

SCHILD MC3D MARINE SEISMIC SURVEY ENVIRONMENT PLAN: PUBLIC SUMMARY

This summary of the Environment Plan for the Fugro Schild MC3D marine seismic survey, which will be acquired in the in the Browse 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 (Schild MC3D MSS), in the in the Browse Basin offshore from WA. The Schild MC3D MSS will be comprised of a maximum of 2,717 square kilometres (km²) of 3D seismic acquisition in Petroleum Exploration Permits WA-411-P, WA-274-P, WA-281-P, and adjacent open acreage areas. Seismic acquisition will take place in an operational area that covers approximately 3,900 km² overlapping these exploration permits (**Figure 1**).

The Schild MC3D MSS is scheduled to occur in the period between November 2012 and May 2013 and is expected to be of approximately ~90 days (three months) duration.

COORDINATES OF THE PROPOSED ACTIVITY

Boundary coordinates for the 3,900 km² operational area (**Figure 1**) are provided in **Table 1**.

Table 1: Schild MC3D MSS operational area

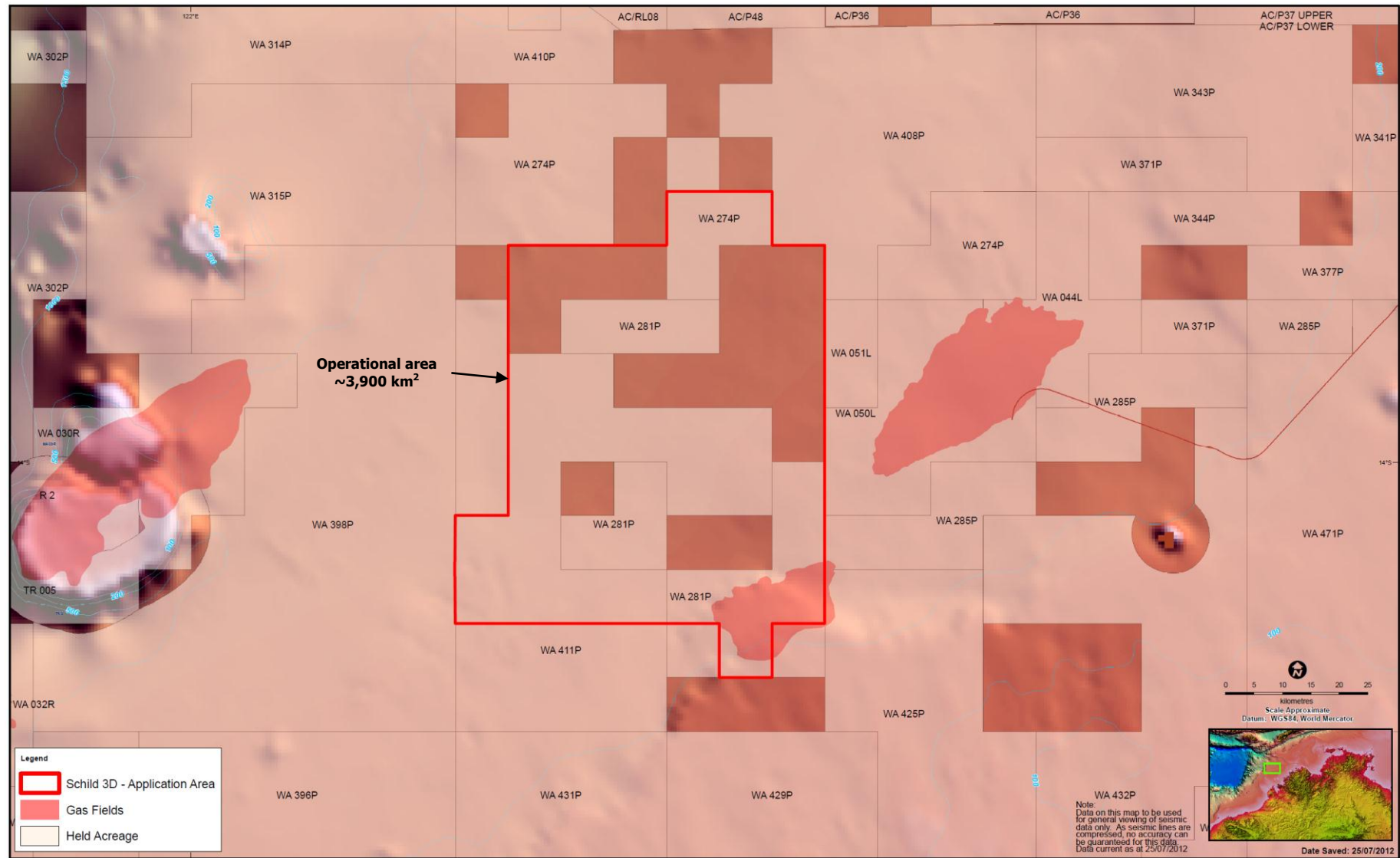
Latitude (S)			Longitude (E)		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
13	34	54.98	122	45	04.51
13	34	54.97	122	55	04.50
13	39	54.98	122	55	04.50
13	39	54.98	123	00	04.51
14	14	54.98	123	00	04.52
14	14	54.98	122	55	04.52
14	19	54.98	122	55	02.10
14	19	54.98	122	50	04.52
14	14	54.98	122	50	04.52
14	14	54.99	122	25	04.52
14	04	54.99	122	25	04.52
14	04	54.98	122	30	04.52
13	39	54.98	122	30	04.51
13	39	54.98	122	45	04.51

Datum: WGS84

At the closest point, the Schild MC3D operational area is situated at a minimum distance of ~208 km from the west Kimberley coastline, at Battery Point on the eastern side of Camden Sound. The operational area is located in Commonwealth waters, ~130 km due north of Adele Island, ~45 km east of south Scott Reef and ~50 km east of Seringapatam Reef, as depicted in **Figure 1**. At the closest point, the eastern boundary of the operational area is located ~58 km west of Browse Island.

Water depths in the operational area range from ~200 to 400 m. There are no shallow shoals or emergent features (water depths <30 m) within the operational area (**Figure 1**).

Figure 1: Location map – Schild MC3D MSS operational area



DESCRIPTION OF THE PROPOSED ACTIVITY

The Schild MC3D MSS is scheduled to occur in the period between November 2012 and May 2013 and is expected to be of approximately ~90 days (three months) 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 6-7 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 eight solid streamers (Sercel Sentinel), with a maximum length of 6 km. The solid streamers do not contain any fluid filled sections. Streamer spacing will be 100 m, and line spacing will be either 400 m or 500 m, depending on which survey vessel is used. 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 μ 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 μ Pa².s within 1 km of the source and ~155 dB re 1 μ Pa².s within 2 km, dependent on the sound propagation characteristics of the area.

Fugro proposes to conduct the Schild 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 operational 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 operational 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 Schild MC3D operational area lies entirely in Commonwealth marine waters in the Kimberley sub-system of the North-west Marine Region (NWMR), which extends from the southern boundary west of Broome to the northern edge of the Exmouth Plateau. Mid-shelf waters (100-500 m water depths) of the Kimberley sub-system consist of submerged reef platforms and mounds that support a diverse array of biological habitats, including coral reefs.

Physical Environment

South-east trade winds are prevalent from April to September, and are usually associated with fine dry weather. They produce a large swell that affects the southern side of most reefs in the area, producing consolidated crustose coralline algae and limestone substrates on the reef slope to depths characteristic of outer reefs or oceanic atolls. During April to September, the predominant direction of the ocean current is west-southwest. In the monsoon season (December to March), when winds come from the north-west or west, the direction of the ocean current reverses, becoming east-northeast. The NWMR's large-scale surface currents are subject to strong seasonal variations, largely due to annual variation in the alongshore pressure gradient that is the main driver of the Region's surface currents. The South Equatorial Current and Eastern Gyral Current intensify during July-September. Similarly, the Leeuwin Current is strongest in autumn, and diminishes during the North-west Monsoon (December-March).

The Kimberley system is also subject to episodic offshore cyclonic activity in the period December to April. Cyclones tend to generate offshore and move south, rarely crossing the coast until they reach the Pilbara region. They can contribute to mixing of water layers as well as play an important role in the dispersal of sediments and species

The seafloor across the NWMR is distinguished by a range of topographic features such as canyons, plateaux, terraces, ridges, reefs, and banks and shoals. The slope is relatively flat, but includes a number of large canyon heads that were probably excavated during and after continental break-up by sediment and water movements. The slope is relatively flat, but includes a number of large canyon heads that were excavated probably during and after continental break-up by sediment and water movements. There a number of reefs and islands in the Kimberley system of the NWMR adjacent to the Schild MC3D survey area including:

- Scott Reef and Seringapatam Reef, located approximately 66 km west and 58 km west of the operational area, respectively. These reefs occur on the upper continental slope in water depths of 500–1,500 m.
- Adele Island, located approximately 135 km south of the operational area. Adele Island is built on a coralline platform reef, and extensive coral reefs surround the island. It is also an important seabird nesting and roosting location.
- Browse Island, located approximately 58 km east of the operational area. Browse Island is an important green turtle and seabird nesting site. It is surrounded by extensive coral reefs. The island is a WA Class 'C' Nature Reserve (No. 22697) vested with the Conservation Commission and managed by the WA Department of Environment and Conservation (DEC), and an IUCN Category 1A protected area.

Biological Environment

Overall, this sub-system is thought to have low productivity, largely due to the influence of the ITF and hence the chlorophyll maximum is too deep to facilitate high primary production on a regular basis. Productivity would be associated with ephemeral events, such as topographically induced water movement around geomorphic features (i.e. coral reefs, canyon heads), therefore causing some mixing of the water column. It was suggested that eddies may form on the inshore side of the emergent reefs and islands in this sub-system and therefore could be an important mechanism for mixing the water column and thereby stimulating primary production.

Repeating patterns of swirling vortices caused by the unsteady separation of flow around islands (referred to as Van Karman vortex streets) are thought to occur around the islands (on their leeward sides) of this sub-system, and may result in enhanced horizontal and vertical mixing of waters around the islands. These ephemeral but repeating events may support large populations of pelagic fish and seabirds. The islands and reefs are a key biodiversity focal point in this subregion. Associated pelagic communities provide a constant food source for cetaceans, dogtooth tuna, Spanish mackerel and pelagic sharks.

Browse Island, located approximately 58 km east of the operational area, is an important site for bird and turtle communities as well as a site of upwelling. Upwelling around the island is believed to be associated with increased concentrations of tropical krill. These tropical krill aggregations may be important as there have been possible, but unconfirmed, sightings of humpback whales feeding around Browse Island.

Benthic Habitats

Generally, the granitic substrate throughout the Kimberley sub-system is hard and rough due to its erosion resistance and provides a diversity of habitats for benthic flora and fauna. Much of the outer mid-shelf is covered by a relatively featureless, sandy-mud seabed with a sparse covering of sessile organisms dominated by filter-feeding heterotrophs such as gorgonians, sponges, soft corals, echinoderms and detritus-feeding crabs and echinoderms. This is especially true of the non-trawled areas in the deeper water, and the soft-bottomed rises. However, the many limestone banks are likely to be a key ecological feature of this region. They have a harder substrate and are likely to support a more diverse range of sessile benthos such as hard and soft corals, gorgonians, encrusting sponges and macroalgae; and consequently, a more reef-associated fish and elasmobranch fauna. The mid-shelf banks of the NWMR are poorly understood. However, they are likely to support a unique and diverse invertebrate and fish fauna, with communities that change significantly with depth along their slopes.

Protected Marine Fauna

A review of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) database (Protected Matters search tool) held by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) was conducted for the operational area polygon described by the boundary coordinates provided in **Table 1**, with the application of a 1 km buffer zone.

The nine listed Threatened species that may occur, or relate to, the operational area are:

1. the blue whale;
2. the humpback whale;
3. the loggerhead turtle;
4. the green turtle;
5. the leatherback turtle;
6. the hawksbill turtle;
7. the olive ridley turtle;
8. the flatback turtle; and
9. the whale shark.

Whales and Dolphins

A number of whale species occur in and/or migrate through the NWMR, including the short-finned pilot whale, false killer whale, tropical Bryde's whale, Antarctic minke whale, killer whale, blue whale, sperm whale and humpback whale. The EPBC Act database lists 20 cetacean species that may occur in, and adjacent to, the operational area of the Schild MC3D MSS, all of which are protected under the Act; one of which is also classified as Endangered, one as Vulnerable and six as Migratory species.

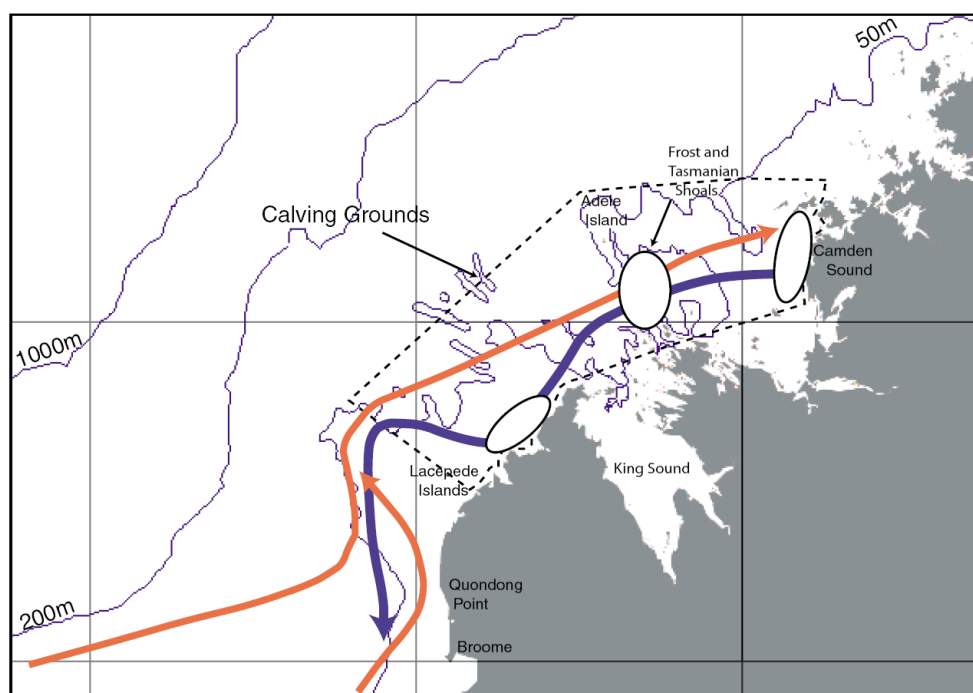
The humpback whale is the most commonly sighted whale in northern WA waters. The species has been observed seasonally to complete their northern migration in the Camden Sound area of the west Kimberley, after feeding in Antarctic waters during the summer months. It is likely that the whales follow a 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 – **Figure 2**) 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.

Upwelling around Browse Island, located approximately 58 km east of the operational area, is believed to be associated with increased concentrations of tropical krill. These tropical krill aggregations may be important

as there have been possible, but unconfirmed, sightings of humpback whales feeding in waters around the island. The breaking of internal waves on the shelf edge and around significant breaks in slope (e.g. west of Browse Island and around submerged cliffs) may play an important role in nutrient generation and thus enhanced productivity. Waters around Browse Island are believed to support the highest diversity of cetacean species in Western Australia, including large numbers of oceanic dolphins.

Figure 2: Positions of the Group IV humpback whale calving grounds and migratory routes leading to and from the area



Notes: Circled areas have the highest concentrations of whales.

The Schild MC3D operational area is located on the upper continental slope in water depths of ~200-400 m, to the north of the Browse Cliffs feature (located approximately 75 km south-west of Browse Island). At the closest point, the southern boundary of the operational area is located approximately 135 km from Adele Island, along the northern edge of the calving ground area identified in **Figure 2**. The operational area is located at least 180 km from the core areas (e.g. Camden Sound) within the calving grounds that have the highest concentrations of whales (**Figure 2**).

The Schild MC3D MSS is scheduled to occur in the period between November 2012 and May 2013 and is expected to be of ~90 days (three months) duration. The survey will, therefore, not overlap the calving/breeding period for humpback whales on the west Kimberley coastline. Given the timing and planned duration, the survey will be completed well prior to beginning of the 2013 migration to the calving grounds.

The blue whale may be present in the operational area and surrounding waters. 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 operational area and adjacent waters does not include any known blue whale feeding, breeding or resting 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 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, there is the possibility that migrating (and possibly feeding) blue whales may be encountered in the operational area during the proposed period of acquisition for the survey (November 2012 to May 2013).

Other 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 area during the survey in significant numbers. There are no known breeding, calving or feeding grounds for any listed threatened or migratory whale species within, or in the immediate vicinity of the survey area.

By applying comprehensive cetacean interaction management procedures (including the use of 'Standard Management Measures': soft starts, a 2 km low-power zone and 500 m shut down zone, plus the additional mitigation measure of two dedicated Marine Fauna Observers [MFOs]), direct adverse physiological effects on any whales that may be encountered during the survey are extremely unlikely and any potential disturbance would be minimised.

The MFOs will be aboard the survey vessel for the entire duration of the Schild MC3D survey.

Marine Reptiles

Six marine turtle species may occur in the operational area - green turtle, leatherback turtle, hawksbill turtle, loggerhead, flatback turtle, and olive ridley turtle. Scott Reef is an important breeding site for two species of marine turtle listed under the EPBC Act. These include a small, genetically distinct, population of the Vulnerable and Migratory green turtle and a population of the Vulnerable and Migratory hawksbill turtle. Adult and juvenile green turtles and hawksbill turtles are also likely to feed in this region.

Browse Island, located approximately 58 km from the eastern boundary of the operational area (**Figure 1**), is a major rookery for green turtles and flatback turtles also nest on the island. The main nesting season for green turtles in the region is likely to be December to February.

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 NWMR. Green, flatback and loggerhead turtles all breed from September to March, while the hawksbill turtle breeds from July to March. The reefal habitats in the photic zone are key feeding habitats for green and hawksbill turtles. The pinnacle habitats on the mid-shelf may be very important habitats along the migration paths for these species in the sub-region. 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.

It is unlikely that marine turtles will be encountered during the seismic acquisition throughout the operational area, given the water depths (~200-400 m) and lack of shallow submerged features.

Other EPBC Act protected marine species that may be present in the operational area include sea snakes. Sea snakes are frequently observed in and around offshore islands and the waters of the shelf generally. There is no information on their frequency of occurrence in deeper offshore waters (except for Scott Reef), though individuals are often observed at the surface.

Sharks and Ray-finned Fishes

The whale shark is listed as Vulnerable and Migratory under the EPBC Act. Although there are no records of whale sharks in the operational 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. The tracks of a whale shark tagged at Ningaloo Reef in 2005 passed through the Browse Basin, just to east of south Scott Reef.

Other EPBC Act protected marine species that may occur within the operational area include various species of pipefishes and seahorses (Family Syngnathidae).

Seabirds and Shorebirds

Two species of the streaked shearwater are listed under the migratory provision of the EPBC Act, and it is possible that this species may fly over the operational area.

The operational area is located approximately 208 km from the nearest coastline and there is no information

concerning the populations of seabirds utilising the waters of these waters. However, the distributions of many common seabirds overlap the southern Browse Basin and are expected to occur in the operational area. These include ten species of tern (family Laridae), three species of booby, and the lesser frigatebird.

Browse Island and Adele Island are important seabird nesting sites. Adele Island (located 130 km south of the southern boundary of the operational area) has significant rookeries of the lesser frigatebird, brown booby, red-footed booby, and masked booby.

Migratory shorebirds are likely to be present in the region between July and October and again between March and April as the operational area is located within the East Asian-Australasian Flyway. Migratory shorebirds are listed as Migratory and Marine species under the EPBC Act and all are also listed under the Convention on Migratory Species (CMS). Additionally, some species are listed on the China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA), or the Republic Of Korea Australia Migratory Bird Agreement (ROKAMBA).

Socio-Economic Environment

Commercial Fisheries

The principal commercial fisheries in the NWMR focus on tropical fin fish, particularly the high-value emperors, snappers and cods which are taken by the Northern Demersal trap fisheries. The typical catch is in the order of 3,000 tonnes annually, making these fisheries, at an estimated annual value of around \$12 million, the most valuable fin fish sector in the state. The NWMR has a number of small, limited-entry trawl fisheries for prawns, producing about 700 tonnes annually, valued at around \$10 million. There are also significant fisheries for Spanish mackerel, barramundi/threadfin salmon and shark, and a developing fishery for blue swimmer crabs. However, the bioregion is increasingly coming under threat from international poaching, particularly for sharks. A number of fin fish activities, including offshore demersal line fishing and near-shore beach seining and gillnetting, also occur in the region.

Commercial fisheries that can operate in the region include:

- the Northern Demersal Scalefish Managed Fishery (NDSF);
- the North Coast Shark Fishery
- the Mackerel Managed Fishery;
- the North West Slope Trawl Fishery;
- the Western Skipjack Fishery;
- the Southern Bluefin Tuna Fishery; and
- the Western Tuna and Billfish Fishery.

These are generally small, non-intensive fisheries that have very limited activity in the southern Browse Basin and are unlikely to be impacted by the proposed survey, with the exception of the NDSF.

The NDSF divided into two fishing areas, an inshore sector (Area 1) and an offshore sector (Area 2). Under a voluntary industry agreement, the offshore sector (Area 2) has been further divided into three zones – A, B and C. Zone B comprises the area of historical fishing activity and exploitation, while Zone A is an inshore developmental area and Zone C is an offshore deep-slope developmental area representing waters deeper than 200 m. Access to the offshore sector (Area 2) of the NDSF is currently limited to 11 licences under an individually transferable effort system. During 2010, seven vessels (trap fishing only) collectively held and operated the effort individually assigned to the 11 licences.

The NDSF principally targets red emperor and goldband snapper, with a number of species of snappers (Lutjanidae), cods (Serranidae) and emperors (Lethrinidae) comprising the remainder of the catch. It is possible that some vessels active in this fishery within Zones A and B will target areas in and around the Schild MC3D MSS operational area. The eastern edge of the operational area is located within Zone A of the offshore sector (Area 2). At present, the majority of the activity (and consequently catch levels of key target species) in the NDSF occurs in Zone B of the offshore sector, which is located further offshore.

The NDSF rarely operates in water depths greater than 100 m, and never in water depths greater than 200 m. Therefore, it is highly unlikely that any vessels fishing in Area 2 Zone C of the NDSF will be operating in the waters of the Schild MC3D operational area, which covers water depths of ~200-400 m.

Traditional Fisheries

Indonesian fishermen have visited the north-western Australian coast and around the islands and reefs of this coastline for almost three centuries, focusing their fishing effort on a range of species, including:

- beche-de-mer (trepang or sea cucumber);
- various molluscs, particularly trochus shell and clams;
- seabirds (particularly frigate birds) and eggs;
- sharks; and
- marine turtles.

In November 1974, traditional Indonesian fishing practices - referring exclusively to non-motorised sailing craft, were permitted in the region and formalised under a Memorandum of Understanding (MOU) between the Governments of Australia and Indonesia. This MOU covers Scott Reef, Seringapatam Reef, Browse Island, Ashmore Reef and Cartier Island (the MOU 74 Box).

The proposed Schild MC3D operational area is situated entirely within the boundaries of the MOU 74 Box

The MOU 74 Box is an area of approximately 50,000 km² within the Australian Fishing Zone where Indonesian traditional fishermen are allowed to fish under the provision of the MOU that recognised the long history of traditional Indonesian fishers, enabling them to continue their customary practices and target species such as trepang, trochus, abalone and sponges. As a result, Indonesian fishing vessels may move through waters adjacent to the operational area, although traditional fishing is predominantly around the shoals. Fishing effort is difficult to estimate.

Petroleum Exploration and Production

The southern Browse Basin has been the target of significant petroleum exploration activity stretching back over the past 40 years. There have been a large number of both 2D and 3D seismic surveys conducted in the region, plus the drilling of both exploration and appraisal wells. No exploration wells have previously been drilled within the Schild 3D MC3D operational area. At present, there are no petroleum production facilities located within or adjacent to the operational area, but the area is adjacent to a number of previously-discovered gas and oil fields (Burnside gas field to the south; Ichthys gas field to the east; and Torosa gas field to the west).

Shipping

No defined commercial shipping lanes exist in the operational area for the Schild 3D MC3D survey, or in adjacent waters. The major commercial shipping route through the region passes well to the west of Scott Reef.

Tourism

Due to the deepwater location of the operational area and distance to coastal areas of the Kimberley there are no recreational activities undertaken in the area.

Cultural Heritage

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

There are a large number of listed historic shipwrecks in the region, located mainly around Browse Island and south Scott Reef. There are nine listed historic shipwrecks around Browse Island, including one which is listed on the Register of the National Estate (Browse Island (East) Wreck).

National Heritage

There are no places listed on the Commonwealth Heritage List or the Register of National Estate within or immediately adjacent to the Schild MC3D operational area. There are three places listed on the Commonwealth Heritage List or the Register of National Estate within the southern Browse Basin region:

- "Scott Reef and Surrounds".
- "Seringapatam Reef and Surrounds".
- "Adele Island and Reefs".

South Scott Reef is located ~45 km west of the Schild MC3D operational area; Seringapatam Reef is located ~50 km west of the operational area; and Adele Island is located ~130 km south of the operational area.

Marine Parks and Reserves

At the closest point, the Schild MC3D operational area is located ~163 km from the boundary of the newly declared Camden Sound Marine Park, which is situated in WA State waters to the south-east of the operational area. At the closest point, the Schild MC3D operational area is situated ~74 km to the north of the final Kimberley Commonwealth Marine Reserve proposal.

Defence Activities

The south-east corner part of the Schild MC3D operational area is located within the northern component of a military exercise area, the RAAF Curtin Air-to-Air Weapons Range R811. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to sea level.

MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

An Environmental Risk Assessment (ERA) has been undertaken to understand and manage the environmental risks associated with the Schild 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—Principles and guidelines*, Handbook *HB 203:2012 Managing environment-related risk*, and Handbook *HB 89-2012 Risk management - Guidelines on risk assessment techniques*.

The risk assessment has been undertaken to identify the sources of risk (aspects) and potential environmental impacts associated with the activity and to assign a level of significance or risk to each impact. This subsequently assists in prioritising mitigation measures to ensure that the environmental impacts are managed to 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 and associated equipment;
- emissions to atmosphere from vessels;
- discharge of ballast water and vessel biological fouling;
- routine discharge of wastewater and waste to the ocean from survey and support vessels;
- accidental discharge of hydrocarbons and chemicals to the ocean from survey and support vessels;
- vessel collisions resulting in fuel and oil spills, and/or damage to benthic habitats;
- interactions with commercial fishing, shipping and defence activities; and
- operation of the survey vessel within, or in the vicinity of, protected and heritage areas.

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 the seabed and benthic habitats and communities;
- 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 commercial fishing vessels, shipping and military vessels/aircraft; and
- disturbance to heritage and conservation values.

The environmental aspects of the Schild 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 Schild 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 the company operating the survey vessel. To ensure Fugro's environmental standards and performance objectives are achieved, the survey vessel operator 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 Schild 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 Schild 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 Schild MC3D MSS is managed in accordance with the Implementation Strategy described in the Environment Plan 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 Schild 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 Schild 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 ~200-400 m and in an area that is located at least 58 km away from any beaches and adjacent shallow waters that are important for turtle nesting, hatching and breeding (e.g. Browse Island; Sandy Islet in south Scott Reef). The operational 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 Schild 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
- Austral Fisheries
- Australian Fisheries Management Authority
- Australian Hydrographic Service
- Australian Maritime Safety Authority
- Border Protection Command
- Center for Whale Research
- 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
- MG Kailis
- National Native Title Tribunal
- Northern Fishing Companies Association
- Shark Bay Seafoods
- TunaWest
- WA Department of Fisheries
- WA Department of Mines and Petroleum
- WA Department of Transport
- WA Fishing Industry Council
- WA Northern Trawl Owners Association
- WA Seafood Exporters
- WestMore Seafoods

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 Schild 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"> • Adherence to EPBC Act Policy Statement 2.1 and the following additional mitigation measures: <ul style="list-style-type: none"> ➢ precaution zones (observation zone: 3 km+; low power zone: 2 km; and shutdown zone: 500 m) ➢ two dedicated MFOs on survey vessel ➢ application of vessel-whale interaction procedures for non-acoustic energy source operations • Detailed reports of all cetacean sightings will be recorded using the DSEWPac CSA • 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 • Operational area is located at least 58 km away from any beaches and adjacent shallow waters important for turtle nesting, hatching and breeding • Operational area is not located close to any locations important for seabird or shorebird breeding or feeding • Survey will not be operating over critical habitat for feeding, spawning, breeding or migrating fish populations 	Low
Disturbance to benthic habitats	Small localised disturbance to epibiota in event of loss of equipment	<ul style="list-style-type: none"> • Survey will be conducted in water depths of ~200-400 m away from any shallow water areas • No anchoring of the either survey or support vessel will take place during survey unless in an emergency • All reasonable efforts taken to retrieve lost equipment • Recording and reporting of all items lost overboard 	Low
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"> • Vessels required for the proposed activity will not discharge ballast water • Adherence the Australian Ballast Water Management Requirements, if necessary • Both the survey and support vessels have all the necessary AQIS clearances to operate unrestricted anywhere in Australian waters 	Low
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"> • All sewage and putrescible wastes will be handled and disposed of in accordance with MARPOL Annex IV • Discharge of sewage and putrescibles waste will be of short duration with high dispersion and biodegradability • Sewage and putrescible wastes macerated where possible prior to disposal • All sewage and putrescible waste treatment systems and holding tanks are to be fully operational prior to survey commencement • Relevant discharge requirements for treated and untreated sewage are adhered to (>3 nm from land for treated sewage; >12 nm from land for untreated sewage) 	Low

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"> • Harmful Packaged Substances handled and disposed of in accordance with MARPOL Annex V • Garbage Management Plan in place detailing wastes generated and disposal requirements • No discharge of plastics or plastic products of any kind from vessels • 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 • Correct segregation of solid and hazardous wastes • Incinerators used are compliant with MARPOL and IMO requirements • 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 • Bilge water will be treated and disposed of in accordance with MARPOL Annex I 	Medium
	Acute toxicity effects on marine fauna from fuel and oil spills	<ul style="list-style-type: none"> • 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) • Spill response bins/kits located in close proximity to hydrocarbon storage areas and replenished if required • Identified personnel trained in the use of the equipment • Hydrocarbons located above deck will be stored with some form of secondary containment to contain leaks or spills • If refuelling at sea does take place its and will be subject to the Fugro Offshore Bunkering Instruction and additional requirements 	Medium
Interaction with commercial fisheries and shipping activities	<p>Interference to commercial fishing vessels and shipping operating within or near the operational 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"> • Notification of activity details as required to relevant commercial fisheries management agencies, fishing industry bodies and individual companies • Consultation with AMSA prior to the survey commencing • Consultation with Department of Defence prior to the survey commencing • Use of a support vessel to manage vessel interactions • Use of standard maritime safety procedures (Notice To Mariners (NTM) via the Australian Hydrographic Service; radio contact, display of appropriate navigational beacons and lights) • Compliance with AMSA administered marine safety regulations and marine notification requirements • Strict adherence to equipment handling and acquisition procedures • Fishermen and other mariners alerted of vessels presence and extent of towed array • Establishment of a vessel exclusion zone around the survey vessel • Where possible in-water equipment lost will be recovered • Detailed records of equipment lost overboard will be maintained 	Low



FURTHER DETAILS

For further information about the proposed Fugro Schild MC3D MSS in the Browse Basin offshore from WA, please contact:

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