

## ZEEKOET MC3D MARINE SEISMIC SURVEY ENVIRONMENT PLAN: PUBLIC SUMMARY

This summary of the Environment Plan for the Fugro Zeekoet MC3D marine seismic survey, which will be acquired in the northern Bonaparte Basin offshore from Western Australia (WA), has been submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), to comply with Regulations 11(7) and 11(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

### INTRODUCTION

The geophysical company Fugro proposes to undertake a multi-client three-dimensional (MC3D) marine seismic survey (Zeekoet MC3D MSS), in the northern Bonaparte Basin offshore from northern WA. The Zeekoet MC3D MSS will be comprised of a maximum of 3,809 square kilometres (km<sup>2</sup>) of 3D seismic acquisition, and ~50 line kilometres of 2D seismic acquisition, in Petroleum Exploration Permits WA-446-P, NT/P80 and adjacent vacant acreage (**Figure 1**).

The Zeekoet MC3D MSS is scheduled to occur in the period between May and August 2012 and is expected to be of ~75 days duration.

### COORDINATES OF THE PROPOSED ACTIVITY

Boundary coordinates for the survey area (**Figure 1**) are provided in **Table 1**.

**Table 1: Zeekoet MC3D MSS survey area**

Latitude (S)			Longitude (E)		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
11	54	50.52	127	41	38.05
11	34	20.67	127	41	23.59
11	25	00.01	127	57	22.21
11	59	31.01	128	19	50.00
11	59	54.87	128	19	49.99
12	12	51.13	128	19	49.99
12	12	50.96	128	12	06.11
12	06	31.31	128	07	27.50
12	05	23.41	127	48	19.29

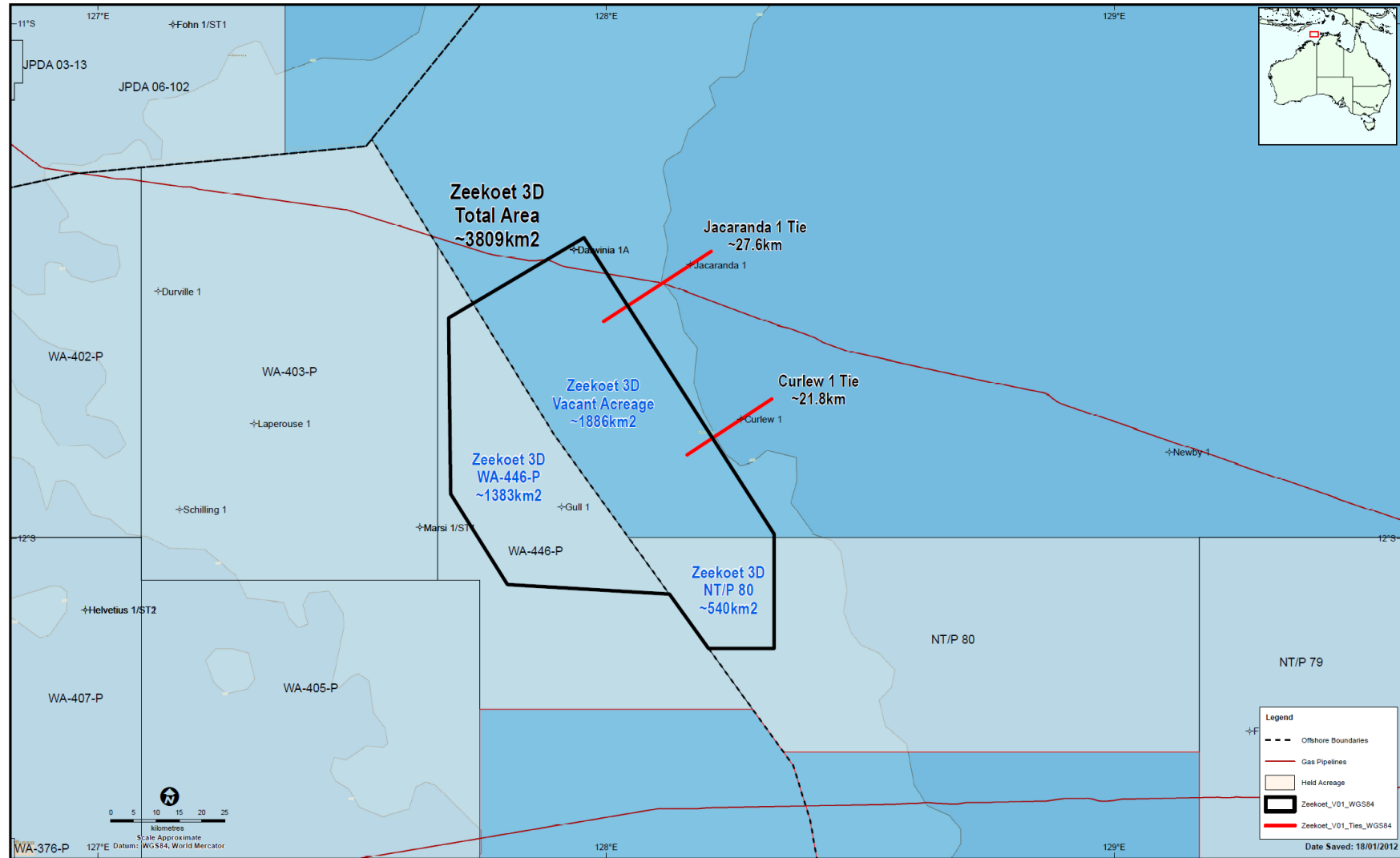
Datum: WGS84

The Zeekoet MC3D survey area is situated at a minimum distance of ~205 km from the north Kimberley coastline, at Cape Londonderry. The survey area is located in Commonwealth waters, ~250 km north-east of East Holothuria Reef (in WA State waters), and 185 km west of Bathurst Island (in NT waters). The north-west boundary of the survey area is situated ~36 km south-east of the southern boundary of the Joint Petroleum Development Area (JPDA).

The survey area is bisected by the WA/NT jurisdictional boundary in Commonwealth waters (**Figure 1**).

Water depths in the survey area range from ~50-125 m. There are no shallow shoals or emergent features (water depths <30 m) within the survey area.

**Figure 1: Location map – Zeekoet Multi Client 3D marine seismic survey**



## DESCRIPTION OF THE PROPOSED ACTIVITY

The Zeekoet MC3D MSS is scheduled to occur in the period between May and August 2012 and is expected to be of ~75 days duration.

Timing of commencement is dependent on fair sea state conditions suitable for marine seismic acquisition, the availability of the survey vessel for conducting the survey, and granting of approvals from the appropriate government bodies.

During the proposed activities, the survey vessel will traverse a series of pre-determined sail lines within the operational area at a speed of ~8-9 km/hr. As the vessel travels along the survey lines, a series of noise pulses (every 8-10 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 number of hydrophone cables (streamers) 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.

The seismic array will comprise of a maximum of ten solid streamers with a maximum length of 6 km. Streamer spacing will be 100 m, and line spacing will be 500 m. The source (airgun array) tow depth will be 6 m (+/- 1 m) and the streamer tow depth will be 7 m (+/- 1 m). The operating pressure for the airgun array will be ~2,000 psi. The airgun array will consist of two sub-arrays, each with a maximum volume of ~3,200 cui. These sub-arrays will be fired alternately, with a shotpoint interval of 25.0 m vertical distance. The source produces sound pulses within a few metres in the order of 210-220 dB re 1 $\mu$ Pa (sound pressure level – SPL) at frequencies extending up to ~128 Hz. These sound pulses are expected to decrease to sound exposure levels (SEL) in the order of 160 to 170 dB re 1 $\mu$ Pa<sup>2</sup>.s within 1 km of the source and ~155 dB re 1 $\mu$ Pa<sup>2</sup>.s within 2 km, dependent on the sound propagation characteristics of the area.

Fugro proposes to conduct the Zeekoet MC3D MSS using a purpose-built seismic survey vessel. The specific survey vessel for this survey is yet to be determined—it could be either the *Geo Atlantic* or possibly the *Geo Coral*. In either case, the vessel will have all necessary certification/registration and be fully compliant with all relevant MARPOL and SOLAS convention requirements for a vessel of this size and purpose, including a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with Regulation 37 of Annex I of MARPOL 73/78.

The survey vessel will travel within the survey area at an average speed of 4.5 knots (~8.3 km per hour).

A support vessel will accompany the seismic survey vessel to maintain a safe distance between the survey array and other vessels, and to manage interactions with shipping and fishing activities, if required. The specific support vessel for this survey is yet to be determined—it is likely to be the *Cassandra VI* if the *Geo Atlantic* is selected as the survey vessel. The support vessel will also re-supply the survey vessel with fuel and other logistical supplies. The support vessel will have a crew of ~15 personnel, and will have an implemented and tested SOPEP in place.

During the survey, it is likely that the survey vessel will be refuelled at sea using the support vessel, either within or immediately adjacent to the survey area. At sea refuelling will only take place during daylight hours, and will not take place within a distance of 25 km from any emergent land or shallow water features.

## DESCRIPTION OF THE RECEIVING ENVIRONMENT

The proposed Zeekoet MC3D survey area is located within the Joseph Bonaparte Gulf Basin, which is one of three sub-systems that constitute the Joseph Bonaparte Gulf system of the North Marine Region (NMR).

### Physical Environment

The climate of the NMR is tropical monsoonal, with two distinct seasons, a summer wet season which occurs broadly between October and March, and a winter dry season, between April and September. The winters are influenced by easterly winds generated over inland Australia, resulting in dry and warm conditions, with very little rainfall and low relative humidity. The high humidity and thunderstorm activity of the wet season is caused by steady west to north-west winds, bringing moisture from the Timor Sea.

Cyclones may occur in the region between December and April, resulting in severe storms with gale force winds. Typically, cyclones form south of the equator in the Timor or Arafura Seas when sea temperatures are greater than 26.5°C. Cyclones may move in any direction; however, the majority of past cyclones have moved over the northern Joseph Bonaparte Gulf overlapping, or north of the Zeekoet MC3D survey area. On average, the Joseph Bonaparte Gulf receives ten cyclones per decade.

The Joseph Bonaparte Gulf is protected from swell generated in the Southern Ocean, therefore swells affecting the area are limited to those generated by cyclones or prolonged strong winds. Sea waves, which are usually short period (1–8 second) waves, are generated by local synoptic winds and reflect wind directionality. Persistent strong winds capable of generating significant seas are generally associated with the south-easterly trade winds which dominate during winter or dry season months. However, the small south-easterly fetch is expected to limit the development of large seas throughout northern Joseph Bonaparte Gulf. Larger seas typically occur during the winter, from June to August. The period of calmest seas occurs from April to May. Tides in the Joseph Bonaparte Gulf are semi-diurnal with two high and two low tides per day. The tidal wave propagates in from the Timor Sea and circulates around an amphidromic point located offshore from Cape Londonderry. As a result, there is considerable variation in the tidal range along the north-west Kimberley coast and within the Gulf.

Joseph Bonaparte Gulf is a broad and relatively shallow embayment with a coastline dominated by sand and mud flats, tidal creeks and estuaries of major river systems. Major inputs of fine silt sediments from the Ord, Victoria and Keep River systems occur during the wet season creating vast areas of high turbidity, particularly in the southern part of the Gulf. The sediments are deposited to form sand bars and mud flats that are the source of high turbidity throughout the year as sediments are resuspended by tidal movements. Consequently, high turbidity levels occur in the lower region of the Gulf throughout the wet season and during phases of high tidal variation (spring tides) during both the wet and dry seasons.

The survey area for the Zeekoet MC3D survey includes two Key Ecological Features identified during the NMR bioregional planning process:

1. Carbonate banks in the Joseph Bonaparte Gulf.
2. Pinnacles of the Bonaparte Basin.

Carbonate banks and shoals consist of a hard substrate with flat tops and steep sides that rise from water depths of between 150 and 300 m. Each bank generally occupies an area less than 10 km<sup>2</sup> and is separated from the next by narrow channels. It is thought that the formation of the carbonate banks is associated with hydrocarbon seeps and the hard carbonate substrate is ideal for reef-building organisms. The carbonate banks are thought to be sites of enhanced biological productivity that may support many tropical reef species. The banks, and the channels between them, are also known foraging areas for flatback and loggerhead turtles. The pinnacles in the Bonaparte Depression and surrounding waters are up to 50 m high and 50–100 m long and are believed to be associated with enhanced local biological productivity and diverse species assemblages. They are believed to be the remnants of calcareous shelf and coastal deposits that have been eroded to their present elevations. The pinnacles are also important foraging areas for green, flatback, loggerhead and olive ridley turtles.

## **Biological Environment**

Very little is known about the biology of the Joseph Bonaparte Gulf Basin subsystem. Benthic faunal assemblages are presumably influenced by depth and the grain-size of the surface sediments. Some bacterial production may occur but deposit feeders are likely to dominate in this environment. Sponges, soft corals and other sessile suspension feeders may be abundant on the hard substrata lining the deep channels. There may also be a more diverse fish fauna associated with the channels. The carbonate pinnacles offer a very different environment to the remainder of the Basin. They are known to offer refugia for fish and presumably support phototrophic organisms where they extend into euphotic surface waters.

The Joseph Bonaparte Gulf supports a very productive banana prawn fishery, which operates in clearer shelf waters outside the coastal boundary layer. Healthy offshore populations of crustaceans, including prawns, are indicators of inshore productivity but the direct linkages between these systems are poorly understood. The by-catch of coastal fisheries, particularly the prawn fishery, indicates different species composition to the trawl by-catch from the Gulf of Carpentaria. By-catch from the prawn fishery contains a high relative abundance of a few species, which is a unique characteristic of the region and has a distinctly different species composition to the other demersal communities found in the Northern Prawn Fishery. Sharks are commercially fished in this subsystem whilst sawfishes are caught as by-catch.

Benthic habitat mapping for the Bonaparte LNG Project (located ~65 km south of the survey area) found that generally the seabed composition was similar, with sparse sessile benthos with the exception of an unidentified white colonial organism (recorded as an hydrozoan species) across all sampled fields. Estimated percentage cover was low for octocorals and sponges (~2% for each) while the unidentified hydroid comprised between 11-30% at all sites. The soft sediment seabed comprised of primarily of sand, coarse shell fragment and silt.

## ***Benthic Fauna***

Studies conducted on the infauna within the Blacktip Gas Project area (located ~185 km south of the survey area) found sediment infauna to be diverse and abundant, with two major phyla, Arthropoda (crustaceans) and Annelida (polychaete worms) contributing over 80% of the total number of individuals. Other abundant infauna were the Cnidaria (hydroids, soft corals), Mollusca (mainly bivalves) and Echinodermata (brittle stars, sea urchins). The studies found that infauna species richness and abundance in the Joseph Bonaparte Gulf was related to sediment particle size. Richness and species abundance increased with distance from the mouth of the Victoria River, which coincided with an increasing proportion of fine particles in the sediment.

The dominant prawn species of the Joseph Bonaparte Gulf are the Penaeid species, namely white banana, red-legged banana, and brown tiger. These species occur in coastal waters to depths of ~200 m, and are widely distributed through subtropical and tropical waters from WA to New South Wales. Shallower inshore waters act as nursery grounds for juveniles, such as the river and tidal creek systems of the Joseph Bonaparte Gulf.

More is known about the distribution and abundance of prawns in the Joseph Bonaparte Gulf compared to other crustaceans because a number of species are commercially harvested. Prawns are commercially caught in the Northern Prawn Fishery in areas of the Joseph Bonaparte Gulf, mainly in the south-west of the gulf and in Fog Bay, ~220 km ESE of the survey area. The juvenile prawns that migrate offshore to the fishery come from mangrove nursery habitats from the Victoria River in the east of the Gulf, to the Ord River and Cambridge Gulf in the west, forming a very extensive migration throughout the lower region of the Joseph Bonaparte Gulf. Although there is no data on the exact timing of the migration, it is likely to be from February to April and October to December. Migration of the juveniles is thought to be triggered by rainfall and river discharge.

## ***Fish Assemblages***

There is limited information available on the fish communities of the Joseph Bonaparte Gulf, though it is expected that the species are similar to those found in comparable habitats in north-western Australia. A WA Museum survey of the eastern Kimberley coast found 43 species in the near coastal areas of the Gulf. The offshore zone is expected to support much less abundant fish and motile invertebrate fauna than the mangrove lined coastal areas and estuaries. Some information on teleost and elasmobranch fish

communities in the Gulf can be gleaned from by-catch studies of the Northern Prawn Fishery. Based on these data, the five most common by-catch teleost species in the Gulf are largehead hairtail, black-finned threadfin, smooth croaker, hairfin anchovy, and threadfin scat. The most common by-catch elasmobranch species in the Gulf is the brown stingray. These data probably give some indication of the demersal and benthic fish communities that could be expected to occur in the vicinity of the shallower areas of the Zeekoet MC3D survey area, given that most trawling in the Northern Prawn Fishery in the Joseph Bonaparte Gulf occurs in water depths of ~50-80 m.

Analysis of 36 BRUV (baited remote underwater video) samples from Bonaparte LNG Project site in the 2010 wet season survey recorded a total of 22 genera representing 17 families (positive identification was made for 33 species plus three unidentified records) for the deep waters of the Petrel, Tern and Pipeline fields. The most common families by density were grunters, threadfin breams, and snappers. None of the species encountered at the Bonaparte LNG Project site are listed as threatened or endangered under the EPBC Act and the relative density of these species is not consistent with an aggregation or sensitive ecological community, or fish nursery grounds.

Although there are no records of whale shark sightings in the survey area there have been sightings in the region, and they are known to occur in both tropical and temperate waters and are normally oceanic and cosmopolitan in their distribution. It is possible that they may be encountered during the proposed survey. Other EPBC Act protected marine species that may occur within the survey area include various species of pipefishes and seahorses. Very little information is available concerning the distribution, abundance, feeding and movement patterns of the green sawfish in Kimberley coastal waters, and in the Joseph Bonaparte Gulf. It is believed to occur mainly in inshore coastal waters and riverine environments, including mangroves and mudflats, and is therefore extremely unlikely to occur in the survey area.

### ***Ambient Underwater Noise***

GDF Suez Bonaparte commissioned a noise monitoring programme within the project area to determine baseline ambient underwater noise sources and levels. Analysis of the six months of noise logger data collected from September 2010 to March 2011 provided evidence of low levels of anthropogenic noise. Low levels of vessel noise and no seismic signals were detected. Biological sources were found to be the primary ambient noise input; dominated by Bryde's whale calls but also the contribution of various fish and fish choruses. Initial results from the ambient noise monitoring indicate that Bryde's whales pass through the Bonaparte LNG Project area. Bryde's whale calls were recorded during all but five days of the six-month recording period. In each instance, the whales passed through the project area, albeit slowly, and did not display any tendency to aggregate in a particular area. This pattern is similar to other sites sampled acoustically in northern Australia.

Sperm whales and humpback whales were also detected. One series of sperm whale clicks was identified, indicating that a pod of sperm whales was present in the area over two days in February 2011. Sperm whales (particularly males) have large geographic ranges and have been sighted in WA waters in all seasons. Sperm whales live offshore and are most common on the edge of the continental shelf or in submarine canyons where they deep dive to feed. However, they also occur in mid-ocean and may occur close to coasts where water depth exceed 200 m. Humpback whale calls, consistent with the WA humpback population, indicated that individual whales passed at least 5 km distant from the noise loggers during September 2010. However, calls were considered to be of a low level, given only one individual was detected at any point in time. No other whale species were recorded during the monitoring period.

A large variety of fish noise signals were detected, with several fish 'choruses' (large schools of fish calling en masse producing a high level chorus over a defined period of several hours). These fish choruses were most prominent around dusk, indicated that they are likely to be calls from nocturnal planktivorous fishes which move into the water column at this time to forage. These choruses did not show any lunar affiliation and fluctuated across the six-month recording period between peaks in noise levels of 5 to 10 days interspersed with periods of low to no chorus activity.

### ***Marine Reptiles***

Six marine turtle species may occur in the survey area and adjacent waters - the green, leatherback, hawksbill, loggerhead, olive ridley, and the flatback. Green turtles feed on macroalgae and are by far the

most common turtle seen in nearshore waters. Loggerhead turtles are carnivorous, feeding mainly on molluscs and crustaceans. Hawksbill turtles feed mainly on sponges and are more often found in deeper waters of the NMR. Green, flatback and loggerhead turtles all breed from September to March, while the hawksbill turtle breeds from July to March. Reefal habitats in the photic zone are key feeding habitats for green and hawksbill turtles. Flatback turtles feed on soft bodied invertebrates, including ascidians and sea cucumbers.

The leatherback turtle is a pelagic feeder, found in tropical, subtropical and temperate waters throughout the world. Nesting is mainly confined to tropical beaches although some nesting occurs on subtropical beaches. No major nesting has been recorded in Australia, although scattered isolated nesting (1-3 nests per annum) occurs in southern Queensland and the Northern Territory.

There is a significant nesting area for flatback turtles on the north side of Cape Domett (located ~285 km south of the survey area), facing the open sea, and lower levels of turtle nesting are reported from Pelican Island. The main nesting period for flatback turtles in the Joseph Bonaparte Gulf is during the dry season, peaking in June, July and August. Nesting has been reported on the eastern side of the Joseph Bonaparte Gulf, at Fog Bay (~220 km ESE of the survey area). Other turtle nesting areas probably occur in the area, but due to the remoteness and the limited studies undertaken, remain undocumented.

The relative numbers of turtles in the area are not known. The low incidence of reefs and the limited areas of seagrass and macroalgae habitat in the area would limit the numbers of green turtles. Leatherback turtles are rare within their range and are probably only occasional visitors. The existence of significant flatback turtle nesting in the area suggests that these may be the most common species present. Due to the distance from the survey area to Fog Bay and Cape Domett (~220 km and 285 km respectively), which are the nearest nesting sites for turtles, the Zeekoet MC3D MSS is not expected to have any impacts on turtle breeding.

Flatback, olive ridley and loggerhead turtles are known to forage on the carbonate banks and limestone pinnacles of the northern Joseph Bonaparte Gulf.

### ***Cetaceans***

The humpback whale is the most commonly sighted whale in northern Western Australian waters. The species has been observed seasonally to complete their northern migration in the Camden Sound area of the west Kimberley, ~520 km south-west of the survey area, after feeding in Antarctic waters during the summer months. It is likely that the whales follow a predictable migratory path and migrate both north and south within the continental shelf boundary (200 m bathymetry). However, on the southbound migration it is likely that most individuals, and particularly cow/calf pairs, will stay closer to the coast than the northern migratory path.

In the Kimberley, humpback whales are seen regularly in coastal waters and out to 50 km offshore from Camden Sound to Joseph Bonaparte Gulf during winter months. As the Group IV humpback whale population continues to recover from whaling, the core calving grounds in the Kimberley (Beagle Bay to Adele Island to Kuri Bay to Montgomery Reef to Cape Leveque—high density areas for calving humpback whales during July-November) will continue to expand as animals seek other areas for calving and breeding. The area from Kuri Bay to Cape Londonderry is a recent extension of this core area. At the closest point, Cape Londonderry is located ~205 km south-west of the Zeekoet MC3D survey area.

It is highly unlikely that any humpback whales will be encountered within the Zeekoet MC3D survey area and adjacent waters during the survey, given the distance from the core calving grounds off the Kimberley coastline, and the proposed timing of the survey (between May and August 2012).

Other rare species of whale include the blue whale, which may be present in, or adjacent to, the survey area. Blue whales are widely distributed throughout the worlds' oceans. This species has been recorded offshore in all states excluding the Northern Territory. 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. Blue whales are believed to calve in tropical waters in winter and births peak in May to June, however the exact breeding grounds of this species are unknown.

The survey area and adjacent waters do not include any known blue whale feeding, breeding or resting areas. In the North-west Marine Region 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 northward component of this migration takes place from May to mid-August, with a peak in July-August, and the southward 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. Consequently, it is unlikely that any blue whales will be encountered in the survey area and adjacent waters, given the shallow water depth range in the survey area (50-125 m), and the proposed timing of the survey (between May and August 2012).

Other cetacean species whose broad distributions cover the region include whales that are infrequently observed usually restricted to cooler or deeper waters (e.g. killer and Bryde's whales) and are unlikely to be encountered in the survey area during the survey in significant numbers. As discussed above, Bryde's whales are likely to occur in the northern waters of the Joseph Bonaparte Gulf. There are no known breeding, calving or feeding grounds for any listed threatened or migratory cetacean species within, or in the immediate vicinity of the Zeekoet MC3D survey area.

### ***Seabirds and Shorebirds***

The three estuaries at the head of the Joseph Bonaparte Gulf (the Keep, Victoria and Fitzmaurice Rivers) support seabird and shorebird colonies of 10,000–15,000 birds. Extensive areas of shorebird and waterbird feeding habitat are associated with the mangroves and mudflats in this location. The Anson Bay to Fog Bay area, on the eastern side of the Joseph Bonaparte Gulf, is one of the most important areas for colonial waterbird breeding in the Northern Territory. There is extensive shorebird feeding and roosting habitat in Fog Bay, Anson Bay and the Little Moyle River. The Peron Islands (located ~215 km south-east of the survey area) contain the Northern Territory's largest Pelican rookery.

The survey area is located ~210 km from the nearest coastline, and more than 185 km from the nearest island. There is no information concerning the populations of seabirds utilising the waters of the survey area. However, the distributions of many common seabirds overlap the Joseph Bonaparte Gulf and they are expected to occur in the survey area. These include ten species of tern, three species of booby, and the lesser frigatebird. Migratory shorebirds are likely to be present in the region between July and October and again between March and April as Joseph Bonaparte Gulf is located within the East Asian-Australasian Flyway.

## **Socio-Economic Environment**

### ***Commercial Fisheries***

There are a range of commercial fisheries located within or adjacent to the Zeekoet MC3D survey area. These fisheries are managed by the Northern Territory, Western Australian or Commonwealth Governments.

#### Northern Prawn Fishery

The Northern Prawn Fishery (NPF) is believed to be the main commercial fishery that could involve activity in waters adjacent to the Zeekoet MC3D survey area. The NPF is a major fishery covering in excess of 700,000 km<sup>2</sup> from Cape York in the east to Cape Londonderry, which is south-west of the Zeekoet MC3D survey area. The NPF is managed by the Australian Fisheries Management Authority (AFMA) on behalf of the Commonwealth Government. In terms of revenue, the NPF is the second biggest fishery in Australia after the Western Rock Lobster Fishery.

The NPF targets nine commercial species of prawns, including white banana, red-legged banana, brown tiger, grooved tiger, blue endeavour, and red endeavour. Scampi, squid, scallops and bugs are also taken as by-catch. The fishery is split into two seasons—for 2011, the first season (banana prawns) occurred from 1 April to 24 June. Season dates for the second season in 2011 (tiger prawns) were 1 August to 30 November.

Adult banana prawns are targeted in areas of the Joseph Bonaparte Gulf, mainly to the west of the Gulf, in WA waters, in the deeper waters (50–80 m) offshore from the Berkeley River. Nursery grounds for red-legged banana prawn include coastal areas from the Ord River and the Cambridge Gulf, to the Victoria River. Adult red-legged banana prawns spawn in these areas and the juveniles mature in river mouths and



mangrove creeks before migrating offshore to the fishing grounds, between 200-300 km to the north-west. Migration of the main cohort probably occurs between November and March, with a possible second cohort migrating from April to June. Migration of the juveniles is thought to be triggered by a combination of rainfall and the size of the juveniles.

#### Demersal Fishery

The Demersal Fishery extends between 15 nautical miles (nm) to the outer edge of the Australian Fishing Zone (AFZ), excluding the waters of the Timor Reef Fishery. The catch is comprised mainly of goldband snappers and red snappers. Red emperors and cods are key byproduct species. Drop lines and traps are the main gears used in the fishery. Most of the fishing effort in the fishery occurs in areas east of the Timor Reef Fishery. Three goldband snapper species made up 52% of the total catch in 2008. The other major target group, red snappers, are made up of saddletail snappers and red snapper, and they constituted 40% of the catch in 2008. The species composition of the catch is gear dependent—operators using drop lines tend to catch a higher proportion of goldband snapper. Comparatively, those operators using baited traps tend to catch almost equal proportions of red snappers and goldband snapper. In 2008, more operators in the fishery used traps than drop lines.

There appears to be a cluster of goldband snapper catch records in the Demersal Fishery in the northern part of the Joseph Bonaparte Gulf. These catch records appear to be located on and south-west the Flat Top Bank area. None of these catch records for goldband snapper in the Demersal Fishery appear to overlap the Zeekoet MC3D survey area, with the closest records located ~60 km south-east of the survey area.

#### ***Petroleum Exploration and Production***

The principal petroleum development project in the northern Bonaparte Basin is Bayu-Undan. Bayu-Undan is located ~130 km WNW of the north-west boundary of the Zeekoet MC3D survey area. The operator is ConocoPhillips, which has a 57.2% stake. Partners are Eni (11%), Santos (11.5%), INPEX (11.3%) and Tokyo Electric Power and Tokyo Gas (9.2%).

The field life is estimated to be 25 years. Commercial production began in April 2004, with the project being developed in two phases. The gas-liquids first phase involved the production and processing of wet gas, the separation and storage of condensate, propane and butane, and the re-injection of dry natural gas back into the reservoir. This phase also involved the construction of a remote wellhead platform, a drilling, production and processing platform and a compression, utilities and quarters platform. The recovered liquids are piped to a floating storage and offloading (FSO) facility. The second phase of Bayu-Undan's development, the gas phase, began production in February 2006. This involved the extraction of lean gas from the reservoir and transportation to Darwin, via a 500 km, 26 in pipeline, where it is liquefied at a single-train processing plant at Wickham Point, then shipped as LNG to customers Tokyo Electric Power Company and Tokyo Gas in Japan. The export pipeline to Darwin crosses the northern corner of the Zeekoet MC3D survey area (see **Figure 1**).

The Blacktip Gas Project is located in Production Licence Area WA-033-L, ~185 km south of the Zeekoet MC3D survey area. The Blacktip Gas Project, which is 100% owned and operated by Eni, delivers gas to the Northern Territory's Power Water Corporation (PWC), with supply rising to 18,000 boe/day over the life of the contract. Gas production from the Blacktip field is processed through an onshore gas plant near Wadeye, on the eastern coast of the Gulf. At the closest point the survey area is located ~37 km north of the proposed Ichthys Project gas export pipeline (**Figure 1**).

#### ***Shipping***

There is limited shipping traffic in the vicinity of the Zeekoet MC3D survey area. The Port of Darwin, located ~275 km east of the survey area, is the most significant port in the region. One of the major shipping routes used by trading and cargo vessels to and from Darwin is located ~50 km north of the northern boundary of the NT/P80 permit, following the same path as the Bayu-Undan export pipeline. A limited amount of traffic passes through the NT/P80 permit, and another route crosses the WA-446-P permit.

#### ***Heritage Values***

There are no known indigenous cultural heritage values or issues for the waters and seabed within and immediately adjacent to the Zeekoet MC3D survey area. Similarly, there are no current or pending Native

Title Determinations for the waters and seabed within and immediately adjacent to the survey area. There are no known historic shipwreck sites within or immediately adjacent to the Zeekoet MC3D survey area. There are no places listed on the Commonwealth Heritage List or the Register of National Estate within or adjacent to the Zeekoet MC3D survey area.

### ***Protected Areas***

The nearest Commonwealth marine reserve to the Zeekoet MC3D survey area is the Cartier Island Marine Reserve, located ~467 km west of the survey area. At the closest point, the survey area is located ~195 km north-east of the boundary of the proposed North Kimberley Marine Park, which is located in WA State waters off the north Kimberley coastline. The survey area is situated within the proposed Oceanic Shoals Commonwealth marine reserve, identified by both NMR and Northwest Marine Region (NWMR) Bioregional Planning Processes. The proposed Oceanic Shoals Commonwealth marine reserve extends west from the NMR into the NWMR, across the WA/NT offshore jurisdictional boundary that bisects the Zeekoet MC3D survey area (**Figure 1**). There are no listed World Heritage Properties within, or adjacent to, the proposed survey area. Similarly, there are no listed Ramsar wetlands within, or adjacent to, the proposed Zeekoet MC3D survey area.

### ***Defence Activities***

The NT/P80 permit, and the eastern part of the WA-446-P permit, overlap a military exercise area, the North Australia Exercise Area (NAXA), including R264B, C, D, E, F and G. These areas are used by the Royal Australian Air Force (RAAF) and the Royal Australian Navy (RAN) for all military operations including live weapons and missile firing. These areas lie within the RAAF Air to Air Weapons Defence Practice Area (DPA). As such, access may be restricted with all vessels and aircraft possibly being ordered to evacuate the DPA at short notice. The NT/P80 permit also coincides with military restricted airspace area R264. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to sea level. Approximately 30% of the Zeekoet MC3D survey area overlaps part of the NAXA, covering the NT/P80 permit and the vacant acreage to the north of the permit up to the Bayu-Undan export pipeline.

## **MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS**

An Environmental Risk Assessment (ERA) has been undertaken to understand and manage the environmental risks associated with the Zeekoet MC3D MSS to a level that minimises impacts on the environment and meets the objectives of the survey. The ERA methodology applied is consistent with the Australian/New Zealand Standard *AS/NZS ISO 31000:2009 Risk management and Handbook 203:2006 Environmental risk management – Principles and process*.

The risk assessment has been undertaken to identify the sources of risk (aspects) and potential environmental impacts associated with the activity and to assign a level of significance or risk to each impact. This subsequently assists in prioritising mitigation measures to ensure that the environmental impacts are managed to As Low As Reasonably Practicable (ALARP).

A summary of the key sources of environmental risk (aspects) for the proposed activity include:

- discharge of underwater seismic pulses;
- light generation from vessels;
- interactions of vessels with marine fauna;
- anchoring or grounding of vessels used for the activity;
- dragging or loss of streamers, streamer fluid and associated equipment;
- emissions to atmosphere from vessels;
- discharge of ballast water and vessel biological fouling;
- routine discharge of wastewater and waste to ocean from survey and support vessels;
- accidental discharge of hydrocarbons and chemicals to ocean from survey and support vessels;
- vessel collisions; and
- interactions with shipping, commercial fishing, and military exercise activities.

A summary of the potential environmental impacts associated with the above sources of environmental risk include:

- disturbance to marine fauna including marine mammals, marine turtles and fish;
- disturbance to marine habitats including seabed and benthic habitats;
- reduced air quality from atmospheric emissions as a result of operation of machinery and use of internal combustion engines;
- introduction of invasive marine species as a result of ballast water discharge and vessel biological fouling;
- marine pollution from routine discharges including sewage water, bilge water and other solid wastes;
- marine pollution from accidental discharges including hydrocarbon spills and hazardous materials;
- disturbance to social and community values due to interactions with shipping, commercial fishing vessels and military vessels/aircraft; and
- disturbance to heritage and conservation values due to operation of vessels within, or in the vicinity of, protected areas.

The environmental aspects of the Zeekoet MC3D MSS that have the potential to cause significant environmental effects have been determined through an evaluation of the proposed activity, the surrounding environment including specific sensitivities and values, and legislative requirements. These environmental aspects are:

- accidental discharge of hazardous materials;
- accidental fuel and oil spills from the survey and support vessels; and
- vessel collisions, resulting in fuel and oil spills and/or damage to benthic habitats.

Implemented control measures documented in **Table 2** ensures that the environmental risks associated with these impacts are maintained at ALARP levels, while maintaining economic viability for the proposed activity. These control measures are taken into consideration in calculating the residual risk associated with the activity of impact.

## MANAGEMENT APPROACH

The design and execution of the proposed Zeekoet MC3D MSS will be conducted under the framework of the Fugro HSE Policy and HSE Management System. The seismic programme will be supported by Fugro's Offshore Emergency Response Procedure, a project-specific HSE Plan, and an Interface Document between Fugro-Geoteam AS and GC Rieber Shipping Ltd for the *Geo Atlantic*, if this vessel is used. To ensure Fugro's environmental standards and performance objectives are achieved, the survey vessel owner will be required to comply with all relevant requirements of Fugro's HSE Policy, HSE Management System and standards.

Fugro will apply a tiered approach to optimising the environmental performance of the project and ensuring that Fugro's environmental standards and performance objectives are achieved. The approach involves identification of local and regional environmental sensitivities, prioritisation of risks, determination of appropriate practices and procedures to reduce those risks, and clear designation of roles and responsibilities for implementation. A series of work instructions, procedures and plans will be used for the Zeekoet MC3D MSS to ensure that appropriate management measures are applied as required to minimise the risk of environmental disturbance from operations. The work instructions, procedures and plans are documented within corporate systems/manuals developed by Fugro as well as documents written specifically for the Zeekoet MC3D MSS. Many of the procedures apply to all vessels in the Fugro fleet, however the associated work instructions are generally vessel specific.

Fugro is responsible for ensuring that the proposed Zeekoet MC3D MSS is managed in accordance with the Implementation Strategy and the Fugro HSE Management System. Given the control measures that will be implemented for all environmental aspects of the survey, the risk of significant adverse environmental effects from the proposed Zeekoet MC3D MSS has been assessed as low for all aspects, apart from discharge of hazardous materials, fuel and oil spills and vessel collisions, which have been assessed as medium.

The implementation of specific whale monitoring and encounter procedures will be used to minimise the

potential for any adverse effects to whales. These procedures comply fully with the Australian Commonwealth Government Guidelines: *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (September 2008). Two dedicated, expert Marine Fauna Observers (MFOs) will be aboard the survey vessel for duration of the Zeekoet MC3D survey. The key role of the MFOs will be to monitor the waters around the survey vessel for the presence of cetaceans and turtles during daylight hours. The MFOs will be responsible for ensuring that the interaction procedures are implemented and followed correctly during survey activities. The MFOs will also be responsible for recording any cetacean sightings during the survey on the appropriate sightings forms, using the DSEWPac CSA software.

The survey will be conducted in water depths of 50-125 m and in an area that is located at least 220 km away from any beaches and adjacent shallow waters that are important for turtle nesting, hatching and breeding. The survey area is not located close to any locations important for seabird or shorebird breeding or feeding. The survey is unlikely to have any significant effects on benthic communities due to the water depths across the operational area. Anchoring of the survey or support vessel will only occur in emergency circumstances and both vessels are fitted with highly sophisticated position fixing equipment. At sea refuelling of the survey vessel will only take place during daylight hours, and will not take place within a distance of 25 km from any emergent land or shallow water features.

## **CONSULTATION PLAN**

Consultation with stakeholder groups concerning Fugro's proposed Zeekoet MC3D MSS has taken place, primarily within the commercial fishing industry, during the preparation of the Environment Plan, and prior to the commencement of the survey. The following organisations have been contacted and informed of the proposed operations:

- A Raptis and Sons
- Australian Fisheries Management Authority
- Australian Hydrographic Service
- Australian Maritime Safety Authority
- Border Protection Command
- Coastwatch
- Commonwealth Fisheries Association
- Department of Broadband, Communications and the Digital Economy
- Department of Defence
- Department of Sustainability, Environment, Water, Population and Communities
- Geoscience Australia
- Kimberley Professional Fishermen's Association
- National Native Title Tribunal
- Northern Fishing Companies Association
- Northern Prawn Fishery (Qld) Trawl Association Inc.
- NT Fisheries Department
- NT Seafood Council
- NT Trawlers Owners Association
- NPF Industry Pty Ltd
- WA Department of Fisheries
- WA Fishing Industry Council
- WA Northern Trawl Owners Association
- WA Seafood Exporters

Consultation with all of the stakeholders listed above, plus any others identified during the consultation process, will continue during and after the survey, if necessary.

**Table 2: Summary of environmental risks and management approach for key aspects of the Zeekoet MC3D MSS**

Impact category	Potential impacts	Control and mitigation measures	Residual risk level
Disturbance to marine fauna	<p>Cetaceans - behavioural reactions (avoidance, diving, increased dive times)</p> <p>Disturbance to marine turtles, fish communities, and seabirds</p>	<ul style="list-style-type: none"> <li>• Adherence to EPBC Act Policy Statement 2.1 and the following additional mitigation measures:               <ul style="list-style-type: none"> <li>➢ precaution zones (observation zone: 3 km+; low power zone: 2 km; and shutdown zone: 500 m)</li> <li>➢ two dedicated MFOs on survey vessel</li> <li>➢ application of vessel-whale interaction procedures for non-acoustic energy source operations</li> </ul> </li> <li>• Detailed reports of all cetacean sightings will be recorded using the DSEWPaC CSA</li> <li>• External lighting of vessels will be minimized to that required for navigation, vessel safety and safety of deck operations, except in the case of emergency</li> <li>• Survey area is located at least 220 km away from any beaches and adjacent shallow waters important for turtle nesting, hatching and breeding</li> <li>• Survey area is not located close to any locations important for seabird or shorebird breeding or feeding</li> <li>• Survey will not be operating over critical habitat for feeding, spawning, breeding or migrating fish populations</li> </ul>	<b>Low</b>
Disturbance to benthic habitats	Small localised disturbance to epibiota in event of loss of equipment	<ul style="list-style-type: none"> <li>• Survey will be conducted in water depths of 50-125 m away from any shallow water areas</li> <li>• No anchoring of the either survey or support vessel will take place during survey unless in an emergency</li> <li>• All reasonable efforts taken to retrieve lost equipment</li> <li>• Recording and reporting of all items lost overboard</li> </ul>	<b>Low</b>
Introduction of invasive marine species	Introduction and establishment of invasive marine species with consequent impacts on benthic communities, fisheries etc.	<ul style="list-style-type: none"> <li>• Vessels required for the proposed activity will not discharge ballast water</li> <li>• Adherence the Australian Ballast Water Management Requirements, if necessary</li> <li>• Both the survey and support vessels have all the necessary AQIS clearances to operate unrestricted anywhere in Australian waters</li> </ul>	<b>Low</b>
Marine pollution from routine discharges	Localised temporary decrease in ambient water quality from discharge of sewage, grey water, putrescible wastes and bilge water	<ul style="list-style-type: none"> <li>• All sewage and putrescible wastes will be handled and disposed of in accordance with MARPOL Annex IV</li> <li>• Discharge of sewage and putrescibles waste will be of short duration with high dispersion and biodegradability</li> <li>• Sewage and putrescible wastes macerated where possible prior to disposal</li> <li>• All sewage and putrescible waste treatment systems and holding tanks are to be fully operational prior to survey commencement</li> <li>• Relevant discharge requirements for treated and untreated sewage are adhered to (&gt;3 nm from land for treated sewage; &gt;12 nm from land for untreated sewage)</li> </ul>	<b>Low</b>

Impact category	Potential impacts	Control and mitigation measures	Residual risk level
Marine pollution from accidental discharges	Acute toxicity effects on marine fauna, such as marine turtles, fishes and seabirds, from accidental discharges of hazardous materials	<ul style="list-style-type: none"> <li>• Harmful Packaged Substances handled and disposed of in accordance with MARPOL Annex V</li> <li>• Garbage Management Plan in place detailing wastes generated and disposal requirements</li> <li>• No discharge of plastics or plastic products of any kind from vessels</li> <li>• All solid, liquid and hazardous wastes (other than sewage, grey water and putrescible wastes) will be incinerated or compacted (if possible) and stored in designated areas and sent ashore for recycling, disposal or treatment</li> <li>• Correct segregation of solid and hazardous wastes</li> <li>• Incinerators used are compliant with MARPOL and IMO requirements</li> <li>• All storage facilities and handling equipment will be in good working order and designed in such a way as to prevent and contain any spillage as far as practicable</li> <li>• Bilge water will be treated and disposed of in accordance with MARPOL Annex I</li> </ul>	<b>Medium</b>
	Acute toxicity effects on marine fauna from fuel and oil spills	<ul style="list-style-type: none"> <li>• Survey and support vessels will comply with MARPOL Annex I requirements to prevent oil pollution (e.g. SOPEP implemented and tested for survey and support vessels)</li> <li>• Spill response bins/kits located in close proximity to hydrocarbon storage areas and replenished if required</li> <li>• Identified personnel trained in the use of the equipment</li> <li>• Hydrocarbons located above deck will be stored with some form of secondary containment to contain leaks or spills</li> <li>• If refuelling at sea does take place its and will be subject to the Fugro Offshore Bunkering Instruction and additional requirements</li> </ul>	<b>Medium</b>
Interaction with commercial fisheries, shipping activities and military exercises	<p>Interference to commercial fishing vessels, shipping and military vessels/aircraft operating within or near the survey area and surrounding waters</p> <p>Potential direct and indirect noise impacts on target species</p> <p>Restriction of access to fishing grounds, loss or damage to fishing gear</p>	<ul style="list-style-type: none"> <li>• Notification of activity details as required to relevant commercial fisheries management agencies, fishing industry bodies and individual companies</li> <li>• Consultation with AMSA prior to the survey commencing</li> <li>• Consultation with Department of Defence prior to the survey commencing</li> <li>• Use of a support vessel to manage vessel interactions</li> <li>• Use of standard maritime safety procedures (Notice To Mariners (NTM) via the Australian Hydrographic Service; radio contact, display of appropriate navigational beacons and lights)</li> <li>• Compliance with AMSA administered marine safety regulations and marine notification requirements</li> <li>• Strict adherence to equipment handling and acquisition procedures</li> <li>• Fishermen and other mariners alerted of vessels presence and extent of towed array</li> <li>• Establishment of a vessel exclusion zone around the survey vessel</li> <li>• Where possible in-water equipment lost will be recovered</li> <li>• Detailed records of equipment lost overboard will be maintained</li> </ul>	<b>Low</b>

## **FURTHER DETAILS**

For further information about the proposed Fugro Zeekoet MC3D MSS in the northern Bonaparte Basin offshore from Western Australia, please contact:

Owen Dyer  
Fugro Multi Client Services Pty Ltd  
69 Outram Street  
West Perth WA 6005

Phone: (08) 9321 4400  
Fax: (08) 9321 4401  
Email: [O.Dyer@fugromcs.com.au](mailto:O.Dyer@fugromcs.com.au)