VICKI
3D MARINE SEISMIC SURVEY
WA-325-P and WA-327-P:
ENVIRONMENT PLAN

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VICKI 3D MSS WA-325-P AND WA-327-P: ENVIRONMENT PLAN.

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1 INTRODUCTION

Roc Oil (WA) Pty Ltd (Roc) as Operator of the WA-325-P and WA-327-P Exploration Permit propose to conduct the Vicki 3D Marine Seismic Survey in the Perth Basin, offshore from Geraldton. The Vicki 3D MSS will comprise approximately 500 square kilometres straddling Permit Areas WA-325-P and Permit Area WA-327-P. The survey is scheduled to be carried out over a period of around 15 days between 1st May and 15th June 2003.

1.1 PURPOSE AND STRUCTURE OF DOCUMENT

This Environment Plan for the Vicki 3D MSS, has been prepared in accordance with the Commonwealth regulatory requirements of the *Petroleum (Submerged Lands) (Management of Environment) Regulations 1999*.

The overall purpose of this Environment Plan is not only to comply with statutory requirements but also to ensure that the seismic acquisition is planned and conducted in line with Roc corporate environmental policies and Health, Safety and Environment (HSE) Management System. It is also intended to serve as a practicable environmental management tool that can be used throughout the proposed seismic survey by operators to implement targeted environmental control measures. This Environment Plan includes:

- A description of the proposed activity;
- A description of the existing environment in the area of proposed operations;
- The identification and assessment of all environmental risks in advance of the seismic operations commencing;
- The identification of environmental performance objectives, standards and criteria; and
- The development of appropriate environmental management and mitigation measures that will allow any environmental risks and effects to be avoided or reduced to as low as is reasonably practicable.

1.2 CORPORATE ENVIRONMENTAL POLICY

Roc is committed to protecting the environment and consequently has a written corporate Environment Policy (see Appendix A) that provides a public statement of the corporate commitment to protecting the environment during offshore exploration operations such as seismic surveys.

1.3 ENVIRONMENT LEGISLATION

All activities conducted during the Vicki 3D MSS will comply with legislative requirements established under the Commonwealth Government regulatory framework. The major relevant Commonwealth statutes and regulations are listed in Table 1.

Table 1 Relevant Commonwealth Legislation and Regulations

Commonwealth	
Environment Protection and Biodiversity Conservation Act 1999	Under this legislation all activities that will, or have the potential to, affect matters of "National Environmental Significance" are prohibited except; when undertaken in accordance with approval by the Minister for Environment, or when approved through a Bilateral Agreement with a State or Territory, or when approved through a process accredited by the Minister.
Petroleum (Submerged Lands) Act 1967	This Act relates to the exploration and exploitation of petroleum resources in the area of the continental shelf of Australia and certain Territories of the Commonwealth. Commonwealth law applies to lands beneath waters that are outside 3 nautical miles, except within zone A of the Zone of Cooperation (ZOCA) off Western Australia and the Northern Territory.
The Petroleum (Submerged Lands)(Management of	These regulations are applicable to petroleum exploration and production activities in Commonwealth waters. The objective of these regulations is to

Environment) Regulations 1999	ensure that petroleum activities are carried out in a manner that is consistent with the principles of ecologically sustainable development and in accordance with an approved 'Environment Plan' that has appropriate performance objectives and standards as well as measurement criteria for determining whether the objectives and standards are met.
Australian Heritage Commission Act 1975	This Act identifies areas of heritage value - listed on the Register of the National Estate.
Historic Shipwrecks Act 1976	This Act protects shipwrecks, which have lain in Territorial waters for 75 years or more. It is an offence to interfere with any shipwreck covered by the Act.
Wildlife Protection (Regulation of Exports and Imports) Act 1982	This Act is concerned with control over the movement of Australian wildlife (fauna and flora) in or out of the country, together with the movement of exotic (non-indigenous) flora and fauna out of the country, as well as various other matters relating to quarantining.
Hazardous Waste (Regulation of Exports and Imports) Act 1989	This Act regulates the import and export of hazardous waste. Permits are required to dispose of waste overseas or to import waste into Australia.
Ozone Protection Act 1989	This Act regulates the import, export and manufacture of ozone depleting substances such as fire fighting equipment and refrigerants.
Navigation Act 1912	This Act requires that ships carrying oil and chemical tankers conform with Annex I of the MARPOL convention for the Prevention of Pollution from Ships.
Protection of the Sea (Civil Liability) Act 1981	This Act imposes civil liability for pollution damage and requires ships carrying more than 2,000 tons of oil in bulk as cargo to maintain insurance to cover liability for pollution damage.
Protection of the Sea (Oil Pollution Compensation Fund) Act 1993	This Act establishes a Commonwealth Fund to provide compensation and indemnification for certain oil pollution damage. The Fund can recover contributions on behalf of the Commonwealth.
Protection of the Sea (Powers of Intervention) Act 1981	This Act regulates discharges from ships to protect the sea from pollution. The Act gives powers to the Australian Maritime Safety Authority to take appropriate measures to protect the Australian coastline.

Under the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, a Proponent must not take, injure or interfere with a cetacean (whales and dolphins) unless a Cetacean Interference Permit has been obtained. Environment Australia's *Guidelines on the Application of the Environment Protection and Biodiversity Conservation Act to Interactions Between Offshore Seismic Operations and Larger Cetaceans* note Environment Australia may consider a seismic operation as interfering with a cetacean when:

> "*Seismic operations that are not controlled actions under Part 3 of the Act, but nonetheless take place in or near migratory paths around the time when migrations may occur. Such seismic operations may cause any present whales to modify their behaviour (for example deviate from their migratory path) and so may interfere with them*".

Because migratory humpback whales may be present in the area at the time of survey (refer to Section 3) an application for a Cetacean Interference Permit has been separately lodged with Environment Australia.

1.4 INTERNATIONAL AGREEMENTS AND CONVENTIONS

A number of international agreements and conventions may have impacts on petroleum activities in both State and Commonwealth waters. The principal ones are:

- *International Convention for the Prevention of Pollution from Ships, London, 1973* (commonly known as MARPOL)
- *Protocol to International Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter, 7 November 1996* (Previously known as the London Dumping Convention)
- *International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990* (commonly known as OPRC 90)
- *Agreement Between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and Their Environment* (commonly

referred to as the China Australia Migratory Bird Agreement or CAMBA)

- *Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and Their Environment* (commonly referred to as the Japan Australia Migratory Bird Agreement or JAMBA)
- *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal*

2 PROPOSED SEISMIC SURVEY

2.1 LOCATION

The WA-325-P and WA-327-P Permit Areas are located in the Perth Basin offshore from Geraldton as shown by Figure 1. The proposed survey will occur in an area to the north of the State waters surrounding Houtman Abrolhos, within the area bounded by 27° 50´S; 28° 10´S; 113° 15´E;and 113° 35´E. At its closest point, the area is approximately 10 km from the islands and emergent reefs of the Houtman Abrolhos (refer to Figure 1). The water depth across the survey area varies from 35 m to approximately 150 m, the majority being 50 m to 100 m.

2.2 DESCRIPTION OF THE SURVEY

Petroleum Permit Areas WA-325-P and WA-327-P is operated by Roc on behalf of the Joint Venture Partners (Apache Northwest Pty Limited, Chimelle Petroleum Limited, and Bounty Oil & Gas N.L.) and administered by the Department of Industry and Resources, Petroleum Division.

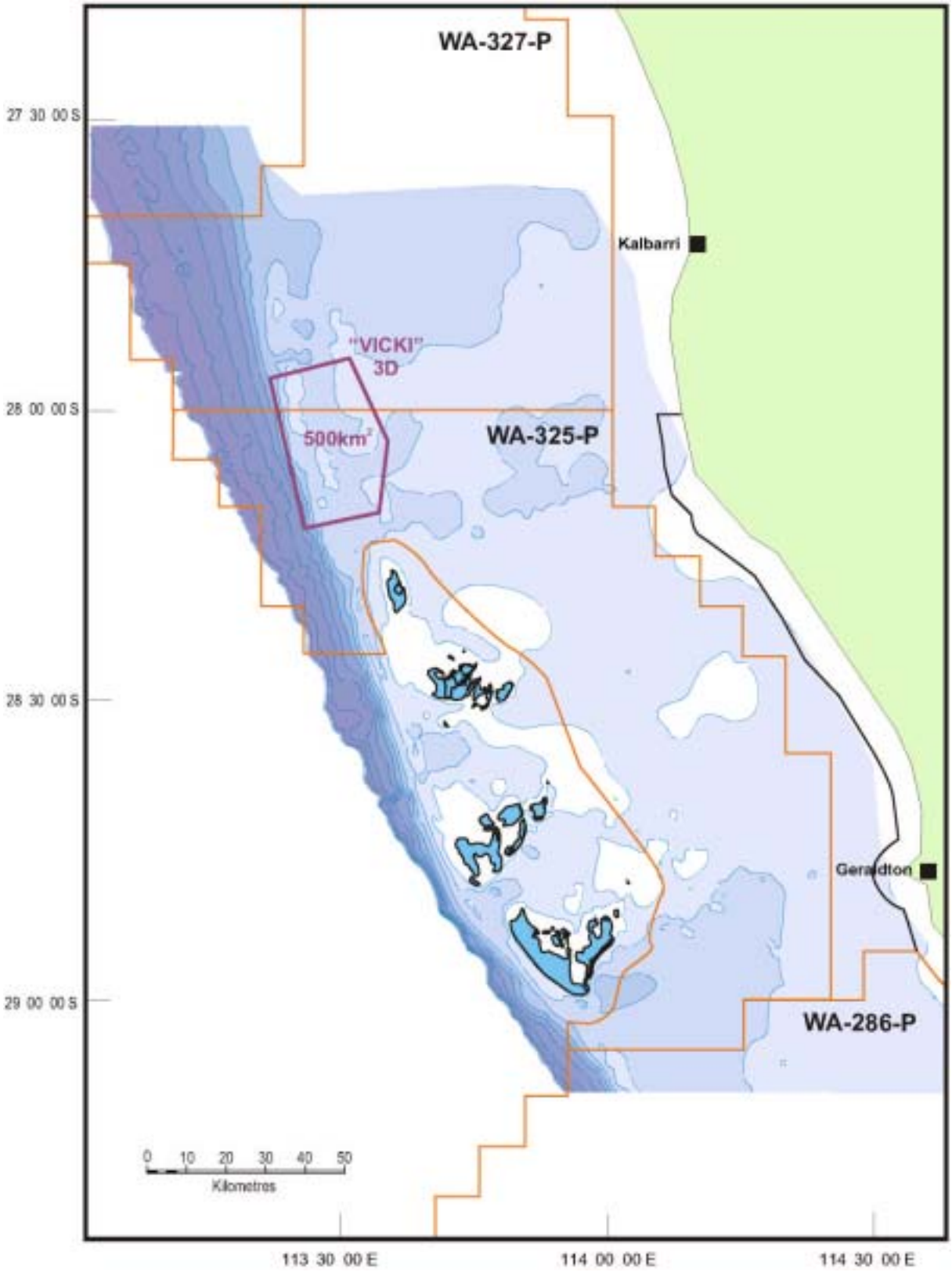
As operator of the Permit Areas, Roc is committed to undertaking seismic surveys in the permit areas. The Vicki 3D MSS is scheduled to commence in early May 2003 and extend for a scheduled duration of approximately 15 days depending on weather. The survey vessel will be the '*GECO Emerald'*, which is operated by WesternGeco. As the survey is of a short duration, the vessel is not expected to return to port during the survey, however if necessary refuelling and logistic supply would occur at the Port of Geraldton. It is anticipated that the vessel will not anchor or enter shallow waters near the shore or the Houtman Abrolhos islands unless an emergency situation develops.

The seismic array will comprise up to six streamers, with a maximum length of approximately 2.5 km. The source depth will be 5 m and the streamer depth will be 7- 8 m. The operating pressure for the airgun array will be approximately 2,000 psi. The airgun array will have a volume of approximately 2,000 cui and will produce at source (ie. within a few metres of the airguns) sound pulses in the order of 220-240 dB re 1μPa-m at frequencies extending up to approximately 110 Hz. These levels will decrease to levels in the order of 170-180 dB re 1μPa-m within 1 km of the source and approximately 150 dB re 1μPa-m within 10 km, dependent on the sound propagation characteristics of the area (McCauley, 1994). Details of the seismic array for the survey are provided in Table 3.

Table 2: Seismic Array Details

Parameter	Value
No of streamers	6
Streamer length	2.5 km
Number of Airgun Arrays	2
Airgun array total volume	2000 cui
Operating pressure	2000 psi
Streamer depth	7 - 8 m
Airgun depth	5 m
Shotpoint interval	12.5 m (~5 seconds)
Peak source sound pulse	220-240 dB re 1μPa-m
Frequency range	10 to 90 Hz

Figure 1: Location of Proposed Vicki 3D Marine Seismic Survey



3 DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 REGIONAL SETTING

The project area lies within the 'Central West Coast' meso-scale region according to the IMCRA classification (IMCRA, 1997). The region is characterised by a relatively narrow continental shelf with

diverse moderate energy coastal landforms (IMCRA, 1997). The region has a range of temperate species and is also at the southern limit of a suite of sub-tropical and tropical species.

The dominant feature of the region wherein the survey is proposed to take place is the Houtman Abrolhos island group. The Houtman Abrolhos is a complex of islands, reefs and lagoons lying near the shelf edge. The Marine Parks and Reserves Working Group (1994) noted that "… of all the marine areas of the Western Australian coast, the Abrolhos is perhaps the most significant for its natural resource, nature conservation, historical and recreational values and the most worthy of reservation" (p.IV-28). The Marine Parks and Reserves Working Group (1994) recommended that the entire area of the Houtman Abrolhos to the limit of State territorial waters should be reserved and managed as a multiple-use area (p. IV-34).

The proposed survey area lies to the east and north of the Houtman Abrolhos. The survey lines do not enter the proposed multiple-use reserve area.

3.1.1 Bathymetry

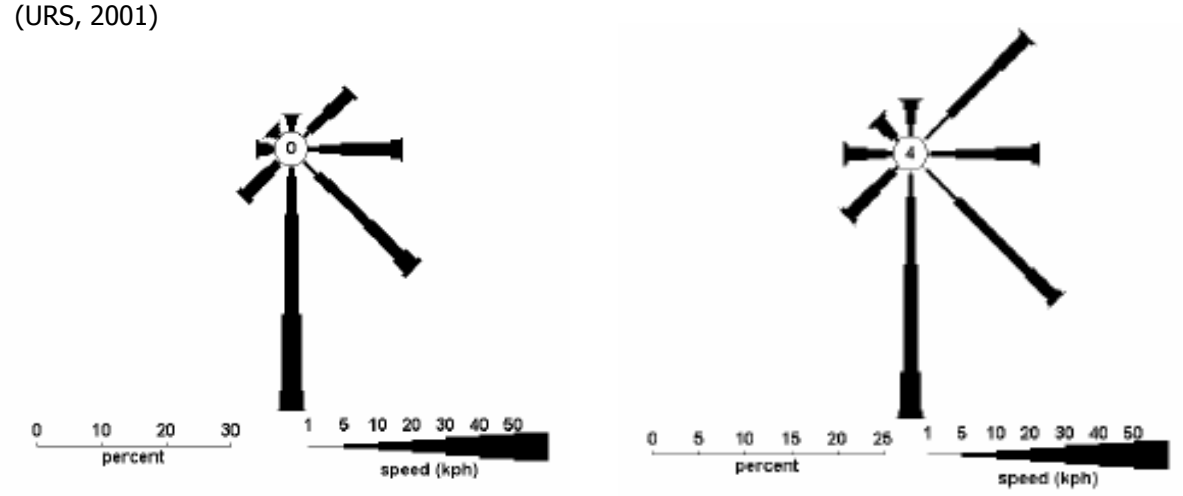
The bathymetry across the survey area ranges from approximately 30 to 300 m water depths as illustrated by Figure 1. The prominent features of the project area are the Houtman Abrolhos islands and reefs that occur as a series of broken ribbon reefs and low islands to the south and west of the survey area.

3.1.2 Metocean Conditions

The wind climate of the project area is highly seasonal. The two primary winds regimes are the sea breeze dominated summer pattern and the synoptically dominated winter pattern (GEMS, 2001). In spring and autumn the winds are in transition between the two main regimes. With the sea-breeze effect less pronounced, the winds are less 'concentrated' and reflect the migratory aspects of weather systems. The proposed timing of survey activity is spring.

Figure 2 illustrates the historical wind regimes recorded at Geraldton for the period of proposed survey. Daily effects overlay the prevailing synoptic pressure gradient flow so that cooling of the land overnight often results in winds dropping off quite markedly in the earlier morning. It is only with the onset of solar heating that the sea breeze winds strengthen. The sea breeze will typically override the early morning synoptic easterlies, so that prevailing winds become southerly to south-westerly, during the afternoon.

Figure 2: Typical Transition Period Winds Recorded at Geraldton
(URS, 2001)



Oceanic swells predominantly arrive from the southwest during spring and summer. The mean swell heights range from 0.9 to 1.3 m with associated maximums of 1.7 to 3.5 m and mean periods of 12 to 16 seconds. Typical annual mean sea heights are 0.5 to 1.2 m with associated maximums of 1.5 to 2.5 m and mean periods of 4 to 7 seconds (WNI, 2000).

Water circulation in the shallower eastern areas is primarily influenced by wind driven currents, although localised wave-forced currents may occur around the shallow reefs, particularly during large swell events. The Leeuwin Current, which is the dominant southward flowing oceanic current in the region, may have a significant effect on the current regime in the inshore area of the proposed survey.

Tides are diurnal, with a small maximum range of less than one meter, and have very limited effect on water circulation in the area.

3.2 HABITATS AND BIOTA

3.2.1 Intertidal Habitats

The nearest intertidal habitats occur along the shores of the Houtman Abrolhos. The main intertidal habitats comprise narrow sandy beaches separated by limestone platforms and exposed beach rock. The platforms and beach rock support turf algae and molluscs with a range of small fish and crabs present in rock pools. There are small stands of mangroves (single species *Avicennia marina*) on some of the sheltered shores.

3.2.2 Sandy Seafloor

Sandy seafloor habitat occurs in sub-tidal areas where the sand forms a thick layer over the underlying limestone pavement. The sands are often shifting, and as a consequence the density of epibiota is low. However, in shallower sheltered areas, mostly in the south eastern parts of the survey area, seagrass colonise the sandy seafloors in low density.

3.2.3 Limestone Pavement

Limestone pavement habitat is widely distributed across the south and eastern parts of the survey area. The extent of vegetation cover depends on the depth of cover of the pavement by sand. Plant growth decreases with increasing sand depth and water depth and is generally absent where the sand cover exceeds 0.3 m, or the water depth exceeds 30 m. Occasionally, small patches of pavement occur which are raised, usually by less than 1 m, above the general level of the seafloor. These areas of 'low relief reef' (also referred to by some as 'raised pavement') support a more diverse and luxuriant algal community and a more abundant sessile fauna of sponges and ascidians. Fish and rock lobster are also attracted to these areas for food and shelter.

3.2.4 Patch Reef

Major physical features of the marine environment in the survey area are the deep limestone patch reefs that extend northwards from the Houtman Abrolhos. These reefs occur at depth of approximately 50 m and rise to 30 m from the sea surface. Although not investigated it is assumed, on the basis of similarity to surveyed reefs within the Houtman Abrolhos, that they are high profile structures with steep reef face and extensive horizontal ledges. Patch reefs support an abundant attached invertebrate cover, particularly rich in sponges and ascidians.

3.2.5 Key Biota

Key biota of the area are taken to be those that are:

- Listed as threatened or endangered and may occur in the area;
- Of importance to recreational and/or professional fisheries; and
- Of 'key' importance in ecological processes of the area.

The key biota considered are listed in Table 3 and discussed in the following sections.

Table 3: Key Biota of Project Area

Species	Common Name	Comment	Likelihood of Presence in Survey Area
Balaenoptera musculus	Blue Whale	Protected under *EPBC Act*	Very unlikely
Megaptera novaeangliae	Humpback Whale	Protected under *EPBC Act*	Very likely

Species	Common Name	Comment	Likelihood of Presence in Survey Area
Eubalaena australis	Southern Right Whale	Protected under *EPBC Act*	Very unlikely
Balaenoptera physalus	Fin Whale	Protected under *EPBC Act*	Very unlikely
Balaenoptera borealis	Sei Whale	Protected under *EPBC Act*	Very unlikely
Carcharodon carcharias	Great White Shark	Protected under *EPBC Act*	Possible
Carchariuas taurus	Grey Nurse Shark (West coast population)	Protected under *EPBC Act*	Possible
Rhincodon typus	Whale Shark	Protected under *EPBC Act*	Unlikely
Neophoca cinerea	Australian Sealion	Protected under *EPBC Act and WA Wildlife Protection Act*	Possible transient
Dermochelys coriacea	Leathery Turtle	Protected under *EPBC Act*	Possible transient
Osteichthyes	Sea horses, Sea dragons and Pipefish	Protected under *EPBC Act*	Probable that one or more species will be present
Class Aves	Seabirds	Protected under *EPBC Act*	Probable that one or more species will be transient
Panulirus cygnus	Rock Lobster	Important commercial and recreational fishery	Present in area

Marine Mammals

Blue whales normally remain in deeper waters off the shelf break (Rafic, 1999) and would be unlikely to occur in the project area.

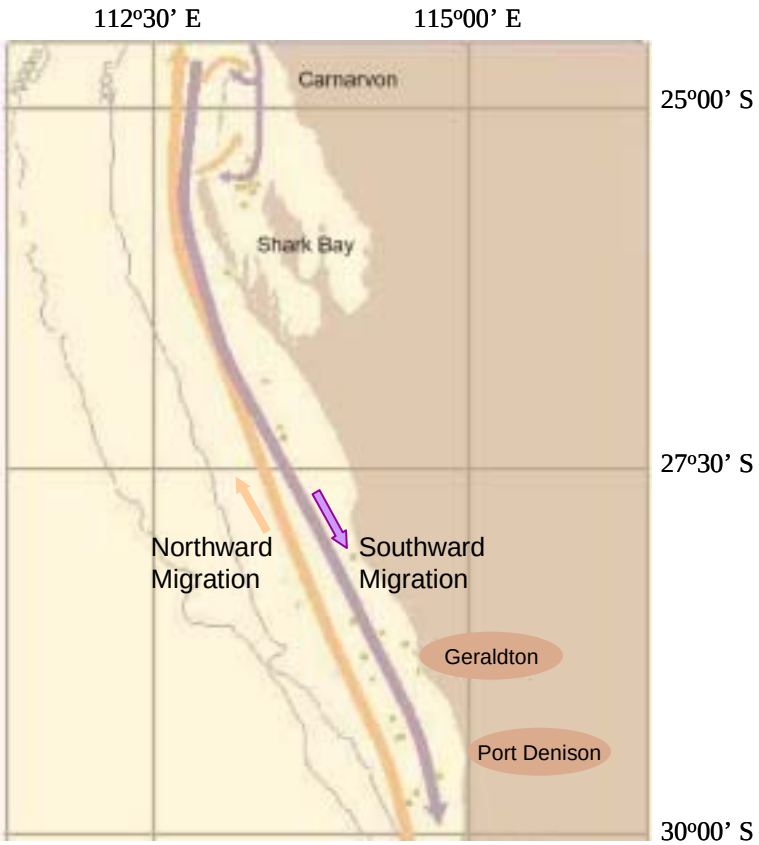
The geographical and temporal movements of humpback whales in Western Australian waters have been reviewed by Jenner *et al*. (2001). The humpback whales migrate between their summer feeding grounds near Antarctica to their winter breeding grounds adjacent to Australia's Kimberley coastline. The migratory path of the humpback whale stock off WA covers approximately 3,600 nautical miles (nm) (Jenner *et al*., 2001). Within the region it is considered that the whales follow a predictable migratory pattern within the continental shelf boundary (200 m bathymetry) between the Abrolhos Islands and the mainland (> 30 nm offshore). Northward migration is generally offshore, whereas southward migration is typically closer to the coastline. The migration routes are presented in Figure 3 (Jenner *et al*., 2001).

The peak of the north-bound humpback whale migration occurs between late June and late July (Jenner *et al*., 2001). The north-bound humpback whale migration route passes through the proposed survey area. Consequently it is likely that humpback whales may be in the region at the proposed time of seismic survey activity

The migratory patterns of the southern right whale are less well known than the humpback. It is thought that southern right whales migrate from sub-Antarctic feeding grounds to their breeding grounds close to Australia's south coast during winter and spring (Bannister, 1994). Marsh *et al*. (1995) indicate that the regular calving areas occur between Augusta in Western Australia and Port Lincoln in South Australia, with less regular calving occurring around the south-west coast up to Perth. Occasional sightings of southern right whales have been made as far north as Geraldton during the winter and spring period but it is unlikely that southern right whales will be present during the period of the survey.
Sei and fin whales generally tend to stay in deeper oceanic waters and migrate to the sub-Antarctic, below latitude 35^{o}S, to feed during the warmer months (Bannister *et al*., 1996). Therefore these species would not be expected to occur in the region at the time of seismic survey.

Australian sea lions are present in small numbers in the Houtman Abrolhos where they are known to breed. Pupping takes place in late winter/early spring.

Figure 3: Humpback Whale Migratory Routes Past Project Area



Turtles

Leathery turtles (also referred to as leatherback turtles) generally frequent deeper offshore waters however it is not uncommon for them to be sighted in the shallower coastal habitats.

The Hawksbill turtle occurs worldwide in tropical and warm temperate waters, typically inhabiting sub-tidal coral and rocky reef habitats. The project area is further south than their normal range, the southern limit of which is Shark Bay, but they have been recorded occasionally in the region.

Whale Shark

The whale shark is a filter feeder, feeding on plankton, small fish and squid. They occur in both tropical and temperate waters and are normally oceanic and cosmopolitan in their distribution. Whale sharks known to aggregate seasonally in the waters off the North West Cape and have been sighted as far south as Point Hicks in Victoria on the east coast, and Cape Leeuwin on the west coast. There are however, no records of the whale shark occurring in the survey area.

The migratory pattern of the whale shark is largely unknown. The main period of the whale shark aggregation at North West Cape is late March to early May, with the largest numbers being recorded in April. The season is, however, somewhat variable and whale sharks have been recorded between mid March and the beginning of June.

Recent work (April/May 2002) by CSIRO to track whale shark movement using satellite tags was only partially successful. Two sharks were successfully tagged. Both the tagged sharks headed northwards, with one reaching Christmas Island before the tag came loose and the other entering Indonesian waters near to Sumba Island before the tag stopped transmitting.

It is unlikely that the whale shark would occur in the survey area. However, they are known to

migrate long distances and have been observed further south than the survey area so their presence in the deeper waters cannot be discounted.

Other Fish

The area is known habitat for the listed white shark, whose range extends primarily from Moreton Bay in Southern Queensland, around the southern coastline to the North West Cape of Western Australia (Bruce, 1995). Although no data exists for the grey nurse shark they may also occur in the area.

The diverse range of ecological niches afforded by the patch reefs across the project area would be expected to provide suitable habitat for the listed Osteichthyes[1] species of seahorses, seadragons and pipefish.

The variety of benthic habitats supports diverse and abundant fish communities. Reef associated fishes, such as scalyfin (*Parma* spp) and wrasse (*Labridae* spp) are common, along with commercial species such as baldchin groper (*Choerodon rubescens*) and dhufish (*Glaucosoma hebraicum*) on outer reefs. Offshore, pelagic fishes such as Spanish mackerel (*Scomberomorus commerson*) and Samson fish (*Seriola hippos*) also occur.

Seabirds

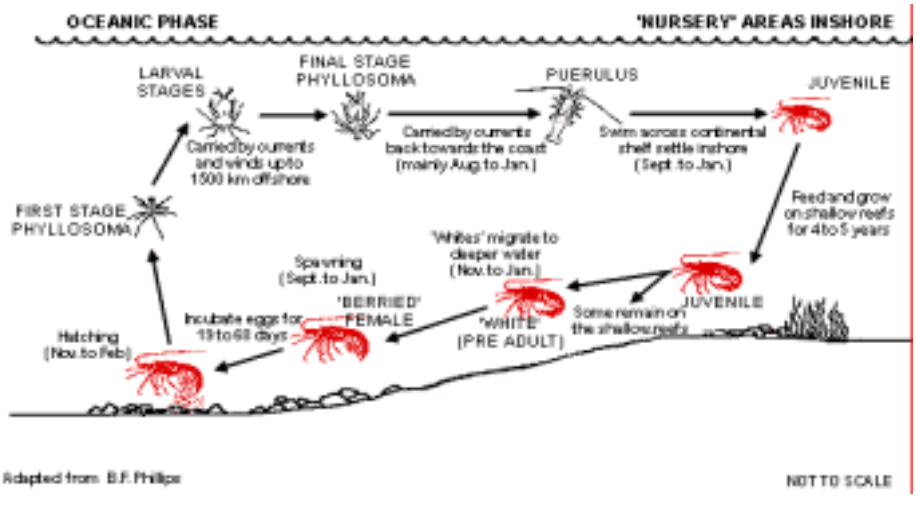
Migratory seabirds, some of which are also protected by international agreements (Bonn Convention, JAMBA and CAMBA), may pass through the proposed survey area. The report of the Marine Parks and Reserves Working Group (1994) noted that the Houtman Abrolhos was considered to be amongst the most significant seabird breeding areas in the world. They listed the following species of seabirds as breeding at the Houtman Abrolhos:

- Wedge-tailed shearwater;
- Little shearwater;
- White faced storm petrel;
- White bellied sea eagle;
- Common noddy;
- Caspian tern;
- Crested tern;
- Roseate tern;
- Fairy tern;
- Eastern reef egret;
- Bridled tern;
- Pied cormorant;
- Pacific gull;
- Sooty oyster catcher; and
- Osprey

Rock Lobster

Rock lobsters are found all around the Australian coast sheltering in caves and crevices during the day and moving out at night to forage in surrounding areas. The western rock lobster (*Panulirus cygnus*) supports the most valuable single species fishery in Australia.

The life cycle of the western rock lobster has been well studied. Breeding occurs in spring and early summer in waters near the edge of the continental shelf of 35 to 90 m depth. The eastern parts of the survey



[1] Osteichthyes includes all 'bony'

area would be an area of lobster breeding.

Fertilised eggs are carried on the underside of the female for nine to 12 weeks before hatching. Hatched larvae, called phyllosoma, rise to the sea surface and drift long distances offshore (generally 400 to 1,000 km offshore) growing to about 35 mm over 9 to 11 months before metamorphosing into the peurulus stage. The peurulus then swims back across the continental shelf to settle in the holes and crevices of the shallow coastal reefs such as occurs in the central and eastern parts of the project area. After settlement the peurulus undergoes a moult and assumes the form of a juvenile rock lobster.

Seagrasses

The region has a high diversity of seagrass species with 14 species represented. The area supports extensive and diverse seagrass communities, nine species have been recorded to date with their distributions and densities varying over the range of habitats represented. Predominant species include *Thalassodendron pachyrhizum, Amphibolis* spp*, Posidonia* spp*, Halophila* spp*,* and *Heterozostera tasmanica*.

3.3 SOCIO-ECONOMIC CONSIDERATIONS

3.3.1 Rock Lobster Fisheries

The survey area is within The Western Rock Lobster Fisheries Area A (Abrolhos Area). It is an area of relatively intense commercial fishing.

The western rock lobster fishery in Area A operates from 8th March to 30th June.

3.3.2 Other Commercial Fisheries

3.3.3 Scallop fishery:

There is a small area reserved for an experimental scallop seeding/harvesting fishery lying between the Abrolhos Islands and the mainland. The current commercial scallop beds lie within the State waters surrounding the Abrolhos Islands. Seeding of the research area with farmed spat is currently proceeding. This fishery is remote from the current survey.

3.3.4 Tourism

Access to the area for tourism and recreational activities is at present limited due to the distance offshore and the lack of accommodation (other than for fishers holding permits to live on the Houtman Abrolhos islands). Most tourism and recreational activity is centred on the islands that are outside of the survey area and little interaction is expected.

3.3.5 Shipping Activity

The project area is not located within any major shipping route. Transient coastal shipping traffic may however pass through the deeper north-western parts of the survey area. Commercial fishery operators (primarily rock lobster fishers) are known to traverse the survey area.

3.3.6 Shipwrecks

There are a number of protected shipwrecks in the region, the most famous of which is the *Batavia*, a Dutch ship wrecked off the Houtman Abrolhos in 1629. The survey will not be traversing any known shipwrecks, furthermore, because of the depth of water across the survey area the survey will not affect any shipwrecks.

Scanning during the 2002 2D seismic programme (Rita and Cheryl Surveys) precludes the possibility of the wrecks of the *Sydney* or the *Kormaran* lying within the survey area.

4 DESCRIPTION AND ASSESSMENT OF ENVIRONMENTAL EFFECTS

4.1 POTENTIAL ENVIRONMENTAL EFFECTS

The components of the seismic survey that could result in significant environmental effects have been determined through an evaluation of the proposed activity, the surrounding environment and the legislative requirements. The activities with potential to cause significant environmental effect include:

- Operation of the seismic vessel and towing of the airgun and streamer (hydrophone) array through the survey area;
- Discharge or 'firing' of the airgun arrays;
- Routine waste discharges from the survey vessel;
- Accidental fuel and oil spills from the survey vessel; and
- Accidental loss of streamers and associated equipment.

Although the risk is considered to be remote, each of these activities has the potential to result in detrimental impacts on the physical, biological and socio-economic environment of the area. The key potential environmental aspects associated with the proposed Vicki 3D MSS are discussed in the following sections.

Background Non-Biological Sea Noise

It is worth noting that aside from the noise generated by operating seismic survey vessels there are a number of general sources of non-biological sea noise (McCauley, 1994). These include wind, rain and shipping:

- Wind – wind noise is consistent and may reach levels in the vicinity of 85-95 dB re $1\mu Pa^2$/Hz at low frequencies under extreme conditions.
- Rain – rain may produce short periods of high underwater noise with flat frequency spectra to levels of 80 dB re $1\mu Pa^2$/Hz.
- Shipping - in areas where ship traffic is high, the averaged noise of many ships may produce a widespread, nondescript, continuous, 'pink' type noise level over the frequency range 1-500 Hz. Highest levels of this widespread background noise from shipping is in the order of 75 dB re $1\mu Pa^2$/Hz at 50 Hz. Source levels for large ships may be in the range of 170-200 dB re 1μPa -m. High shipping noise levels may be experienced in narrow or shallow shipping channels.

4.2 DISTURBANCE TO MARINE FAUNA

McCauley (1994) provides a detailed review of the potential effects of seismic acquisition on marine animals. The review was undertaken by an Independent Scientific Review Committee (ISRC), chaired by Professor John Swan, and commissioned by the Australian Petroleum Exploration Association (APEA) and the Energy Research and Development Corporation (ERDC). The ISRC report examined all aspects of the possible effects of seismic surveys on marine life, from whales to plankton. Potential impacts on hearing, and behaviour at different stages of development were studied. The ISRC report concluded on this note:

> *"Given the relatively small scale of seismic activity, the often large scales over which biological events occur, and the low probability of encounter between seismic surveys and 'at risk' populations at an appropriate time and place, then the wider implications of disruption by seismic surveys appear to be small for most species."*

4.2.1 Sonic Disturbance

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

- Pathological effects (lethal and sub-lethal injuries) – immediate and delayed mortality and physiological effects to nearby marine organisms;

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

Pathological Effects

The response of marine fauna to marine seismic survey sounds will range from no effect to various behavioural changes. Immediate pathological effects are likely to be restricted to very short ranges and high sound intensities and are unlikely to occur for the majority of species, as most free-swimming animals will practice avoidance manoeuvres well before they get within the ranges at which pathological effects may occur. Table 4 lists pathological effects observed to occur as a result of seismic survey noise.

It is prudent to point out that there is presently confusion in some quarters caused by people wrongly associating the biological effects of high explosives with those of other types of underwater sound sources. High explosives produce a shock wave in the water that is subtly different to that of a sound wave, as produced by most underwater sources (including airguns), but vastly different in its biological implications. Shock waves produce severe pathological effects at considerable ranges, which vary depending on charge size, and physical or biological factors. Airguns do not produce shock waves and the effects described for high explosives do not apply to them. For example Larson (1985) concluded from experiments with caged fish that mortality from shock waves only occurs when two criteria are met simultaneously:

- peak pressure is $\geq 2.75 \times 10^5$ Pa, and
- rise time and decay time is ≤ 1 ms.

Airguns do not meet these criteria and do not cause shock waves.

Table 4: Observed Seismic Noise Pathological Effects

Species	Source	Level (dB re 1µPa @ 1m)	Distance From Source (m)	Exposure Level (dB re 1µPa)	Observed Effect	Reference
Fish and Plankton						
Cod (adults)	Single airguns and arrays, 1,000 – 20,000 cm3	220-240 (estimated)	0.5	226 – 246	Haemorrhaging and eye damage	Kosheleva, 1992
			1.0	220 - 240	No harmful effects	
Cod (adults)	Electrically generated signal in laboratory conditions	Not stated	Not stated	192 – 198	Transient stunning, no subsequent mortalities	Hastings, 1990
Cod (larvae 5 days)	Single airgun	250	1	250	Delamination of the retina	Matishov, 1992
Cod (larvae 2- 110 days)	Single airgun	222	1	222	No injuries detected	Dalen and Knutsen, 1987
			10	202	No injuries detected	
Fish eggs Anchovy	Single airgun	230 dB (estimated)	1	230	7.8% of eggs injured relative to control	Kostyvchenko, 1973
			10	210	No injuries detected	
Fish eggs Red Mullet			1	230	No injuries detected	
			10	210	No injuries detected	
Dungeness	Seven	244	1	233.5	No significant	Pearson *et al.*,

Species	Source	Level (dB re 1µPa @ 1m)	Distance From Source (m)	Exposure Level (dB re 1µPa)	Observed Effect	Reference
crab (larvae)	airgun array	(estimated)	3	230.9	difference in survival rate relative to controls	1994
			10	222.5		
Benthic Species						
Mussel Periwinkles Crab	Single airgun	223 (estimated)	0.5	229	No detectable effect, all three groups continued to function normally after airgun exposure. Monitoring over next 30 days revealed no adverse effects.	Kosheleva, 1992
Sea Urchin	Single airgun	223 (estimated)	2	217	15 % of spines fell off	Matishov, 1992

Disruption to Benthic Invertebrates

Most marine benthic invertebrates, including rock lobster, have poorly developed mechano-sensory systems and would therefore be little affected by seismic survey noise. It has been postulated that shellfish, crustaceans and most other invertebrates can only hear seismic survey sounds at very close range, such as less than 15 m away[2]. This means that only surveys run in very shallow water will have any detrimental effects. The proposed seismic programme will not traverse any such areas and therefore it is unlikely that any benthic invertebrates would suffer any direct negative impacts. Because of the scarcity of data concerning the interaction of scallops and seismic, Roc intends to directly monitor scallops in the seeded area with the assistance of the fishing operators.

Disruption to Planktonic Organisms

Except for larvae, fish eggs and other minute planktonic organisms within a few meters of an air-gun, no planktonic organisms are likely to significantly affected by air-gun array discharges (McCauley, 1994). Data presented in Table 4 indicates that the range of pathological effect on plankton is likely to be restricted to less than approximately 2 m. Calculations show that less than 0.02% of plankton in the area would be effected[3]. Any effect on the plankton of the seismic on planktonic organisms is insignificant compared with the size of the planktonic population in a survey area or natural mortality rates for planktonic organisms.

Disruption to Fish

Studies[4] have shown that fish can be exposed directly to the sound of seismic survey without lethal effects, outside of a very localised range of pathological effects. There is a wide range of susceptibility among fish, however, those with a swimbladder will be more susceptible than those without this organ. Many adult fishes, including the elasmobranchs (sharks and rays) do not possess a swimbladder and so are not susceptible to swimbladder-induced trauma. Most pelagic fish are expected to swim away when seismic noise reaches levels at which it might cause pathological effects, however the presence of many open sea fish near operating vessels suggest that some of these species are hardly affected by the sounds at all.

For some fish, strong 'startle' responses have been observed at sound levels of 200-205 dB re 1µPa, indicating that sounds at or above this level may cause fish to flee. Sound levels of this level are likely to occur approximately 100-300 m from an airgun array. Based on this an approximate range of 200 m is given as the minimum distance at which fish may flee from an operating array and below which

[2].

[3] This assumes; plankton are uniformly distributed, single gun array, 18.75 m shot point interval, maximum range of pathological effect 2m.

[4] For example refer to APPEA (1998). Seismic surveys and the petroleum industry. Independent Scientific Review Committee Internet Database, Fact Sheet 1. Australian Petroleum Production and Exploration Association.

pathological effects may occur (McCauley, 1994). Based on existing information, significant impacts on fish populations resulting from seismic survey noise are likely to be restricted to:

- Short ranges and high sound intensities (ie <200 m range from source);
- Populations that cannot move away from operating arrays (eg shallow water site-attached benthic species);
- Surveys that take place over protracted periods close to areas important for the purposes of feeding, spawning or breeding; and
- Surveys that take place over protracted periods close to areas that constitute narrow restricted migratory paths.

Fish may possibly be exposed to noise levels sufficient to cause startle response or pathological damage if air-gun arrays start suddenly. In circumstances where arrays are already operating (as a vessel moves along an acquisition line), individuals would be expected to implement avoidance measures before entering ranges at which pathological damage might take place. There are no narrow or restricted areas within the permit areas that could 'trap' fish.

Disruption to Cetaceans

Cetaceans employ an extremely acute acoustic sense to monitor their environment and are correspondingly sensitive to sounds below and, to a lesser extent, above the water surface (Richardson *et al*., 1995). Sound waves created from seismic operations, if they are of high enough intensity, may interfere with the acoustic perception and communication of any cetaceans in the vicinity, and may have the potential to induce stress.

Many marine mammals, including whales, often react to man-made noises. Reactions take many forms including avoidance or other behavioural changes (Richardson et al., 1995). The distance at which reactions become evident varies widely, even for a given species and a given human activity (Richardson *et al*., 1995). Baleen whales are sensitive to low and moderate frequency sounds, therefore they would be able to hear and respond to seismic surveys (McCauley, 1994).

A study carried out by McCauley, *et al*. (1998) has recently monitored the effects of seismic survey noise on Humpback Whales in the Exmouth Gulf region of Western Australia. The following conclusions were drawn from this research:

- Only localised avoidance was seen by migrating whales during the seismic operation, indicating that the 'risk factor' associated with the seismic survey was confined to a comparatively short period and small range displacement;
- Coupled with the fact that Humpbacks were seen to be actively utilising the 'sound shadow' near the surface, then it is unlikely that animals will be at any physiological risk unless at very short range from a large air-gun array, perhaps of the order of a few hundred metres; and
- Given these two factors, that displacements to migratory animals are comparatively short in time and involve small ranges and the low chance of physiological effects, then there appears to be a low risk for migratory animals.

Recordings of offset sound levels were taken during the Roc 2002 2D seismic programmes in this area (Jean and Rita surveys). Detailed reports on the sound levels and the observed whale behaviour are currently awaited from the workers contracted (McCauley, Jenner and Burton). Unanalysed field observations suggest that the conclusions set out above also apply to these surveys.
No published information is available about the reactions of any smaller toothed cetaceans (dolphins and porpoises) to seismic noise. Smaller toothed cetaceans have poor hearing in the low frequency range of air-gun array noise (10-300 Hz), so may be able to approach operating seismic vessels closely without adverse behavioural or pathological effects (McCauley, 1994). The hearing capability of larger toothed whales (such as the Killer Whale) is unknown, but it is possible that they can hear better in the lower frequencies than the smaller toothed cetaceans. If this is the case, in lieu of any other information, their reactions to seismic survey vessels may be akin to those of the baleen whales.

4.2.2 Disturbance to Benthic Habitats

Disturbance to benthic habitats from the Vicki 3D MSS is highly unlikely given the depth of water in the survey area and the fact that the survey vessel will not be anchoring during the survey. The only possible activity that could have impacts on benthic habitats would be the accidental loss of equipment that could sink to the seabed as debris.

In the event of damage to or loss of a streamer, potential environmental effects to benthic communities will be limited to physical impacts from the cable and associated equipment sinking to the seafloor. Physical impacts on soft sediment infauna from a lost streamer and associated equipment (such as the 'birds') will be limited, as the gear is not likely to penetrate the substrate to any extent and the sensitivity of the seafloor communities of the area to direct physical disturbance is low. Any damaged/lost equipment would be immediately recovered.

4.3 INTERFERENCE WITH COMMERCIAL FISHING

As identified in Section 3.3, the survey area is utilised by rock lobster fisheries for the duration of the survey. Minor effects on this fishery could result from restriction of access to fishing grounds for the short term that the seismic programme overlaps specific areas.

The Guideline for Seismic Surveys in Western Australian Rock Lobster Fishing Grounds allow for seismic surveys to be conducted in the period being sought where the agreement of local fishing associations can be obtained. Discussions have been initiated with the Geraldton Professional Fishermen's Association, the United Mid West Fishers Association, and the Kalbarri Fishermen's Group. In addition discussions have also been held with the Western Rock Lobster Council in Perth, and Fisheries Western Australia in Geraldton. Discussions are ongoing.

Roc intends to conduct the survey with individual lines running parallel to the SSE to NNW long axis of the block to be covered. The whole area would be divided into six approximately equal sectors with two abutting sectors active at any one time. In one of these sectors the vessel would be heading NNW, in the adjoining one it would return on a SSE heading with turn around sections at each run end. In this way only one third of the total area would be unavailable for fishing at any one time. The survey expects to complete each pair of blocks in about five or six operating days.

Laying of lobster pots within the operational blocks and their associated turning areas would be incompatible with the survey. A deferral of catch from these particular areas would therefore result, but no overall loss of catch is expected to be associated with the survey.

4.4 INTERFERENCE WITH SHIPPING

Shipping in the area slight, however and it is not expected that the short survey will cause any disruption to shipping activity in the region.

4.5 WASTE DISPOSAL

Routine discharges from seismic survey vessels are restricted to sewerage and putrescible wastes (food scraps).

4.5.1 Sewerage and Putrescible Wastes

No sewage or putrescible wastes will be discharged within 12 nautical miles of the coastline or the Houtman Abrolhos unless the vessel has a certified approved sewage treatment plant in place under Regulation 8 (1) (b) of MARPOL 73/78 Annex IV. The discharge of these wastes overboard may cause a slight increase in the nutrient content in the water column however the total nutrient loading from the survey vessel is insignificant in comparison to the natural daily nutrient flux that would occur in the region.

4.5.2 Other Wastes

The survey vessel also produces a variety of other solid and liquid wastes, including packaging and

domestic wastes, such as aluminium cans, bottles, paper and cardboard and hazardous materials such as acids, solvents and toxic wastes. A variety of chemicals, such as lubricating oils and cleaning chemicals, are also stored and used on the survey vessel. All of these materials could potentially impact the marine environment if discharged in significant quantities; however routine procedure will be for all wastes (other than sewage and putrescible food scraps) to be returned for recycling/disposal onshore.

4.6 FUEL AND OIL SPILLS

The potential for spillage of oil or fuel, other than the risk associated with the streamers, is similar to the risk associated with normal maritime activities in the area, such as fishing fleet and general transport activities. Due to the short duration of the project it is not expected that refuelling will be necessary. Any refuelling would occur within Geraldton Harbour under the normal vessel refuelling arrangements established by the Port Authority.

The streamer type to be used contains a hydrocarbon fluid within its core. Approximately 125 litres are contained within each isolated 100 metre section of the streamer. Maximum spills are therefore limited to this volume other than for the extremely unlikely event of more than one section being damaged in an incident. Spills of small volumes of streamer fluid within the survey area are extremely unlikely to persist on the surface for sufficient time to reach any shoreline.

5 ENVIRONMENTAL RISK ASSESSMENT

5.1 METHODOLOGY

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

- Identifies the activity and the environmental aspects associated with it (Section 2);
- Identifies the values/attributes at risk within and adjacent to the survey area (Section 3);
- Defines the potential environmental effects of the activity (Section 4);
- Identifies the likelihood of occurrence and potential consequences (Section 5.2); and
- Determines overall environmental risk levels using a likelihood and consequence matrix (Section 5.3)

The overall method applied is consistent with that described within AS/NZS 4360 however the terminology used for ranking of likelihood and consequence differ slightly in accordance with emerging industry standards. The terminology used in the assessment of likelihood and consequences are defined in the following Sections.

5.2 ASSESSMENT OF LIKELIHOOD OF OCCURRENCE AND ENVIRONMENTAL IMPACT

The likelihood of occurrence for the key potential environmental impacts from the survey (see Section 4) have been estimated based on industry incident reporting. Quantitative probabilities have been determined as the number of occurrences per year.

Table 5: Definitions for Qualitative Assessment of Likelihood and Environmental Effect

	Qualitative Description
Likelihood of Occurrence	
Likely	More than once per year. Includes continuous emissions
Quite Likely	Once every 1 to 10 years. Has occurred frequently
Possible	Once every 10 to 100 years. Has occurred once or twice
Unlikely	Once in every 100-10,000 years. Not likely during project lifetime
Highly Unlikely	Once every 10,000-100,000 years. Has occurred a few times worldwide
Remote	Once in more than 100,000 years. Has almost never occurred, but conceivably could
Category of Effect	
Slight	Possible incidental impacts to flora and fauna in a locally affected environmental setting. No ecological consequences.
Minor	Reduction of the abundance/biomass of flora and fauna in the affected environmental setting. No changes to biodiversity or ecological system.
Moderate	Reduction of abundance/biomass in the affected environmental setting. Limited impact to local biodiversity without loss of pre-incident conditions.
Major	Substantial reduction of abundance/biomass in the affected environmental setting. Recovery to pre-incident conditions within medium term (years).
Massive	Substantial reduction of abundance/biomass in the affected environmental setting. Significant impact to biodiversity and ecological functioning. Eventual recovery of ecological systems possible, but not necessarily to the same pre-incident conditions.
Catastrophic	Irreversible and irrecoverable changes to abundance/biomass in the affected environmental setting. Loss of biodiversity on a regional scale. Loss of ecological functioning with little prospect of recovery to pre-incident conditions.

5.3 OVERALL ENVIRONMENTAL RISK ASSESSEMENT

Table 7 below shows the overall environmental risk assessment matrix (also referred to as an event potential matrix) that compares the likelihood and consequences of key environmental aspects arising

from the survey and assigns a level of risk. Table 8 presents a summary of the assessed level of environmental risk associated with the proposed Vicky 3D MSS.

Table 6: Generic Environmental Risk Assessment Matrix

	LIKELIHOOD					
CONSEQUENCE	**Remote**	**Highly Unlikely**	**Unlikely**	**Possible**	**Quite Likely**	**Likely**
Catastrophic	2	2	2	1	1	1
Massive	3	3	2	2	1	1
Major	3	3	3	2	2	1
Moderate	4	4	3	2	2	2
Minor	4	4	4	3	3	2
Slight	4	4	4	4	3	3

Risk Level 1: Intolerable risk, apply strict precautionary principle

Risk level 2: High risk, apply industry best practise to reduce to ALARP

Risk level 3: Tolerable risk, apply standard cost:benefit approach to reduce risk to ALARP

Risk level 4: Low risk, apply normal business management practise to avoid impact.

Table 7: Summary of Overall Environmental Risk Associated With Vicki 3D MSS

Aspect / Source of Risk	Potential Environmental Effects	Likelihood	Consequence	Environmental Risk Ranking
Interference with commercial fishery activities	Disruption to rock lobster fishing	Likely	Minor	2
Disturbance to marine fauna	Behavioural change and avoidance of noise source	Likely	Minor	2
	Disruption to populations of fish.	Likely	Slight	3
	Disruption to populations of benthic invertebrates (scallops and lobsters)	Unlikely	Slight	4
	Disruption to populations of plankton	Unlikely	Slight	4
Disturbance to benthic habitats	Small localised disturbance to epibiota	Possible	Slight	4
Interference with shipping	Disruption to vessels in the shipping route	Unlikely	Slight	4
Waste disposal	Localised temporary decrease in ambient water quality from discharge of sewage, putrescible waste, chemicals and solid and hazardous wastes	Likely	Slight	3
Fuel and oil spills	Damage to or loss of streamer resulting in loss of fluid	Likely	Slight	3
Fuel and oil spills	Leak from survey vessels fuel tanks, or during at sea refuelling operations	Possible	Minor	2

6 PERFORMANCE OBJECTIVES, STANDARDS AND CRITERIA

Performance objectives, standards and criteria for the Vicky 3D MSS are described in Table 9 below. Project specific performance criteria derived from the operation of the Roc Safety and Environmental Management System requirements, also apply and are to be found in **Appendix D.**

Table 8: Environmental Performance Objectives, Standards and Criteria for the Vicky 3D MSS

Objectives	Standards	Criteria
Minimise disruption to cetaceans	• Roc *Environment Policy* • Environment Australia *Guidelines for Minimising Acoustic Disturbance to Whales* • Environment Australia *Whale and Dolphin Sighting Report* • Any conditions attaching to EA Permit.	• Guidelines in place and adhered to • 'Soft start' procedures • Dedicated observer present onboard to keep watch for whales • Scout vessel used to assist in keeping watch for whales • Flights carried out to search for whales in area of survey operations • Stop work procedures if whales within 3 km • Responsibilities for monitoring and recording • Sighting reports completed and returned to Roc and Environment Australia
Minimise disturbance to benthic habitats	Roc *Environment Policy*	• No anchoring of the vessel will take place during the survey unless in an emergency. • Recording and reporting of all items lost overboard
Minimise interference with commercial fishing	• P(SL)A 1967, Section 124 • Rock Lobster Guidelines	• Operations carried out so that the survey is never operating in areas where lobster fishing is current. • Fishermen advised of survey location in time to redeploy fishing equipment
Minimise interference with shipping traffic	• AMSA requirements • P(SL)A 1967, Section 124	• Written and radio warnings to shipping • Operations carried out in a manner that does not interfere with navigation to a greater extent than is necessary
Minimise effects of sewage discharge	• Roc *Environment Policy* • P(SL)A Schedule 1995, clause 222(4) • MARPOL 73/78 Annex IV • Survey vessel standards for sewage disposal?	• Procedures for treatment and disposal of sewage are in place • Sewage treatment system operational and includes maceration and disinfection • Relevant discharge requirements are adhered to. • Sewage not discharged within 12 nautical miles of the coastline unless vessel has a certified approved sewage treatment plant in place under Regulation 8 (1) (b) of MARPOL 73/78 Annex IV, in which case, sewage must not be discharged within 4 nautical miles of land.
Minimise occurrence of fuel and oil spills	• Roc *Environmental Policy* • MARPOL 73/78 Annex I • AMSA *Marine Notice 6/1995* • P(SL)A Schedule 1995, Clause 220 • P(SL)A Schedule 1995, Clause 285 • Vessel *Oil Spill Contingency Plan*	• Procedures comply with MARPOL 73/78 requirements • MARPOL *Oil Record Book* kept up to date • Fuel spill contingency procedures are in place and operational • Designated containment areas onboard the vessel for storage of oils, greases and streamer fluid • Sufficient spill response equipment on

Objectives	Standards	Criteria
	• Vessel SOPEP (*Shipboard Oil Pollution Emergency Plan*) • Survey vessel oil spill standards	board to respond to foreseeable spill events • Appropriate actions are taken to minimise pollution • Any spills >80 litres are reported to the Designated Authority • Personnel responsibilities are clearly identified
Minimise potential impacts of solid and hazardous wastes	• Roc *Environment Policy* • MARPOL 73/78 Annex V • Survey vessel standards for waste disposal	• Correct segregation of solid and hazardous wastes • A vessel *Waste Log Form* is kept detailing quantities of wastes transported ashore • Procedures comply with MARPOL requirements

7 IMPLEMENTATION STRATEGY

7.1 MANAGEMENT OF ENVIRONMENTAL RISK

To either eliminate potential environmental risks or to reduce them to as low as reasonably practicable, a number of key control and mitigation measures must be implemented. The management actions and strategies for control of the significant environmental risks associated with the proposed survey are described in the following sections.

7.1.1 Management of Disturbance to Marine Fauna

Table 10 summarises the control and mitigation measures that eliminate or reduce any significant environmental impacts on marine life to ALARP levels. The management actions and implementation strategy are discussed further in the following sections.

Table 9: Control and Mitigation Measures to Minimise Marine Fauna Impacts

Sensitive Ecological Values	Control and Mitigation Measures
Cetaceans	The surveys will be operated such that a distance of 3 kilometres is maintained between the towed energy source and any observed whales. This will be achieved through; • Meeting the measures set out in the Environment Australia Guidelines (October 2001) in respect of pre start-up procedures, start-up delay procedures, soft start procedures, visual observation procedures, stop work procedures, and recording and reporting procedures. • Operating daily aerial observation flights on each day that wind and sea conditions allow reliable whale observations. Experience in this area suggests that wind speeds need to be below 15 knots for reliable observations. • Operating a scout boat as part of the seismic spread. • Maintaining a dedicated whale watcher (with appropriate equipment) onboard the seismic vessel for the duration of the surveys.
Fish	The survey will not be operating over critical habitat for feeding, spawning, breeding or migrating fish populations. 'Soft start' of airguns at the start of each line.
Epibenthic Communities	The survey is unlikely to have any significant effects on benthic communities due to the water depth.

The implementation of specific whale monitoring and encounter procedures will be used to minimise the potential for any adverse effects to whales.

The surveys will be operated such that a distance of 3 kilometres is maintained between the towed energy source and any observed whales. This will be achieved through:

1. Meeting the measures set out in within Environment Australia 'Guidelines on the Application of the EPBC Act to Interactions Between Offshore Seismic Operations and Larger Cetaceans, 2001'. The procedures have the following key elements :
   - ***Visual observations*** A visual check for the presence of whales must be made before the commencement of each acquisition line (during daylight hours);
   - ***Delay procedures*** Airgun discharge must not begin unless whales are a minimum distance of three kilometres from the survey vessel,
   - ***Soft start procedures*** A sequential build-up of warning pulses (over a period of 20 minutes) must be made at the start of each acquisition line ('soft start') to warn and deter whales from approaching the survey vessel. 'Soft starts' over a 20 minute period at the start of each new line will also serve to warn and scatter any other free-swimming fauna (ie dolphins, pelagic and demersal fish) in the area, thereby minimising the likelihood of animals being within pathological effects range;

- ***Whale watch*** A continuous watch for whales must be maintained during 'soft start' sequences and during operations to determine the presence or absence of whales within three kilometres of the vessel; and
- ***Stop work procedures*** Airgun array discharge must cease if whales approach within three kilometres, and are moving towards, the vessel. Operations must not recommence until the animals have moved outside a range of three kilometres or have not been seen for twenty minutes.

2. A scout boat will be utilised as part of the seismic spread, to be available to assist with the monitoring of any observed whales and ensure that the 3 kilometre separation distance is observed.

3. Daily aerial observation flights will be made on all days where conditions permit reliable whale observation. Experience in this area suggests that wind speeds need to be below 15 knots for reliable aerial observations.

4. A dedicated independent whale watcher (with appropriate skills, expertise and equipment) will be onboard the seismic vessel for the duration of the survey.

5. Any cetacean sightings during the proposed survey will be recorded on Environment Australia *Whale and Dolphin Sighting Report* sheets (see Appendix C). Copies of these sheets will be sent to the Roc Project Geophysicist during the survey. They will then be forwarded to Environment Australia's Wildlife Management Unit at the end of the survey and made available to interested stakeholders.

7.1.2 Management of Interference With Shipping And Commercial Fishing

Notice of the seismic operation will be sent to AMSA in the usual way.
The control and mitigation measures to eliminate or minimise potential impacts from the proposed survey on commercial fisheries in the WA-325-P and WA-327-P area are;

- To complete a round of discussions with the professional fishermen's associations at Kalbarri(1), Geraldton(2), and Dongara(1) prior to the survey,
- Circulate an advice pamphlet immediately prior to the survey outlining the planned operation and arrangements,
- Retain a local scout boat from the fishing fleet to continually liaise with fishermen in the area,
- Mark with Norwegian buoys the blocks the subject of immediate operations,
- Progressively distribute update pamphlets advising details of progressive operations.
- Liaise with Fisheries Western Australia throughout the seismic programme.

Roc has the benefit of recent experience in operating drilling activities within similar operating lobster fisheries south of the survey area and is confidant that the measures set out will prevent fishing equipment being damaged by the seismic survey equipment.

7.1.3 Management of Disturbance to Benthic Habitat

The survey is unlikely to have any significant effects on benthic communities due to the water depth. The survey vessel and support vessels will not anchor during the duration of the survey unless in an emergency. As a result of the water depths there are unlikely to be any significant effects from discharge of the airgun arrays on the benthic environment. In the event of loss of a streamer or associated equipment (eg paravanes, tail buoys) there is the potential for some limited disturbance of benthic habitats to occur. Wherever possible, streamers and associated equipment are recovered when lost during survey activities.

7.1.4 Management Of Waste

Risks to the marine environmental resources in WA-325-P and WA-327-P area and adjacent areas from disposal of wastes are considered to be negligible given that wastes other than routine sewage and putrescible material discharge will be returned to shore for recycling or disposal.

Sewage and Putrescible Wastes

Sewage and foodscraps disposal must conform to the requirements of MARPOL 73/78 Annex IV and must be macerated to a diameter of less than 25 mm, prior to disposal. No sewage or putrescible

wastes (ground or unground) is to be discharged within 12 nautical miles of any land unless vessel has a certified approved sewage treatment plant in place under Regulation 8 (1) (b) of MARPOL 73/78 Annex IV. No significant environmental impacts are expected because of the biodegradability of the waste, short period of seismic activities and large dilution factor. Total nutrient (nitrogen and phosphorus) input levels will be insignificant compared with natural nutrient flux in the area.

Solid Wastes

No significant environmental impacts are expected as solid wastes will not be discharged to the ocean. All solid wastes, such as packaging and domestic wastes must be segregated into clearly marked containers prior to onshore disposal. In accordance with MARPOL 73/78 regulations, no plastics or plastic products of any kind are to be disposed of overboard. No domestic waste ie. cans, glass, paper or other waste from living areas is to be discharged overboard. No maintenance wastes ie. paint sweepings, rags, deck sweepings, oil soaks, machinery deposits etc., are to be disposed of overboard.

Chemical and Hazardous Wastes

All chemical and hazardous wastes, such as cleaning products, acids, solvents, toxic waste and medical waste, will be segregated into clearly marked containers prior to onshore disposal. No significant environmental impacts are expected as chemical and hazardous wastes will not be discharged to the ocean.

All storage facilities and handling equipment must be segregated in good order and designed in such a way as to prevent and contain any spillages as far as practicable.

7.1.5 Management of Potential Fuel and Oil Spills

The survey vessel will have a specific fuel spill contingency procedures in the unlikely event of a fuel spill and a *Shipboard Oil Pollution Emergency Plan* (SOPEP). Minor spillages will be managed through housekeeping cleanliness and the use of sorbent materials to clean up any spilled fuel or oils.

Any fuel or oil spills must be reported to Roc, all spills of greater than 80 L will be reported to the Designated Authority.

Incineration of any oil sludges onboard, or disposal of any oil sludges/slops in port, must be recorded in the vessel *Oil Record Book* (a requirement under MARPOL 73/78).

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

7.2 ROLES AND RESPONSIBILITIES

The organisation and structure of the seismic survey to be undertaken, including roles and responsibilities for all key personnel onboard the survey vessel, are described in the Contract Plan for the Vicki 3D MSS. All staff and contractors taking part in the survey will be advised of their responsibilities prior to commencement of survey activities. A dedicated induction meeting will ensure all key personnel understand their roles. If contractors personnel do not have appropriate skills to undertake the identified responsibilities training will be provided or they will be replaced with competent personnel.

With regard to the implementation and management of this Environment Plan, the key responsibilities are:

Vessel Master

1. Responsible for the safe execution of all operations of the survey vessel.
2. Overall responsibility for HSE management onboard the vessel, and for ensuring that appropriate control and mitigation measures are implemented to minimise potential environmental effects resulting from vessel operations (eg waste management/disposal, and fuel/oil spill response).
3. Responsible for immediately notifying the Client Site Representative of any

incidents/activities arising from vessel operations that are likely to have a negative impact on the performance objectives detailed in this Environment Plan.

Party Chief

1. Responsible for safe execution of all operations carried out by the seismic crew onboard the survey vessel.
2. Responsible for ensuring that appropriate control and mitigation measures are implemented to minimise potential environmental impacts resulting from seismic acquisition (eg 'soft start' procedures, whale watch and stop work procedures, cetacean recording).
3. Responsible for ensuring compliance with all aspects of HSE reporting and for investigations of all incidents and near misses.
4. Responsible for immediately notifying the Roc Representative of any incidents/activities arising from seismic operations that are likely to have a negative impact on the performance objectives detailed in this Environment Plan.

Roc Onboard Representative

1. Responsible for ensuring that, during the Vicki 3D MSS all sub-contractors perform operations in a manner consistent with the performance objectives and environmental management procedures detailed in this Environment Plan.
2. Responsible for ensuring that the Vessel Master and Party Chief are adhering to the requirements of this Environment Plan.
3. Responsible for keeping himself fully appraised of ongoing operations, particularly for environmentally critical activities.
4. Responsible for immediately alerting the Roc Regional Manager – WA of any changes in operations that could have a negative impact on environmental performance.
5. Responsible for immediately reporting any reportable incidents to the Roc Project Geophysicist.

Roc Regional Manager - WA

1. Responsible for ensuring that the Designated Authority is notified of all reportable incidents in a timely fashion.
2. Responsible for ensuring full briefing all project personnel of the environmental sensitivities of the survey area and environmental management procedures and commitments detailed in this Environment Plan.
3. Responsible for communicating details of the survey programme to relevant Government agencies in advance of operations commencing.

Environmental Advisor

1. Responsible for ensuring survey personnel are aware of their roles and responsibilities, with respect to environmental protection and the requirements of this Environment Plan.

Whale Observer

1. Responsible for maintaining watch for whales during course of the survey and advising Vessel Master of presence of whales.
2. Responsible for monitoring and recording any interactions with cetaceans.

Scout Vessel Operator

1. Responsible for assisting Whale Observer in maintaining watch for whales.
2. Responsible for communication and liaison with any fishing vessels in the area. (Note: Where fishing equipment would interfere with the execution of the seismic survey and the fishermen responsible for the equipment are not prepared to relocate it, then the Scout Vessel Operator will contact the nearest WA Fisheries Officer with a view to assisting that Officer to relocate the equipment as expeditiously as practicable.)

All Roc personnel and contractors in all areas of the Company's activities are responsible for applying the Corporate Environment Policy (Appendix A).

7.3 MONITORING, AUDIT AND REVIEW

The monitoring, audit and review programme for the Vicki 3D MSS will consist of the following actions:

1. The project start-up meeting will include a presentation to review the environmental sensitivities of the survey location, key environmental performance objectives and commitments, as detailed in this Environment Plan.
2. Recording of interactions with commercial fishing vessels/equipment
3. Recording of all cetacean sightings on Environment Australia *Whale and Dolphin Sighting Report* sheets. Copies of these sheets will be provided to Roc Project Geophysicist and will be forwarded to the Wildlife Management Unit of Environment Australia.
4. Total number of environmental incidents (minor spills, streamer loss etc.) and reportable environmental incidents (spills >80 litres) will be recorded.
5. A *Waste Log* will be maintained, detailing the quantities of wastes produced and returned to shore for disposal.
6. A report of the implementation of mitigation and monitoring measures will be prepared at completion of the survey and will be provided to stakeholders on request.

7.4 REPORTING

All incidents that have the potential to cause significant effects on the environment must be reported and investigated according to legislative requirements, survey vessel procedures and the Roc Environmental Policy.

The Designated Authority will be notified of all reportable incidents, according to the requirements of Regulation 26 of the *Petroleum (Submerged Lands)(Management of Environment) Regulations 1999.* Under these regulations, a reportable incident is defined as "*for the operator of an activity, means an incident arising out of operations for the activity that is not within the parameters of the environmental performance standards in the environment plan in force for the activity*". As operator of the survey, Roc has to provide written reports on any reportable incidents to the Designated Authority, and it is the responsibility of the Roc Regional Manager - WA, to comply with this requirement.

All environmental incidents and interference with commercial fishery vessels or equipment will be reported to the Client Site Representative and the Roc Regional Manager - WA within 24 hrs of the incident occurring. The following is a summation of reporting requirements:

1. Roc must be informed within one hour of any incidents involving fuel/oil spill, the loss of streamers/individual streamer sections and spillage of ISOPAR M. If it is determined that these are reportable incidents, under definitions of the P(SL)(MoE) Regulations then Roc must report these to the Designated Authority within 2 hours of the incident occurring (or being detected).
2. Roc is responsible for reporting all spills >80 litres to the Designated Authority the Australian Maritime Safety Authority (AMSA). Any spills greater than 10 tonnes must be reported to Roc within one hour.
3. All oil pollution incidents in Commonwealth waters must be reported to AMSA, under Marine Notice 1/1996. Any spills greater than 10 tonnes in Commonwealth waters must be reported to AMSA within one hour, via the national 24 hour emergency notification contacts:

   Freecall: 1800 641 792
   Fax: (02) 6230 6868
   Telex: +7162349 (computer connected)
   Email: mdo@amsa.gov.au

7.5 CONSULTATION

Ongoing consultation during planning and preparation for the proposed Vicki 3D MSS will involve discussions with the following agencies and stakeholder organisations and individuals:

Geraldton Professional Fishermen's Association
United Midwest Fishers Association
Kalbarri Professional Fishermen's Group
Dongara Professional Fishermen's Association
Western Rock Lobster Association
Western Australian Pelagic Longline Association

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APPENDIX A

Roc Oil Company Environment Policy

Roc Oil Company Limited

Occupational Health, Safety and Environmental Policy

Obligations

ROC recognises its moral and legal responsibility to provide a safe and healthy work environment. This commitment extends to ensuring that Roc's operations do not place the local community at risk of injury, illness or property damage.

Objectives

- provide safe plant and systems of work;
- provide written procedures and instructions to ensure safe systems of work;
- ensure compliance with legislative requirements and current industry standards;
- provide information, instruction, training and supervision to employees, contractors and customers to ensure their safety;
- implement and maintain ROC's safety and environment management system;
- as a priority consider health, safety and environment equally with cost, quality, and production considerations;
- communicate openly;
- commitment to ensuring risks to health, safety and the environment are reduced to ALARP;
- set health, safety and environmental objectives and targets so as to demonstrate continuous improvement; and
- provide support and assistance to employees.

Responsibilities

Each management representative is accountable for implementing this policy in his/her area of responsibility. This will be measured via their annual performance reviews. Management is responsible for:

- the provision and maintenance of the workplace in a safe condition;
- involvement in the development, promotion and implementation of health, safety and environmental polices and procedures;
- training employees in the safe performance of their assigned tasks; and
- the provision of resources to meet the health, safety and environmental commitment.

Employees are to:

- Follow all health, safety and environmental policies and procedures; and
- Report all known or observed hazards to their immediate supervisor or manager.

Application of the Policy

This policy is applicable to ROC in all its operations and functions including those situations where employees are required to work off site.

Consultation

The organisation is committed to consultation and cooperation between management and employees. The organisation will consult with employees in any workplace change that will affect the health and safety of any of its employees.

Policy Authorised by _____ **Chief Executive Officer**

Date 5 July '01

APPENDIX B

EA *Guidelines on the Application of the EPBC Act to Interactions Between Offshore Seismic Operations and Larger Cetaceans*, 2001

http://www.ea.gov.au/epbc/assessmentsapprovals/guidelines/seismic/index.html

APPENDIX C

Environment Australia Whale Sighting Forms

http://www.ea.gov.au/coasts/species/cetaceans/guide-report.html

APPENDIX D

ROC Oil Company Limited

Safety and Environmental Management System Requirements Vicki 3-D Seismic Survey

DATE: FEBRUARY 2003

Doc No.: SEMS-Vicki -1 Rev 0.doc

INTRODUCTION

ROC is operating the project to conduct the Vicki 3D offshore seismic survey in Exploration Permits WA-325 and WA-327 located in Federal waters off the coast of Western Australia in the area around Kalbarri and Geraldton. ROC is operating on behalf of the Joint Ventures in the two Permits. This document sets out the expectations ROC has of the Project Team to manage the project under ROC's Safety and Environment Management System ("SEMS"), to ensure sound health, safety and environmental (**"HSE"**) performance. The requirements are set out in the format of ROC's SEMS Manual. The SEMS Manual should be used to guide implementation of these requirements. Roc's Corporate Health Safety and Environment Committee ("CHSEC") will monitor performance of the Project Team against these expectations.

SEMS OVERVIEW AND MODEL

ROC's SEMS is based on the following principles:

- identification and management of risk;
- employees and contractors to accept responsibility for HSE;
- operate to HSE regulations and safety case and environmental management plan;
- ensure competency / provide training;
- regular audits / action for continuous improvement.

ROC has structured the SEMS on the E&P Forum Model. The core elements are:

1. Leadership and Commitment from the top down
2. HSE Policy and Strategic Objectives
3. Organisation, resources and documentation
4. Hazard Identification and Risk Management
5. Work Procedures; Change Management and Emergency Response
6. A system for Monitoring of work – reporting, investigation and documentation of corrective action
7. Audit and Review of the SEMS

The guidelines and expectations for the Project Team are listed under each element.

ELEMENT 1: MANAGEMENT, LEADERSHIP, COMMITMENT and ACCOUNTABILITY

1. Asset Manager, Project Co-ordinator, and Project HSE Manager (Project Management) will sign off on their awareness of, understanding of and commitment to Roc's Occupational Health, Safety and Environmental ("OHSE") Policy and the SEMS.
2. Project Management to make all team members, contractors and subcontractors aware of the policy and the expectations of them under Roc's SEMS
3. Project HSE progress and plans to be reported to the CHSEC with a detailed review prior to commencement of seismic vessel mobilisation.
4. Project HSE progress to be reported monthly in the Roc Board papers.
5. Maintain active liaison with WADME and the local communities and interests in Kalbarri, Geraldton and Dongara.

ELEMENT 2: OHSE POLICY AND STRATEGIC OBJECTIVES

1. The Policy (see following page) is to be adopted by the Project Team and used to guide decisions and actions associated with the Project, particularly in dealing with and setting expectations for contractors and subcontractors
2. The following HSE Targets are set by the CHSEC for the Project Team to use as a guideline in setting detailed project Targets
    - No Lost Time injuries
    - No significant "near miss" incidents
    - No significant environmental incidents
    - Project implemented according to P(SL)A Safety Regulations
    - Project implemented according to project Environmental Plan and P(SL)A Environmental Regulations
    - Ensure the details of the Environmental Plan are implemented with respect to the terms and conditions of the EPBC whale permit
    - No reasonable cause for complaint from the local fishing industry or the Kalbarri or Geraldton communities on conduct of the project
    - Management of all project risks to as low as reasonably practicable (ALARP)

Roc Oil Company Limited

Occupational Health, Safety and Environmental Policy

Obligations

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- implement and maintain ROC's safety and environment management system;
- as a priority consider health, safety and environment equally with cost, quality, and production considerations;
- communicate openly;
- commitment to ensuring risks to health, safety and the environment are reduced to ALARP;
- set health, safety and environmental objectives and targets so as to demonstrate continuous improvement; and
- provide support and assistance to employees.

Responsibilities

Each management representative is accountable for implementing this policy in his/her area of responsibility. This will be measured via their annual performance reviews. Management is responsible for:

- the provision and maintenance of the workplace in a safe condition;
- involvement in the development, promotion and implementation of health, safety and environmental polices and procedures;
- training employees in the safe performance of their assigned tasks; and
- the provision of resources to meet the health, safety and environmental commitment.

Employees are to:

- Follow all health, safety and environmental policies and procedures; and
- Report all known or observed hazards to their immediate supervisor or manager.

Application of the Policy

This policy is applicable to ROC in all its operations and functions including those situations where employees are required to work off site.

Consultation

The organisation is committed to consultation and cooperation between management and employees. The organisation will consult with employees in any workplace change that will affect the health and safety of any of its employees.

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Date 5 July '01

ELEMENT 3: ORGANISATION AND RESOURCES; 3RD PARTY SERVICES; INFORMATION / DOCUMENTATION

a) Organisation and Resources

1. Broad HSE roles, responsibilities and authorities for the Project Team are set out below:

Role	Key SEMS Responsibilities
Roc Regional Manager WA	• **Ensure project objectives are met in a safe and environmentally responsible manner** • **Ensure implementation of these SEMS requirements in the North Perth Basin 2-D Seismic Surveys project** • **Oversee project HSE risk assessment and management** • **Supervise the ROC representative on site** • **Ensure contractor / subcontractor awareness and compliance with Roc SEMS, Environmental Plan, the terms and conditions of the whale permit and other relevant Government Regulations**
Project HSE Manager	• **Develop project Safety and Environmental documentation for government approval and implementation** • **Performance monitoring and review of project health, safety and environmental compliance and performance;**
Legal Counsel	• **Ensure awareness of regulations (through HSE Manager)** • **Legal services and overview of the Project from a HSE Legal perspective;** • **Ensure consideration of health, safety and environmental component into goods and services contracting and procurement.**
On-site Representative	• **Ensure on-site HSE management is delivered according to all requirements and undertakings under this document , the seismic contract and the relevant permits and regulations**
Employees and Contractors	• **Must take reasonable care to protect themselves and others in the workplace including reporting of hazards and incidents;** • **Principal contractors must operate according to the Environmental Plan and according to Regulations** • **Subcontractors must understand and work according to Roc's SEMS** • **Cooperate with employers; and** • **Use safe work practices and personal protective equipment.**

3. Develop and publish an organization chart to describe work and reporting relationships (Roc and Contractors)

4. Develop and implement induction arrangements covering new team members and contract employees. Ensure a mechanism for ongoing communication of HSE issues and initiatives to team members and employees.
5. Develop procedure for communication of HSE and other work issues between Contractors and Roc.

b) Management of Third Party Services

Management of Contractors

1. Ensure contractors are covered by a contract with an appropriate OHSE annexure.
2. Sign off that providers of third party services are qualified and capable of to performing the work on the project under the contracts
3. Review safety management systems adopted by providers of third party services and ensure they are appropriate for ROC's standards

ELEMENT 4: HAZARD ID AND RISK MANAGEMENT

1. Ensure the seismic contractor has performed and documented a risk assessment for all activities associated with the project, incorporating an hazard identification process

ELEMENT 5: PLANNING AND CONDUCT OF WORK

a) Change Management Control

b) Emergency Response

a) Change Management

1. Review the Change Management Procedures for the Principal Contractor
2. Ensure contractors are fully briefed and committed to the particular safety and environmental issues associated with the operations and the Environmental Plan provisions in place to manage these issues

c) Emergency Response Management

1. Ensure bridging between the Project Emergency Response Plan and Roc's Corporate Emergency Response Procedures

ELEMENT 6: SYSTEM IMPLEMENTATION AND MONITORING; INCIDENT REPORTING AND INVESTIGATION

1. Ensure the seismic contractor's incident reporting and investigation procedure for the project is consistent with the Roc system. The procedure requires a mechanism to ensure Corrective Actions are implemented and reported
2. Ensure a mechanism for incidents to be reported to the ROC CHSEC

ELEMENT 7: AUDIT AND REVIEW

1. Review the recent independent audit of the seismic contractor's vessel and ensure appropriate responses are in hand