DIRK

MULTI CLIENT 3D MARINE SEISMIC SURVEY

ENVIRONMENT PLAN: PUBLIC SUMMARY

CGG Multiclient and New Ventures

Revision 1

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ENVIRONMENT PLAN: PUBLIC SUMMARY

This summary of the Environment Plan (EP) for the CGG Dirk MC3D marine seismic survey, which will be acquired in the Carnarvon 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 CGG Multiclient and New Ventures (CGG) proposes to acquire a multi-client three-dimensional (MC3D) marine seismic survey (Dirk MC3D MSS), in the Carnarvon Basin offshore from Western Australia (WA) (**Figure 1**). The Dirk MC3D MSS will be comprised of approximately (~) 13,675 km^2 of 3D seismic data acquisition in Petroleum Exploration Permits WA-364-P, WA-366-P, WA-367-P, WA-439-P, WA-489-P, WA-491-P and adjacent open acreage areas.

The commencement date of the Dirk MC3D MSS is yet to be finalised as it is dependent on the availability of the survey vessel for conducting the survey, client data requirements, fair sea state conditions suitable for marine seismic acquisition. The Dirk MC3D MSS is expected to extend for a total duration of ~9 months and this period is for acquisition of the entire survey programme.

ASSESSMENT UNDER THE EPBC ACT

As the proponent for the Dirk MC3D MSS, CGG took the decision not to refer the proposed survey under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The survey area for the proposed Dirk MC3D MSS is not considered a habitat that is critical to the survival of any listed species. Similarly, there are no EPBC Act-listed threatened ecological communities (TECs) in the vicinity of the survey area. There is no real chance or possibility that the proposed survey will result in significant impacts to any matters of National Environmental Significance (NES)—as defined in the Commonwealth Department of Environment significant impact guidelines for NES matters.

The survey will be carried out in accordance with the Australian Commonwealth Government Guidelines: *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (September 2008).

COORDINATES OF THE PROPOSED ACTIVITY

Boundary coordinates for the ~13,675 km^2 survey area (**Figure 1**) are provided in **Table 1**.

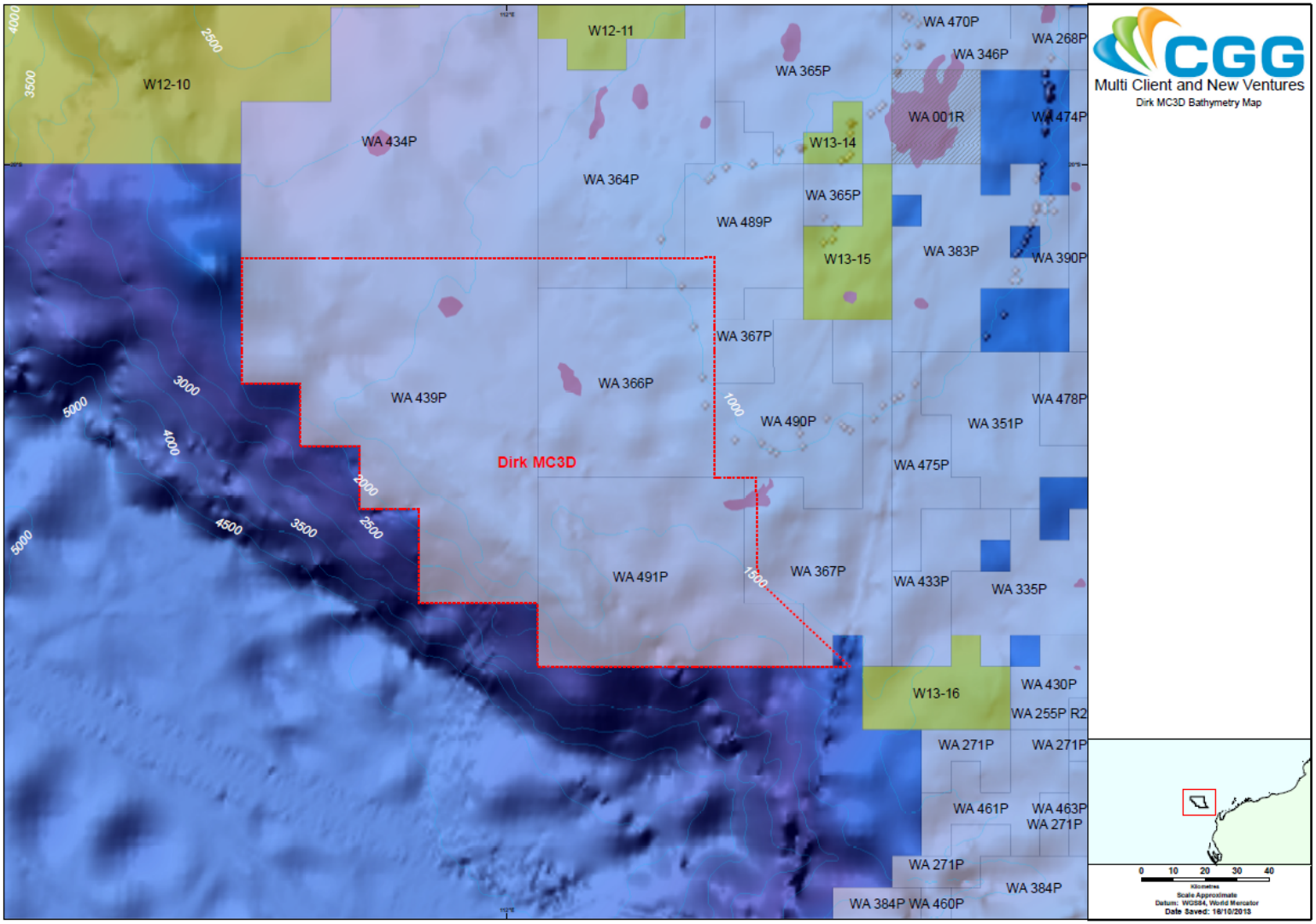

Figure 1 – Location map - Dirk MC3D MSS area

Table 1 - Dirk MC3D survey area – boundary coordinates

Longitude	Latitude
111.251325633	-20.248721492
112.584672869	-20.248553121
112.584664954	-20.832048877
112.702078383	-20.831707888
112.706153346	-21.103915431
112.965281000	-21.331943999
112.084670156	-21.332057315
112.084668483	-21.165389881
111.751334576	-21.165392807
111.751332099	-20.915390700
111.584666081	-20.915392151
111.584664445	-20.748722811
111.417996509	-20.748724255
111.417994883	-20.582056820
111.251328843	-20.582058254
111.251325633	-20.248721492

Datum: WGS84

At the closest point, the Dirk MC3D survey area is located ~123 km west of North West Cape and ~150 km northwest of Exmouth Gulf. The Muiron Islands lie ~150 km to the east of the survey area and Barrow Island and the Montebello Islands are ~250 km and ~280 km to the west, respectively.

Water depths in most of the survey area range from ~1,000 m to 3,200 m, with the deepest water depths situated in the southwest portion of the survey area (**Figure 1**).

DESCRIPTION OF THE PROPOSED ACTIVITY

The commencement date of the Dirk MC3D MSS is yet to be finalised as it is dependent on the availability of the survey vessel for conducting the survey, client data requirements, fair sea state conditions suitable for marine seismic acquisition, with an expected duration of over nine months. The period indicated is for acquisition of the entire survey programme, in reality the survey will probably be acquired in phases due to vessel availability and environmental considerations.

During the proposed activities, the survey vessel will traverse a series of pre-determined sail lines within the survey 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 eight to 12 solid streamers, with a maximum length of 8,100 m. Streamer spacing will be between 50, and 100 m, and line spacing will be between 500 and 1,000 m. The source (airgun array) tow depth will be 5-9 m (+/- 1 m) and the streamer tow depth will be 6 m at the head of the streamers and 50 m at the tail. The operating pressure for the airgun array will be ~2,000 psi. The airgun array will consist of two sub-arrays, each with a maximum volume of 4,500 cui. These sub-arrays will be fired alternately, with a shotpoint interval of either 18.75 or 25.0 m vertical distance, and will produce at source (i.e. within a few metres of the airguns) sound pulses in the order of 263 dB re 1µPa-m (sound pressure level - SPL), at frequencies extending up to ~200 Hz.

CGG proposes to conduct the Dirk MC3D MSS using the purpose-built seismic survey vessel *Geo Caspian*, which is owned by Volstad Maritime AS and operated by CGG. The survey vessel has all necessary certification/registration and is fully compliant with all relevant MARPOL and SOLAS convention requirements for a vessel of this size and purpose, including a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with Regulation 37 of Annex 1 of MARPOL 73/78.

The vessel will travel within the survey area at an average speed of 8-9 km per hour (~4.5 knots).

During the survey, 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 (<20 m water depth).

DESCRIPTION OF THE ENVIRONMENT

The proposed Dirk MC3D survey area lies entirely in Commonwealth marine waters in the Northwest Province of the North-west Marine Region (NWMR). The Northwest Province is located offshore between Exmouth and Port Hedland, covers 16.7% of the total area of the NWMR and occurs entirely on the continental slope. Water depths in the bioregion are predominantly between 1,000-3,000 m and reach a maximum depth of over 5,170 m on the Exmouth Plateau.

Physical Environment

The North West Shelf (NWS) is subject to an arid (mainly summer rain) subtropical climate with tropical cyclone activity from November to April. The summer and winter seasons fall into the periods September-March and May-June, respectively.

During the summer months (October–March) the prevailing winds are from the southwest, west and northwest, bringing with them warm, humid air. The southern region of the NWS is characterised by a more arid, subtropical climate. The peak wind speeds are in the range of 15–25 knots but tend to average less than 10 knots. The winter wind (June–August) is characterised by moderate to strong east northeast to southeast winds. April–May and September are the transitional periods when winds are lighter and more variable.

The North-west or West Monsoons prevail from December to March and are associated with prominent cloud, rain and thunderstorm activity. Annual rainfall is typically low and highly variable. Most intense falls occur during the first half of the ‘wet’ season, where Barrow Island receives an average 320 mm per annum from 25.6 rain days. The average annual rainfall at Dampier is 315 mm and at Port Hedland is 327 mm. The region has a very high cyclones incidence and these may occur between December and April. Typically, cyclones move south-west across the Arafura and Timor Seas. Gale to hurricane force winds are likely to be encountered over an area between 32 km and 240 km wide. Lower rainfall and humidity are typically associated with the Southeast Monsoon, in contrast to the high levels of rainfall and humidity associated with the Northwest Monsoon.

The most distinguishing feature of the oceanography of the Northwest Province, compared with bioregions further north, is the result of the narrowing of the continental shelf at North West (NW) Cape. The generally southward moving surface waters consolidate along the narrow shelf break and become the Leeuwin Current. The Leeuwin Current is shallow (less than 300 m deep), narrow (50-100 km wide), and flows south along the shelf break. The Leeuwin Undercurrent is also a feature of this bioregion and flows northward beneath the Leeuwin Current, between 250-450 m water depth on the continental slope. It transports higher salinity, oxygen-rich waters but nutrient-depleted water, characteristic of subantarctic water masses, northwards.

The Leeuwin Current is strongest during autumn and winter. During summer, strengthening southwesterly winds counter the alongshore pressure gradient and weaken the southward flow of the Leeuwin Current, allowing the generation of the northward flowing Ningaloo Current. The Ningaloo Current intrudes into this bioregion inshore of the 50 m depth contour along Cape Range Peninsula. The narrowness of the shelf in these bioregions brings the opposing flows of the Leeuwin and Ningaloo currents into close proximity, creating and area of enhanced mixing and increased productivity. Other seasonal influences on the oceanography of the Northwest Province include an increase in cyclone incidence and intensity during summer, as well as an increase in internal wave activity around the Exmouth Plateau and its associated canyons.

A range of topographic features such as canyons, plateaux, terraces, ridges, reefs, and banks and shoals are distinguishing features of the seafloor across the NWMR. 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 Dirk MC3D survey area is located on the Exmouth Plateau, a Key Ecological Feature (KEF) and a significant geomorphic feature of the outer shelf and slope in the NWMR. It covers an area of ~50,000 km^2 or 26% of the Northwest Province bioregion in the NWMR.

There are a number of reefs and islands in the Pilbara system of the NWMR adjacent to the Dirk MC3D survey area:

- Barrow Island, located ~250 km to the east of the eastern boundary;
- the Montebello Islands, located ~280 km to the northeast of the eastern boundary of the survey area in WA State waters; and
- the Muiron Islands, located ~150 km to the east-southeast of the survey area.

Biological Environment

The biological productivity above the Exmouth Plateau and slope is generally low due to the overriding influence of the oligotrophic tropical waters typical of the NWS. However, the Exmouth Plateau acts as a physical obstacle, forcing deeper, cooler and more nutrient-rich waters onto the plateau. Internal wave activity during summer may further stimulate biological productivity when nutrient-rich waters are raised into the photic zone. Satellite imagery has identified areas of increased biological productivity along the northern and southern boundaries of the plateau, as well as in the east along the shelf edge through the Montebello Trough. The extent to which internal waves play a part in these increases in productivity is poorly understood.

The trophic dynamics of deeper waters in the Northwest Province, and in particular on the Exmouth Plateau, can be separated into pelagic and benthic food webs. Detritus falling from the pelagic environment to the seabed plays a key role in nutrient cycling from pelagic to benthic environments and the amount of food sinking to the ocean floor ultimately depends on the feeding rate in the water column. The number of large benthic animals living on the sea floor is thought to be low and the vast majority of deep-sea animals are small invertebrates living in the sediment.

Small pelagic fish are thought to be the main consumers of phytoplankton and zooplankton in the pelagic system and are preyed on by larger tertiary consumers such as billfish, sharks and dolphins. Bacteria on the seabed are likely to utilise available nutrients in sediments and detritus, they are fed upon by primary consumers such as nematodes and copepods. Detritivores such as molluscs and crustaceans also directly feed upon the detritus. Both the primary consumers and detritivores are most likely preyed upon by larger secondary consumers such as crustaceans and demersal fish.

Biological Communities

The Northwest Province represents the beginning of a transition between tropical and temperate biological communities. The predominantly southward flowing surface currents continue to bring

tropical Indo-Pacific organisms into this bioregion, but the presence of the northward flowing Leeuwin Undercurrent also transports temperate species from more southern regions.

The NWMR supports internationally important breeding and feeding grounds for a number of threatened and migratory marine species that transit through the bioregion, including humpback whales, which mate and give birth in the waters off the Kimberley coast. Significant turtle rookeries are found on coastal beaches and offshore islands and the surrounding waters provide important resting and internesting habitats (i.e. in between egg laying periods). The annual aggregation of whale sharks around Ningaloo Reef is the highest known density of whale sharks in the world. Cetaceans, marine turtles (e.g. loggerheads, leatherbacks and green turtles), sharks, are all known to feed on and around the adjacent Ningaloo Reef, which is situated on the shelf and slope of the Cape Range Peninsula.

The Exmouth Plateau is recognised as a KEF of the NWS, for its enhanced biological productivity that supports a range of species. The Exmouth Plateau is thought to be an important area for biodiversity as it provides an extended area offshore for communities adapted to depths of around 1,000 m. The circulation of deep-water currents in the bioregion probably brings deep-water species in closer proximity to species that occur on the plateau and may result in important associations of biological communities. For example, channels and valleys from the plateau to the deeper slope and adjoining abyss may act as conduits for the delivery of materials and sediments and may sustain suites of communities at the base of the plateau. The deeper waters of the inner edge of Exmouth Plateau, around the Montebello Trough, are believed to be an important feeding site for sperm whales (based on nineteenth century whaling data), indicating an area of high biological productivity. However, little specific information is available on the biological communities of the Exmouth Plateau and associated slope.

Despite the poor knowledge of the benthic communities on the Exmouth Plateau, information on sediments in the bioregion indicates that benthic communities are likely to include filter feeds and epifauna. Soft-bottom environments are likely to support patchy distributions of mobile epibenthos, such as sea cucumber, ophiuroids, echinoderms, polychaetes and sea-pens. The biological communities within the canyons of the bioregion are also poorly understood. The canyons in this bioregion most likely channel currents onto the plateau, driving upwellings in the canyon heads, such features are associated with large aggregations of baitfish, which in turn attract larger pelagic species such as billfish and tuna.

Pelagic species occurring above the plateau slope and canyons are likely to include nekton and small pelagic fish, attracted to seasonal upwellings, as well as larger predators such as billfish, sharks and dolphins. The upper and middle parts of the continental slope in this bioregion have important demersal fish communities, which display a high degree of endemism. In particular, the continental slope between NW Cape and the Montebello Trough supports over 508 species of fish, of which 76 are endemic. The high numbers of species found here is thought to be associated with areas of enhanced biological productivity as a result of the interaction between seasonal currents and seabed topography.

Protected Marine Fauna

A review of the EPBC Act database (Protected Matters search tool) held by the DoE was conducted for the survey area polygon described by the boundary coordinates provided in **Table 1**, with the application of a 1 km buffer zone. The 10 listed Threatened species that may occur, or relate to, the Dirk MC3D survey area are:

1. the southern giant petrel;
2. the soft-plumaged petrel;
3. the blue whale;
4. the southern right whale;

5. the humpback whale;
6. the loggerhead turtle;
7. the green turtle;
8. the leatherback turtle;
9. the hawksbill turtle; and
10. the flatback turtle.

As indicated by the Protected Matters search the Dirk MC3D MSS area overlaps part of two KEF:

11. Cape Range, Cloates and Carnarvon Canyons; and
12. Exmouth Plateau.

The Dirk MC3D survey area overlaps a Biologically Important Area (BIA) for the pygmy blue whale—migration area (north and south).

Whales and Dolphins

The EPBC Act database lists 24 cetacean species that may occur in, and adjacent to, the survey area of the Dirk MC3D MSS, all of which are protected under the Act. Two of these species are also listed as Endangered, one as Vulnerable and seven as Migratory species.

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 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) (**Figure 2**). 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. This is confirmed by recent satellite tracking of southbound female humpback whales in the Kimberley region.

The commencement date of the Dirk MC3D MSS is yet to be finalised but is expected to extend for a total duration of ~9 months. Therefore it is possible the survey will coincide with the humpback whale migration season. However, given the distance offshore (~123 km) and water depths (~1,000-3,200 m) it is unlikely that humpback whales will be encountered, and those individuals encountered would be transient.

Other rare species of whale include the blue whale (listed as Endangered and Migratory), which may be present in, or adjacent to, the Dirk MC3D survey area. Blue whales are widely distributed throughout the world's 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.

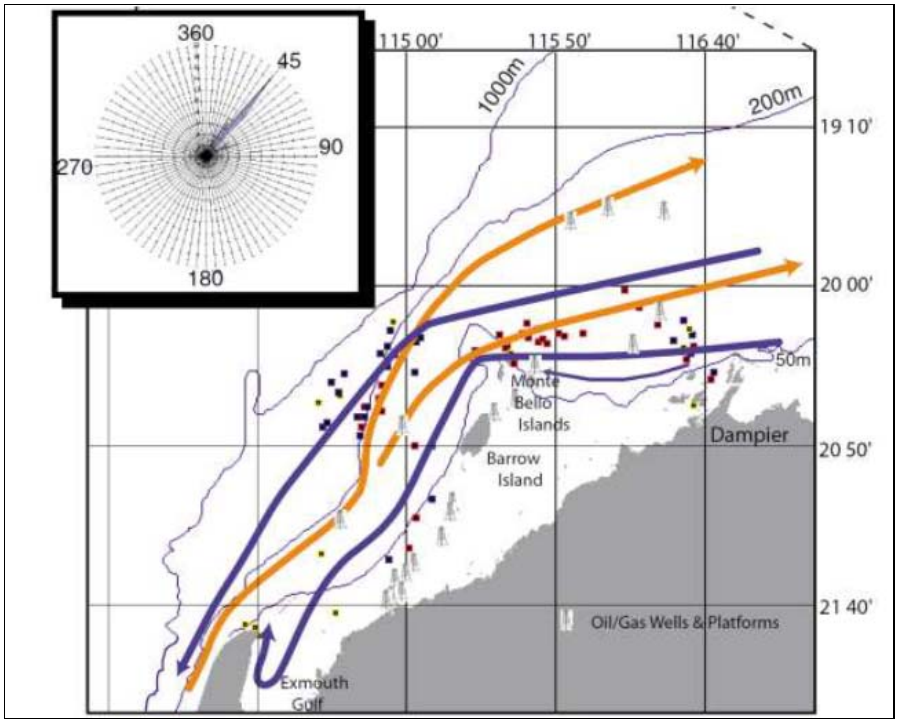

Figure 2 - Humpback whale migratory routes past the survey area

In the NWMR, pygmy blue whales migrate along the 500 m to 1,000 m depth contour on the edge of the slope, and are likely to be feeding on ephemeral krill aggregations. The northbound component of this migration takes place from May to mid-August, with a peak in July–August, and the southbound component occurs from late October to November–December, with a few isolated individuals moving south in January. The migration appears to be centred on the 500 m depth contour (**Figure 3**).

The southeastern corner of the Dirk MC3D survey area overlaps a small section of the BIA for pygmy blue whales. However, it is unlikely that significant numbers of individuals will be encountered as the majority of animals will be moving north/south inshore of the survey area, as supported by the satellite tracking data shown in **Figure 3**.

The southern right whale migrates from summer feeding grounds in the Southern Ocean to calve and breed in warmer coastal waters. Southern right whales are seasonally present off the Australian coast between about May to November and have been recorded in the coastal waters of all Australian states. The main calving areas in Western Australia include Doubtful Island Bay, Albany to Cape Riche area and the Yokinup Bay to Cape Arid area and although they are unlikely to be encountered in the Dirk MC3D survey area or surrounding waters, southern right whales have the potential to transit the survey area. The Protected Matters Search identified the southern right whale as a listed Migratory species, which may be present in the waters of the Dirk MC3D survey area.

Dolphins are relatively common in the waters of the NWS. Species known to occur in this region include the common, bottlenose and Risso's dolphins. The bottlenose dolphin is a cosmopolitan species found in all Australian waters (except the Northern Territory), and is coastal, estuarine, pelagic and oceanic in nature. Common dolphins are recorded in all Australian waters and are not thought to be migratory. The species is associated with high topographical relief of the ocean floor, escarpments and upwelling areas, and there are no known key localities in Australia. Risso's dolphin is distributed through all oceans, occurs inshore and offshore, but is generally considered pelagic and oceanic. The Dirk MC3D survey area does not contain any significant or limiting habitat or feeding grounds for these dolphin species.

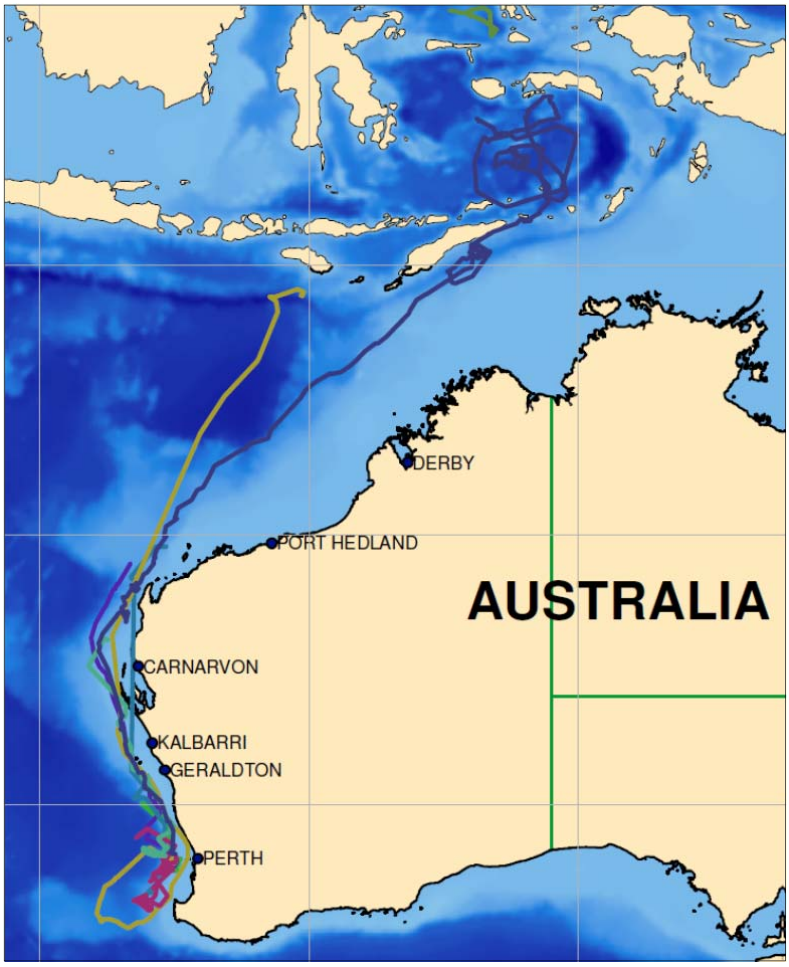

Figure 3 - Satellite tracking of blue whales in 2010/2011

There are no known breeding, calving or feeding grounds for any other listed threatened or migratory whale species within, or in the immediate vicinity of the Dirk MC3D survey area.

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

Marine Reptiles

Five marine turtle species may occur in the survey area and surrounding waters – the green turtle, hawksbill turtle and flatback turtles (all listed as Vulnerable and Migratory) and the loggerhead turtle and leatherback turtles (listed as Endangered, and Migratory). The Montebello Islands and the Lowendal Islands have been identified as regionally significant rookeries for the hawksbill, green and flatback turtles, and to a lesser extent the loggerhead turtle. The green turtle is common around Barrow Island, while identified rookeries for the flatback turtle include Barrow Island, the Murion Islands and more north-easterly beaches including those at Cape Thouin, which is located to the east of the Dampier Archipelago.

It is unlikely that marine turtles will be encountered during the seismic acquisition throughout most of the survey area, given the water depths (~1,000-3,200 m) and lack of shallow submerged features.

Other EPBC Act protected marine reptile species that may be present in the survey area and surrounding waters 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, though individuals are often observed at the surface. Given the water depths (~1,000–3,200 m) and distance offshore (~123 km) it is unlikely that sea snakes will be encountered during the Dirk MC3D MSS.

Sharks and Ray-finned Fishes

Whale sharks are known to aggregate in the reef front waters adjacent to the Ningaloo Reef during the autumn months (mid-March through to early-June). Although there are no records of the whale shark's presence 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. The tracks of a whale shark tagged at Ningaloo Reef in 2005 passed through the Browse Basin, just to east of South Scott Reef. A BIA (foraging area) for the whale shark is in the vicinity of the Dirk MC3D survey area. It is possible that whale sharks will be encountered during the proposed survey but it is unlikely that significant numbers will be encountered.

Other EPBC Act protected shark species that may occur within the survey area and surrounding waters include the shortfin mako and longfin mako sharks, listed as Migratory under the EPBC Act. The longfin mako is widely distributed but rarely encountered oceanic shark which ranges from Geraldton around the north coast to at least Port Stephens (New South Wales). The shortfin mako is an oceanic and pelagic species, although they are occasionally seen inshore. They are found throughout temperate seas but are rarely found in waters colder than 16°C.

Seabirds and Shorebirds

Two EPBC Act-listed species of seabird may occur in the survey area and surrounding waters: the southern giant petrel (listed as Endangered) and the soft-plumaged petrel (listed as Vulnerable). However, there are no BIA for either of these species within or adjacent to the Dirk MC3D survey area and although some individuals might be encountered during the survey it is unlikely to be in significant numbers. The highest abundance of shorebirds occurs on the southeastern and southern coasts of Barrow Island which is located ~250 km east of the Dirk MC3D survey area. Serrurier Island (~178 km to the east of the Dirk MC3D survey area) and Airlie Island (~230 km to the east) are also important breeding areas for migratory birds including little tern, caspian tern, wedge-tailed shearwaters and ospreys.

Socio-economic Environment

Commercial Fisheries

Commercial fisheries that can operate in the region include:

- the Mackerel Managed Fishery (MMF - WA Department of Fisheries [DoF] administered);
- the West Coast Deep Sea Crustacean Managed Fishery (WCDSCF - DoF administered)
- the Western Deepwater Trawl Fishery (WDTF – Australian Fisheries Management Authority [AFMA] administered);
- the Western Skipjack Fishery (WSF - AFMA administered);
- the Western Tuna and Billfish Fishery (WTBF - AFMA administered); and
- the Southern Bluefin Tuna Fishery (SBTF - AFMA administered).

The Mackerel Managed Fishery extends from the West Coast Bioregion to the WA/NT border, with most effort and catches recorded north of Geraldton, especially from the Kimberley and Pilbara coasts. The fishery is divided into three Areas – Area 1 – Kimberley (121°E to WA/NT border); Area 2 – Pilbara (114°E to 121°EW); Area 3 – Gascoyne (27°S to 114°E) and West Coast (Cape Leeuwin to 27°S). The Dirk MC3D survey area is located within Area 3 (Gascoyne and West Coast) of the MMF.

The fishery uses near-surface trolling gear from small vessels in coastal areas around reefs, shoals and headlands to target Spanish mackerel. Jig fishing is also used to capture grey mackerel, with other species from the genera *Scomberomorus*, *Grammatorcynus* and *Acanthocybium* also contributing to commercial catches. There are currently 21 permits in Area 3 of the fishery with the combined quota allocations being consolidated onto nine vessels.

The WCDSCF extends from the WA/NT border (129°E), west and then south to Cape Leeuwin (34°24'S). The fishery is divided up into five fishing zones and the Dirk MC3D MSS survey area is located in Zone 1 of the fishery. The WCDSCF is a quota based 'pot' fishery that operates mainly in depths of 500-800 m. No fishing is permitted in depths <150 m, with the only allowable method for capture being baited pots ('traps'). These are operated in 'long-lines', which have between 50 and 150 pots attached to a main line marked by a float at each end. The WCDSCF targets crystal (snow) crabs, giant (king) crabs and champagne (spiny) crabs using baited pots operated in a long-line formation on the shelf edge waters (>150 m) of the West Coast. There are currently seven permits operating in the fishery and four vessels were operating in 2011.

Petroleum Exploration

There are no offshore production facilities within, or immediately adjacent to, the Dirk MC3D survey area.

Commercial Shipping

No defined commercial shipping lanes exist in the Dirk MC3D survey area, or in adjacent waters. The closest fairway in the waters adjacent to the survey area is ~25 km east of the southeast corner.

Tourism and Recreation

Due to the location of the survey area and distance to coastal areas of the North West Cape and the Gascoyne and Pilbara regions, 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 Dirk 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 Dirk MC3D survey area.

National Heritage

There are no places listed on the Commonwealth Heritage List or the Register of National Estate within or immediately adjacent to the Dirk MC3D survey area. The nearest Commonwealth Heritage site to the survey area is the Ningaloo Coast, which is located ~123 km to the east of the southeast corner of the survey area.

Marine Parks and Reserves

The Dirk MC3D MSS area overlaps the Gascoyne Commonwealth Marine Reserve (GCMR) Multiple Use Zone (IUCN Category VI), and is located ~20 km to the north of the GCMR Habitat Protection Zone and ~20 km to the northeast of the GCMR Marine National Park Zone. The Ningaloo Commonwealth Marine Reserve (NCMR) Recreational Use Zone (IUCN IV) is ~110 km to the east of the survey area, and the Muiron Islands Marine Management Area (located in WA State waters) is situated ~120 km from the eastern boundary of the survey area.

Defence Activities

The northern extent of a military exercise area (MEA), the RAAF Learmonth Air Weapons Range (R862B, R862A, R861A, R861B) overlaps the Dirk MC3D MSS area. When activated by a Notice to Airmen (NOTAM), the restricted airspace within the MEA 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 Dirk 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 has been measured in terms of likelihood and consequence, where consequence is defined as the outcome or impact of an event, and likelihood as a description of the probability or frequency of the identified consequence occurring. 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 (biofouling);
- 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;
- interactions with commercial fishing and shipping; and
- operation of the survey and support vessels within, or in the vicinity of protected areas and heritage places.

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

- disturbance to marine fauna including cetaceans, whale sharks, 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, and shipping;
- disturbance to heritage and conservation values.

The environmental aspects of the Dirk 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 discharged 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 levels that are As Low As Reasonably Practicable (ALARP), 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 Dirk MC3D MSS will be conducted under the framework of the CGG Environment Policy and Health, Safety and Environment (HSE) Management System.

The programme will also operate under CGG Event Management Standard Operating procedure (MAR QPM PRC 005E) and a project-specific HSE Plan. To ensure CGG's environmental management standards and performance objectives are achieved, Volstad Maritime AS will be required to comply with all relevant requirements of CGG's HSE systems/policies and standards.

CGG and its contractor will apply a tiered approach to optimising the environmental performance of the project and ensuring that CGG's environmental management 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.

CGG is responsible for ensuring that the proposed Dirk MC3D MSS is managed in accordance with the Implementation Strategy describing in the Environment Plan and the CGG HSE Management System. Given the control measures that will be implemented for environmental aspects of the survey, the risk of significant adverse environmental effects from the proposed Dirk 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 EPBC Act Policy Statement 2.1. Two dedicated, expert Marine Fauna Observers (MFO) will be aboard the survey vessel for the duration of the Dirk MC3D MSS. The key role of the MFO will be to monitor the waters around the survey vessel for the presence of cetaceans, whale sharks and turtles during daylight hours. The MFO will be responsible for ensuring that the interaction procedures are implemented and followed correctly during survey activities. The MFO will also be responsible for recording any cetacean sightings during the survey on the appropriate sightings forms, using the DoE CSA (Cetacean Sightings Application) database.

The survey will be conducted in water depths of ~1,000–3,200 m and in an area that is located at least 120 km from any beaches and adjacent shallow waters that are important for turtle nesting, hatching and breeding (e.g. Ningaloo Coast). 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 survey area. Anchoring of the survey or support vessel(s) will only occur in emergency circumstances and 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 (<20 m water depth) water features.

The spill risk assessment, which was conducted as part of the evaluation of environmental impacts and risks for the proposed survey, indicated that the probability of surface diesel slicks contacting the Ningaloo Coast is highly unlikely. Approximately 98% of a surface diesel slick will have dispersed and evaporated within about 18 hours in summer, and ~93% of a surface diesel slick would have dispersed and evaporated after 24 hours in winter. On this basis, and using the standard assumption

that a surface slick would move at 3% of wind speed (6 m/s) and 100% of current speed (0.3 m/s), a surface slick is calculated to travel a maximum distance of 35 km within 24 hrs. Hence, the maximum zone of potential impact (ZPI) for a large (283 m^3) diesel spill resulting from vessel collision is a circle with a radius of 35 km. Therefore, the boundary of the ZPI is located ~90 km from the Ningaloo Coast (see **Figure 4**).

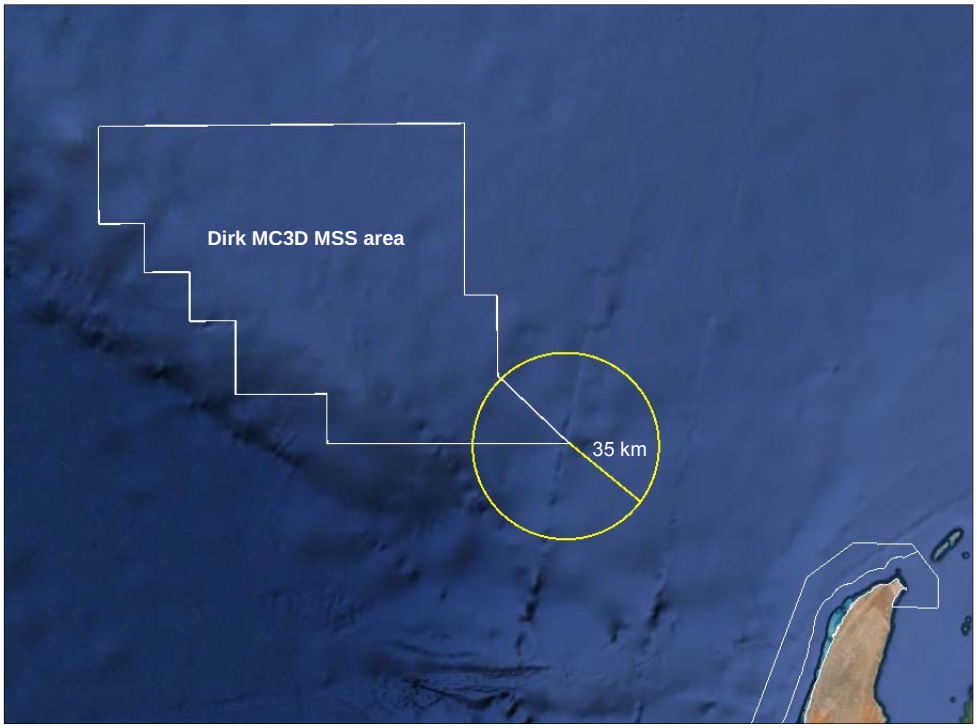

Figure 4 - ZPI for a 283 m^3 diesel spill in the Dirk MCD MSS area

CONSULTATION PLAN

Consultation with stakeholder groups, primarily within the commercial fishing industry, concerning the proposed Dirk MC3D survey has taken place prior to, and during the preparation of the EP. The following fisheries bodies and organisations have been contacted and informed of the proposed operations:

- A Raptis & Sons
- Austral Fisheries Pty Ltd
- Australian Fisheries Management Authority
- Australian Southern Bluefin Tuna Industry Association
- Commonwealth Fisheries Association
- MG Kailis Group
- Northern Fishing Companies Association
- Recfishwest
- WA Fishing Industry Council
- WA Seafood Exporters
- WestMore Seafoods

In addition, 31 individuals or entities who currently hold licences (one or more) that enable them to operate in the MMF and WCDSCF were contacted and provided with details of the Dirk MC3D MSS. Consultation with all of the stakeholders listed above, plus others identified during the consultation process will continue during, and after the survey if required.

Table 2 - Summary of environmental risk assessment for key aspects of the Dirk MC3D MSS

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level
Disturbance to marine fauna	Cetaceans – behavioural reactions (avoidance, diving, increased dive times) Disturbance to marine turtles, whale sharks, fish communities, and seabirds	• Adherence to EPBC Act Policy Statement 2.1 Part A Standard Management Procedures, and the following additional mitigation measures: o precaution zones (observation zone: 3 km+; low power zone: 2 km; and shutdown zone: 500 m) o two dedicated MFO on survey vessel • Application of vessel-whale interaction procedures for non-acoustic energy source operations • Pre-survey induction includes coverage of EPBC Act Policy Statement 2.1 requirements • Detailed reports of all cetacean sightings will be recorded using the DoE CSA database • External lighting of vessels will be minimized to that required for safe navigation, vessel safety and safety of deck operations, except in the case of an emergency • Survey area is located at least 120 km from any beaches and adjacent shallow waters important for turtle nesting, hatching and breeding • Survey area is not located close to any locations important for seabird or shorebird breeding or feeding • Survey area will not be operating over critical habitat for feeding, spawning, breeding or migrating fish populations • Use of streamer tail buoys fitted with appropriate turtle guards	**Low**
Disturbance to benthic habitats	Small localised disturbance to epibiota in event of loss of equipment	• Survey will be conducted in water depths of ~1,000–3,200 m and away from any shallow water areas • No anchoring of either the survey or support vessel will take place during the survey except in an emergency • Anchoring in shallower waters near reefs, islands or Pilbara coastline will only occur in an emergency. All measures will be taken to avoid sensitive habitats – corals, seagrasses, macroalgal beds • 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.	• Vessels required for the proposed activity will not discharge ballast water • Adherence to the Australian Ballast Water Management Requirements • Both the survey and support vessel(s) will have all the necessary AQIS clearances to operate unrestricted 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	• All sewage and putrescible wastes will be handled and disposed of in accordance with MARPOL Annex IV • Discharge of sewage and putrescible 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) • Bilge water will be treated and disposed of in accordance with MARPOL Annex I requirements o Discharge restrictions for bilge water with oil content >15 ppm, or bilge water contaminated with toxic chemicals o No discharge of bilge water with oil content of >15 ppm, or bilge water contaminated with toxic chemicals within 12 nm of the Ningaloo Coast World Heritage Property boundary	**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	• 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 • No discharge of sewage, putrescible wastes within 12 nm of the Ningaloo Coast World Heritage Property boundary • 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	**Medium**
	Acute toxicity effects on marine fauna from fuel and oil spills	• 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 will be subject to CGG Offshore Bunkering Instruction and additional requirements including: o No refuelling within 25 km of emergent land or shallow water features (20 m or less depth) o Refuelling will only be undertaken during daylight hours	**Medium**
Interaction with commercial fisheries and shipping activities	Interference to commercial fishing vessels and shipping operating within or near the survey area and surrounding waters Potential direction and indirect noise impacts on target species Restriction of access to fishing grounds, loss or damage to fishing gear	• Notification of the activity and details of the activity as required to relevant commercial fisheries management agencies, fishing industry bodies and individual companies • Consultation with AMSA prior to the survey commencing • Use of a support vessel or vessels to manage vessel interactions • Use of standard maritime safety procedures Notice to Mariners (NTM]) via the Australian Hydrographic Service; radio contact; display of appropriate navigation 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**
Operation of survey vessel within protected and heritage areas	Disturbance to heritage and conservation values	• Survey and support vessels will not enter any protected areas or heritage places, except in an emergency • All CGG and contractor personnel made aware of, and comply with, requirements of accepted EP	**Low**

FURTHER DETAILS

For further information about the proposed CGG Dirk MC3D MSS in the Carnarvon Basin offshore from WA, please contact:

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