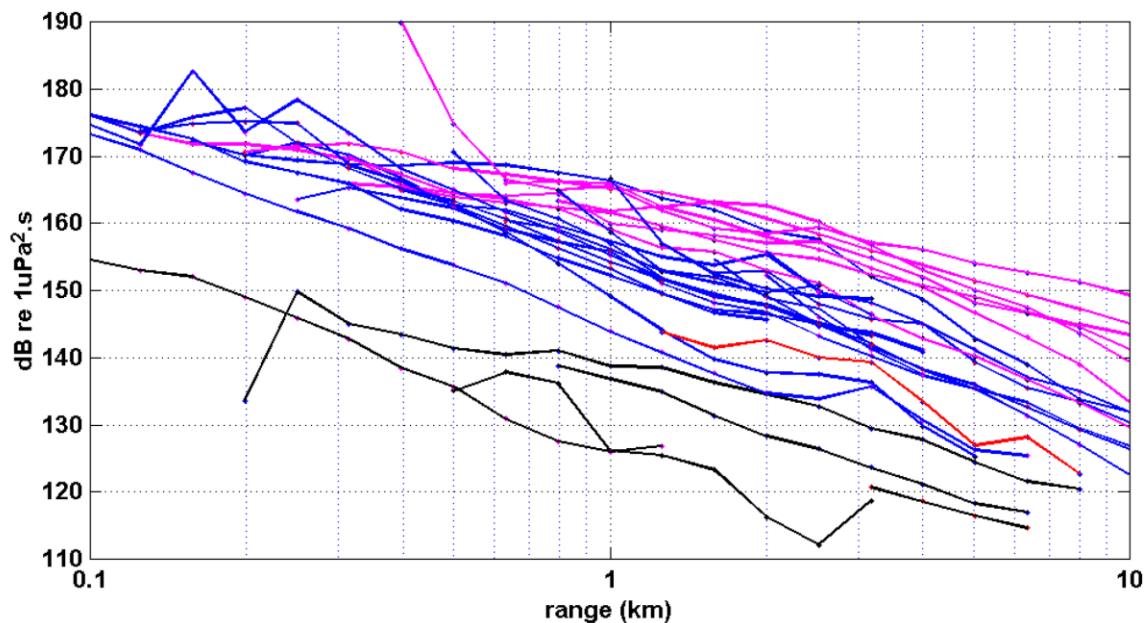
A summary of the parameters for the Rocket MC2D MSS is provided in **Table 3-1**. The seismic array will comprise of a single solid streamer, with a maximum length of 8,100 m. The source (airgun array) tow depth will be 6 m (+/- 1 m) and the streamer tow depth will be 12 m (+/- 1 m). The operating pressure for the airgun array will be ~2,000 psi. The airgun array will have a maximum volume of 3,680 cui. This array will be fired at a shotpoint interval of 25 m horizontal distance, and will produce at source (i.e. within a few metres of the airgun array) sound pulses in the range of 237 dB re 1 µPa-m (sound pressure level - SPL), at frequencies extending up to ~150 Hz.

**Table 3-1 - Rocket MC2D MSS acquisition parameters**

Parameter	Value
No. of streamers	1 (solid)
Streamer length	max. 8,100 m
Streamer tow depth	12 m (+/- 1 m)
Size of airgun array	3,680 cui
Operating pressure	2,000 psi
Source interval	25 m
Source depth	6 m (+/- 1 m)
Line spacing	~6 to ~80 km
Peak source sound pulse (SPL)	237 dB re 1 µPa-m (at 1 m)
Frequency range	0 to ~150 Hz

Based on (unpublished) empirical measurements of a number of seismic airgun sources in western and southern Australian waters (CMST, Curtin University), the sound pulses from a 3,680 in<sup>3</sup> airgun array are expected to decrease to sound exposure levels (SEL) of ~160 to 165 dB re 1µPa<sup>2</sup>.s within 1 km of the source and ~155-160 dB re 1µPa<sup>2</sup>.s within 2 km, dependent on the sound propagation characteristics of the area (**Figure 3-1**).

**Figure 3-1 - Noise decay curves for a number of different seismic airgun sources in western and southern Australian waters**



All air gun measures where received levels for a given survey have been averaged in log spaced range bins and presented as the mean value/bin + 95% confidence limit. The black curves are arrays or single air guns of < 1000 cui capacity; the red curve is array of 1000-2000 cui; the blue curves 2000-3000 cui and the magenta curves 3000-4000 cui.

The survey will be conducted in water depths >50 m to ~4,000 m. Therefore, it is unlikely that any of the towed equipment will make contact with the seabed or benthic communities.

### 3.3.2 Survey Vessels

Spectrum proposes to conduct the Rocket MC2D MSS using a specifically converted seismic survey vessel, the RV *BGP Explorer*, which is owned by Exploiter Pte. Ltd (a subsidiary of BGP in Singapore) and operated by BGP – one of the world’s leading geophysical acquisition companies. The *BGP Explorer* has all necessary certification/registration and is fully compliant with all relevant MARPOL and SOLAS convention requirements for a vessel of this size and purpose. The vessel will travel within the Phase 1 and Phase 2 operational areas at an average speed of 8-9 km per hour (approximately 4.5 knots).

No support vessel will be used during the survey, as the *BGP Explorer* will refuel and re-supply in port during the course of the survey. All crew changes will be carried out in port as well. A dedicated chase vessel will be utilised during the survey for all seismic acquisition operations in the Phase 2 operational area. The purpose of the chase vessel will be to manage interactions with commercial fishing vessels and shipping during acquisition and movements of the survey vessel in the Phase 2 operational area. The chase vessel that will be used for acquisition operations in the Phase 2 operational area is the MV *Browse Express*.

No at sea refuelling of the survey vessel will occur during the Rocket MC2D MSS. The *BGP Explorer* will be re-supplied and refuelled in port, probably in the Port of Geraldton.

## 4 ENVIRONMENTAL IMPACTS AND RISKS

An Environmental Risk Assessment (ERA) has been undertaken to understand and manage the environmental impacts and risks associated with the Rocket MC2D MSS. This ERA is designed to provide:

- details of the environmental impacts and risks for the survey;
- an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk; and

- details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable (ALARP) and to an acceptable level.

#### 4.1 METHODOLOGY

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. The environmental risks associated with the 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 operational areas;
- 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.

Risks were identified during the ERA for both planned (routine and non-routine) and unplanned (accidents/incidents) activities. Potential environmental impacts are then determined based on the stressor type. Risk evaluation further develops the understanding of a risk by defining the impacts and assessing appropriate controls. Risk evaluation for the Rocket MC2D MSS considered previous risk assessments for similar activities, review of relevant studies, review of past performance, external stakeholder consultation feedback and review of the existing environment and key sensitivities/values.

The following key steps were undertaken for each identified risk during the risk assessment:

- identification of decision type in accordance with a decision support framework;
- identification of appropriate control measures (preventative and mitigation) aligned with the decision type; and
- determination of the residual risk rating.

#### 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, the precautionary principle and the corresponding environmental risk threshold decision-making principles used to determine acceptability.

##### 4.2.1 Demonstration of ALARP

For the evaluation of all environmental impacts and risks associated with the Rocket MC2D MSS impacts and risks are considered to be 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.

##### 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, the Spectrum 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 RISK EVALUATION SUMMARY**

The ERA for the Rocket MC2D 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 17 sources of environmental risk, including 11 planned and six unplanned types, which are all assessed as having a **Low** or **Medium** residual risk following implementation of identified control measures (**Table 4-1**).

The ERA identified a number of environmental impacts and risks that were assessed as not being applicable (not credible) to normal acquisition operations within the Phase 1 and Phase 2 operational areas. These impacts and risks were not included in the detailed risk evaluation. All of these impacts and risks were determined to have a **Low** level of residual risk.

A summary of the risk evaluation for the Rocket MC2D MSS, and the control measures that will be implemented reduce impacts and risks to ALARP and acceptable levels, is provided in **Table 4-1**.

**Table 4-1 - Summary of environmental impacts and risks, potential impacts and control measures**

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Residual Risk	
<b>PLANNED (ROUTINE AND NON-ROUTINE) ACTIVITIES</b>						
Physical presence of survey vessel	Vessel noise emissions (excluding seismic acoustic emissions)	Short-term localised disturbance to marine fauna, such as alteration of behaviours and localised displacement	Slight	Unlikely	<b>Low</b>	Interaction between survey and chase vessels and cetaceans, turtles, Australian sea lions and whale sharks within operational areas will be consistent with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.04) – Interacting with cetaceans: <ul style="list-style-type: none"> <li>during periods when survey vessel is transiting operational areas without seismic array deployed, or during process of deployment or retrieval of array, the vessel will not travel at speeds greater than 6 knots within 300 m of a cetacean, turtle or whale shark (caution zone), and will not approach closer than 100 m from an animal (with exception animals bow riding)</li> </ul> These interaction procedures will apply for chase vessel for duration of activities in the Phase 2 operational area
	Interaction with commercial fisheries and shipping	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	Minor	Possible	<b>Medium</b>	Operations of survey vessel must comply with COLREG; STCW Convention; Marine Orders Part 21; Marine Orders Part 30; Marine Order 28 Operations of survey vessel will be in accordance with Marine Notice 21/2013, and with Marine Notice 4/2012 AMSA RCC will be advised of survey prior to mobilisation to ensure that NAVAREA X and AUSCOAST warnings can be issued and kept up to date. AMSA RCC will also be notified of survey completion AHS is advised of survey details not less than two weeks prior to mobilisation so that AHS can then issue a NTM Survey vessel will have an AIS tracking device installed and operating to aid identification by other vessels Fishermen and other mariners will be alerted of survey vessels' presence and extent of towed array Further notification of activity details to relevant commercial fisheries management agencies, fishing industry bodies and individual companies and licence holders, three weeks prior to the survey commencing Provision of seven to ten day forecasts of operations within Phase 2 operational area to WRLC, GFC, GPFA, KPFA, UMWPFPA. These key stakeholders will also be provided with notification of completion of activities in Phase 2 operational area, and overall completion of the survey Further notification of acquisition operations within Phase 2 operational area to Geraldton Port Harbour Master prior to mobilization, so that Harbour Master can inform Pilots, Agents and owners of any shipping using shipping fairway during survey operations to be further advised of survey details Use of dedicated chase vessel to manage interactions with commercial fishing vessels and shipping, during seismic acquisition operations in Phase 2 operational area Use of smallest possible seismic source - lowest possible total capacity for airgun array Lost towed equipment will be relocated and recovered where safe and practicable to do so Recreational fishing from survey vessel will be prohibited Adherence to relevant BGP shipboard safety procedures relating to navigational management and interactions with other vessels and shipping



Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Residual Risk	
	Biofouling of vessel hull, other niches and immersible equipment	Introduction and establishment of IMS and displacement of native marine species	Slight	Highly Unlikely	Low	<p>Whilst in Australian waters, survey vessel must operate in accordance with conditions detailed in "Approval to Berth" issued by AQIS</p> <p>Risks of introducing IMS via biofouling into WA waters and ports will be managed in accordance with marine pest management guidelines (as enforced under WA <i>Fish Resources Management Act 1994</i>; and Fish Resources Management Regulations 1995)</p> <p>Application of guidelines detailed in National Biofouling Management Guidance for the Petroleum Production and Exploration Industry, and in IMO <i>Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species</i></p> <p>Survey vessel will have had a recent dry dock, IMS inspection and antifoulant application prior to mobilising to Australian waters</p> <p>Survey vessel will have only operated in Australian waters between arriving in WA in February 2015 and commencement of Rocket MC2D MSS</p> <p>If survey vessel has to leave Australian waters before completion of survey, it will be required to undergo a further IMS inspection and cleaning (if required), prior to re-entering Australian waters to complete survey</p> <p>The chase vessel that will be utilized for activities in the Phase 2 operational area will be a local fishing vessel sourced from Geraldton, which does not represent an IMS risk</p>
Seismic acoustic emissions	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	Unlikely	Low	<p>Operation of seismic source within Phase 1 and Phase 2 operational areas at all times during survey must comply with all requirements of EPBC Act Policy Statement 2.1 - Interactions between offshore seismic activities and whales Part A Standard Management Procedures, including:</p> <ul style="list-style-type: none"> <li>precaution zones (Observation zone: 3 km+; Low power zone: 2 km; and Shut-down zone: 500 m)</li> <li>A.3.6 night-time and low visibility procedures</li> </ul> <p>All of Part A Standard Management Procedures will be applied for whale sharks as well as for whales</p> <p>Operation of seismic source within Phase 1 and Phase 2 operational areas at all times during survey must comply with following Part B Additional Management Procedures:</p> <ul style="list-style-type: none"> <li>two dedicated Marine Fauna Observers (MFO) on survey vessel for duration of survey</li> </ul> <p>Operation of the seismic source within the Phase 1 and Phase 2 operational areas during the entire survey period (mid-August to end October) must comply with the following EPBC Act Policy Statement 2.1 Part B Additional Management Procedures:</p> <ul style="list-style-type: none"> <li>application of increased precaution zones (Observation zone: &gt;3 km; Shut-down zone: 2 km)</li> <li>application of an increased Pre Start-up Visual Observation of 45 minutes, rather than 30 minutes</li> <li>if acoustic source is required to power-down / shutdown three or more times during preceding 24-hour period as a result of whales, then 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 whale sightings</li> </ul> <p>Use of smallest possible seismic source - lowest possible total capacity for airgun array</p> <p>Survey vessel personnel (seismic crew) provided with pre-survey briefing on EPBC Act Policy Statement 2.1 requirements</p> <p>No discharge of seismic source will occur outside of Phase 1 and Phase 2 operational areas</p>

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Residual Risk	
						<p>Upon commencement of the survey in the Phase 1 operational area the four lines that partially overlap the humpback whale BIA will be acquired first. The portions of these lines that overlap the BIA will not be acquired after the end of August</p> <p>Upon commencement of acquisition within the Phase 2 operational area, the five lines closest to the humpback whale resting BIA around the Arolhos Islands will be acquired first. There will be no acquisition within 60 km of the northern boundary of the Arolhos Islands resting BIA after mid-October</p> <p>There will be no acquisition within the humpback whale BIA in the Phase 2 operational area. During some line turns the survey vessel and towed equipment will enter the western extent of the BIA, but the airgun array will be shutdown. On line run-ins adjacent to the boundary of the BIA soft starts will only commence when the survey vessel and airgun array are outside the BIA</p> <p>There will be no acquisition in either the Phase 1 or Phase 2 operational areas after the 31<sup>st</sup> October 2015</p> <p>The following specific adaptive management measures will apply during acquisition in either the Phase 1 or 2 operational areas, to manage the potential increased likelihood of encountering either humpback or pygmy blue whales:</p> <ol style="list-style-type: none"> <li>1. if there are three (3) consecutive days during which there are three (3) or more whale-instigated power downs / shut downs, then there will be no acquisition during night time of any shotpoints that are within 45 km of the boundary of the humpback whale BIA (migration)</li> <li>2. if there are three (3) consecutive days during which there are three (3) or more pygmy blue whale-instigated power downs / shut downs in the pygmy blue whale BIA, then, there will be no acquisition during night time for the remainder of the survey</li> <li>3. if there are three (3) consecutive days during which there are six (6) or more whale-instigated power downs / shut downs then acquisition will cease completely and the survey will be terminated</li> <li>4. measure #3 will apply for either humpback or pygmy blue whale-instigated power downs / shut-downs</li> </ol> <p>These additional control measure for night time operations applies concurrently with the other controls specified above</p> <p>If there are sightings of humpback whale or pygmy blue whale cow/calf pairs Spectrum will review the situation to determine if acquisition should continue. Any decision to postpone or terminate the survey, or to alter the pattern/forward plan of acquisition, will depend on the number, frequency and location of the cow/calf sightings, and on any other relevant information provided by the MFOs aboard the survey vessel</p> <p>No discharge of the seismic source will occur in water depths shallower than 80 m</p>
Routine discharges	Discharge of ballast water	Introduction and establishment of IMS and displacement of native marine species	Slight	Highly Unlikely	Low	<p>Ballast water discharges from survey vessel must comply with requirements of Australian Ballast Water Management Requirements</p> <p>The Ballast Water Management Plan for the <i>BGP Explorer</i> must comply with:</p> <ul style="list-style-type: none"> <li>• Regulation B-1 of International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004</li> </ul> <p>and should have been prepared in accordance with:</p> <ul style="list-style-type: none"> <li>• IMO Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (IMO Resolution MEPC.127(53))</li> </ul> <p>Application of AQIS guideline that ballast exchanges be conducted as far as possible away from shore and in water at least 200 m deep</p>

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Residual Risk	
	Discharge of bilge water, sewage and food wastes	Localised eutrophication of the water column; and localised adverse effect to marine biota	Slight	Unlikely	Low	<p>Bilge water discharges (machinery space bilges) from survey and chase vessels must comply with requirements of:</p> <ul style="list-style-type: none"> <li>MARPOL Annex I – Oil</li> <li><i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> - Section 9</li> </ul> <p>Survey vessel – bilge water discharges can occur only if:</p> <ul style="list-style-type: none"> <li>vessel has an IMO approved / MARPOL compliant oily water separator (International Oil Pollution Prevention Certificate [IOPPC])</li> <li>vessel is proceeding en route (i.e. is not stationary); and oil content less than 15 parts per million (ppm); and</li> <li>oil discharge monitoring and control system and oil filtering equipment are operating</li> </ul> <p>Chase vessel:</p> <ul style="list-style-type: none"> <li>oil and all oily mixtures must be retained aboard for onshore disposal</li> <li>or: - 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</li> </ul> <p>Sewage discharges from survey and chase vessel must comply with requirements of:</p> <ul style="list-style-type: none"> <li>MARPOL Annex IV – Sewage</li> <li><i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> - Section 26D</li> <li>Marine Order 96</li> </ul> <p>Sewage will be comminuted and using an IMO approved / MARPOL compliant sewage treatment plant, and can be discharged if:</p> <ul style="list-style-type: none"> <li>vessel is &gt;3 nm from nearest land; and</li> <li>sewage originating from holding tanks is discharged at a moderate rate (as defined in Marine Order 96) while vessel is proceeding en route at a speed not less than 4 knots</li> </ul> <p>Sewage that is not comminuted or disinfected can be discharged if:</p> <ul style="list-style-type: none"> <li>vessel is &gt;12 nm from nearest land; and</li> <li>sewage originating from holding tanks is discharged at a moderate rate (as defined in Marine Order 96) while vessel is proceeding en route at a speed not less than 4 knots</li> </ul> <p>Food waste discharges from survey and chase vessels must comply with requirements of:</p> <ul style="list-style-type: none"> <li>MARPOL Annex V – Garbage</li> <li><i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> - Section 26F</li> <li>Marine Order 95</li> </ul> <p>Food wastes can be discharged from survey and chase vessel if:</p> <ul style="list-style-type: none"> <li>it is comminuted or ground to a particle size &lt;25 mm; the vessel is en route; and</li> <li>the discharge takes place as far as practicable from the nearest land, but in any case, ≥3 nm from the nearest land</li> </ul> <p>Food wastes that are not comminuted or ground can be discharged from survey and chase vessel if:</p> <ul style="list-style-type: none"> <li>the vessel is en route; and the discharge takes place as far as practicable from the nearest land, but in any case, ≥3 nm from the nearest land</li> </ul> <p>Operations of survey and chase vessel will be in accordance with Marine Notice 6/2012</p> <p>Adherence to relevant BGP shipboard safety procedures that relate to discharge of bilge water, sewage and food wastes, as described in the Safety Management System Manual (SMSM)</p>
<b>UNPLANNED ACTIVITIES (ACCIDENTS / INCIDENTS)</b>						
Physical presence of survey vessel and towed array	Collision between survey vessels / towed array and marine fauna	Injury or fatality to protected marine fauna (cetaceans, turtles, Australian sea lion, whale shark)	Minor	Highly Unlikely	Low	<p>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:</p> <ul style="list-style-type: none"> <li>Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 – Regulation 26</li> </ul> <p>Interaction between survey and chase vessels and cetaceans, turtles and whale sharks within operational areas will be consistent with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.04) – Interacting with cetaceans:</p>

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Residual Risk	
						<ul style="list-style-type: none"> <li>during periods when survey vessel is transiting operational areas without seismic array deployed, or during process of deployment or retrieval of array, the vessel will not travel at speeds greater than 6 knots within 300 m of a cetacean, turtle or whale shark (caution zone), and will not approach closer than 100 m from an animal (with exception animals bow riding)</li> </ul> <p>These interaction procedures will apply for chase vessel for duration of activities in the Phase 2 operational area</p> <p>Operations of survey and chase vessel will be in accordance with Marine Notice 12/2011</p>
	Equipment dragging or loss	Localised physical damage to benthic habitats	Slight	Unlikely	Low	<p>Adherence to relevant BGP shipboard safety procedures, as described in the Safety Management System Manual (SMSM)</p> <p>Streamer equipped with pressure-activated, self-inflating buoys (streamer recovery devices – SRDs) designed to bring the equipment to the surface if lost accidentally</p> <p>Use of a solid streamer, rather than a fluid-filled streamer</p> <p>Lost towed equipment will be relocated and recovered where safe and practicable to do so</p> <p>Streamer deployment and recovery will only take place within Phase 1 and Phase 2 operational areas</p>
Waste management	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	<p>Handling of hazardous wastes aboard survey and chase vessels must comply with requirements of:</p> <ul style="list-style-type: none"> <li>MARPOL Annex III – Harmful Substances</li> <li><i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> - Section 26AB</li> <li>Marine Order 94</li> </ul> <p>Handling of non-hazardous wastes (garbage) aboard survey and chase vessels must comply with requirements of:</p> <ul style="list-style-type: none"> <li>MARPOL Annex V – Garbage</li> <li><i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> - Section 26F</li> <li>Marine Order 95</li> </ul> <p>Operations of survey and chase vessel will be in accordance with Marine Notice 6/2012</p> <p>Adherence to relevant BGP shipboard safety procedures, as described in the Safety Management System Manual (SMSM)</p> <p>Application of garbage, solid and liquid wastes handling and disposal requirements:</p> <ul style="list-style-type: none"> <li>No discharge of plastics or plastic products of any kind from survey or chase vessel</li> <li>No discharge of domestic wastes or maintenance wastes from survey or chase vessel</li> <li>All waste receptacles aboard survey and chase vessel covered with tightly fitting, secure lids to prevent any solid wastes from blowing overboard</li> <li>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</li> <li>Hydrocarbons located above deck stored with some form of secondary containment to contain leaks or spills (e.g. bund, containment pallet, transport packs)</li> <li>Correct segregation of solid and hazardous wastes</li> </ul>
Non-routine/ accidental hydrocarbon release	Hydrocarbon release caused by topsides (vessel) loss of containment	Localised and temporary reduction in water quality due to hydrocarbon contamination Toxic effects on marine fauna and flora Direct and indirect effects on commercial and recreational fisheries	Slight	Unlikely	Low	<p>Control measures to prevent release of hydrocarbons to sea resulting from spill to deck aboard survey and chase vessels must comply with requirements of:</p> <ul style="list-style-type: none"> <li>MARPOL Annex I – Oil</li> <li><i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> - Section 9</li> <li>Marine Order 91</li> </ul> <p>Survey vessel must have a Shipboard Oil Pollution Emergency Plan (SOPEP) that complies with requirements of:</p> <ul style="list-style-type: none"> <li>Regulation 37 of MARPOL Annex I</li> <li>Marine Order 91</li> </ul>

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Residual Risk	
						<p>Survey vessel must have valid International Oil Pollution Prevention Certificate (IOPPC) applicable to vessel class</p> <p><u>Storage:</u></p> <ul style="list-style-type: none"> <li>Any hydrocarbon storage on deck of 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 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</li> </ul> <p><u>Equipment:</u></p> <ul style="list-style-type: none"> <li>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</li> <li>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</li> </ul> <p><u>Spill Response:</u></p> <ul style="list-style-type: none"> <li>Survey vessel SOPEP will be in prescribed format described in Guidelines for the Development of Shipboard Oil Pollution Emergency Plans, adopted by IMO as Resolution MEPC.54(32)</li> <li>The latest SOPEP drills aboard the BGP Explorer were conducted in Australian waters on 12<sup>th</sup> and 23<sup>rd</sup> July 2015</li> <li>A further two SOPEP drills will be conducted during the course of the survey</li> <li>All drills will be reported as per MARPOL Annex I (Regulation 15) requirements and reviewed as part of ongoing monitoring and improvement of emergency control measures</li> <li>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</li> </ul>
	Hydrocarbon release caused by loss of structural integrity from vessel collision between survey vessel and third-party vessel	<p>Localised and temporary reduction in water quality due to hydrocarbon contamination</p> <p>Toxic effects on marine fauna and flora</p> <p>Direct and indirect effects on commercial and recreational fisheries</p>	Moderate	Highly Unlikely	<b>Medium</b>	<p>Operations of survey vessel must comply with COLREG; STCW Convention; Marine Orders Part 21; Marine Orders Part 30; Marine Order 28</p> <p><u>Prevention of vessel collisions:</u></p> <ul style="list-style-type: none"> <li>Good industry practice measures to minimise the likelihood of vessel collision</li> </ul> <p><u>Immediate actions:</u></p> <ul style="list-style-type: none"> <li>In the event of a vessel-to-vessel collision, implementation of measures described in the BGP Ship's Collision, Grounding and Stranding Emergency Plan (ECM)</li> </ul> <p>Survey vessel must have Shipboard Oil Pollution Emergency Plan (SOPEP) in place that complies with requirements of:</p> <ul style="list-style-type: none"> <li>Regulation 37 of MARPOL Annex I</li> <li>Marine Order 91</li> </ul> <p>Reporting of any spills of hydrocarbons to sea from survey vessel must comply with requirements of:</p> <ul style="list-style-type: none"> <li>Marine Order 91</li> </ul> <p><u>Reporting:</u></p> <ul style="list-style-type: none"> <li>When a fuel/oil spill to sea occurs survey vessel Master will inform RCC Australia using POLREP form. RCC Australia, in turn, will notify AMSA and/or WA DoT</li> <li>Any diesel spills to sea &gt;80 L will be reported to NOPSEMA and WA DMP as reportable incidents</li> </ul>

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Residual Risk	
						<p><u>Response strategy:</u>                      The primary response strategy in the event of a diesel spill to sea from the survey vessel will be to:</p> <ul style="list-style-type: none"> <li>• Immediate notification to RCC Australia</li> <li>• Allow small diesel spills to disperse and evaporate naturally, and monitor position and trajectory of any surface slicks</li> </ul>
						<p><u>Spill monitoring:</u></p> <ul style="list-style-type: none"> <li>• In the event of a major diesel spill from the survey vessel to the sea, BGP and Spectrum will implement relevant Type I "Operational Monitoring" implemented for spill surveillance and tracking</li> <li>• If there is a likelihood of a diesel spill impacting any protected areas (e.g. Ningaloo Coast and Shark Bay WHP, Abrolhos Islands FHPA) Spectrum 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</li> </ul>
						<p><u>Stakeholder consultation:</u></p> <ul style="list-style-type: none"> <li>• Pre-survey consultation with AMSA and WA DoT to ensure agreement in place for SOPEP interface with NATPLAN, WestPlan-MOP and WA DoT OSCP</li> <li>• Consultation in event of major diesel spill - relevant stakeholders (apart from Combat Agencies) will be contacted in event of a large diesel spill occurring in Phase 1 and Phase 2 operational areas during survey</li> </ul>
						<p><u>Insurances:</u></p> <ul style="list-style-type: none"> <li>• BGP has public liability insurance that covers any pollution that could result in environmental damage, specifically pollution emanating from their vessels. As such, this insurance would cover cost of environmental monitoring or clean-up post spill</li> </ul>

## 4.4 POTENTIAL ENVIRONMENTAL IMPACTS FROM UNDERWATER NOISE EMISSIONS

### 4.4.1 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. 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.

Decapod crustaceans have a variety of external and internal sensory receptors that are potentially responsive to sound and vibration. Many of these resemble vertebrate receptors that respond to hydrodynamic stimulation, particle motion and possibly pressure. However, the exoskeleton and body plan of aquatic decapods are more capable of responding to particle displacement components of an impinging sound field than pressure changes. The limited acoustic sensitivity of decapods is also related to their lack of any gas-filled spaces such as those associated with pressure detection in fishes. However, many decapods have extensive arrays of hair-like receptors both on and inside their exoskeleton that most probably respond to water- or substrate-borne displacements, and they also have many proprioceptive organs that may perceive vibrations.

An extensive and thorough review, published in 2004, provides a summary of impacts of seismic airguns on marine invertebrates based on literature reviews. It 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 (**Table 4-2**). One study showed physiological impacts and another showed no physiological impact. Three cases showed behavioural impacts and one study showed no impact on behaviour.

**Table 4-2 - Summary of impacts of seismic airguns on marine invertebrates based on literature reviews**

	Lethal / physical	Physiological / pathological	Behavioural	Catch rate
Negative impacts observed	<i>Loligo vulgaris</i> <i>Chionoecetes opilio</i> (eggs) <i>Chlamys islandicus</i> Sea urchins <i>Architeuthis dux</i>	<i>Bolinus brandaris</i>	<i>Alloteuthis subblata</i> <i>Sepioteuthis australs</i> <i>Architeuthis dux</i>	<i>Bolinus brandaris</i>
No impacts observed	<i>Chionoecetes opilio</i> <i>Mytilus edulis</i> <i>Gammarus locusta</i> <i>Crangon crangon</i>	<i>Chionoecetes opilio</i>	<i>Chionoecetes opilio</i>	<i>Crangon crangon</i> <i>Penaeus blebejus</i> <i>Nephrops norvegicus</i> <i>Illes coindetti</i> <i>Squilla mantis</i> <i>Paphia aurea</i> <i>Anadara inaequalvis</i>

In the winter of 2003 and spring of 2004, the Canadian Department of Fisheries and Oceans (DFO) conducted a study on the effects of seismic on snow crab in conjunction with a seismic survey off the western coast of Cape Breton. Crabs were caged at water depths of 63 and 73 m (experimental site) and 85 m (control site). The seismic survey involved 132 hours of survey time with a low volume (1,310 cui) airgun array. Maximum sound pressure levels (rms SPL) received at the test and control sites were 174 dB re 1µPa and 118 dB re 1µPa, respectively. The caging experiment examined short (12 days) and medium (five months) term differences in the morphology and physiology of snow crab at test and control sites. Snow crabs from both groups were also observed under laboratory conditions for differences in mortality, morphology, physiology, feeding and orientation (turnover rate) over a five month period. This seismic survey did not cause any acute or mid-term mortality of the crab, nor was there any evidence of changes to feeding in the laboratory. Survival of embryos being carried by female crabs, and locomotion of the resulting larvae after hatch, were unaffected by the seismic survey. In the short term, gills, antennules and statocysts (balance organs) were soiled in the test group but they were found to be completely cleaned of sediment when sampled five months later.

In this study, some differences were reported between the test and control animals. There was indication of some slight histological differences in the control and test groups but the differences can reasonably be

attributed to natural variability associated with the different oceanography/feeding regimes at the locations where the control and experimental animals were collected and held in the environment.

A number of studies have examined the potential effects of seismic surveys on catch levels in fisheries targeting benthic crustaceans such as prawns and rock lobster. One study investigated the effect of seismic surveys on prawn fisheries in relatively shallow waters (2-15 m) in Camamu Bay, north-western Brazil. Catch rates of various shrimp species were measured before and after use of a four airgun array with a source peak pressure of 196 dB re 1 $\mu$ Pa at 1 m. Catch rates were found to be unaffected. The experiment was carried out over a period of a few days whereby in-migration would not be a confounding factor. It is also noted that the authors carried out histopathological studies on gonadal and hepatopancreatic tissue and reported that there was no damage that could be associated with exposure. This study did not detect any significant deleterious impacts of seismic airgun noise on various penaeid species, suggesting that prawn stocks are resilient to the disturbance by airguns under the experimental conditions applied.

The findings of this study are supported by pilot observations carried out by the DFO on commercially important northern shrimp where no “flight or fright” reactions were found in animals exposed to relatively high sound levels in the laboratory. Thus, although crustaceans can be expected to detect the particle motion component of sound as revealed by sensitive electrophysiological or other techniques, this does not mean that they would be “scared” and subsequently move away from a seismic operation, thereby causing ramifications for catchability.

Another study investigated the effect of seismic airgun discharges on southern rock lobster via statistical analysis of the coincidence between seismic surveys and changes in commercial catch rates in western Victoria between 1978 and 2004. There was no evidence that catch rates of rock lobsters in western Victoria were affected by seismic surveys in the weeks or years following the surveys. However, most seismic surveys occurred in deep water, where impacts would be expected to be minimal. The apparent lack of impact of seismic surveys on catch rates of rock lobsters is consistent with the limited information available on the physiological effects of seismic surveys on invertebrates, including rock lobsters.

The majority of benthic crustaceans will only exhibit a behavioural response to airgun pulses at extremely close range, which means that only surveys run in very shallow water will have any effect. A conservative figure for the minimum depth for a response would be at 15 m from the array. Any disturbance to benthic crustaceans immediately beneath an airgun array would be extremely short-lived as they would be only exposed to one or two pulses before the source moves out of the potential range within which any disturbance may occur. The response of benthic crustaceans, such as rock lobster, at close range to an airgun array discharge may be little more than a ‘tail flip’ response.

#### **4.4.2 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. Data presented in **Table 4-3** indicates that the range of pathological effect on fish eggs and larvae is likely to be restricted to less than approximately 2 m. Calculations show that less than 0.02% of plankton in the area would be affected. Any effect on the planktonic organisms from the seismic discharge is insignificant compared with the size of the planktonic population in a survey area or natural mortality rates for planktonic organisms.



**Table 4-3 - Observed seismic noise pathological effects on fish eggs and larvae**

Species	Source	Source level (dB re 1 $\mu$ Pa @ 1m)	Distance from source (m)	Exposure level (dB re 1 $\mu$ Pa)	Observed effect
Cod (larvae 5 days)	Single airgun	250	1	250	Delamination of the retina
Cod (larvae 2-10 days)	Single airgun	222	1	222	No injuries detected
			10	202	No injuries detected
Fish eggs (Anchovy)	Single airgun	230 (estimated)	1	230	7.8% of eggs injured relative to control
			10	210	No injuries detected
Fish eggs (Red Mullet)			1	230	No injuries detected
			10	210	No injuries detected
Dungeness Crab (larvae)	Seven airgun array	244 (estimated)	1	233.5	No significant difference in survival rate relative to controls
			3	230.9	
			10	222.5	

#### 4.4.3 Disturbance to Fish

Studies with caged fish have shown that some fish species that are caged, and therefore unable to swim away from the noise source, can suffer physiological damage to eyes and hearing. Conditions that could result in fish being trapped and unable to move more than a few metres from the noise source as the survey vessel traverses the area do not exist in the proposed survey area (indeed it is difficult to conceive of any vessel-based seismic survey causing fish to be trapped within a few metres of the noise source). Therefore, it is considered that the risk of physiological effects on fish is negligible.

For some fish, strong ‘startle’ responses have been observed at sound levels of 200 to 205 dB re 1 $\mu$ Pa, indicating that sounds at or above this level may cause fish to move away from the vessel. Sound levels of this intensity are likely to occur approximately 100 to 300 m from an airgun array. Based on this an approximate range of 200 m is given as the minimum distance at which fish may move away from an operating array and below which physical effects may occur. More recent studies have found that active avoidance may occur in some fish species at sound levels of approximately 161–168 dB re 1 $\mu$ Pa rms, which corresponds to a distance of approximately 1 km from the survey vessel.

Based on existing information, significant impacts on fish populations resulting from seismic survey noise are likely to be restricted to the following:

- short ranges and high sound intensities (i.e. <200 m range from source);
- populations that cannot move away from operating arrays (e.g. site-attached reef species);
- surveys that take place over protracted periods close to areas important for the purposes of feeding, spawning or breeding; and
- surveys that take place over protracted periods close to areas that constitute narrow, restricted migratory paths.

Available evidence suggests that behavioural changes for some fish species may be no more than a nuisance factor. For example, the temporary, short range, displacement of pelagic or migratory fish populations may have insignificant repercussions at a population level.

There is a high likelihood that seismic airgun noise could cause the following effects in some finfish:

- avoidance;

- startle/alarm response;
- changes in swimming patterns (including change in swimming speed and direction); and
- changes in 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. The ecological significance of such effects is expected to be low, except where they influence reproductive activity.

The threshold received sound exposure levels (SEL) that could result in various behavioural effects in fish outlined above are:

Low level behavioural effects:

- avoidance at >140 dB re  $1\mu\text{Pa}^2\cdot\text{s}$  (pelagic species and the more nomadic demersal species);
- startle/alarm at >160 dB re  $1\mu\text{Pa}^2\cdot\text{s}$  (species with limited home ranges or site-attached and/or territorial strategies).

High level behavioural effects:

- fright/flight at >180 dB re  $1\mu\text{Pa}^2\cdot\text{s}$  (species with limited home ranges or site-attached and/or territorial strategies).

There are no documented cases of fish mortality upon exposure to seismic airgun noise under field operating conditions.

The threshold received SELs that could result in various sub-lethal and/or physiological effects are:

- onset of short term reversible loss in hearing sensitivity (temporary threshold shift - TTS) at >180 dB re  $1\mu\text{Pa}^2\cdot\text{s}$  (site-attached species);
- onset of longer term loss in hearing sensitivity (TTS/permanent threshold shift – PTS) at >187 dB re  $1\mu\text{Pa}^2\cdot\text{s}$  (site-attached species); and
- TTS onset but no injury to non-auditory tissues to ~1 kg sized fish at >200 dB re  $1\mu\text{Pa}^2\cdot\text{s}$  (site-attached species).

The potential effects of marine streamer 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. 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.

Minimum water depths at the line ends closest to the coast in the Phase 1 operational area are >100 m, and in the Phase 2 operational area minimum water depths at the line ends range from 80 m to >100 m. Therefore, there will be no shotpoints in any water depths less than 80 m. No significant communities of site-attached fish are expected to occur in water depths >50 m, given the lack of suitable hard substrates and benthic habitats (e.g. coral reefs, macro-algal beds, seagrass meadows etc.). Therefore, it is highly unlikely that any site-attached fish communities will be exposed to received SELs of a magnitude that could cause either low or high level behavioural effects, due to the separation distance between the shotpoints closest to areas where these communities may be present.

#### **4.4.4 Disturbance to Baleen Whales**

Baleen whales produce a rich and complex range of underwater sounds ranging from about 12 Hz to 8 kHz but with the most common frequencies below 1 kHz. This combined with studies of their hearing apparatus suggests that their hearing is also best adapted for low frequency sound. Baleen whales make

individual sounds that may last for up to 16 seconds and humpback whales are known to “sing” for long periods. These sounds are thought to be used in social interactions and communication between individuals and groups.

**Table 4-4** lists the estimated source levels, frequency ranges and dominant frequencies of baleen whale calls for species that may be encountered during the proposed survey. It can be seen that some species produce quite high sound levels. Likewise, other studies report humpback whale song components reaching 192 dB re 1µPa<sup>2</sup> (pk-pk) as well as levels of 180 to 190 dB re 1µPa<sup>2</sup> (pk-pk) for humpback pectoral fin slapping and breaching sounds.

Physical damage to the auditory system of cetaceans may occur at noise levels of about 230 to 240 dB re 1µPa, which is equivalent to a distance of about one to two metres 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.

**Table 4-4 - Sounds produced by baleen whales that may be encountered during the proposed survey**

Species	Frequency (Hz)	Dominant frequency (Hz)	Estimated source level (dB re 1µPa.m)
Blue	12-31,000	16-25, 6,000–8,000	130–188
Humpback	25–8,200	25–4,000	144–192
Minke	60-20,000	60-12,000	151-175
Bryde's	70–950	700-900	152-174

Noise associated with airguns used during seismic surveys can cause significant behavioural changes in whales. Behavioural responses to airgun noise include swimming away from the source, rapid swimming on the surface and breaching. The level of noise at which response is elicited varies between species and even between individuals within a species. Some evidence suggests that different groups of cetaceans adopt different strategies for responding to acoustic disturbance from seismic surveys with baleen and killer whales displaying localised avoidance, pilot whales showing few effects and sperm whales showing no observed effects.

A comprehensive study carried out in the Exmouth Gulf region of WA monitored the effects of seismic survey noise on humpback whales. The following conclusions were drawn from this research:

- only localised avoidance was seen by migrating whales during the seismic operation, indicating that the ‘risk factor’ associated with the seismic survey was confined to a comparatively short period and small range displacement;
- coupled with the fact that humpback whales were seen to be actively utilising the ‘sound shadow’ near the surface, then it is unlikely that animals will be at any physiological risk unless at very short range from a large airgun array, perhaps of the order of a few hundred metres; and
- upper levels of noise at 1.5 km from the seismic survey array are in the order of 182 dB re 1µPa<sup>2</sup>, which is still well below the source levels of the highest components of humpback whale song (192 dB re 1µPa<sup>2</sup>). Thus at 1.5 km the received airgun signal is still well within the range which humpback whales would be expected to cope with physiologically, since it would be difficult to argue that humpback whale song can cause physiological problems to the animals.

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. The survey area and adjacent waters are not known critical habitats for any cetacean species.

The study conducted in Exmouth Gulf found that migrating humpback whales show a general avoidance of an operating seismic source at 157 to 164 dB re 1µPa (rms). Resting cow pods show avoidance at

somewhat lower levels—for example, a mean sound level for avoidance of 140 dB re 1µPa (rms) and a mean standoff range at 143 dB re 1µPa (rms).

#### 4.4.5 Disturbance to Toothed Whales

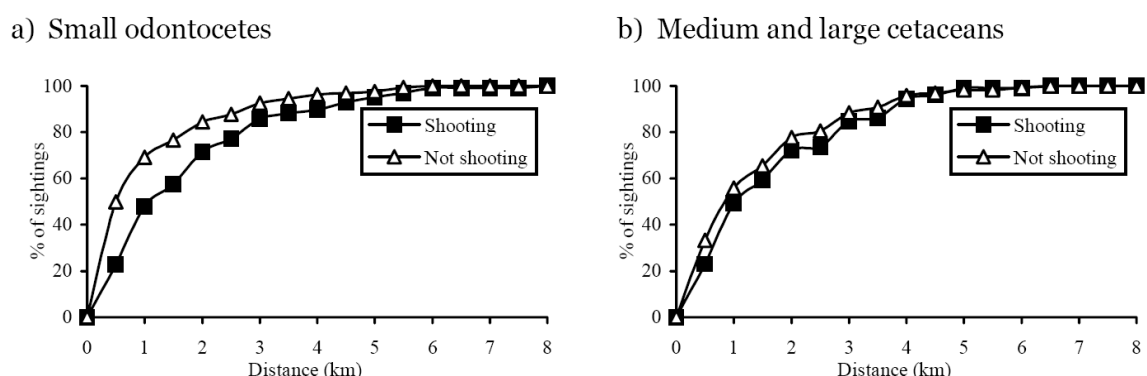
Toothed whales produce a wide range of whistles, clicks, pulsed sounds and echolocation clicks. The frequency range of toothed whale sounds excluding echo location clicks are mostly <20 kHz with most of the energy typically around 10 kHz, although some calls may be as low as 100 to 900 Hz. Source levels range from 100 to 180 dB re 1 µPa. The sounds produced, other than echo location clicks, are very complex in many species and appear to be used for communication between members of a pod in socialising and coordinating feeding activities.

For toothed whales exposed to single short pulses, the TTS threshold appears to be in the range of 186 to 202 dB re 1 µPa. Seismic pulses with received levels of 186 dB re 1 µPa or more are usually restricted to a radius of no more than about 300 m around a seismic airgun array, therefore the potential for TTS is extremely low as it would be necessary for the whale to be less than one kilometre from the airgun array and remain within this range as the vessel traversed a distance of four to five kilometres.

There is little systematic data on the behavioural response of toothed whales to seismic surveys. One study reported 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 study supported by the US Minerals Management Service 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.

Smaller toothed cetaceans have poor hearing in the low frequency range of airgun array noise (10 to 300 Hz) and seismic operators sometimes report dolphins and other small toothed whales near operating airgun arrays. However, there is a component of seismic pulses in the higher spectrum and in general most toothed whales do show some limited avoidance of operating seismic vessels. One study examined the effects of 3D seismic surveys on common dolphins in the Irish Sea. The results indicated that there was a local displacement of dolphins around the seismic operation. This observation is consistent with other data from marine mammal observers aboard seismic vessels in the North Sea that shows small toothed whale species tend to move away from operating airguns (see **Figure 4-1**).

**Figure 4-1 - Proportion of marine mammal sightings occurring within specified distances of the airguns during seismic surveys**



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).

#### 4.4.6 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'. Studies indicate that marine turtles may begin to show behavioural responses to an approaching seismic array at received sound levels of approximately 166 dB re 1  $\mu$ Pa (rms), and avoidance at around 175 dB re 1  $\mu$ Pa (rms). This corresponds to behavioural changes at approximately two kilometres, and avoidance from approximately one kilometre.

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.

Based on current information, it would appear that significant impacts on marine turtle populations resulting from seismic survey noise are likely to be restricted to:

- short ranges and high sound intensities (perhaps less than 30 m range from source);
- surveys that take place over protracted periods close to areas important for feeding, breeding and nesting; and
- surveys that take place over protracted periods close to areas that constitute narrow, restricted migratory paths.

Feeding areas and migratory paths of turtles traverse both shallow and deep-water areas, and therefore individuals of all sizes may be encountered in a seismic survey area. It has been speculated that migrating turtles may use various acoustic cues and that acoustic disturbances might interfere with their navigational ability. The auditory sensitivity of marine turtles is reported to be centred in the 400 to 1,000 Hz range, with a rapid drop-off in noise perception on either side of this range. This auditory range matches their weak vocalisation abilities, which are also in the low frequency range (100 to 700 Hz).

From airgun exposure tests on a caged green turtle and a loggerhead turtle (see **Table 4-5**), that were extrapolated to response levels for a typical airgun array operating at full power in 100 m water depth, it can be concluded that turtles would, in general, probably show behavioural responses at two kilometres and avoidance behaviour at one kilometre from such operations. However, they also noted that such rules of thumb for acoustic sources with frequencies within the range of turtle hearing (<1 kHz), cannot be reliably applied to shallow coastal waters near reefs, islands and nesting beaches, where transmission losses are typically much higher than in deeper, open water areas.

There is no evidence implying that turtles actively avoid or are attracted to close range (less than 500 m) encounters with operating airgun arrays. However, one study tested if hearing sensitivity of caged loggerhead turtles altered after exposure to several hundred pulses within 30-65 m of a single airgun (pulse numbers and received sound levels not stated). Hearing was tested before, within a day, then two weeks after exposure. Approximately 50% of the exposed individuals indicated altered hearing sensitivity when tested within a day of their exposure, but none provided any sign of altered hearing two weeks later, compared to the pre-exposure tests.

**Table 4-5 - Results of airgun exposure to marine turtles**

Species	Received level (dB re 1 $\mu$ Pa rms)	Effect
Loggerhead turtle	175-176	Avoidance response
One green and one loggerhead turtle	166	Noticeable increase in swimming behaviour, presumed avoidance response
One green and one loggerhead turtle	175	Behaviour becomes increasingly erratic, presumed alarm response

#### 4.4.7 Disturbance to Pinnipeds

Pinnipeds are divided into two families: Phocidae and Otariidae. Based on a review of the literature, phocid species (true seals) have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range. This is believed to be because phocid ears are anatomically distinct from otariid ears in that phocids have larger, more dense middle ear ossicles, inflated auditory bulla, and larger portions of the inner ear (i.e. tympanic membrane, oval window, and round window), which make them more adapted for underwater hearing.

Australian sea lions are otariids (sea lions and fur seals). Based on a review by NOAA the functional hearing range of phocid pinnipeds has been estimated as 75 Hz to 100 kHz, and the functional hearing range of otariid pinnipeds has been estimated as 100 Hz to 40 kHz. The airgun array proposed for the Rocket MC2D MSS will produce pulses across a frequency range of 0-150 Hz – i.e. largely below the functional hearing range of otariids such as the Australian sea lion, which are better adapted to detecting higher frequency underwater sounds.

Underwater audiograms for some sea lions and fur seals indicate that their greatest sensitivity lies in the range 2-32 kHz and these pinnipeds are therefore likely to be less sensitive to low frequency (<1 kHz) sounds than to higher frequency (>1 kHz) sounds. The low frequency sounds (10-300 Hz) produced by seismic airgun arrays appear to fall below the range of otariid pinniped greatest hearing sensitivity. This interpretation must be treated with caution, as little data exists for low frequency thresholds and hearing sensitivities of Australian pinnipeds. However, it is recognised that seismic activity will only be a threat to pinnipeds if it take place close to critical habitats.

Australian sea lions make underwater sounds including barks, whinnies and buzzing associated with social interactions. It has been measured that the projected energy for these sounds is between 0.25 and 2 kHz frequency, and their hearing range is approximately between 0–4 kHz, in comparison to the airgun array proposed for the Rocket MC2D MSS, which will produce pulses in the range of 0-150 Hz.

One study reported that an airgun caused an initial startle reaction among South African fur seals, but was ineffective in scaring them away from fishing gear. Gray seals exposed to noise from airguns reportedly did not react strongly. Seals in both water and air sometimes tolerate strong noise pulses from nonexplosive and explosive scaring devices, especially if attracted to the area for feeding or reproduction. Monitoring studies conducted in 1996–97 for an open-water seismic programme in the Alaskan Beaufort Sea indicated that seals (mainly ringed seals) usually tolerate strong sound pulses from nearby seismic vessels. Only a minority of the seals within a few hundred metres show evidence of localised avoidance, and any effects on seal behaviour are not very consistent or conspicuous. During discharge of a full seismic array it was measured that there was a partial avoidance zone of Arctic seals from the vessel at distances under 150 m, with the seals not moving farther than 250 m from the vessel.

Based on the limited data on pinnipeds in water exposed to multiple pulses, exposures in the ~150 to 180 dB re 1  $\mu$ Pa range (rms values over the pulse duration) generally have limited potential to induce avoidance behaviour in pinnipeds. Received levels exceeding 190 dB re 1  $\mu$ Pa were determined to be likely to elicit responses, at least in some ringed seals, which are phocids. Based on the modelled sound pressure levels (SPL) for the 3,680 cui proposed for use during the Rocket MC2D MSS, SPL >190 dB re 1  $\mu$ Pa would only occur within ~500 m of the operating array.

In the case of pinnipeds exposed to sequences of airgun pulses from an approaching seismic vessel, most animals may show little avoidance unless the received levels are high enough for mild temporary threshold shift (TTS) to occur. A paper published in 2007 proposed injury (i.e. TTS onset) criteria for pinnipeds in water of 218 dB re 1  $\mu$ Pa (SPL), or an SEL of 186 dB re 1  $\mu$ Pa<sup>2</sup>-s. SPL / SEL of these magnitudes would only be experienced at extremely close range (e.g. <50 m or so) from an operating array of the size proposed for the Rocket MC2D MSS, particularly for otariid species such as Australian sea lions. The noise created during seismic surveys is generally considered to be outside of the hearing range of Australian sea lions, and is therefore not considered to be a great source of disturbance, and the species is mobile and can exhibit avoidance behaviour if disturbed.

#### 4.4.8 Disturbance to Sharks

Limited research has been conducted on shark responses to marine seismic surveys. Sharks differ from bony fish in that they have no accessory organs of hearing such as a swim bladder and therefore are

unlikely to respond to acoustical pressure. One study also suggested that the lateral line system does not respond to normal acoustical stimuli, and is unable to detect sound-induced water displacements beyond a few body lengths, even with large sound intensities. Other reports indicate that sharks are highly sensitive to sound between approximately 40 and 800 Hz, which overlaps with seismic sound frequencies. Another study established that an individual shark will suddenly turn and withdraw from a sound source of high intensity (more than 20 dB re 1 $\mu$ Pa above broadband ambient SPL) when approaching within 10 m of the sound source.

The available evidence indicates sharks will generally avoid seismic sources and the likely impacts on whale sharks and white 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 **Section 4.4.9**).

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 whale sharks and white sharks.

#### **4.4.9 Spatial and Temporal Overlap with Critical Habitat and Peak Periods of Activity for Protected Marine Fauna**

##### Humpback whales

The Phase 1 and Phase 2 operational areas for the Rocket MC2D MSS do not represent critical habitat (e.g. calving, nursing, resting, breeding, feeding areas; narrow restricted migratory pathways) for any cetacean species that may occur in the region. The central part of the Phase 1 operational area is located adjacent to the humpback whale resting area in Shark Bay (see **Figure 4-2**), but at the closest point the minimum separation distance is ~30 km. The minimum separation distance between a Phase 1 line end and the resting BIA in Shark Bay is approximately 43 km. However, the two southernmost line ends are separated from the BIA by Dirk Hartog Island. The shortest clear water (unrestricted) distance between a line end and the western boundary of the BIA is approximately 45 km. The minimum separation distance between the northern line ends and the BIA is approximately 68 km, but Bernier and Dorrier Islands are located between a number of these lines and the BIA.

Based on (unpublished) empirical measurements of a number of seismic airgun sources in western and southern Australian waters by researchers from the Centre for Marine Science and Technology (CMST) at Curtin University, the sound pulses from a 3,680 in<sup>3</sup> airgun are expected to decrease to sound exposure levels (SEL) of 125-135 dB re 1 $\mu$ Pa<sup>2</sup>.s within 45 km of the source, dependent on the sound propagation characteristics of the area (see **Figure 4-3**). Transmission loss is likely to be accelerated in shallow water to the east of the line ends, as sound will bounce repeatedly between the sea surface and seabed and so lose energy rapidly, or not bounce at all but enter the seabed and so not be pertinent for lateral sound transmission. Therefore, it is likely that received SEL at the western edge of the Shark Bay resting BIA will not exceed 130 dB re 1 $\mu$ Pa<sup>2</sup>.s.

McCauley *et al.* (2003) found that migrating humpback whales show a general avoidance of an operating seismic source at 157 to 164 dB re 1 $\mu$ Pa (rms), and resting cow pods show avoidance at somewhat lower levels—for example, a mean sound pressure level (SPL) for avoidance of 140 dB re 1 $\mu$ Pa (rms) and a mean standoff range at 143 dB re 1 $\mu$ Pa (rms). These SPL rms levels are equivalent to SEL of approximately 10 dB less – i.e. 130-133 dB re 1 $\mu$ Pa<sup>2</sup>.s. It is highly unlikely that any humpback whales within the Shark Bay resting BIA will experience received SEL of a magnitude sufficient to result in a marked avoidance of the stimulus. Additionally, this situation will only arise during the short period of time the vessel is acquiring the eastern ends of the lines adjacent to Shark Bay.

**Figure 4-2** shows the lines that have to be acquired within the Phase 1 operational area, and the location of the humpback whale BIA (migration – north and south). There are a number of lines where the line ends extend into the BIA (coloured orange in **Figure 4-2**). Lines that do not overlap the BIA are coloured green.

Figure 4-2 - Phase 1 lines and humpback whale BIA

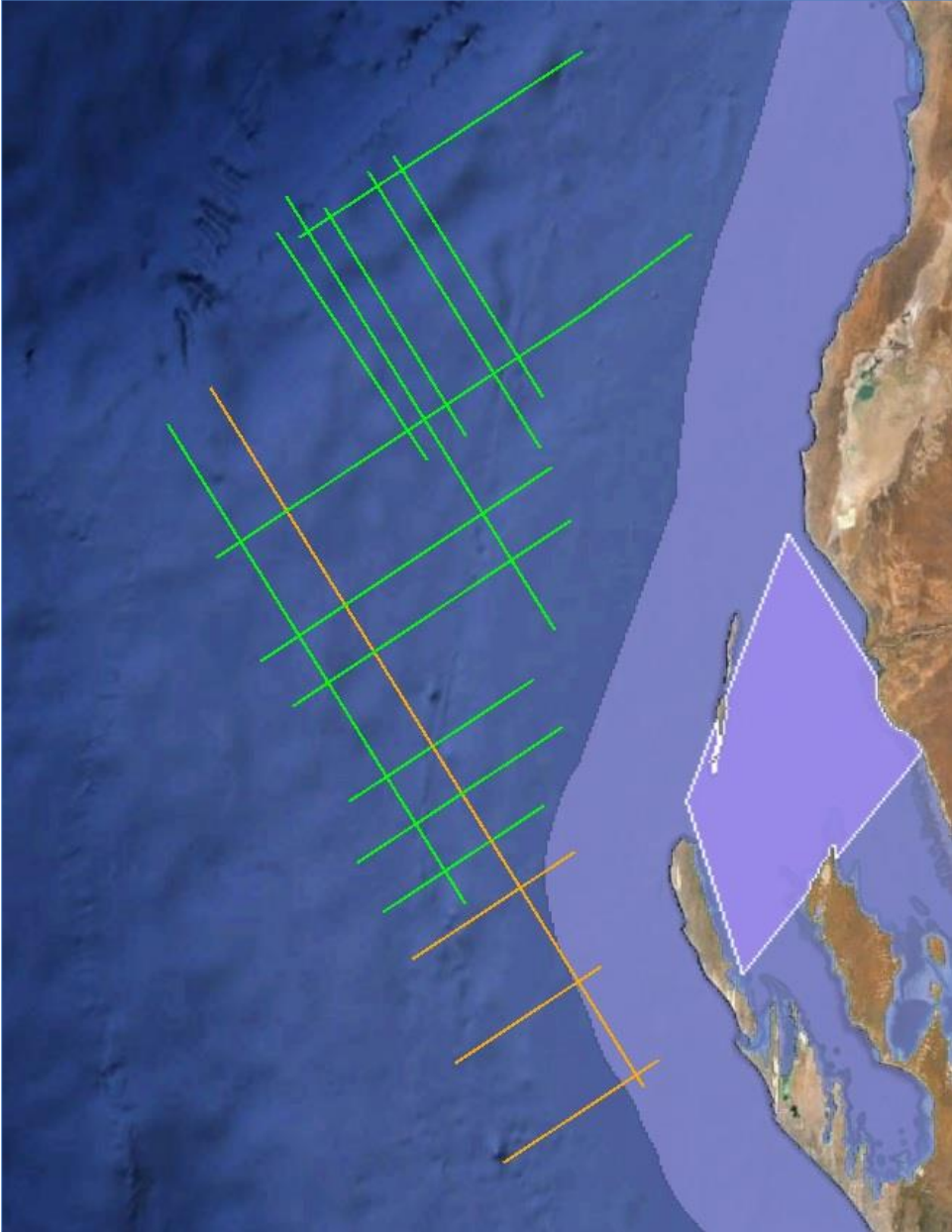
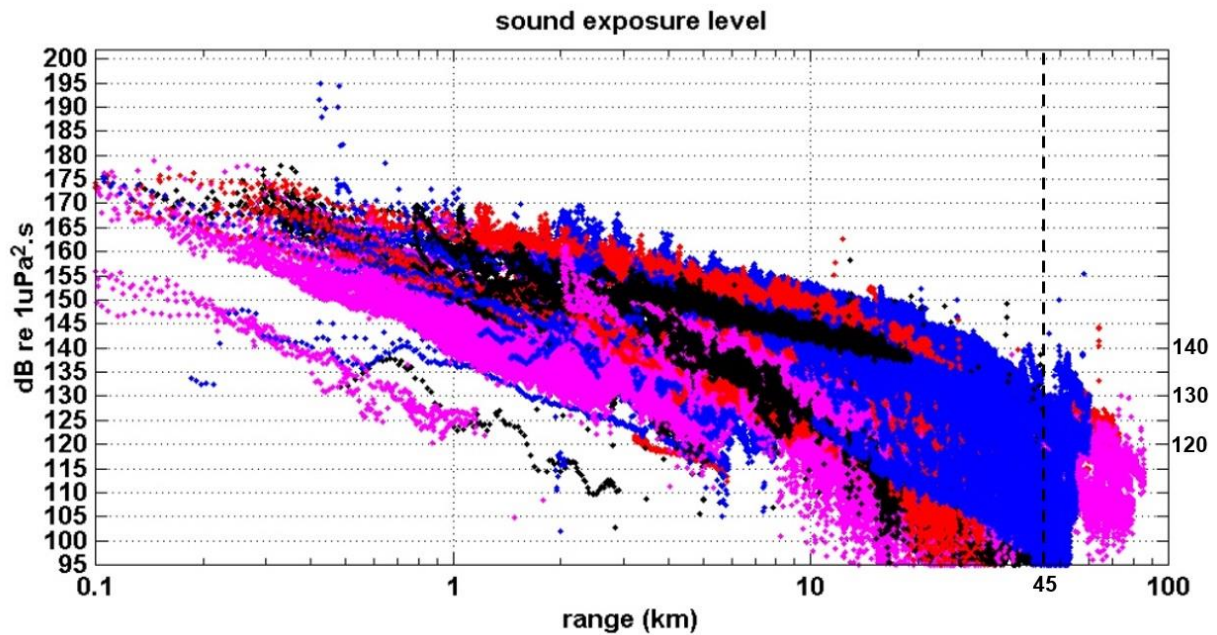




Figure 4-3 - Twenty-eight seismic survey decay curves, western and southern WA waters, 20 – 4,900 cui



The majority of animals moving through the waters between North West Cape and Shark Bay during the southbound migration are likely to occur in water depths <100 m, on the continental shelf closer to the coast. This will particularly apply to cow/calf pairs.

Figure 4-4 shows the lines within the Phase 2 operational area and the location of the humpback whale BIA. No lines cross over into the humpback whale BIA. The minimum separation distance between a line end and the BIA (migration) is ~2.5 km. The minimum separation distance between a line end and the BIA (resting) around the Abrolhos Islands is ~28 km (see Figure 4-5).

Again, the majority of animals moving through the waters between Shark Bay and Geraldton during the southbound migration are likely to occur in water depths <100 m, on the continental shelf closer to the coast. This will particularly apply to cow/calf pairs. The southbound peak for humpback whale cow/calf pairs in the area around the Abrolhos Islands is end October – early November (see Table 4-6).

Figure 4-4 - Phase 2 lines and humpback whale BIA

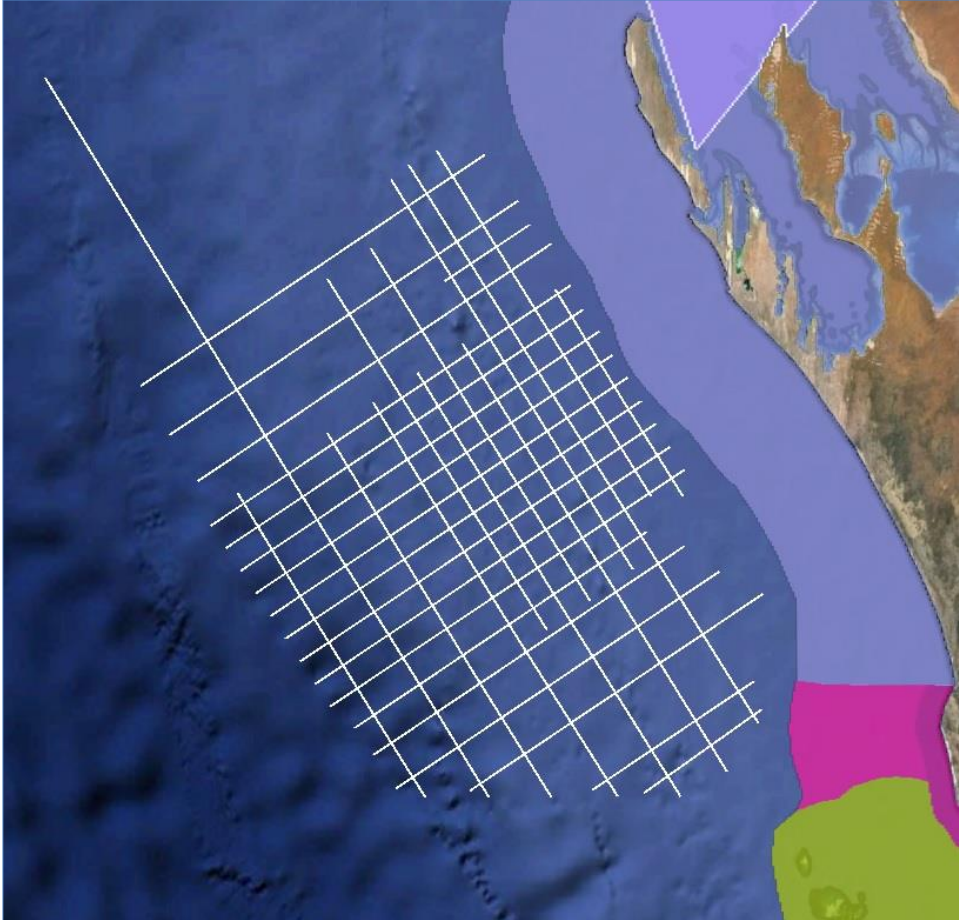
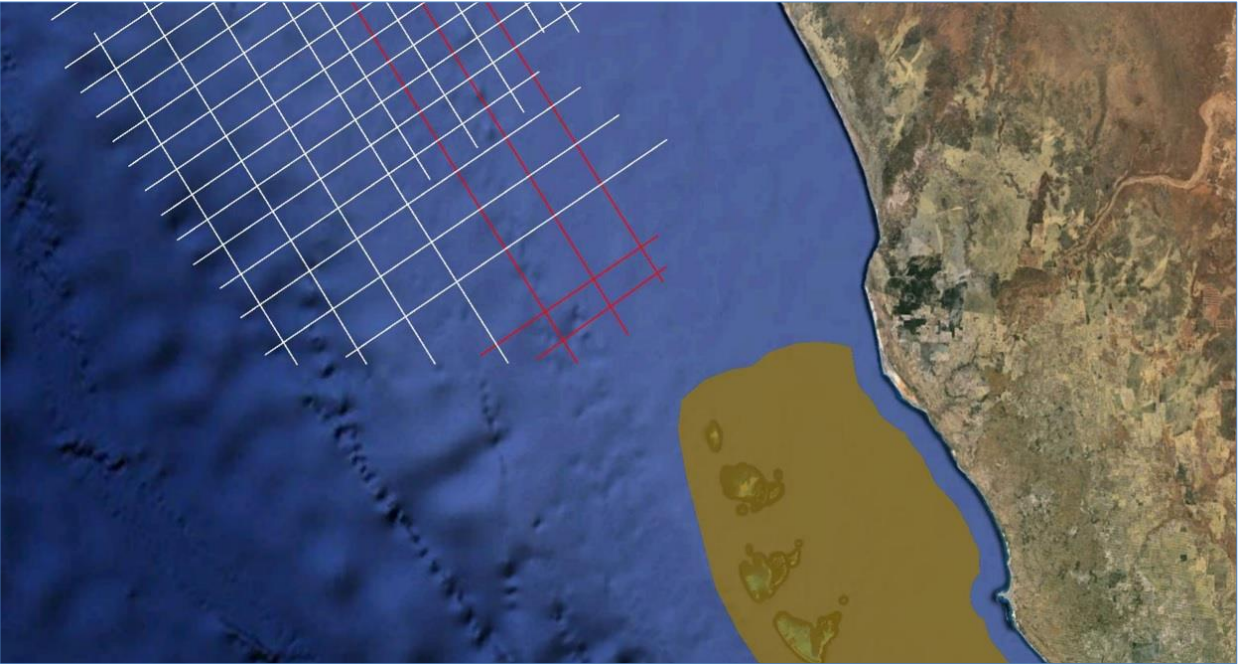


Figure 4-5 - Phase 2 lines and Abrolhos Islands humpback whale resting BIA



**Table 4-6** shows the timing of both the northbound and southbound migration of humpback whales off the west coast of WA. The table shows the period when significant numbers of animals may be encountered in the Phase 1 and Phase 2 operational areas, and the likely peak period for the southbound migration—for both the bulk of the population and the later pulse of cow/calf pairs.

It is expected that very few, if any, animals will be encountered in the Phase 1 operational area in August, and in the Phase 2 operational area in the period August to early September. Both of these periods represent the transition phase when the animals will have reached the end point of their northbound migration (the west Kimberley coastline), and whilst some animals may have commenced their southbound migration they are not likely to reach the area south of North West Cape until September.

Acquisition in either operational area during August would represent a low risk of impacts to humpback whales. Whilst acquisition in September would overlap the peak northbound and the peak southbound migration periods, only lines outside the BIA in the Phase 1 operational area (green lines in **Figure 4-2**) would be acquired in September and October, minimising the potential impacts on humpback whales.

To eliminate the potential for resting humpbacks in the Abrolhos Islands BIA to be exposed to received SEL of a sufficient magnitude to cause significant behavioural responses the lines closest to the BIA will be acquired first upon commencement of acquisition within the Phase 2 operational area (see red lines in **Figure 4-5**). This means that there will be no acquisition within approximately 60 km of the northern boundary of the Abrolhos resting BIA after mid-October – i.e. acquisition of these lines closest to the BIA will be completed 3-4 weeks prior to the southbound peak of cow/calf pairs. With a separation distance of 60 km it is likely that maximum received SEL at the northern boundary of the BIA will be in the order of 110 to 120 dB re 1 $\mu$ Pa<sup>2</sup>.s (see **Figure 4-3**) - i.e. well below levels that could cause a marked avoidance of the stimulus by humpback whale resting cow pods, and approaching background ambient noise levels that probably exist in the area.

Additionally, as described below, a set of adaptive management measures would be applied in the event that a large number of whales are present at the time resulting in a significant number of power down / shut down situations.

#### Pygmy blue whales

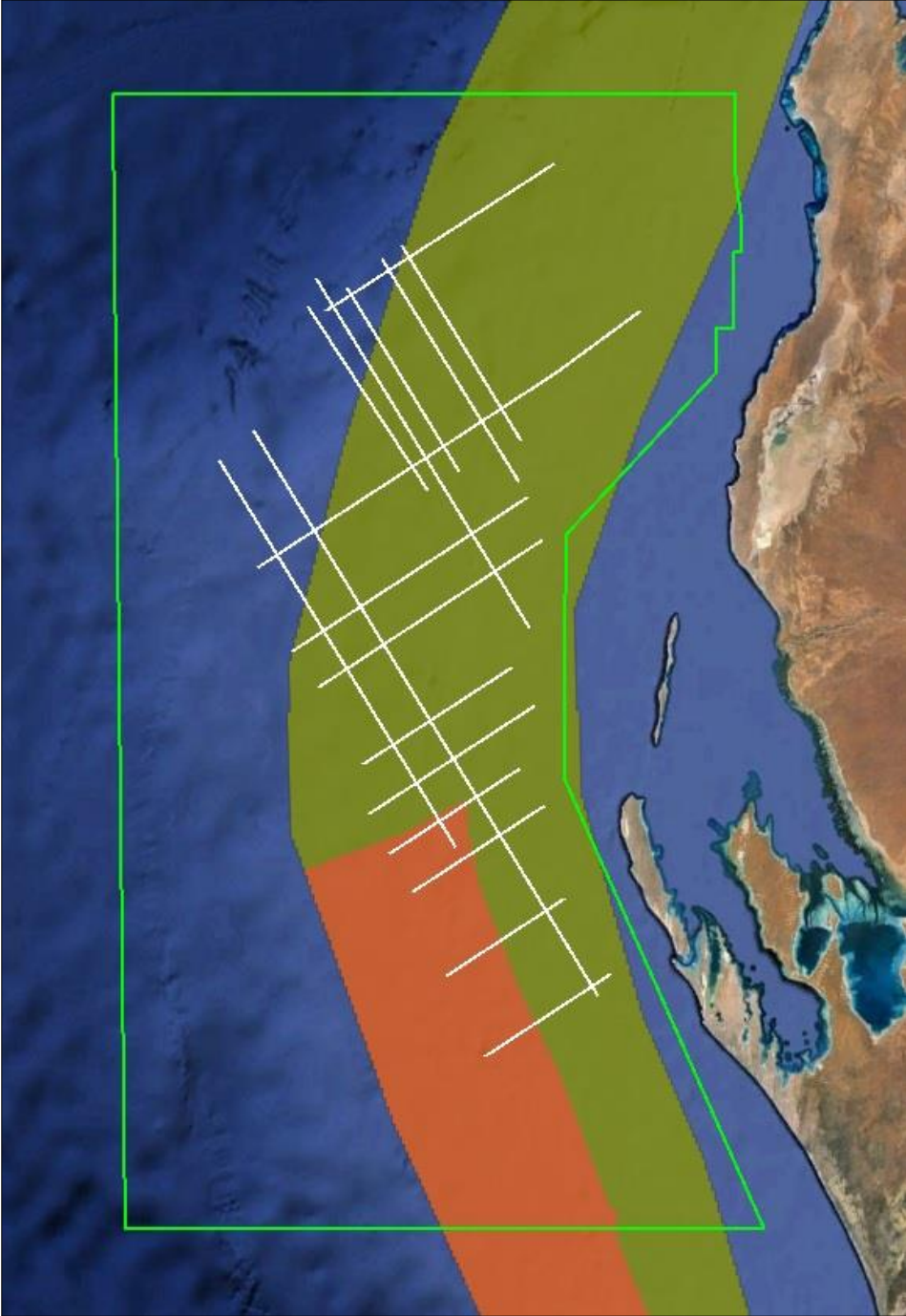
**Figures 4-6** and **4-7** show the overlap between the pygmy blue whale BIA (migration – north and south) and the Phase 1 and Phase 2 operational areas and pre-plot line plan, respectively.

The timing of both the northbound and southbound migration of pygmy blue whales off the west coast of WA is shown in **Table 4-6**. The table shows the period when significant numbers of animals may be encountered in the Phase 1 and Phase 2 operational areas, and the likely peak period for the southbound migration.

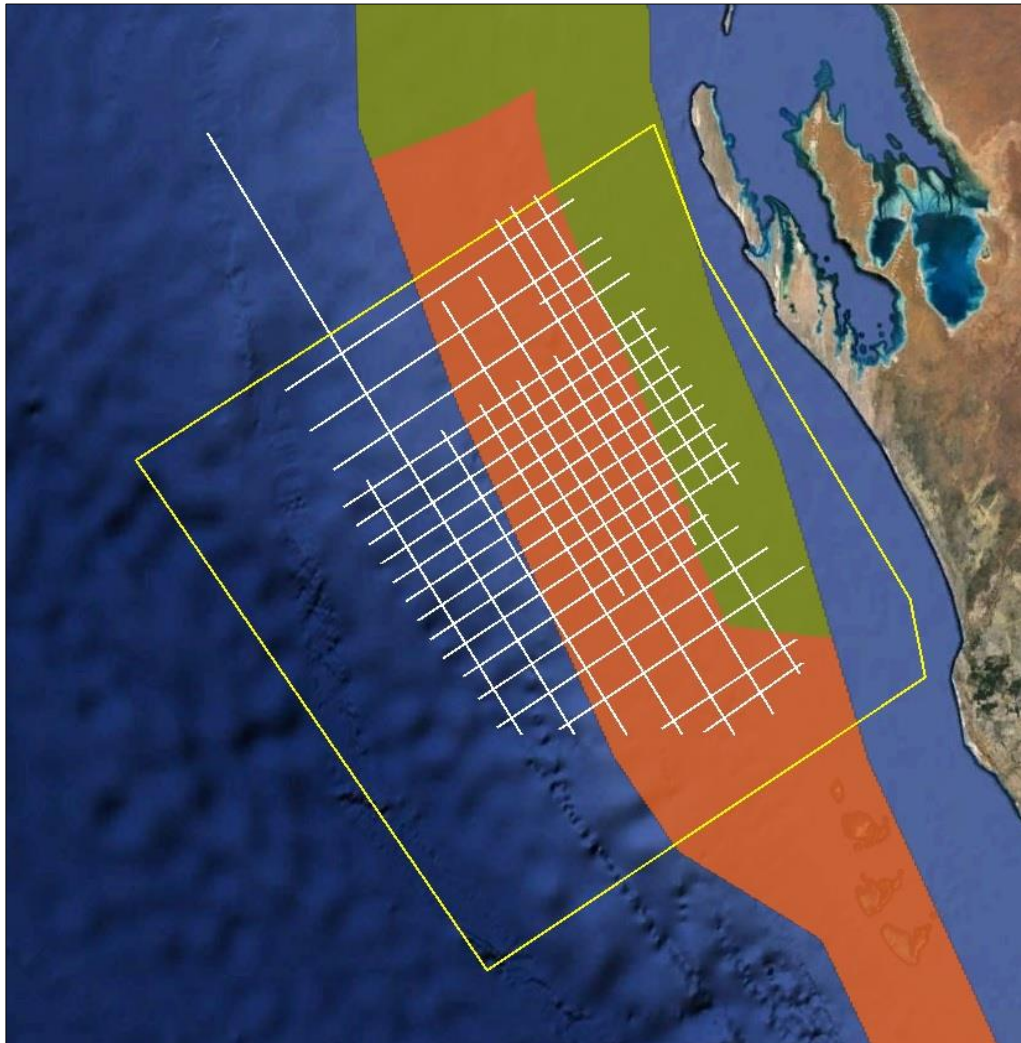
It is expected that very few, if any, animals will be encountered in the period between August and mid-October in either operational area, as these months represent the transition period when the animals will have reached the end point of their northbound migration, and whilst some animals may have commenced their southbound migration they are not likely to reach the area south of North West Cape until October.

Essentially, acquisition in either operational area during the period mid-August to the end of October would represent a lower risk of impacts to pygmy blue whales than acquisition in the preceding months, given that it would avoid the peak period for the northbound migration of pygmy blues whales between the Perth Canyon and North West Cape between early April to late May, and would also avoid the peak period for the southbound migration between late November and mid-December (see **Table 4-6**).

Figure 4-6 - Phase 1 operational area and lines, and the pygmy blue whale BIA



**Figure 4-7 - Phase 2 operational area and lines, and the pygmy blue whale BIA**



#### Marine turtles

The Phase 1 and Phase 2 operational areas for the Rocket MC2D MSS do not represent critical habitat (e.g. nesting, internesting, breeding, feeding areas; narrow restricted migratory pathways) for any marine turtle species that may occur in the region. Additionally, the two operational areas do not overlap any BIA for marine turtles in the NWMR (there are no designated BIA for turtles in the SWMR).

#### Australian sea lion

The Phase 2 operational area does not overlap the BIA (foraging [male]) for Australian sea lions in the waters surrounding the Abrolhos Islands.

#### White shark

The Phase 2 operational area does not overlap the BIA (foraging) for white sharks in the waters surrounding the Abrolhos Islands.

#### Whale shark

The Phase 1 and Phase 2 operational areas do not represent critically important areas (migration, breeding or foraging areas) for the whale shark. The Phase 1 operational area does not overlap the BIA (foraging – high density prey) that is located along Ningaloo Reef, and acquisition in the Phase 1 operational area will occur after the end of the seasonal aggregation of whale sharks at Ningaloo Reef (April to June). It is not expected that whale sharks will be encountered in significant numbers and those individuals that are encountered are likely to be transient.

**Table 4-6 – Temporal characteristics of humpback and pygmy blue whale migration for west coast of WA**

	Jul	Aug	Sep	Oct	Nov	Dec	Jan
<b>Pygmy blue whale</b>							
Phase 1 OA <sup>1</sup>	Green	Green	Green		Yellow	Yellow	Yellow
Phase 2 OA	Green				Yellow	Yellow	Yellow
<span style="color: green;">■</span> Northbound <span style="color: yellow;">■</span> Southbound <span style="color: orange;">■</span> Southbound peak							No acquisition
<b>Humpback whale</b>							
Phase 1 OA		Blue	Blue	Pink	Pink	Red	Red
Selected line acquisition			<span style="color: green;">—</span> <span style="color: orange;">—</span>			No acquisition	
Phase 2 OA	Blue	Blue		Pink	Pink	Red	Red
Selected line acquisition				<span style="color: red;">—</span>		No acquisition	
<span style="color: blue;">■</span> Northbound peak <span style="color: pink;">■</span> Southbound peak <span style="color: red;">■</span> Southbound cow/calf peak							

Notes: <sup>1</sup> OA – Operational Area.

### **Specific Control Measures to Minimise Impacts/Risks to Humpback Whales and Pygmy Blue Whales**

The following control measures will be implemented to reduce potential impacts/risks to migrating humpback and pygmy blue whales to levels that are ALARP and acceptable:

- Upon commencement of the survey in the Phase 1 operational area, the four lines that partially overlap the humpback whale BIA (orange lines in **Figure 4-2**) will be acquired first. The portions of these lines that overlap the BIA will not be acquired after the end of August. Hence, there will be no acquisition within 45 km of the resting BIA after the end of August, which is well before the southbound cow/calf peak in mid to late October (see **Table 4-6**).
- Upon commencement of acquisition within the Phase 2 operational area, the five lines closest to the humpback whale resting BIA around the Abrolhos Islands (red lines in **Figure 4-5**) will be acquired first. There will be no acquisition within 60 km of the northern boundary of the Abrolhos Islands resting BIA after mid-October – i.e. acquisition of these lines closest to the BIA will be completed 3-4 weeks prior to the southbound peak of cow/calf pairs (see **Table 4-6**).
- There will be no acquisition within the humpback whale BIA in the Phase 2 operational area. During some line turns the survey vessel and towed equipment will enter the western extent of the BIA, but the airgun array will be shutdown. On line run-ins adjacent to the boundary of the BIA soft starts will only commence when the survey vessel and airgun array are outside the BIA.
- There will be no acquisition in either the Phase 1 or Phase 2 operational areas after the 31<sup>st</sup> October 2015.
- The following specific adaptive management measures will apply during acquisition in either the Phase 1 or 2 operational areas, to manage the potential increased likelihood of encountering either humpback or pygmy blue whales:
  - if there are three (3) consecutive days during which there are three (3) or more whale-instigated power downs / shut downs, then there will be no acquisition during night time of any shotpoints that are within 45 km of the boundary of the humpback whale BIA (migration);
  - if there are three (3) consecutive days during which there are three (3) or more pygmy blue whale-instigated power downs / shut downs in the pygmy blue whale BIA, then, there will be no acquisition during night time for the remainder of the survey;
  - if there are three (3) consecutive days during which there are six (6) or more whale-instigated power downs / shut downs then acquisition will cease completely and the survey will be terminated; and
  - the measure above will apply for either humpback or pygmy blue whale-instigated power downs / shut-downs.
- The following Part B Additional Management Procedures must be applied throughout acquisition operations in both the Phase 1 and Phase operational areas:
  - 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 pygmy blue whales, i.e. the time between surfacing events is longer for animals that are feeding; and
  - if the acoustic source is required to power down / shut-down three (3) or more times during the preceding 24-hour period as a result of sighting 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 whale sightings.
- If there are sightings of humpback whale or pygmy blue whale cow/calf pairs Spectrum will review the situation to determine if acquisition should continue. Any decision to postpone or terminate the survey, or to alter the pattern/forward plan of acquisition, will depend on the number, frequency and location of the cow/calf sightings, and on any other relevant information provided by the MFOs aboard the survey vessel.

#### **4.4.10 Cumulative Impact Assessment**

There are no other marine seismic surveys scheduled to take place over the same area, and during the same timeframe (late August to end of October 2015) as the Rocket MC2D MSS. Therefore, there is no likelihood of cumulative impacts on matters of National Environmental Significance (NES), such as cetaceans, turtles and whale sharks resulting from concurrent seismic acquisition activities.

Other planned surveys in the region included the following:

#### *Imperial Multiclient 2D MSS, CGG Services (Australia) Pty Ltd*

Based on the summary information posted on NOPSEMA's website, this survey was proposed to take place in a polygon located in Commonwealth waters adjacent to WA, ~100 km from Exmouth, ~90 km from Carnarvon and 25 km from Geraldton, in water depths of ~40 m to >1,000 m. Information posted on NOPSEMA's website indicates that "due to current restrictions on vessel availability it may not be possible to acquire data during this period and therefore the activity may occur at any time from Q4 2014 to Q4 2015." However, Spectrum has been in communication with CGG and has established that this proposed survey will not occur in this indicative timeframe, and it will not overlap the Rocket MC2D MSS.

#### *Houtman Sub-basin 2D Seismic Survey, Geoscience Australia*

Based on the summary information posted on NOPSEMA's website, this survey was proposed to take place in an area defined by a Special Prospecting Authority (WA-23-SPA) and an Access Authority (WA-67-AA) covering part of the Houtman Sub-basin. This survey was scheduled "to commence from approximately the 8th November 2014 and be concluded by 31st January 2015". The Houtman Sub-basin 2D MSS was completed in January 2015, and will not overlap the Rocket MC2D MSS.

## **5 MONITORING OF ENVIRONMENTAL PERFORMANCE**

### **5.1 ONGOING MONITORING**

The Rocket MC2D MSS will be managed in compliance with the accepted EP for the activity, all applicable laws and regulations, the Spectrum HSE Policy, and BGP's Health, Safety, Security & Environment (HSSE) Management System.

The EP is intended to serve as a practical environmental management tool that can be used throughout the proposed survey by BGP to implement targeted environmental control measures. The objective of the EP is to ensure that potential adverse environmental impacts and risks associated with the proposed activities, during both routine and non-routine operations, are continuously reduced to as low as reasonably practicable (ALARP) and that the environmental performance outcomes (EPO) and environmental performance standards (EPS) included in the EP are met. To facilitate this objective, a comprehensive Environmental Risk Assessment (ERA) has been undertaken to determine those activities and environmental aspects that pose an elevated risk of environmental impact. The outcomes from the ERA form the foundation upon which relevant preventative and mitigation measures can be identified and implemented to ensure that adverse environmental impacts and risks are avoided or minimised.

The implementation strategy for the EP, including procedures that will apply during emergencies or potential emergencies, describes in detail the arrangements in place to allow Spectrum to continually manage the environmental impacts and risks of its activities to acceptable levels and ALARP. It includes:

- details of when the titleholder will report to the Regulator in relation to the titleholder's environmental performance;
- a description of the environmental management system for the activity, including specific measures to ensure that:
  - the environmental impacts and risks of the activity continue to be identified and reduced to a level that is ALARP;
  - control measures detailed in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and an acceptable level;
  - environmental performance outcomes and standards set out in the EP are being met;
  - chain of command, and roles and responsibilities in relation to the implementation, management and review of the EP;
  - training and competencies, including induction into the EP; and
  - monitoring, recording, audit, management of non-conformance and review of the environmental performance and the implementation strategy.

Environmental performance of the Rocket MC2D MSS is reviewed in a number of ways. These reviews are undertaken to:

- ensure all significant environmental aspects of the activity are covered in the EP;



- ensure that environmental management measures to achieve EPO and EPS are being implemented, reviewed and where necessary amended;
- identify potential non-conformances and opportunities for continuous improvement;
- ensure that all EPO and EPS have been met before completing the activity: and
- ensure that all environmental commitments contained in the Environmental Commitments Register (ECR) have been fulfilled.

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

- An inspection(s) of the survey vessel 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 enable compliance with the EP.
- A summary of the key information, commitments, EPO, EPS and MC for the activity (ECR) will be distributed aboard the survey vessel, and implementation of the environmental EPO and commitments will be monitored on a regular basis by the Client Site Representative and MFOs.

Regulation 26C of the Environment Regulations requires that “a titleholder undertaking an activity must submit a report to the Regulator in relation to the titleholder’s environmental performance for the activity, at the intervals provided for in the environment plan”. Spectrum will prepare a Post-survey Environmental Review Report (PERR) for the Rocket MC2D MSS that will comprise a review of achievement of the EPO for the survey to determine if they have been met, The PERR will include:

- A review of the following routine activities and incident records
  - start-up delays, power downs or stop work procedures instigated as a result of whale sightings;
  - cetacean sighting records;
  - turtle and whale shark sighting records;
  - records of any vessel or towed equipment interaction with marine fauna ;
  - accidental discharge of hazardous materials;
  - fuel and oil spills;
  - vessel collisions; and
  - negative interactions with commercial fishing vessels and shipping.
- An assessment of adherence to requirements of the EP, including the EPO and EPS.
- A review of compliance with the Spectrum HSE Policy.
- A review of all environmental incidents (recordable and reportable) and any other issues.
- Performance in fulfilling all commitments listed on the Environmental Commitments Register.

A copy of the PERR will be submitted to NOPSEMA within two months following completion of the survey.

## 5.2 REVIEW OF THE EP

Management of changes to the scope (e.g. timing, location or survey details described in the EP) are the responsibility of the Spectrum Project Manager. As required under Regulation 17 of the Environment Regulations, Spectrum will submit a revision of the EP to NOPSEMA if any of the following criteria are met:

- The commencement of any new activity, or any significant modification, change, or new stage of an existing activity, not provided for this EP.
- The occurrence of any:
  - significant new environmental impact or risk;
  - series of new environmental impacts or risks;
  - significant increase in an existing environmental impact or risk; and
  - series of increases in existing environmental impacts or risks,
  - not provided for in this EP.

- Any significant change to the receiving physical, biological or socio-economic environment within, or immediately adjacent to, the Rocket MC2D MSS Phase 1 and Phase 2 operational areas.
- The identification of any:
  - KEF not already described in this EP;
  - threatened species of cetacean, marine reptile, pinniped, sharks and ray-finned fish not already described in this EP; and
  - critical habitat/BIA for threatened species not already described in this EP, which has spatial overlap with the Rocket MC2D MSS Phase 1 and Phase 2 operational areas.

A risk assessment will be undertaken for all changes in scope to assess potential impacts of the change. If the change meets any of the criteria detailed above, a revision/resubmission of the EP will occur, and the proposed change to the activity will not commence until the revised EP has been accepted by NOPSEMA.

Notification to other government authorities, where required, will be undertaken by the Project 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.

## 6 OIL POLLUTION EMERGENCY PLAN RESPONSE ARRANGEMENTS

The Oil Pollution Emergency Plan (OPEP) for the proposed Rocket MC2D 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 Shipboard Oil Pollution Emergency Plan (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.
- 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.

### 6.1 VESSEL SOPEP

The survey vessel 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. The latest SOPEP drills aboard the *BGP Explorer* were conducted in Australian waters on 12th and 23rd July 2015.

A further two drills of the oil spill emergency response arrangements will be conducted during course of the Rocket MC2D MSS. All drills will be reported as per MARPOL Annex I (Regulation 15) requirements and reviewed three times a year as part of the ongoing monitoring and improvement of emergency control measures. The SOPEP is subject to four scheduled drills per annum, therefore a minimum of two drills will be conducted during the course of the Rocket MC2D MSS.

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. Stocks of absorbent materials aboard the survey vessel will be checked for their adequacy and replenished as necessary prior to the commencement of activities.

## 6.2 EMERGENCY RESPONSE ARRANGEMENTS

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. Deployment of small absorbent booms and other materials will be undertaken so as to maximise recovery of spilled material. All deck spills aboard the survey vessel will be cleaned-up immediately, using appropriate equipment from the onboard spill response kits (e.g. absorbent materials etc.) to minimise any likelihood of discharge of spilt hydrocarbons or chemicals to the sea. This is a standard operating procedure (SOP) for the survey vessel.

Given the offshore location of the most of the Rocket MC2D MSS Phase 1 and Phase 2 operational areas 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 (see below).

### 6.2.1 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. 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.

### 6.2.2 State Waters

If surface slicks appear likely to enter WA State waters then subsequent actions will be determined in consultation with the WA DoT under WestPlan-MOP and the WA DoT OSCP. The WA DoT is the designated combat agency for oil spills from vessels within the WA State jurisdiction.

Treatment measures addressing the generation of impacts associated with shoreline protection and clean-up are addressed in the WestPlan-MOP and WA DoT OSCP that requires the provision of temporary storage, transportation and final disposal in compliance with Government disposal approvals.

In the event of a large diesel spill occurring during the Rocket MC2D MSS, Spectrum will inform a number of key stakeholders (apart from the response and combat agencies outlined above), primarily within the commercial fishing industry, but also including a number of WA State Government departments (e.g. Department of Mines and Petroleum [DMP]; Department of Fisheries [DoF]; DPAW).

### 6.2.3 Type I Operational Monitoring

In the event of an accidental event that resulted in a large diesel spill to the waters surrounding the survey vessel, BGP and Spectrum would be responsible for undertaking Type I “Operational Monitoring” 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 WA DoT), via a POLREP form, to determine and plan appropriate response actions under NATPLAN or the WestPlan-MOP / WA DoT OSCP (if either of these plans are actually 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 (see below).

Specific monitoring / data requirements are:

- estimation of sea state; wind direction and speed
- locating and characterising any surface diesel slicks;
- GPS tracking, manual or computer predictions; and
- GIS mapping.

This operational monitoring will be restricted to daylight hours only, when surface slicks will be visible from either vessels or via aerial surveillance. The information gathered from this monitoring will be passed on to the relevant Combat Agency, via the POLREP form, but also via ongoing SITREP reports following the initial spill notification to RCC Australia.

BGP and Spectrum will implement, assist with, or contribute to (including funding if required) any other operational monitoring as directed by the Combat Agency.

#### **6.2.4 Type II Scientific Monitoring**

Stochastic spill modelling conducted as part of the oil spill risk assessment for the Rocket MC2D MSS indicates low level probabilities of surface slicks and entrained oil from a large MGO spill contacting sensitive receptors adjacent to the eastern boundaries of the Phase 1 and Phase 2 operational areas.

Given this level of risk, if a large diesel spill occurs from the survey vessel during the Rocket MC2D MSS and this incident results in surface slicks or entrained oil entering the waters of the Ningaloo Coast or Shark Bay World Heritage Properties or the Abrolhos Islands FHPA, Spectrum 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

For development of a Type II scientific monitoring plan that would be applied in the event of a large diesel spill from the Rocket MC2D MSS impacting upon the Ningaloo Coast or Shark Bay World Heritage Properties or the Abrolhos Islands FHPA, the relevant stakeholders would be (but not necessarily be limited to):

- the Combat Agency (WA DoT);
- the WA Environmental Protection Authority (EPA);
- the WA Conservation and Parks Commission (CPC);
- the WA DPaW;
- NOPSEMA;
- the Commonwealth Department of Environment (DoE);
- appropriate marine research and monitoring organizations, such as:
  - the WA Marine Science Institution (WAMSI);
  - the Australian Institute of Marine Science (AIMS);
  - the 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 Ningaloo Coast or Shark Bay World Heritage Properties or the Abrolhos Islands FHPA; 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;
- benthic primary producer habitat (BPPH);
- rocky shore/intertidal reef platform communities; intertidal sand/mudflat communities;
- subtidal soft-bottom communities;
- sea birds; dugong; Australian sea lions; turtles; whale sharks; finfish; benthic invertebrates; and
- commercial and recreational fishing; and tourism.

The scientific monitoring program will be developed to ensure that it is sufficient to inform any remediation activities, particularly with respect to shoreline environments, and that it meets the monitoring guidelines and methodologies described in the following best practice guidance documents:

- the AMSA Oil Spill Monitoring Handbook; and
- the Oil Spill Monitoring Background Paper.

BGP has public liability insurance that covers any pollution that could result in environmental damage, specifically pollution emanating from their vessels. As such, this insurance would cover the cost of environmental monitoring or clean-up post spill. These policies cover activities in Australian Commonwealth and State waters, including the Rocket MC2D MSS.

### 6.2.5 Reporting

Any fuel or oil spills aboard either the survey or support vessels must be reported to Spectrum as required by BGP's HSSE Management System. In the event of spillage of any oil or diesel spills to the sea, AMSA will be notified 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 as reportable incidents.

## 7 DETAILS OF CONSULTATION

Consultation with stakeholder groups, primarily within the commercial fishing industry, concerning the proposed Rocket MC2D MSS operational area 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 Rocket MC3D MSS.
- Phase 2: Pre-survey 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: Ongoing Consultation:
  - Includes complying with requests from stakeholders for notification of the completion of the survey.

### 7.1 PHASE 1: PREPARATORY CONSULTATION

#### 7.1.1 Stakeholder Identification and Initial Notification

The following fisheries bodies and organisations were originally informed of the survey, via letters or emails sent on 29<sup>th</sup> August 2014 as part of Phase 1: Preparatory Consultation.

- A Raptis & Sons;
- Austral Fisheries Pty Ltd;
- Australian Fisheries Management Authority (AFMA);
- Australian Longline Pty Ltd;
- Australian Southern Bluefin Tuna Industry Association (ASBTIA);
- Commonwealth Fisheries Association (CFA);
- Geraldton Fishermen's Co-operative;
- Geraldton Professional Fishermen's Association (GPFA);
- Kalbarri Professional Fishermen's Association (KPFA);
- Northern Fishing Companies Association (NFCA);
- Recfishwest;
- Tuna West - Indian Ocean Tuna Association;
- United Mid West Professional Fishermen's Association (UMWPFA);
- WA Department of Fisheries (DoF);
- WA Fishing Industry Council (WAFIC);
- WA Seafood Exporters;
- Western Rock Lobster Council (WRLC); and
- WestMore Seafoods.

Spectrum obtained extracts from the Public Register held by the WA Department of Fisheries (DoF) for the seven WA State-managed fisheries that can operate in the waters overlapped by the Rocket MC2D MSS Phase 1 and Phase 2 operational areas. These extracts showed that the following number of

individuals or entities currently hold licences (one or more) that enable them to operate in the AIMWTMF, GDSF, MMF, SBPR, SBSC, WCDSCMF and WCDSF;

- Abrolhos Islands and Mid West Trawl Managed Fishery (AIMWTMF);
- Gascoyne Demersal Scalefish Fishery (GDSF);
- Mackerel Managed Fishery (MMF);
- Shark Bay Prawn Managed Fisheries (SBPR);
- Shark Bay Scallop Managed Fisheries (SBSF);
- West Coast Deep Sea Crustacean Managed Fishery (WCDSCMF); and
- West Coast Demersal Scalefish Fisheries (WCDSF).

Note that as there are 597 individual licence holders in the West Coast Western Rock Lobster Fishery (WCWRLF), communication and consultation with individual licence holders in the WCWRLF was via the peak industry body for this fishery – Western Rock Lobster Council (WRLC).

Ninety-two separate individuals or entities holding licences were identified across the seven WA State-managed fisheries. These individuals or entities may hold more than one licence either within a fishery or across multiple fisheries. Stakeholder letters were sent on 29<sup>th</sup> August 2014 to all licence-holding individuals or entities, informing them of the proposed activities.

In addition, the following Commonwealth and WA State government departments and agencies were informed of the proposed activities, via letters or emails sent on 29<sup>th</sup> August 2014.

- Australian Hydrographic Service (AHS);
- Australian Maritime Safety Authority (AMSA);
- Department of Defence (DoD);
- Commonwealth Department of the Environment (DoE);
- WA Department of Mines and Petroleum (DMP);
- WA Department of Parks and Wildlife (DPaW); and
- WA Department of Transport (DoT).

The following Non-Governmental Organisations (NGOs) were informed of the proposed activities, via letters or emails sent on 29<sup>th</sup> August 2014:

- International Fund for Animal Welfare (IFAW); and
- Centre for Whale Research (CWR).

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

Courtesy calls, to remind stakeholders/organisations that had not yet responded to the Rocket MC2D MSS stakeholder letter, was made to the following organisations on the 25<sup>th</sup> and 26<sup>th</sup> September 2014:

- Geraldton Fishermen's Co-operative Ltd;
- Geraldton Professional Fishermen's Association;
- Kalbarri Professional Fishermen's Association;
- United Mid West Professional Fishermen's Association;
- Panorama Management Pty Ltd;
- Recfishwest;
- Western Rock Lobster Council; and
- Westmore Seafoods.

### **7.1.2 Stakeholder Submissions**

As of 30<sup>th</sup> November 2014 responses had been received from 12 stakeholders contacted during the Phase 1 preparatory consultation. Details of these submissions and Spectrum's responses are provided in **Table 7-1**.

**Table 7-1 – Phase 1: Preparatory Consultation – stakeholder submissions and Spectrum responses**

Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
AFMA	Email – 29/08/14	AFMA informed Spectrum that there are a quite a few fisheries that overlap the Phase 1 and Phase 2 polygon. AFMA also included instructions in using the Geosciences Australia Australian Marine Spatial Information System (AMSIS) online tool. AFMA recommended that Spectrum consult with the stakeholders associated with the fisheries in the area, and provided a link to the AFMA fisheries consultation directory on the AFMA website.	Spectrum has complied with AFMA's requests, individual fisheries stakeholders have been contacted via the Phase 1 - Preparatory Consultation. Consultation with AFMA (and individual fishermen) will be ongoing throughout the period the Rocket MC2D MSS EP is valid.
AHS	Email – 12/09/14	AHS informed Spectrum that AHS requires survey details confirmed two weeks prior to survey commencing, a Notice To Mariners (NTM) will then be issued.	Spectrum has complied with this request from AHS.
AMSA	Email – 19/09/14	<p>AMSA issued Spectrum a vessel traffic plot of Phase 1 and 2 polygons. AMSA informed Spectrum that the main commercial traffic route for WA passes through the proposed Phase 1 and 2 survey areas. Therefore, heavy commercial bulk shipping traffic will be encountered within these proposed areas. The Phase 2 survey area will also encounter commercial and domestic vessels inbound and outbound of Geraldton and Port Denison. The Phase 1 survey area will encounter vessels heading in and out of Shark Bay.</p> <p>AMSA advised Spectrum to be active and maintain clear and effective communication with all shipping approaching and within the operational area, (particularly given the streamer length of 10,000 m and greater) as there may be a considerable speed difference between commercial shipping and the survey vessel whilst the latter is conducting operations. AMSA also advised Spectrum that it must also be considered than any avoiding or diversionary action that may be taken by a non-survey related commercial vessel does not compound the issue of navigational safety and as such, the survey Master and support vessel must establish communications early with any potential vessel that may be of issue, and made all the more important given the closeness of Houtman Abrolhos Group of Islands. AMSA also informed Spectrum that the survey vessel must display appropriate day shapes, lights and streamers, reflective tail buoys, to indicate the vessel is towing and is therefore restricted in her ability to manoeuvre. Visual and radar watches must be maintained on the bridge at all times.</p> <p>AMSA also requested that the AMSA's Rescue Coordination Centre (RCC) is contacted through <a href="mailto:rccaus@amsa.gov.au">rccaus@amsa.gov.au</a> for AUSCOAST warning broadcasts before any operations commence. AMSA's RCC will require the details of the survey vessel, the area of operation, and will need to be advised when the survey starts and ends. Additionally, the Australian Hydrographic Service (AHS) must be contacted through <a href="mailto:hydro.ntm@defence.gov.au">hydro.ntm@defence.gov.au</a> no less than 2 working weeks before operations commence for the promulgation of related Notices to Mariners (NTM).</p> <p>It is also highly recommended that the survey company contact, and closely liaise with, the Geraldton Port Harbour Master well in advance of this proposed activity. This will enable Pilots, Agents and owners of any shipping using the shipping fairway during survey operations to be further advised of the survey ground location, survey vessel(s), support vessel(s), and the proposed survey activity. At the conclusion of the survey, please be in touch to comment on the operations and the interaction with commercial shipping at the time of the survey (i.e. any lessons learnt).</p>	<p>Spectrum responded to AMSA via email sent on 19/09/14.</p> <p>Spectrum has complied with these requests from AMSA.</p>
DoD	Email – 22/09/14	<p>The DoD advised Spectrum that they have no objection to the seismic survey environment plan and informed Spectrum that AHS will require advanced notification of any seismic surveys and infrastructure developments within the designated area. The information will need to be furnished to the AHS with a minimum of three weeks' notice prior to actual commencement. DOD informed Spectrum that this information is critical to maritime safety and should be provided to reduce negative impacts on other maritime user.</p> <p>The AHS can be contacted directly through the Manager Nautical Assessment and Maintenance, Mr Mark Bolger, on (02) 4223 6590 and/or at the address listed on the website. <a href="http://www.hydro.gov.au/about-us/contact.htm">http://www.hydro.gov.au/about-us/contact.htm</a> . Should Spectrum require any further information, the point of contact in this matter is Andrew Blythe, telephone (02) 266 8255.</p>	Spectrum has complied with this request from the DoD.
DoE	Email – 29/08/14	<p>The DoE informed Spectrum that offshore petroleum and greenhouse gas activities in Commonwealth waters must now be assessed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) under the Offshore Petroleum and Greenhouse Gas (Environment) Regulations 2009 (OPGGG(E) Regulations) to have Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) coverage. NOPSEMA has issued an information paper outlining considerations for titleholders in the preparation of submissions for activities that may impact matters protected under the EPBC Act (<a href="http://www.nopsema.gov.au/assets/Information-papers/N-04750-IP1382-Streamlining-environmental-regulation-of-petroleum-activities-in-Commonwealth-waters.pdf">http://www.nopsema.gov.au/assets/Information-papers/N-04750-IP1382-Streamlining-environmental-regulation-of-petroleum-activities-in-Commonwealth-waters.pdf</a> ).</p>	No action is required from Spectrum regarding this response from the DoE.

Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
		<p>The Department of the Environment is not a relevant agency for consultation under the OPGGS(E) Regulations, as the NOPSEMA authorisation process encompasses the functions, interests and activities of the Department. The Department is currently collating advice for titleholders about its ongoing role in the Commonwealth marine area beyond the scope of the NOPSEMA environmental management authorisation process.</p>	
DoF	Email – 18/09/14	<p>The DoF provided Spectrum with the following advice in response to the request for advice/comment on the project: Dagmar MC2D MSS. DoF recommendations outlined in the correspondence is as follows:</p> <p>1. Consultation:</p> <ul style="list-style-type: none"> <li>- DoF noted that seismic surveys have the potential to affect fish population and the operations of fishers who harvest these resources and referred Spectrum to the 'Guidance Statement on Undertaking Seismic surveys in Western Australian Waters'.</li> <li>- Recommended that Spectrum should consult with the Western Australian Fishing Council (WAFIC), Recfishwest and individual licensed fishers regarding the overall proposal, including methods, and incorporate comments from this consultation in the EP submission.</li> <li>- Should the multi-phase EP receive approval from the regulator (i.e. NOPSEMA) further consultation with the Department and other stakeholders on individual phases under the EP should occur a minimum of three months prior to commencement of an activity.</li> <li>- As part of this consultation, Spectrum will need to provide: Specific start and finish dates, the spatial extent of proposed activities (including exclusion zones); and information on identified specific fishing interests, including previous consultation with individual licenced fishers.</li> </ul> <p>Should there be any objections or claims raised during the consultation process, the Department requests that these matters are addressed to the satisfaction of the regulator prior to the commencement of the activity. In the event of unresolved issues, the Department reserves the right to seek further engagement.</p>	<p>Spectrum responded to DoF via a letter emailed on 20/10/14.</p> <p>Spectrum has complied with the request from DoF to contact WAFIC, Recfishwest and individual fishers, this was undertaken during Phase 1 preparatory consultation process. Spectrum will undertake further consultation with the DoF on individual surveys, should any significant and relevant changes in fisheries management occur.</p>
		<p>The DoF provided Spectrum with the following advice in response to the request for advice/comment on the project: Dagmar MC2D MSS. DoF recommendations outlined in the correspondence is as follows:</p> <p>2. Consultation:</p> <ul style="list-style-type: none"> <li>- DoF noted that seismic surveys have the potential to affect fish population and the operations of fishers who harvest these resources and referred Spectrum to the 'Guidance Statement on Undertaking Seismic surveys in Western Australian Waters'.</li> <li>- Recommended that Spectrum should consult with the Western Australian Fishing Council (WAFIC), Recfishwest and individual licensed fishers regarding the overall proposal, including methods, and incorporate comments from this consultation in the EP submission.</li> <li>- Should the multi-phase EP receive approval from the regulator (i.e. NOPSEMA) further consultation with the Department and other stakeholders on individual phases under the EP should occur a minimum of three months prior to commencement of an activity.</li> <li>- As part of this consultation, Spectrum will need to provide: Specific start and finish dates, the spatial extent of proposed activities (including exclusion zones); and information on identified specific fishing interests, including previous consultation with individual licenced fishers.</li> </ul> <p>Should there be any objections or claims raised during the consultation process, the Department requests that these matters are addressed to the satisfaction of the regulator prior to the commencement of the activity. In the event of unresolved issues, the Department reserves the right to seek further engagement.</p>	<p>Spectrum responded to DoF via a letter emailed on 20/10/14.</p> <p>Spectrum has complied with the request from DoF to contact WAFIC, Recfishwest and individual fishers, this was undertaken during Phase 1 preparatory consultation process. Spectrum will undertake further consultation with the DoF on individual surveys, should any significant and relevant changes in fisheries management occur.</p>
		<p>3. Fishing activities in the area:</p> <ul style="list-style-type: none"> <li>- DoF advised Spectrum of commercial fishing interests that exist in the bioregion associated with the proposed multi-client survey area.</li> </ul>	<p>Potential impacts to fisheries, fish and fish habitat are described in Sections 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.4.3, 5.4.4 and 5.4.5 of the EP. Strategies to mitigate or minimise these impacts are defined in these sections, and in Table 9-1 of the EP.</p>



Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
		<p>4. Fish Spawning:</p> <ul style="list-style-type: none"> <li>- DoF requested that Spectrum specifically includes strategies in the EP to minimise the impacts of survey activities on fish spawning. The strategies may include (but are not limited to) soft starts, and sound and exposure time minimisation. Alternatively, it is preferable that seismic activities do not occur during the times of year that the key fish species may be spawning within your proposed area of activities.</li> </ul>	<p>As detailed in this EP, the mitigation strategies recommended by DoF have already been included in control measures to minimise the potential noise impacts on marine. DoF has not provided any specific locations of fish spawning grounds or nursery areas within the Rocket MC2D MSS Phase 1 and Phase 2 operational areas. Without this information Spectrum cannot practically devise a mitigation measure to avoid spawning locations or nursery areas.</p>
		<p>5. Fish Spawning:</p> <ul style="list-style-type: none"> <li>- DoF requested that Spectrum specifically includes strategies in the EP to minimise the impacts of survey activities on fish spawning. The strategies may include (but are not limited to) soft starts, and sound and exposure time minimisation. Alternatively, it is preferable that seismic activities do not occur during the times of year that the key fish species may be spawning within your proposed area of activities.</li> </ul>	<p>As detailed in this EP, the mitigation strategies recommended by DoF have already been included in control measures to minimise the potential noise impacts on marine. DoF has not provided any specific locations of fish spawning grounds or nursery areas within the Rocket MC2D MSS Phase 1 and Phase 2 operational areas. Without this information Spectrum cannot practically devise a mitigation measure to avoid spawning locations or nursery areas.</p>
		<p>6. Fish Spawning:</p> <ul style="list-style-type: none"> <li>- DoF requested that Spectrum specifically includes strategies in the EP to minimise the impacts of survey activities on fish spawning. The strategies may include (but are not limited to) soft starts, and sound and exposure time minimisation. Alternatively, it is preferable that seismic activities do not occur during the times of year that the key fish species may be spawning within your proposed area of activities.</li> </ul>	<p>As detailed in this EP, the mitigation strategies recommended by DoF have already been included in control measures to minimise the potential noise impacts on marine. DoF has not provided any specific locations of fish spawning grounds or nursery areas within the Rocket MC2D MSS Phase 1 and Phase 2 operational areas. Without this information Spectrum cannot practically devise a mitigation measure to avoid spawning locations or nursery areas.</p>
		<p>7. Biosecurity:</p> <ul style="list-style-type: none"> <li>- In accordance with the Fish Resources Management Regulations 1995 (reg. 176(1)), the Department requires that all vessel managers and operators of immersible equipment minimise the risk of translocating pests and diseases into or within WA waters. Vessel hulls, sea chests and niche areas must be 'clean' before each voyage.</li> <li>- Spectrum have noted that it is the DoF policy that the suspected or confirmed presence of any marine pest or disease be reported within 24 hours by email (biosecurity@fish.wa.gov.au) or telephone (FishWatch tel. 1800 815 507). This includes any organism listed in the Western Australian Prevention List for Introduced Marine Pests which can be accessed from the Department's website: (<a href="http://fish.wa.gov.au/Documents/biosecurity/epa_introduced_marine_pests.pdf">http://fish.wa.gov.au/Documents/biosecurity/epa_introduced_marine_pests.pdf</a>), and any other non-indigenous organism that demonstrates invasive characteristics.</li> </ul>	<p>The control measures to minimise the likelihood of introduction of IMS of concern includes hull and other niche cleaning of both the survey and support vessels prior to mobilisation of the vessels to Australian waters.</p>
		<p>8. DoF requests that this information is forwarded directly to all vessel operators associated with this project and that any queries regarding the advice should be directed to Fiona Rowland on 9482 7200.</p>	<p>Spectrum has complied with this request from the DoF and a copy of the EP has been made available on the survey vessel.</p>

Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
DoT	Email – 29/08/14	The DoT confirmed that the Spectrum Rocket MC2D MSS stakeholder letter had been received and had no comment regarding the proposed survey.	No action is required from Spectrum regarding the response from the DoT.
DMP	Email – 19/09/14	DMP thanked Spectrum for providing information on the proposed Dagmar (Rocket) MC2D MSS in the Houtman Sub-basin in Commonwealth waters adjacent to the WA coast. DMP noted that this activity will be assessed under the OPGGS(E)R by NOPSEMA. DMP reviewed the notification and advised Spectrum that it does not require any further information at this stage. DMP advised Spectrum that any future activity notifications can be sent to the Petroleum Environment Branch email address: <a href="mailto:petroleum.environment@dmp.wa.gov.au">petroleum.environment@dmp.wa.gov.au</a> .	Spectrum has directed all future correspondence to DMP to the email address identified.
IFAW	Email – 24/09/14	IFAW responded to the Rocket MC2D MSS stakeholder letter by requesting a copy of the GIS shapefile for the Phase 1 and 2 operational areas.	Spectrum responded to IFAW via email sent on 25/09/14, and provided the GIS shapefiles as requested Consultation with IFAW will be ongoing throughout the survey.
RAAF	Email – 1/09/14	The RAAF responded by informing Spectrum that the stakeholder letter had been received and forwarded for action/response as required.	No action is required from Spectrum regarding the response from RAAF.
KPFA	Phone – 26/09/14	Ian Ralph confirmed that the KPFA have no concerns regarding the Rocket MC2D MSS, as they do not fish in the area.	No action is required from Spectrum regarding the response from KPFA.
CCG	Emails – 19/10/14, 27/10/14, 4/11/14; 13/11/14	Jacqueline Hine, Secretary of the CCG, requested further information about the survey on 19 October. Emails were sent to Jacqueline on 20 and 21 October providing additional details. On 27 October, Jacqueline sent a further email requesting information on survey start and finish dates, and on what mitigation factors have been put in place for pygmy blue whales. A response was emailed to Jacqueline on 27 October. On 4 November, Jacqueline sent an email requesting information on how cumulative impacts of other surveys operating in nearby areas or along migration routes at the same time. A response was emailed to Jacqueline on 5 November. On 13 November, another email was received from Jacqueline asking whether all marine fauna sighting data would be sent to the Department of Environment. A response to this last email was emailed to Jacqueline on 16 November.	Spectrum responded to CCG via emails sent on 20/10/14, 21/10/14, 27/10/14, 5/11/14, 16/11/14. No further action is required from Spectrum regarding the responses from CCG.

## **7.2 PHASE 2: PRE-SURVEY CONSULTATION**

### **7.2.1 Commencement Notifications**

At least three weeks prior to commencing the Rocket MC2D MSS, Spectrum contacted relevant stakeholders and provided detailed information for the proposed activity, location and geographical coordinates for the Phase 1 and Phase 2 operational areas, timing and duration, parameters for the towed seismic array (airgun array, towed streamer, tail buoy etc.), and details of the survey vessel and chase vessel. At this point, stakeholders had a further opportunity to raise any specific concerns or issues with Spectrum, regarding the proposed survey.

On 17<sup>th</sup> December 2014, all stakeholders contacted during the Phase 1: Preparatory Consultation were sent a pre-start notification letter providing information about the change in survey name (Rocket MC2D MSS rather than Dagmar MC2D MSS), the proposed start date for the survey (6<sup>th</sup> January 2015), and the survey vessel (*MV Duke*).

On 16<sup>th</sup> July 2015, an updated pre-start notification letter was sent out to all stakeholders. This letter informed stakeholders of the temporary suspension of the survey due to the unavailability of the survey vessel, and the planned re-commencement of acquisition in mid-August 2015. The letter also provided details on survey duration, parameters for the towed seismic array (airgun array, towed streamer, tail buoy etc.), details of the survey vessel and chase vessel, and offered stakeholders the opportunity to receive 7-10 day forecasts of survey operations on a weekly basis, if required.

### **7.2.2 Stakeholder Submissions**

As of 3<sup>rd</sup> August 2016, 11 responses had been received from stakeholders contacted during the Phase 2 pre-survey consultation. Details of these submissions and Spectrum's responses are provided in **Table 7-2**.

**Table 7-2 – Phase 2: Pre-survey consultation – stakeholder submissions and Spectrum responses**

Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
<b>Email communications</b>			
AMB Holdings (GDSF)	Email - 16/7/2015	AMB administration returned a read receipt confirming the further notification email was received. No additional response has been received.	No response required from Spectrum.
AMSA	Email - 17/7/2015	<p>AMSA provided Spectrum with the following information:</p> <ol style="list-style-type: none"> <li>Updated vessel traffic plot of both Phases of the proposed Rocket MC2D survey.</li> <li>The main commercial shipping traffic route for Western Australia passes through both the proposed Rocket Phase 1 and Phase 2 survey areas. Therefore, heavy commercial bulk shipping traffic will be encountered within these proposed areas.</li> <li>The Phase 2 survey area will also encounter commercial and domestic vessels inbound and outbound of Geraldton and Port Denison.</li> <li>The Phase 1 survey area will encounter vessels heading in and out of Shark Bay.</li> <li>There will be a need to be active and maintain clear and effective communication with all shipping approaching and within a proposed survey area in this vicinity, (particularly given the streamer length of 10,000 m and greater).</li> <li>It must also be considered than any avoiding or diversionary action that may be taken by a non-survey related commercial vessel does not compound the issue of navigational safety and as such, the survey Master and support vessel must establish communications early with any potential vessel that may be of issue. This is made all the more important given the closeness of Houtman Abrolhos Group of Islands.</li> <li>The survey vessel must display appropriate day shapes, lights and streamers, reflective tail buoys, to indicate the vessel is towing and is therefore restricted in her ability to manoeuvre. Visual and radar watches must be maintained on the bridge at all times.</li> <li>Please ensure that AMSA's Joint Rescue Coordination Centre (JRCC) is contacted through rccaus@amsa.gov.au for Auscoast warning broadcasts before any operations commence.</li> <li>AMSA's JRCC will require the details of: <ol style="list-style-type: none"> <li>survey vessel;</li> <li>area of operation;</li> <li>survey starts and end date;</li> </ol> </li> <li>The Australian Hydrographic Service (AHS) must be contacted through hydro.ntm@defence.gov.au no less than 2 working weeks before operations commence for the promulgation of related Notices to Mariners (NtM).</li> <li>It is also highly recommended that the survey company contact, and closely liaise with, the Geraldton Port Harbour Master well in advance of this proposed activity. This will enable Pilots, Agents and owners of any shipping using the shipping fairway during survey operations to be further advised of the survey ground location, survey vessel(s), support vessel(s), and the proposed survey activity.</li> </ol> <p>At the conclusion of the survey, please be in touch to comment on the operations and the interaction with commercial shipping at the time of the survey (i.e. any lessons learnt).</p>	<p>Spectrum responded to AMSA on the 17/7/2015 confirming receipt of the nautical advice.</p> <p>Spectrum will ensure that the updated chartlet for the Rocket MC2D MSS is passed on to the vessel prior to the start of the survey.</p> <p>AMSA-RCC and AHS has been notified of the proposed commencement of the survey. Once the timing is finalised a request for the promulgation of the Marine Safety Notifications will be sent as per your advice.</p> <p>Spectrum held a face-to-face meeting with the Geraldton Ports Harbour Master to discuss any concerns and advice they may have. Once again, Spectrum will be requesting the crew to log vessel interactions with fishermen and shipping vessels whilst conducting the survey.</p>
AHS	Email - 16/7/2015	Activities noted, AHS would like to receive 7 to 10 day operation forecast.	Spectrum will adhere to the request of the AHS and has included this stakeholder on the list of recipients for the 7 to 10 day forecasts upon commencement of the survey.
Australian Longline Pty Ltd	Email - 16/7/2015	Australian Longline returned a read receipt confirming the further notification email was received. No additional response has been received.	No response required from Spectrum.
Austuna	Email - 16/7/2015	Austuna returned a read receipt confirming the further notification email was received. No additional response has been received.	No response required from Spectrum.
CCG	Email - 22/7/2015	CCG requested an update on the new time-frame for the proposed survey, and pointed out that it would now overlap the peak humpback whale migration season, which may not have been considered in the approval process if it were due to finish by the end of June.	Spectrum responded to CCG on 29/7/15 and informed them that a revision of the EP was being submitted for proposed acquisition after the end of June 2015, and that the revision would include the outcomes of a risk assessment that examined the spatial/temporal overlap with the northbound and southbound humpback whale migrations.

Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
CWR	Email – 16/7/2015	CWR returned a read receipt confirming the further notification email was received. No additional response has been received.	No response required from Spectrum
Chaceon (WCDSFC)	Email - 17/7/2015	Requested a 7 day forecast as they have set lines and floats in the survey operational areas.	Spectrum will adhere to the request of Chaceon and has included this stakeholder on the list of recipients for the 7 to 10 day forecasts upon commencement of the survey.
Deep Sea Services (WCDSFC)	Email - 16/7/2015	Deep Sea Services returned a read receipt confirming the further notification email was received.	No response required from Spectrum.
DoT	Email - 16/7/2015	DoT returned a read receipt confirming the further notification email was received. No additional response has been received.	No response required from Spectrum.
DMP	Email - 22/7/2015	Thank you for keeping DMP informed. DMP acknowledges that the Rocket MC2D MSS is being regulated by NOPSEMA under the provisions of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. Please continue to keep DMP informed by sending activity commencement and cessation notifications to <a href="mailto:petroleum.environment@dmp.wa.gov.au">petroleum.environment@dmp.wa.gov.au</a> .	Spectrum will adhere to the request of the DMP and will continue to keep DMP informed of the survey by sending the activity commencement and cessation notifications as requested.
GPFA	Email - 18/7/2015	Please include my email address to receive the Forecast of Operations on behalf of the Geraldton Professional Fishermen's Association.	Spectrum will adhere to the request of the GPFA and has included this stakeholder on the list of recipients for the 7 to 10 day forecasts upon commencement of the survey.
IFAW	Email – 22/7/2015	<p>IFAW requested a response from Spectrum no later than 31<sup>st</sup> July on the following issues:</p> <ol style="list-style-type: none"> <li>On what legal basis is the survey able to proceed? The EP summary identifies that the survey was due to end by June 2015. IFAW therefore assumes the permission granted by NOPSEMA was only relevant for surveying during the time period outlined in the Environment Plan and not beyond those dates. IFAW is not aware of any new or revised EP having been approved to operate outside the dates stated in the original EP.</li> <li>Section 5.2 of the EP summary (pp.39-40) clearly states that Spectrum will submit a revision in the event that changes to the scope of the work, including timing, happen and certain criteria are met. In IFAW's view extending the timing of the survey well beyond the dates originally envisioned constitutes a 'significant modification' as outlined in the first of the criteria given in the EP summary section 5.2. It also meets the second of the criteria in that there will be a significant change to the receiving environment within the operational areas, with the new timing coinciding with the increased presence of threatened blue and humpback whales migrating both northwards and southwards through the region. While IFAW acknowledges the attached letter states no acquisition will take place during November and December to avoid migrating blue whales there is no mention of any restrictions during August, which the EP itself says includes the peak in northbound migration (p.9 – "The northbound component of this migration takes place from May to mid-August, with a peak in July–August"). There is also no mention in the letter of any further measures to reduce impacts on humpback whales migrating southwards who will be with newborn calves during the new acquisition period. As the EP acknowledges, the Exmouth Gulf study on humpback whale responses to airguns showed cow/calf pairs exhibiting avoidance behaviour at lower SEL thresholds i.e. over larger distances. The extra energetic resources required for cow/calves to avoid the source could therefore have a significant impact on their migration.</li> <li>IFAW requests that you share with us a copy of the Spectrum risk assessment that should have taken place according to section 5.2. of the EP summary, to demonstrate how you have come to the conclusion that a revised EP was not required. Please provide a map showing the overlay of the operational area AND proposed seismic lines with Commonwealth Marine Reserves, INCLUDING specific current zoning boundaries within those reserves. Please also clarify if it is Spectrum's intention to still acquire seismic data within Marine National Park Zones of the Gascoyne and Abrolhos Marine Reserves, as statements in the press when this issue was raised during the first acquisition period suggested Spectrum may no longer do this. IFAW would object to any plans to obtain seismic data in Marine National Park Zones, and believes Spectrum is mistaken in its understanding of transitional arrangements that would allow it to legally do so. The EP summary mistakenly states that seismic surveys are permitted to take place within any zone of the new Commonwealth marine reserves under transitional arrangements until management plans come into effect. The EPBC Act Streamlining offshore petroleum environmental approvals Strategic Assessment Program Report identifies that if there is no plan of management for a Commonwealth reserve, acceptance of an Environment Plan must not be inconsistent with the IUCN reserve management principles. The EPBC Act Regulations 2000, schedule 8, contains the Australian IUCN reserve management principles. Part 2 of that Schedule outlines the principles for each IUCN category and section 3 of that part, the principles for National Park (category II). These include that the zone "should be protected and managed to conserve its natural condition",</li> </ol>	Spectrum responded to IFAW on these issues in a letter emailed on 29/7/2015 (see <b>Appendix A1</b> ).

Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
		<p>protected for "spiritual, scientific, educational, recreational or tourist purposes", that "visitor use should be managed for inspirational, educational, cultural and recreational purposes at a level that will maintain the reserve or zone in a natural or near natural state" and that "management should seek to ensure that exploitation or occupation inconsistent with these principles does not occur".</p> <p>Furthermore The IUCN's own Guidelines for Applying the IUCN Protected Area Management Categories to Marine Protected Areas clearly do not envisage seismic surveys or any other oil and gas activities in IUCN category II reserves. These guidelines highlight how this category of reserve should be managed for ecosystem protection, visitation, non-extractive recreational activities and nature tourism and research, and state "Extractive use (of living or dead material) is not considered consistent with the objectives of category II".</p> <p>Therefore, on this basis IFAW believes NOPSEMA acted unlawfully against the commitments in the streamlining offshore petroleum environmental approvals program in approving those aspects of the EP in the first place, and we believe Spectrum would be operating illegally if it chooses to proceed with seismic surveying in Marine National Park Zones.</p>	
MG Kailis	Email - 17/7/2015	MG Kailis returned a read receipt confirming the further notification email was received. No additional response has been received.	No response required from Spectrum.
RAAF	Email – 20/7/2015	Your email has been received at AIS-AF and forwarded for action/response a required.	No response required from Spectrum.
Recfishwest	Email - 16/7/2015	Recfishwest returned a read receipt confirming the further notification email was received. No additional response has been received.	No response required from Spectrum.
RDGS Glen Brodie	Email - 26/7/2015	On receiving your letter 16/7/15 in regards to phase 1 and 2 of Rocket MC2D MSS I am requesting your regular updates right from the onset of your commencement of operations. If you send to <a href="mailto:justgeorge1@gmail.com">justgeorge1@gmail.com</a> it would be much appreciated.	Spectrum will adhere to the request of RDGS Glen Brodie and has included this stakeholder on the list of recipients for the 7 to 10 day forecasts upon commencement of the survey.
WAFIC	Email - 16/7/2015	WAFIC returned a read receipt confirming the further notification email was received. No additional response has been received.	No response required from Spectrum.
Geraldton Fishermen's Co-operative Ltd (GFC)	Email – 2/8/2015	Thank you for your email and attachment. The best way to communicate with lobster fishermen is via the channels you are currently pursuing, and at this stage there is no need or benefit from meeting with myself or GFC. I do appreciate the efforts of Spectrum Geo/Scope Resources to inform industry.	Spectrum thanked GFC for their response and informed them that they will continue to receive updates and notifications for the Rocket MC2D MSS.
IFAW	Email – 31/7/2015	<p>IFAW expressed disappointment that Spectrum was no prepared to share the risk assessment for change in survey timing with stakeholders.</p> <p>IFAW reminded Spectrum that Department of the Environment's website is not a legal document, whereas the commitment in the EPBC Act <i>Streamlining offshore petroleum environmental approvals Strategic Assessment Program Report</i> is a binding commitment on NOPSEMA not to accept Environment Plans if this would be inconsistent with IUCN reserve management principles in the event there is no management plan for a reserve. IFAW pointed out that this is a matter for NOPSEMA and the Department of Environment to decide as to how best to communicate this to operators, given that the Department's website is clearly creating confusion on this issue currently.</p> <p>IFAW requested that Spectrum should respond to one point from IFAW's previous correspondence (22/7/2015 – see above) that was not picked up in Spectrum response back to IFAW.</p>	Spectrum responded to IFAW on these issues in a letter emailed on 21/8/2015 (see <b>Appendix A2</b> ).
<b>Face-to-face meetings</b>			
GPFA	Meeting – 3/08/2015	<p>GPFA informed Spectrum that most fisheries have finished due to completion of quotas. Only Phil Haddon remaining fishing activity in Phase 2 area – mid Aug to end of Sept. Kalbarri fishermen would like regular contact, say every 4 days, on whereabouts and next shooting direction. Whale migration is already coming through, close to the shore, wider arrays than has been seen before</p> <p>Peter Bailey requested: details of the line plan to be sent ahead of acquisition, once it has been firmed up. Terry Mouchemere requested copy of the map to be emailed.</p>	Spectrum will comply with these requests.
KPFA	Phone call – 27/7/2015	KPFA informed Spectrum that he will be away on the 3/8/2015 and will not be able to attend the meeting. KPFA informed Spectrum that the survey will not affect them as they do not fish out that far. Spectrum acknowledged that this was KPFA response during the last round of consultation but wanted to touch base with members to let them know we would be in town if they wanted to discuss any concerns, KPFA appreciated the call - but still does not have any concerns to raise.	Spectrum thanked KPFA for their response and informed them that they will continue to receive updates and notifications for the Rocket MC2D MSS.
United Mid West Professional Fishermen's	Meeting - 3/08/2015	UMWPFPA informed Spectrum that only interest is from Kalbarri fishermen, due to inboard section of Phase 2, but as the survey is being trimmed, it falls outside of area of interest. Whale migration in October closes off their fishing. Phase 1/Phase 2 operational areas have no pending fishing activity Aug/Sept. 6-17 Oct Big Bank and Abrolhos research cruise – may not go ahead as they do not want to pay day rates, and fishermen have reached quotas.	No response required from Spectrum

Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
Association (UMWPFA)			
DoF	Meeting – 29/7/2015	<p>Meeting Participants: DoF, Spectrum Geo, Scope Resources and Quest Marine.</p> <ol style="list-style-type: none"> <li>1. DoF suggested that Spectrum inform the Commonwealth Marine Reserves Branch of the changes to the operational area and the survey line plan, in the vicinity of the proclaimed CMRs in the vicinity of the Aboholhos Islands.</li> <li>2. DoF requested to be included in the 7 to 10 day forecasts so that the DoF division conducting rock lobster spawning assessment can be informed of the locations where the acoustic source has been discharged.</li> <li>3. DoF informed Spectrum that most fishers in the area of the Aboholhos Island have reached their allocated quota and that big bank fishing area is now closed to fishers and due to the offshore location of the survey area they do not anticipate increased numbers of interactions with rock lobster fishers.</li> <li>4. Regarding the change of vessel to the BGP Explorer - DoF advised Spectrum that there is a new online biofouling risk assessment tool and this could be incorporated into the Rocket EP revision.</li> <li>5. DoF requested the revised coordinates of the operational area to update the fisheries exemption licence requested by Quest Marine - to joanne.kennedy@fish.wa.gov.au .</li> <li>6. If fishing gear has to be moved due to it being in the way of a proposed seismic acquisition line and is found to be unmarked, DoF requested that the DoF Geraldton Office be contacted and they will deal with the unmarked equipment.</li> <li>7. DoF requested a synopsis of the concerns raised and requests made during the face-to-face stakeholder consultation meetings with professional fisheries associations and co-operatives.</li> <li>8. GDSF- contact through WAFIC:             <ol style="list-style-type: none"> <li>a. Potential for interaction with set fishing gear (gills nets) - need to liaise with licence holders.</li> </ol> </li> <li>9. WRLF - contact through WRLF:             <ol style="list-style-type: none"> <li>a. John McNath is the best person to liaise with to ensure WRLF licence holders are kept up to date with the details of the project.</li> </ol> </li> </ol> <p>Marine Safety - discussion with DoF regarding marine safety and survey timing to avoid bad weather. The department is in full agreement that marine safety and the lives of crew are of the utmost importance.</p>	<ol style="list-style-type: none"> <li>1. Spectrum will adhere to DoF suggestion and will inform CMR Branch at DoE of the changes to the Rocket MC2D MSS operational area and line plan.</li> <li>2. Spectrum will adhere to this request and has included DoF on the list of recipients for the 7 to 10 day forecasts upon commencement of the survey.</li> <li>3. Spectrum appreciates the advice from DoF, however will continue to engage a chase vessel throughout the survey to manage interactions with fishers and set fishing gear.</li> <li>4. Spectrum has incorporated scenario test of the BGP Explorer using online Vessel Check biofouling risk assessment into the revised EP (see Section 5.3.3.3).</li> <li>5. Spectrum will forward the revised coordinates to Spectrum as requested.</li> <li>6. Quest Marine will adhere to DoF request to inform DoF Geraldton Office of all unmarked equipment removed.</li> <li>7. Upon completion of the stakeholder consultation face-to-face meetings Spectrum will provide DoF with a synopsis of concerns and issues raised by stakeholders.</li> <li>8. Spectrum has already included WAFIC in the on-going stakeholder consultation process via the further notification letter sent to stakeholders on the 16 July 2015.</li> <li>9. Spectrum has since met with WRLF to discuss the concerns of WRLF licence holders (see below).</li> </ol> <p>Spectrum explained to DoF that's the timing of the survey is proposed in order to avoid extreme weather conditions on the central west coast.</p>
Western Rock Lobster Council (WRLC) & WAFIC	Meeting – 31/7/2105	<p>Meeting Participants: WRLC, WAFIC, Spectrum Geo and Scope Resources.</p> <ol style="list-style-type: none"> <li>1. WRLC provided the contact details of the CEO of the GFC.</li> <li>2. WRLC confirmed with Spectrum that the best way to contact fishers in Geraldton is through directly liaising with the professional fishers associations.</li> <li>3. WRLC would like Spectrum to continue to provide WRLC with details of the survey timing, in the event that the survey is postponed or delayed so that it can keep its members informed. Spectrum informed WRLC of the offer of the 7 to 10 day forecast. WRLC advised Spectrum that the 10 day forecast is better as fishers don't tend to have their pots out longer than 10 days,</li> </ol>	<ol style="list-style-type: none"> <li>1. Spectrum have contacted the CEO of the GFC inviting the CEO to attend the face-to-face meetings with co-ops in Geraldton.</li> <li>2. Spectrum will continue to keep the professional fishers associations informed of all survey notifications and the 7 to 10 day forecasts.</li> </ol>

Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
		<p>4. WRLC informed Spectrum that some members fishing around the Arolhos have not reached their quota and are holding off fishing until later in the year, there may be fishers out there later in the year. They have 232 active fishing vessels in their fishing industry.</p> <p>5. WAFIC raised the importance of the online web portal for increased transparency in the industry.                      WAFIC raised concerns regarding the assessment process and if there is no evidence of effects then how can NOPSEMA accept an EP.</p>	<p>3. Spectrum will ensure that WRLC will be kept up to date with the progress of the EP revision acceptance so that it can keep its members informed of any delays in acquisition. Spectrum will include WCRLF in the 7 to 14 day forecast of operations along with members of the WCDSFC.</p> <p>4. Spectrum will continue to engage a chase vessel to manage interactions with fishers and set fishing gear throughout the remainder of the survey in both Phase 1 and Phase 2 Operation areas.</p> <p>5. Spectrum agreed that there needs to be a better way than only obtaining address details to post letters to contact fishers who are out on the water fishing.                      Spectrum explained to WAFIC that the assessment process requires titleholders to conduct a risk assessment and show that the impacts are ALARP and acceptable, if there is no evidence to show ALARP then an EP will not obtain acceptance under the new objective based regime.</p>
<p>West Coast Deep Sea Crustacean Fishery (WCDSFC)</p>	<p>Meeting – 29/7/2015</p>	<p>Meeting Participants:                      Spectrum Geo, Scope Resources, Quest Marine, Chaceon, Southern Trading, Deep Sea Services and WAMRL.</p> <p>1. Concerns were raised that fishers were not included in the first round of consultation, they would like to have been included in the Phase 1 consultation as they also fish in the phase 1 area.                      a. Chaceon requested information regarding the lines that had already been acquired during Phase 1 as they would have had set fishing gear in the survey area.                      b. This is to include latitude and longitude, dates and times.</p> <p>2. Forecast of Operations to WCDSFC - prefer a 7 - 14 day forecast as their set gear is left in for 7 - 10 days.                      a. Date start, latitude and longitude of starting position, which direction the line will be acquired and how long to complete the line.</p> <p>3. Chaceon raised concerns regarding the acoustic impact on deep sea crustaceans (Snow Crabs) and informed Spectrum that this crab species as is only found in Western Australia.                      a. Chaceon would like to view the risk assessment undertaken.</p> <p>4. Map forwarded on to WCDSFC and Jason from WAMRL of the operational area and proposed survey lines including latitude and longitude, defined bathymetry, highlight 100 m, 500 m and 1,000 m bathymetry</p> <p>5. Provide David, Neil and Glen with emails of <i>BGP Explorer</i> - Party Chief and <i>MV Browse Express</i> - Captain email addresses to Chaceon, Southern Trading, Deep Water Services.</p> <p>6. Confidentiality - WCDSFC expressed their concern regarding their confidential fishing locations. They do not want other fishermen to find out where they are fishing, how can they be assured the information passed on is kept secure? This will also need to include the 2nd support vessel that will relieve the <i>Browse Express</i> during supply and refuelling trips.                      WAMRL is responsible for crustacean stock assessment and liaises directly with the fishermen. They obtain catch data from the fishermen to determine the sustainability of the stock. WAMRL has requested commercially confidential information in order to plot seismic acquisition locations with catch data locations. They would like the Phase 1 and Phase 2 Operational Area - location of lines already acquired and proposed, including date and time of acquisition.</p>	<p>1. Spectrum confirm that all members of the WCDSFC were sent a stakeholder consultation letter via post. Efforts were also made to contact stakeholders via phone call on the 25/9/2015.                      a. Spectrum will adhere to the request of Chaceon and will send through lines acquired during the Phase 1 acquisition earlier in the year.                      b. Spectrum will provide the data as requested.</p> <p>2. Spectrum will adhere to WCDSFC and provide a 7 to 14 day forecast to assist fishers when they are planning where to set their fishing gear so interactions can be avoided.                      a. Spectrum will adhere to requests that the forecast include the date, latitude and longitude of starting position, direction of the line and line completion timing.</p> <p>3. Spectrum informed Chaceon that a risk assessment of the acoustic impacts to benthic organisms was</p>



Stakeholder	Submission	Stakeholder Feedback	Spectrum Response
			<p>undertaken and included in the EP submission to NOPSEMA that has previously been accepted by NOPSEMA, and this can be provided to WCDSCF upon request.</p> <p>a. Spectrum will provide a summary of the risk assessment undertaken to Chaceon,</p> <p>4. Spectrum will provide a map as requested to members of the WCDSCF and WAMRL.</p> <p>5. Spectrum will provide emails of both the Seismic vessel Party Chief and chase vessel captain to WCDSCF.</p> <p>6. Spectrum and Quest Marine respect the confidentiality concerns of the fishers. Quest Marine suggested that a confidentiality agreement be written up for information passed on to seismic / support vessel and the fishers.</p> <p>Upon completion of the stakeholder consultation meetings Spectrum will be able to respond and adhere to the request from WAMRL.</p>
Geraldton Harbour Master	Meeting - 3/08/2015	<p>Mid West Port Harbour Master (Captain Martin North) informed Spectrum that commercial shipping traffic is approx. 300 ship per year., which come South to Geraldton, and then outward. Offered an additional acknowledgement on MWP's shipping schedule – email: <a href="mailto:harbourmasters@midwestports.com.au">harbourmasters@midwestports.com.au</a></p> <p>Spectrum should advise commencement date, regular positioning, and when completed, for inclusion on the shipping schedule. Provide contact email for further info.</p> <p>Will Spectrum have required usage of Geraldton Port? Can suffer from congestion problems.</p> <p>Raised details of the vessel, and whether suitable for “dynamic positioning” – would allow vessel to sit in middle of harbour, pending berth allocation, which is 1st come, 1st served.</p> <p>Late night berthing? Can be done, but prefer daylight hours. Can anchor in the bay.</p>	Spectrum will comply with these requests.

### 7.3 PHASE 3: ONGOING CONSULTATION

Consultation with stakeholders will be ongoing throughout the period the Rocket MC2D MSS EP is valid. Spectrum will comply with requests by stakeholders for additional information and requests for updates during any activities undertaken within the Phase 1 and Phase 2 operational areas.

As required under sub regulation 16(b), Spectrum 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, Spectrum shall modify management of the activity.

Under subregulation 8(1) it is an offence for a titleholder to continue if a new impact or risk, or increase in the impact or risk, is not provided for in the EP in force. Consequently, Spectrum shall undertake an internal assessment to determine whether there is a significant new environmental impact or risk, or significant increase in an existing environmental impact or risk that is not provided for in the EP. 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, Spectrum shall submit a proposed revision to the EP.

Spectrum shall determine at the time of the assessment whether a risk or impact is considered 'significant' based on information available at that time.

All the stakeholders contacted as part of the preparatory and pre-survey and consultation phases have been informed of the change in survey timing and of the operations that will now be occurring in both of the operational areas. This process does not preclude the commitments already made in the EP in respect of pre-survey on-going consultation and notifications prior to any operations within the Phase 2 operational area.

## 8 DETAILS OF TITLEHOLDER'S NOMINATED LIASON PERSON

Details for Spectrum as the Titleholder, and for Spectrum's nominated liaison person with respect to the EP, are as follows:

Name:	Spectrum Geo Pty Ltd
Business address:	105 St Georges Terrace Perth WA 6000
Telephone:	+61 8 9322 3700
Fax:	+61 8 9322 1844
Email address:	<a href="mailto:jane.conder@spectrumasa.com">jane.conder@spectrumasa.com</a>
ABN:	90 003 632 166
Nominated liaison person:	Jane Conder, Commercial Director, Asia Pacific.

## **APPENDIX A – RESPONSES SENT TO IFAW**

**Appendix A1:** Letter emailed to IFAW on 29/7/2015



27<sup>th</sup> July 2015

Matthew Collis  
IFAW Oceania  
6 Belmore Street, Surry Hills  
Sydney, NSW 2010

[mcollis@ifaw.org](mailto:mcollis@ifaw.org)

Dear Mr Collis,

**Rocket MC2D MSS, Houtman Sub-basin, WA**

Thank you for your email of 17<sup>th</sup> July 2015 to Scope Resources in response to the further notification letter sent to stakeholders on 16<sup>th</sup> July. With regards to the issues that you raised in your email, Spectrum responds as follows:

1. Spectrum will be submitting a revision of the Environment Plan (EP) to NOPSEMA to cover any proposed acquisition in the Phase 1 and Phase 2 operational areas after the end of June 2015.
2. Spectrum has undertaken a detailed risk assessment, based on a new survey design for the remaining lines in both operational areas, and on acquisition after the end of June. This risk assessment will be incorporated into the revision of the EP.
3. There is no need to provide a copy of the risk assessment to IFAW, as the EP is being revised and re-submitted to NOPSEMA. NOPSEMA, as the Regulator, will make a decision as to whether to accept this revision of the EP or not.
4. A map showing the spatial overlap between the revised 2D line plan for Phase 2 of the Rocket MC2D MSS and the zoning of the Abrolhos Commonwealth Marine Reserve (ACMR) is provided in Attachment 1 to this letter. This map shows that the new line plan eliminates overlap with the Marine National Park Zone (MNPZ) components of the ACMR to the west and north of the Abrolhos Islands. Furthermore, the revised line plan also significantly reduces overlap with the Multiple Use Zones (MUZ) components of the ACMR to the west of the Abrolhos Islands.

In respect of your comment that IFAW believes NOPSEMA acted unlawfully in approving those aspects of the EP that relate to overlap with the ACMR, Spectrum is of the view that NOPSEMA acted entirely within all relevant legislation in accepting the EP. As stated on the Department of the Environment's website for the South-west Commonwealth Marine Reserves Network—"Until a management plan comes into effect, transitional arrangements apply. Under the transitional arrangements, there are NO CHANGES ON THE WATER for users of new areas added to the Commonwealth marine reserves estate."

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The draft management plan for the South-west Commonwealth Marine Reserves Network was prepared in 2013, but is currently under review. Hence, there is no statutory management plan in place for the ACMCR and transitional management arrangements apply in the interim.

As previously indicated, Spectrum is available for face-to-face meetings to discuss any of your issues or concerns regarding the Rocket MC2D marine seismic survey. Please contact me if you wish to meet, or if you require any further information.

Yours sincerely,



Jane Conder  
Commercial Director, Asia Pacific

Tel: +61 (0) 8 9322 3700  
Email: [jane.conder@spectrumasa.com](mailto:jane.conder@spectrumasa.com)

Att: 1) Overlay of revised Phase 2 line plan and proposed Abrolhos CMR

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**Appendix A2:** Letter emailed to IFAW on 21/8/2015



21<sup>st</sup> August 2015

Matthew Collis  
IFAW Oceania  
6 Belmore Street, Surry Hills  
Sydney, NSW 2010

[mcollis@ifaw.org](mailto:mcollis@ifaw.org)

Dear Mr Collis,

**Rocket MC2D MSS, Houtman Sub-basin, WA**

Thank you for your email of 31 July. Please note that the revised Environment Plan (EP) for the Rocket MC2D MSS was accepted by NOPSEMA on 20 August, and an EP Public Summary is currently being prepared.

The EP Public Summary will be posted on NOPSEMA's website within 10 days of the date of acceptance of the EP. This document will provide a summary of the extensive environmental evaluation and the management provisions that have been incorporated into the revised EP, and will include details of the modifications in the revised EP in relation to Commonwealth marine reserves and timing in relation to pygmy blue whale migration. The EP Public Summary will also describe the additional control measures that will be implemented to reduce potential impacts/risks to migrating humpback and pygmy blue whales to levels that are as low as reasonably practicable and acceptable.

With regards to overlap between the activity and Commonwealth marine reserves, as you have pointed out this is a moot point now that there is no acquisition planned in the marine national park zones of the Abrolhos Commonwealth marine reserve. Spectrum will continue to take advice from NOPSEMA and the Department of Environment (DoE) as to the legal aspects of the acceptance of the EP in the first place, and proposed petroleum activities within or adjacent to Commonwealth marine reserves. I suggest that IFAW takes this matter up directly with NOPSEMA and the DoE, if you have not done so already.

On the last point raised in your email—the EP Public Summary will detail the further control and mitigation measures to reduce potential impacts/risks to humpback whales on their southbound migration. The ends of a number of lines in the Phase 1 operational area overlap with the humpback whale biologically important area (BIA - migration). These lines will be acquired first to minimise potential temporal overlap with southbound humpbacks. At the closest point, the ends of the lines that impinge on the BIA are located ~45 km from the boundary of the resting area BIA in Shark Bay.

Based on (unpublished) empirical measurements of a number of seismic airgun sources in western and southern Australian waters by researchers from the Centre for Marine Science and Technology (CMST) at Curtin University, the sound pulses from a 3,680 in<sup>3</sup> airgun are expected to decrease to sound exposure levels (SEL) of 125-135 dB re 1µPa<sup>2</sup>.s within 45 km of the source, dependent on the sound propagation characteristics of the area. Transmission loss is likely to be accelerated in shallow water to the east of the line ends, as sound will bounce repeatedly between the sea surface and seabed and so lose energy rapidly, or not bounce at all but enter the seabed and so not be pertinent

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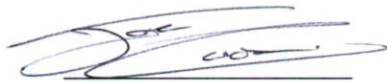
for lateral sound transmission. Therefore, it is likely that received SEL at the western edge of the Shark Bay resting BIA will not exceed 130 dB re 1 $\mu$ Pa<sup>2</sup>.s.

McCauley *et al.* (2003)<sup>1</sup> found that migrating humpback whales show a general avoidance of an operating seismic source at 157 to 164 dB re 1 $\mu$ Pa (rms), and resting cow pods show avoidance at somewhat lower levels—for example, a mean sound pressure level (SPL) for avoidance of 140 dB re 1 $\mu$ Pa (rms) and a mean standoff range at 143 dB re 1 $\mu$ Pa (rms). These SPL rms levels are equivalent to SEL of approximately 10 dB less – i.e. 130-133 dB re 1 $\mu$ Pa<sup>2</sup>.s.

It is highly unlikely that any humpback whales within the Shark Bay resting BIA will experience received SEL of a magnitude sufficient to result in a marked avoidance of the stimulus. Additionally, this situation will only arise during the short period of time the vessel is acquiring the eastern ends of the lines adjacent to Shark Bay.

As I indicated in my previous correspondence, Spectrum is available for face-to-face meetings to discuss any of your issues or concerns regarding the Rocket MC2D survey. Please contact me if you wish to meet, or if you require any further information.

Yours sincerely,



Jane Conder  
Commercial Director, Asia Pacific

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Email: [jane.conder@spectrumasa.com](mailto:jane.conder@spectrumasa.com)

<sup>1</sup> McCauley, RD, Fewtrell, J, Duncan, A, Jenner, C, Jenner, M-N, Penrose, JD, Prince, RT, Adhitya, A, Murdoch, J, and McCabe, K (2003). Marine seismic surveys: analysis and propagation of air-gun signals; and effects of exposure on humpback whales, sea turtles, fishes and squid. Curtin University Centre for Marine Science and Technology (CMST) Report R99-15 for the Australian Petroleum Production and Exploration Association (APPEA). Published in: Environmental Implications of Offshore Oil and Gas Development in Australia: Further Research, APPEA, 2003, 520 pp.

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