



Eni Timor Leste

3D SEISMIC SURVEY ENVIRONMENTAL MANAGEMENT PLAN



Geco Eagle with 3D seismic array deployed

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<p>Eni Timor Leste</p> <p>3D SEISMIC SURVEY</p> <p>ENVIRONMENTAL MANAGEMENT PLAN</p>					
Abstract:					
<p>Eni Timor Leste SpA (Eni) plans to undertake a three-dimensional (3D) Marine Seismic Survey (MSS) in Production Sharing Contract (PSC) Blocks S06-02, S06-03, S06-04 and S06-05 in the Timor Sea off the south coast of Timor-Leste. This Environmental Management Plan (EMP) is submitted to the Government of Timor-Leste, through the National Directorate of Environmental Services (DNSMA), in accordance with the terms of the PSCs between the Government of Timor-Leste and Eni. The EMP describes the MSS and the marine environment of the survey area, and determines environmental risks and mitigation measures allowing the setting of environmental performance objectives, standards and criteria.</p>					
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ABBREVIATIONS

2D	Two-dimensional
3D	Three-dimensional
ALARP	As Low As Reasonably Practicable
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
BOM	Bureau of Meteorology, Australia
DEW	Department of the Environment and Water Resources, Australia
DNPG	Direcção Nacional de Petróleo e Gas (National Directorate of Oil and Gas), Timor-Leste
DNSMA	Direcção Nacional dos Serviços do Meio Ambiente (National Directorate of Environmental Services), Timor-Leste
DNPA	Direcção Nacional de Pescas e Aquicultura (National Directorate of Fisheries and Aquaculture), Timor-Leste
E&P	Exploration and Production
EEZ	Exclusive Economic Zone
Eni	Eni Timor Leste SpA
EMP	Environmental Management Plan
ERA	Environmental Risk Assessment
ERP	Emergency Response Plan
FPSO	Floating Production, Storage and Offloading (vessel)
HAZID	Hazard Identification
HSEQ	Health, Safety, Environment and Quality
IRC	International Risk Consultants
IUCN	International Union for Conservation of Nature
JHA	Job Hazard Analysis
JPDA	Joint Petroleum Development Area
JSA	Job Safety Analysis
MARPOL 73/78	<i>International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto</i>
MOU74	<i>Memorandum of Understanding between the Governments of Australia and the Government of the Republic of Indonesia regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Exclusive Fishing Zone and Continental Shelf, 1974</i>



MSDS	Material Safety Data Sheet
MSS	Marine Seismic Survey
MZA	<i>Maritime Zones Act 2002</i> , Government of Timor-Leste
PSC	Production Sharing Contract
Ramsar Convention	<i>The Convention on Wetlands of International Importance especially as Waterfowl Habitat</i> , Ramsar, Iran, 1971
SOPEP	Shipboard Oil Pollution Emergency Plan
TBA	To Be Advised
TSDA	Timor Sea Designated Authority
UN	United Nations
UNCLOS	<i>United Nations Convention on the Law Of the Sea 1982</i>
UNEP	United Nations Environment Programme
WCMC	World Conservation Monitoring Centre, UNEP

Units of measurement

°C	degree Celsius
BLPD	Barrels of Liquid Per Day (42 US gallons liquid per day) (168 L/d)
d	day
dB	decibel
in ³	cubic inch
km	kilometre
km ²	square kilometres
km/h	kilometres per hour
L	litre
L/d	litres per day
m	metre
m ³	cubic metre
m/s	metres per second
nm	nautical mile
psi	pounds per square inch
t	tonne
t/y	tonnes per year
y	year
µg/L	micrograms per litre
µPa	Micro Pascal



EXECUTIVE SUMMARY

Eni Timor Leste SpA (Eni) has been awarded a number of Production Sharing Contracts (S06-01, S06-02, S06-03, S06-04 and S06-05) by the Government of Timor-Leste which allows Eni to conduct a range of scheduled petroleum exploration activities. Eni is planning an offshore three-dimensional (3D) Marine Seismic Survey (MSS) commencing June 2007 for 11 months. The survey will be conducted by WesternGeco (the seismic survey contractor) using the *Geco Eagle*.

This Environmental Management Plan (EMP) is submitted to the National Directorate of Environmental Services (DNSMA) as the designated authority for environmental assessment. It is based on best practice standards and is compliant with Timor-Leste laws, regulations and guidelines. All aspects of the Eni 3D MSS will be managed to comply with Eni's Health, Safety, Environment and Quality (HSEQ) Policy.

The scope of the EMP is all operational activities relating to the 3D MSS in the PSC Blocks. The EMP describes:

- the activities of the MSS and the environment in the vicinity of the MSS area;
- the potential environmental effects, risks and measures designed to minimise and/or mitigate actual and potential risks of the MSS;
- Eni's Environmental Performance Objectives, Standards and Criteria for the MSS; and
- the management measures and strategies to be used in implementing the best practice requirements and commitments made in the EMP.

The environment in the vicinity of the Eni 3D MSS is essentially tropical with mangroves, coral reefs and other deeper water marine communities present. The marine fauna includes whale, dolphin, turtle, bird, fish and other species with several of these protected by international treaties or legislation.

An environmental risk analysis was conducted to identify potential environmental hazards from the Eni 3D MSS activities. There were 26 risks identified, with no High risks, 17 Medium and 9 Low risks. The potential risks are related to mobilisation, survey operations and the potential for accidental discharges.

Eni's performance objectives, relevant standards, and criteria to measure its performance are outlined in this EMP.

Eni's environmental management strategies and procedures to be used for the Eni 3D MSS include responsibilities, training, reporting frameworks, mitigation and response activities and monitoring and auditing procedures. Commitments associated with these, listed in Table ES.1, will be used to reduce environmental risk to as low as reasonably possible (ALARP) and to ensure that environmental performance criteria are met. Responsibility for implementation of the strategies and procedures is clearly defined in the EMP with Eni and WesternGeco individual responsibilities listed.



Table ES.1: Commitments Checklist

Item	Topic	Management Action	Actionee	Target Date
1	Waste segregation	Waste segregated on the seismic and support vessels into clearly marked bins for appropriate disposal.	Eni and WesternGeco	Throughout survey
2	Refuelling times	The vessels will undertake at sea refuelling in daylight hours, suitable weather and steady sea-state conditions using Eni approved procedures.	Eni, WesternGeco and supply contractors	Throughout survey
3	Deck drainage	Used lubricants stored aboard the vessels for onshore disposal. Wastes not to be discharged via deck drains.	WesternGeco and supply contractors	Throughout survey
4	Fuel usage	Engines will be well maintained to maximise fuel efficiency.	WesternGeco and supply contractors	Throughout survey
5	Hazardous materials disposal	Choose the most environmentally acceptable materials where possible. No disposal of hazardous wastes in Timor-Leste	WesternGeco and supply contractors	Throughout survey
6	Spills >80L	All vessels have accepted reporting and recording procedures. Ensure that the vessels and equipment are well maintained. Ensure that Shipboard Oil Pollution Emergency Plan (SOPEP) is available and followed in a spill. Record all incidents and report to DNSMA all spills >80L.	Eni, WesternGeco and supply contractors	
7	Vessel Collision	Ensure that Timor-Leste and Australian Authorities are notified in advance of proposed activity. Record all incidents and report to DNSMA.	Eni	Throughout survey
8	Environmental Awareness of Crew	Conduct environmental inductions prior to mobilisation to maximise awareness of both crew shifts. Ensure crew of both the support observation vessel and the <i>Geco Eagle</i> are trained in marine mammal identification, behaviour and reporting by a marine mammal expert.	Eni	Prior to and during survey
9	Introduced pests	Flush ballast water prior to entering the survey area. Conduct hull inspection prior to entering the survey area.	Eni, WesternGeco and supply contractors	Prior to mobilisation
10	Environmental legislation review	Monitor, review and update list of relevant legislation.	Eni	Ongoing
11	Coral reefs/ intertidal habitats	Ensure detailed bathymetric maps are available and consulted. Ensure a 500 m exclusion zone is observed between any part of the <i>Geco Eagle</i> or its streamers and any coral reef or intertidal shoal.	Eni and WesternGeco	Throughout survey



Item	Topic	Management Action	Actionee	Target Date
12	Cetacean interactions	<p>Ensure that the <i>APPEA Code of Environmental Practice 1996</i> requirements for reporting cetacean sightings are followed.</p> <p>Ensure a support observation vessel is present during the survey, with a specific role of observing and recording marine mammal movements.</p> <p>Ensure crew of both the support observation vessel and the <i>Geco Eagle</i> are trained in marine mammal identification, behaviour and reporting by a marine mammal expert, onboard for two days.</p> <p>Ensure all marine mammal observations are logged, with logsheets sent to DNSMA on a weekly basis. A heightened observation period for marine mammals will exist between September and November.</p> <p>Ensure soft start procedures are followed: a sequential build-up of warning pulses over a period of 20 minutes made at the start of each acquisition line to warn and deter cetaceans from approaching.</p> <p>Ensure a 2 km "heightened awareness zone" around the <i>Geco Eagle</i> and its seismic arrays. In the event of observed cetacean distress, the seismic arrays will power down. If there are no signs of distress, a 1 km cetacean exclusion zone will apply.</p> <p>In the event of three or more power-downs per day for large baleen whales (humpbacks, blues or southern rights), demonstrate a low risk of encountering whales during night time operations through enhanced support vessel observations 5km ahead of the <i>Geco Eagle's</i> course.</p>	Eni and WesternGeco	Throughout survey
13	Fishing vessel interaction	<p>Ensure a support observation vessel is present during the survey, with a specific role of liaising with fishing vessels ahead of the <i>Geco Eagle's</i> course.</p>	Eni and WesternGeco	
14	Audits	<p>Conduct HSE audits of the <i>Geco Eagle</i> prior to the vessel entering the survey area, and at three, six and nine months into the survey. Audits at three, six and nine months will be observed/assisted by DNSMA personnel.</p> <p>Make available to DNSMA all audit reports and non-conformance reports.</p> <p>Allow DNSMA to observe <i>Crest Supply 1</i> vessel practices when in port in Dili.</p>	Eni, WesternGeco and DNSMA	Prior to and during survey
15	Communications with DNSMA	<p>Submit a weekly report to DNSMA by <i>Geco Eagle</i> Vessel Master, showing the seismic array's actual course for the previous week and predicted course for the forthcoming week.</p> <p>Supply daily GPS coordinates of the <i>Geco Eagle</i> to DNSMA if required.</p>	WesternGeco	Throughout survey



1. INTRODUCTION

1.1 BACKGROUND INFORMATION

Eni Timor Leste SpA (Eni) has been awarded Production Sharing Contracts (PSC) by the Government of Timor-Leste to develop petroleum operations in designated Contract Areas. Eni is planning to undertake an offshore three-dimensional (3D) marine seismic survey (MSS), known as the "Albacora" survey, in PSC Blocks S06-02 (B), S06-03 (C), S06-04 (E) and S06-05 (H) off the south coast of Timor-Leste in the Timor Sea.

1.2 THE PROPONENT

Eni is one of the world's major integrated energy companies. Regionally, Eni has operations in the Joint Petroleum Development Area (JPDA) south east of Timor-Leste through a 12.04% joint venture partnership in the Bayu-Undan gas/condensate field. Deliveries from the field commenced in February 2006.

Eni is committed to achieving the highest practicable standard of environmental protection and this commitment is documented in the Eni Health, Safety, Environment and Quality (HSEQ) Policy (Appendix A). All aspects of the Eni 3D MSS will be managed to comply with this Policy. Key features of Eni's HSEQ Policy are:

- the commitment of senior management to meeting or exceeding industry standards and legislative requirements;
- assigning high priority to environmental issues;
- committing to the continuous improvement of environmental performance; and
- integrating environmental protection into all aspects of operations and ensuring involvement of employees and contractors.

1.3 SCOPE AND OBJECTIVES OF THIS EMP

The scope of this EMP is all operational activities relating to the offshore 3D MSS, including the use of supply vessels. The overall aim of this EMP is to demonstrate to the Government of Timor-Leste, through its designated authority, the National Directorate of Environmental Services (DNSMA), that Eni have implemented safeguards to reduce potential environmental risks to as low as reasonably practicable (ALARP).

This EMP has been prepared for submission to DNSMA, in accordance with the terms of the PSC between the Government of Timor-Leste and Eni.

The objectives of this EMP are to:

- provide a description of the proposed activity (Section 2);



- describe the environment in the area of the proposed activity (Section 3);
- indicate the potential environmental risks of with the proposed activity and measures designed to minimise and/or mitigate actual and potential risks (Section 5);
- outline Eni's Environmental Performance Objectives, Standards and Criteria for the proposed activity (Section 6); and
- describe the management measures and strategies to be used in implementing the best practice requirements and commitments made in this EMP (Section 7).

1.4 EXTERNAL CONSULTATION

External consultation was initiated in 2006 through the identification of key stakeholders with an interest in the Timor-Leste offshore MSS project. Consultation was undertaken with:

- DNSMA on 12 December 2006;
- National Directorate of Oil and Gas (DNPG) (formerly Oil, Gas and Energy Directorate) on 12 December 2006;
- National Directorate of Fisheries and Aquaculture (DNPA) on 13 December 2006; and
- Timor Sea Designated Authority (TSDA) on 13 December 2006.

This document was submitted as a Draft (Rev. 0) to DNSMA on 17 May 2007, with copies distributed to the stakeholders above. A two-week public comment period was held between 22 May and 4 June 2007, when the Draft (Rev. 0) document was available on the DNPG's website. Comments from the Government Directorates and stakeholders during the public comment period have been addressed in this revised EMP (Rev. 1).

1.5 RELEVANT ENVIRONMENTAL LEGISLATION

DNSMA is the designated authority to assess and approve this EMP under Timor-Leste law and has developed guidelines relating to EMP development which were applied in the preparation of this document. Specific environmental regulations for the offshore petroleum industry in Timor-Leste are currently under development. Industry best practice guidelines and international agreements, such as the *Petroleum Mining Code* (Article 7) of the *Timor Sea Treaty*, were used to guide this document.

Under the Timor-Leste constitution, Indonesian laws in effect on 25 October 1999 are applicable in the absence of Timor-Leste laws, and thus a number of Indonesian environmental laws are applicable to the Eni 3D MSS program.

Table 1.1 highlights the most significant legislation, agreements and codes of practice relevant to this project. Eni will review the environmental legislation database when significant environmental legislation changes occur.



Table 1.1: Legislation, Agreements and Codes of Practice Relevant to the Albacora 3D MSS.

Democratic Republic of Timor-Leste Legislation and Regulations
<i>Maritime Zones Act 2002 (MZA).</i> This Act claims for Timor-Leste its Exclusive Economic Zone (EEZ) and seabed (continental shelf) entitlement extending 200 nautical miles (nm) from Timor-Leste's coast, pending an agreement on boundaries with Australia and Indonesia. The MZA is based on international law, notably the 1982 United Nations Convention on the Law of the Sea (UNCLOS).
<i>Timor-Leste Petroleum Act 2004.</i>
<i>DNSMA Guideline #5 on Public Engagement</i>
<i>DNSMA Guideline #6 on Environmental Screening</i>
<i>DNSMA Guideline #7 on Preparation of an Environmental Management Plan</i>
Indonesian Legislation and Regulations in effect on 25 October 1999
<i>Law 23/1997 on Environmental Management</i>
<i>Reg. 20/1990 on Control of Water Pollution</i>
<i>Reg. 51/1993 on Environmental Impact Assessment</i>
International Agreements
<i>Timor Sea Treaty 2002.</i>
<i>Petroleum Mining Code, Article 7, Timor Sea Treaty 2002</i>
<i>United Nations Convention on the Law of the Sea 1982 (UNCLOS).</i>
<i>Convention on the Conservation of Migratory Species of Wild Animals 1979 (commonly known as the Bonn Convention).</i>
<i>International Convention on Civil Liability for Oil Pollution Damage 1969.</i>
<i>International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971.</i>
<i>International Convention on Oil Pollution Preparedness, Response and Co-operation 1990.</i>
<i>Convention on Biological Diversity 1992.</i>
<i>International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (commonly known as MARPOL 73/78).</i>
<i>Protocol to International Convention for the Prevention of Marine Pollution by Dumping of Waste and Other Matter 1972 (commonly known as the 1996 Protocol).</i>
<i>The Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar, Iran, 1971 (commonly referred to as the Ramsar Convention).</i>
Codes of Environmental Practice
<i>APPEA Code of Environmental Practice 1996:</i> This provides guidance on recommended minimum standards for petroleum industry activities offshore. These standards are aimed at minimising adverse impacts on the environment and ensuring public health and safety by using best practical technologies available.
<i>Management Guidelines for Seismic Vessels Operating in Australian Waters so as to Avoid or Minimise Interference with Whales and Certain Other Larger Cetaceans 2001.</i> Produced by the Australian Government's Department of the Environment and Water Resources (DEW), this details procedures that should be followed by all seismic vessels operating in Australian waters so as to avoid interference with marine mammals.

2. DESCRIPTION OF ACTIVITIES

2.1 OVERVIEW OF SEISMIC SURVEYS

In marine seismic surveying, energy waves are directed at the sea floor and underlying geological strata to various depths – from several hundred to several thousand metres underground (APPEA 2005). The energy waves are reflected and refracted off the different substrata and recorded for processing and interpretation. The data collected from seismic surveys is interpreted to identify structures likely to contain petroleum hydrocarbons.

The energy waves are in the form of low frequency and high intensity sound waves. For this MSS, they are generated by air gun arrays, producing a pulse by rapidly releasing a volume of compressed air. Airguns are typically discharged every 6 to 20 seconds with a duration of 10 to 30 milliseconds. Airguns are placed in arrays and towed behind the survey vessel (Figure 2.1). The reflected signals are recorded by sound detection recorders (hydrophones) embedded in a hydrophone streamer or cable, typically 4 to 7 km in length (URS 2001). The streamers are towed behind the survey vessel at predetermined depths of 5 m to 12 m below the surface. The streamers maintain buoyancy through either solid buoyancy devices or kerosene (URS 2001).

3D seismic surveys capture and process data of multiple slices of substrate at any one time. Airguns are arranged into either single or multiple array sources with multiple hydrophone streamers towed behind the vessel (McCauley 1994). In Australia and Asia, 3D seismic ships typically tow 6 to 10 streamers, at about 50 m to 100 m spacing, with each traverse typically being 300 m to 500 m apart.

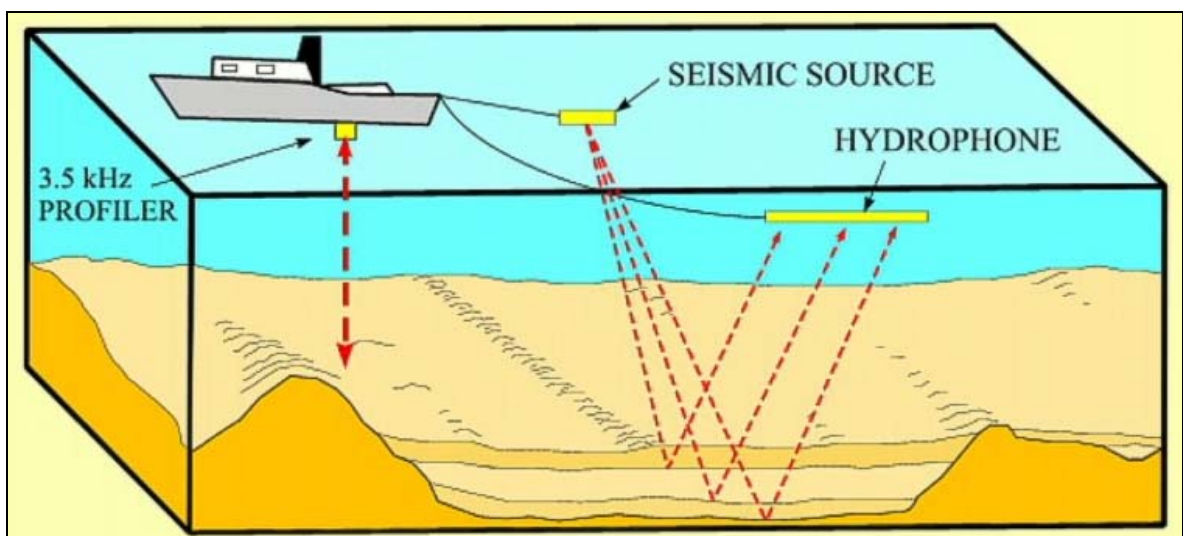


Figure 2.1: Seismic exploration techniques

2.2 PROJECT LOCATION AND WORK PROGRAM

The Eni 3D MSS will be conducted in the PSC Blocks S06-02 (B), S06-03 (C), S06-04 (E) and S06-05 (H), which are located in Timor-Leste territorial waters in depths ranging from approximately 200 m to over 2000 m (Figure 2.2). Eni proposes to conduct the 3D MSS from June 2007 for approximately 11 months.

During the seismic survey, a temporary safety exclusion zone will be declared, with a radius of 500 m in front of the vessel and from the vertices of its streamers in tow.

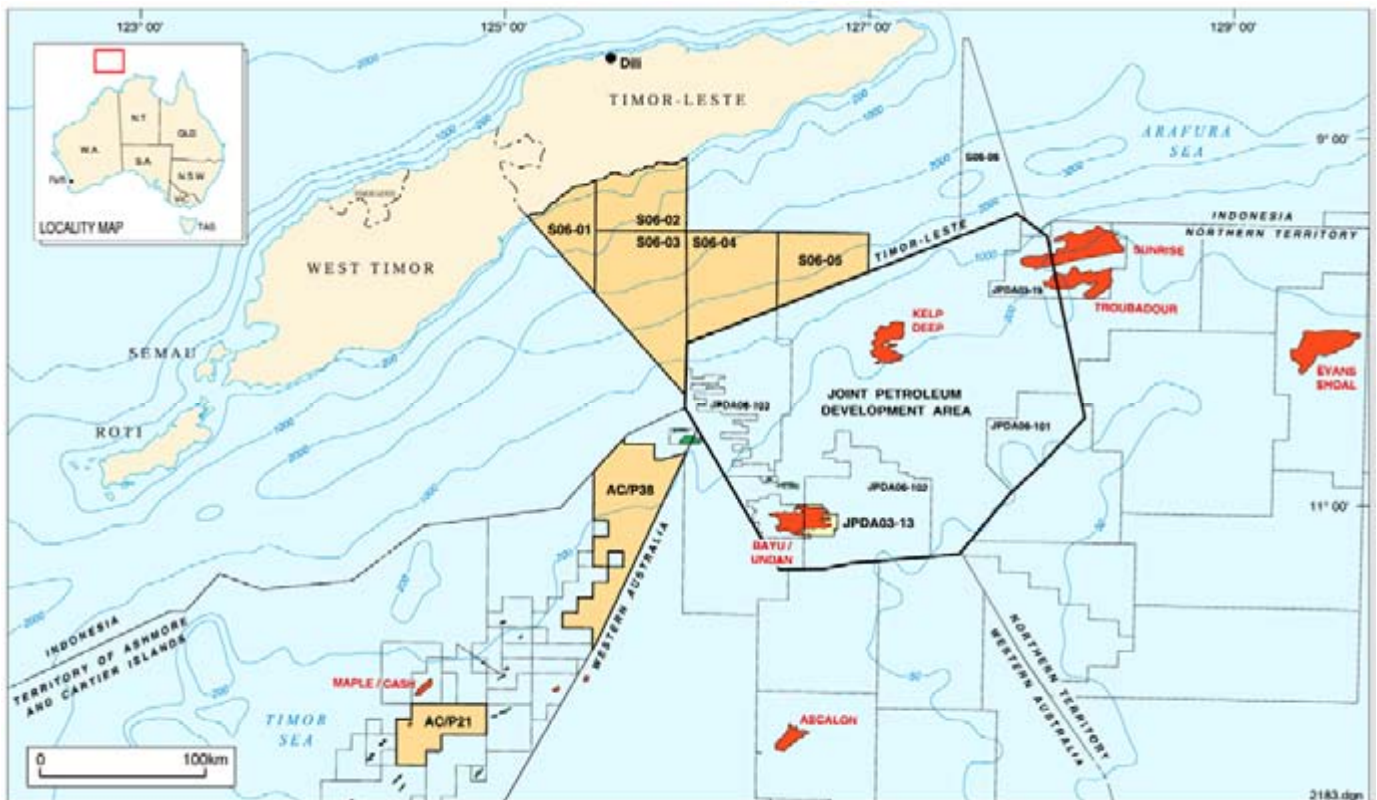


Figure 2.2: PSC Blocks location map

The proposed Eni 3D MSS will be conducted by the seismic survey contractor WesternGeco using the vessel *Geco Eagle*. Built in 1999, the *Geco Eagle* is 94.8 m in length and is equipped with a helideck for helicopter support. The survey will utilise dual 3,147 in³ air-gun arrays with an operating pressure of approximately 2,000 psi. Ten receiver streamer cables will extend 6,000 m behind the vessel and be towed at 7m below the sea surface. The maximum sonic emission will be 10.1 MPa, 260 db re 1 µPa at 1 m.

The air-guns will be discharged at 25 m intervals, alternating between starboard and port gun arrays, along grid-lines running approximately northeast-southwest and northwest-southeast. The proposed acquisition areas are shown in Figure 2.3 and the work program



is detailed in Table 2.1. Acquisition will be undertaken on a 24 hour per day basis and 3D data will be acquired at an average rate of 25 km² per day.

Table 2.1: Proposed Work Program - Albacora 3D Seismic Survey

Work area	Area	PSC Blocks	Duration (approximate)	Timing (approximate)
Priority Area	2742 km ²	S06-03 (C), S06-04 (E) and 3 nm buffer zone	110 days	June - October 2007
Secondary Area	4859 km ²	S06-03 (C), S06-02 (B) and S06-04 (E)	194 days	October 2007 - April 2008
Third Area	801 km ²	S06-05 (H)	32 days	April - May 2008

The north-western boundary of the MSS's Secondary Area is the shallowest part of the survey (200 m water depth) and the closest to the coast (approximately 9.5 km from the shoreline). During the MSS the *Geco Eagle* and its steamers will get closer to the coast – to around 3 to 4 km, given that a further 3 km trajectory will be required to get full-fold coverage, and the turning circle of the vessel and its streamers is 2.5 km. This will take the *Geco Eagle* and streamers into water depths of approximately 100 m. Detailed bathymetric charts will be available to the vessel master and an exclusion zone of 500 m will be in place between any part of the *Geco Eagle* or its streamers and any coral reef or intertidal shoal.

The *Geco Eagle* operates on Marine Gas Oil (diesel) which produces lower greenhouse gas emissions compared with traditional Heavy Fuel Oil. The vessel will arrive at the planned MSS area at full fuel capacity (3414 m³) and will be required to refuel at sea approximately every two weeks during the planned offshore Eni 3D MSS. Potential spills will be managed under the vessel's Shipboard Oil Pollution Emergency Plan (SOPEP).

The *Geco Eagle* will be supported by two vessels during the seismic survey. The *Crest Supply 1*, a 45 m vessel from Strato Maritime Services Pte Ltd, will operate out of Darwin and Dili supplying fuel and other necessities to the MSS operations. In addition, a dedicated support observation vessel will travel with the *Geco Eagle* during the survey, providing dedicated observation of marine mammals and liaison with fishing vessels in the area. Helicopters will be used for crew change and emergency support for the *Geco Eagle*. Eni staff will mobilise from the company's Australian offices in Perth and Darwin.

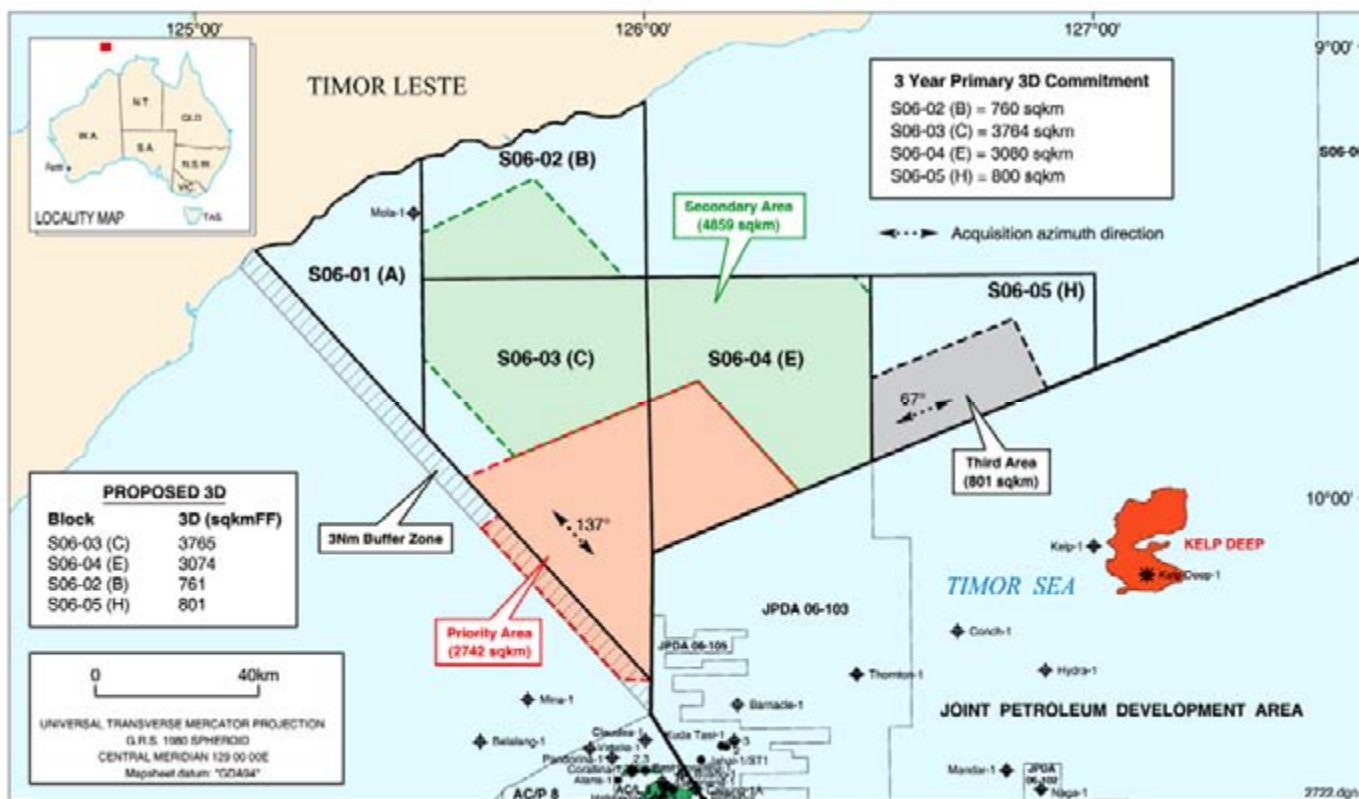


Figure 2.3: Acquisition Areas of Eni’s Proposed Albacora 3D MSS



3. DESCRIPTION OF ENVIRONMENT

3.1 CLIMATE

Timor-Leste has two annual seasons and three climatic zones which are the result of monsoon activity. The two distinct seasons are the Northwest Monsoon (wet season) from November to May and the Southeast Monsoon (dry season) from April to September with brief transitional periods in between (Timor-Leste 2006).

High rainfall is associated with the Northwest Monsoon and low rainfall with the Southeast Monsoon. Heavy rainfalls are also associated with tropical cyclones and thunderstorm activity. Mean annual rainfall for the Timor Sea region is 1770 mm (Heyward et al. 1997).

Mean air temperatures recorded at the Jabiru Floating Production, Storage and Offloading (FPSO) vessel, approximately 180 nm south of Timor-Leste in the Timor Sea, are 24.9°C in July and 29.6°C in December (URS 2002).

3.2 WINDS

Winter in the region is characterised by steady easterly and south-easterly winds of 5 to 12 m/s (the south-east trade winds). The summer is characterised by the north-west monsoon, a steady moist west-south-west to north-west wind reaching speeds of 5 m/s for periods of 5 to 10 days (SKM 2001).

Surface winds in the region, during the September/October transition season possess a westerly component, will be light and frequently less than 5 m/s and during the March/April transition season south-easterly shifting to easterly by the end of April.

The majority of cyclones occur in the region between January and March, with the most severe cyclones most often occurring in the months December to April (SKM 2001). Most (75%) of these cyclones are not fully mature, having an estimated wind speed of less than 80 km/h. Severe cyclones, with wind speeds exceeding 100 km/h occur, on average, once every 2.6 years (Heyward et al. 1997).

3.3 OCEANOGRAPHY

3.3.1 Tides

Tides in the Echo Shoals area (approximately 50 km to the south of the Eni 3D MSS area), are semidiurnal, with a typical tidal range of 4 m at springs and 1.8 m at neaps (Australian National Tide Tables - Echo Shoals). Tidal transformations for the Laminaria FPSO facility, to the south-east of the Eni 3D MSS, indicate a 10% increase in amplitude, and a phase-lead of 40 minutes (Heyward et al. 1997).



3.3.2 Tidal and Non-tidal currents

The tidal currents in the Echo Shoals area are expected to flow east-north-east, and ebb west-south-west, in the upper 100 m of the water column, while flooding southeast, and ebbing west-north-west in the lower portion of the water column. Tidal current speeds in the order of 0.6 m/s (springs), and 0.2 m/s (neaps) are anticipated for the region (Heyward et al. 1997). The tidal currents are influenced by wind driven currents.

The Timor Sea region is influenced by the Pacific-Indian Ocean Throughflow. This produces a current moving at a rate of between 0.1 and 0.4 m/s throughout the year in the Timor Sea between Timor-Leste and northern Australia (Molcard et al. 1996).

3.3.3 Water temperatures

Seawater temperatures in the Timor Sea region range from 25°C – 31°C at the surface and 22 °C – 25°C below 150 m (OMV 2003) and down to 10°C at the seafloor (Heyward et al. 1997).

3.4 BIOLOGICAL ENVIRONMENT

3.4.1 Marine Protected Areas

The nearest currently declared marine conservation zones or marine protected areas to the offshore Eni 3D MSS area are: Jaco Island Marine Park, at the eastern end of Timor-Leste (approximately 130 km north-east); the Australian Ashmore Reef National Nature Reserve (approximately 370 km south-west); and the Indonesian Teluk Kupang/Pulau Kera Marine Recreation Park (approximately 220 km west) (SKM 2001). All are considered to be too far away to be impacted by the survey activities.

3.4.2 Regional Overview

Physical, biological and environmental data for the marine and coastal environment in Timor-Leste is very scarce (Sandlund et al. 2001) hence referral has to be made to isolated or more general studies.

The marine fauna of the Timor Sea is part of the Indo-West Pacific biogeographical province (Figure 3.1). The majority of species are widely distributed in this region (Wilson & Allen 1987). Timor-Leste has been identified as part of the Wallacea region (relating mainly to the terrestrial environment) in Southeast Asia which has been identified as a biodiversity “hotspot” (CI 2007). The most ecologically important marine habitats in the Timor Sea region, in terms of biodiversity and productivity can be grouped into:

- the various submerged banks or shoals on the northern Australian continental shelf and shelf slope;
- the coastal intertidal coral reefs and shallow (20 to 30m) reefs; and

- the mangrove and seagrass areas located along the Timor and northern Australian coast and islands (Sandlund et al. 2001; SKM 2001).

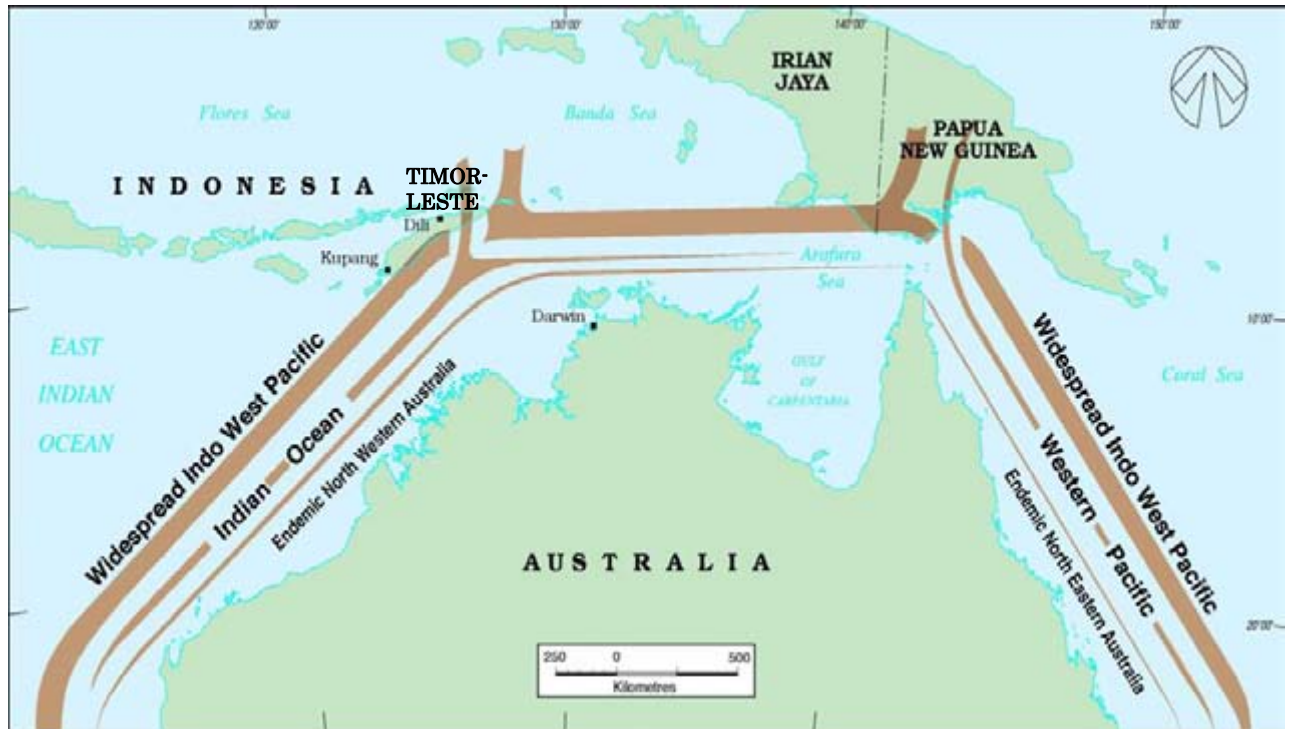


Figure 3.1: Indo-West Pacific biogeographical province (Wilson & Allen 1987).

3.4.3 Mangroves

Mangroves occupy approximately 7,500 acres along the coastline of Timor-Leste. On the south coast, they tend to form small communities at the mouths of streams and in marshy or swampy terrain (timorNET 2007).

The mangroves species that occur along the coast of Timor-Leste include, *Bruguiera parvifolia*, *Sonneratia alba*, *Rhizophora conjugata*, *Excoecaria agallocha*, *Avicennia marina*, *Aegiceras corniculatum*, *Acanthus ilicifolius*, *Lumnitzera racemosa*, *Heritiera littoralis*, *Acanthus ilicifolius*, *Achrosticum aureum*, *Xylocarpus granatum*, *Corypha utan*, *Pandanus odoratissimus*, *Cycas circinalis*, *Dolichandrone spathacea* and *Melaleuca leucadendron* (timorNET 2007).



3.4.4 Intertidal

Wyatt (2004) surveyed a small area of the nearshore coastal marine environment on the south coast of Timor-Leste. Brittle stars (ophiuroids) and other mobile organisms as well as a total of 27 taxa of sessile organisms were identified as inhabiting the reef platform. Of the sessile organisms, 18 taxa were algae (a brown alga *Ascidium sp.* and a green alga *Caulerpa sp.*), three sponges (poriferans), two hard corals (scleractinians), two ascidians, one anemone (cnidarian) and one foraminifer.

3.4.5 Coral Reefs

Timor-Leste is near the centre of the global region with the highest coral species diversity and there may be in excess of 500 species of coral occurring in Timor-Leste waters (Veron and Stafford-Smith 2000). Sensitive intertidal reefs and islands occur approximately 9.5 km to the north, north east and north west of the Eni 3D MSS areas, along the south coast of Timor-Leste. A 500 m exclusion zone will be observed between any part of the *Geco Eagle* or its streamers and any coral reef or intertidal shoal. This will be accomplished through the use of detailed bathymetric maps.

A series of surveys conducted in Indonesian waters between 1990 and 1998 (Burke et al. 2002) determined that the percentage of coral reefs in good or excellent condition (live coral cover of more than 50%) in eastern Indonesia were 45% compared to only 23% in western Indonesia. Burke et al. (2002) also identified a number of coral reefs along the Timor-Leste coast, including five distinct communities along the south coast of Timor-Leste, that were considered to be at Medium to High risk of impact from the combined effects of coastal development, marine-based pollution, sedimentation, overfishing and destructive fishing (Figure 3.2).

3.4.6 Offshore Benthic Habitats

Heyward et al. (1997) identified four broad benthic communities for the Big Bank Shoals area, encompassing the shallow banks to the deep water: Halimeda (shallow waters); encrusting sponges (shallow waters); coral filter-feeders (shallow waters); and continental shelf communities (deep water).

With little sea floor topography and hard substrate, such areas offered minimal habitat diversity or niches for animals to occupy. Detritus-feeding crustaceans, holothurians and echinoderms tend to be the dominant epi-benthic organisms of these habitats, however, where an area of hard substrate is available filter-feeding heterotrophs, such as sponges, soft corals and gorgonians may occur (Heyward et al. 1997).

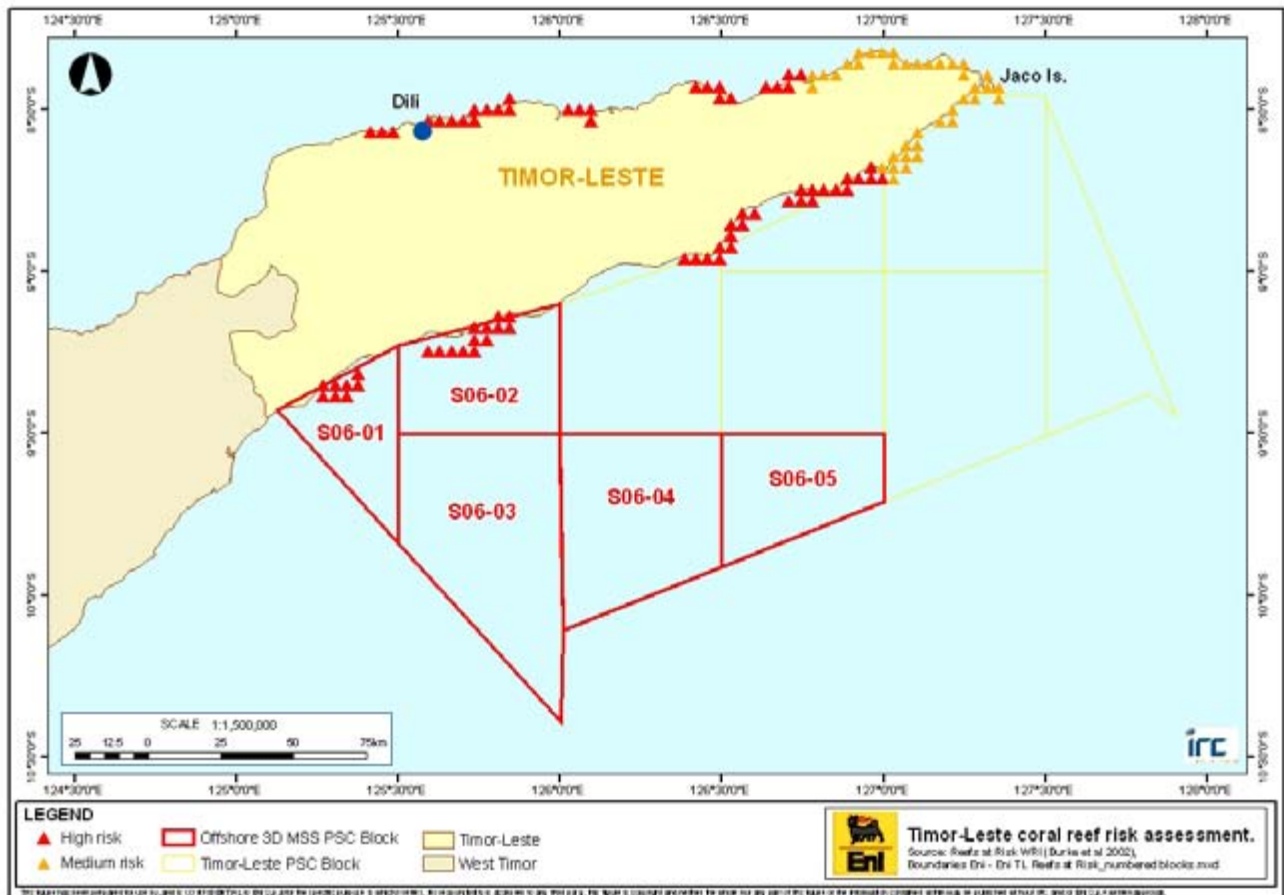


Figure 3.2: Timor-Leste coral reefs risk assessment map (Burke et al. 2002)

3.4.7 Marine Mammals

A number of whale, dolphin and porpoise species have broad distributions (including the Timor Sea). Of these, a number of whale species are considered endangered, vulnerable or might be encountered due to their migratory habit. These are listed in Table 3.1.

Some are very rare (blue whale), or usually restricted to deep or cool waters (Sperm whale), and are very unlikely to be encountered in this region (Bannister et al. 1996). Humpback whales (*Megaptera novaeangliae*), which are seasonally the most abundant whale along the Western Australian coast, complete their northern migration in Camden Sound near Broome, Australia, in September/October, well south west of the Eni 3D MSS area (reported in Woodside 2000). Based on observations in northern Australia it is reasonable for the MSS to observe a heightened observation period for marine mammals between September and November. Marine mammal observations from the MSS, to be logged and sent to DNSMA on a weekly basis, will greatly assist knowledge regarding these species in the Timor Sea.

A number of dolphins may occur within the Eni 3D MSS area. These species include the Irrawaddy dolphin, the Australian snubfin dolphin, the long snouted spinner dolphin, the



spotted bottlenose dolphin, Risso's dolphin, the Indo-Pacific humpback dolphin and the pantropical spotted dolphin.

Dugongs (*Dugong dugon*) occur within Timor-Leste waters. Major concentrations of dugongs tend to occur in areas coinciding with sizeable seagrass beds. These areas are typically in shallow water (depths less than 10 m) and are relatively protected (Marsh 2006). The location of the Eni 3D MSS area, the depth of water (greater than 100 m), the relatively unprotected nature of the seas and the distance of at least 70 km from known seagrass beds (UNEP-WCMC 2003), makes an encounter during the survey highly unlikely.

The commitment to log marine mammal sightings throughout the MSS will greatly enhance knowledge of their abundance, distribution and diversity.

Table 3.1: Whale species that are endangered, vulnerable and or migratory which may occur in the region.

Common Name	Scientific Name	Distribution	Status
Humpback Whale	<i>Megaptera novaeangliae</i>	Species or species habitat may occur within area	Vulnerable, Migratory
Blue Whale	<i>Balaenoptera musculus</i>	Species or species habitat may occur within area	Endangered, Migratory
Bryde's Whale	<i>Balaenoptera edeni</i>	Species or species habitat may occur within area	Migratory
Sperm Whale	<i>Physeter macrocephalus</i>	Species or species habitat may occur within area	Migratory
Antarctic Minke Whale	<i>Balaenoptera bonaerensis</i>	Species or species habitat may occur within area	Migratory
Killer Whale	<i>Orcinus orca</i>	Species or species habitat may occur within area	Migratory

3.4.8 Marine Reptiles

Turtles

There are no turtle nesting sites or other critical habitat (e.g. breeding or feeding sites) identified within the Eni 3D MSS areas (UNEP-WCMC 2006). However, Jaco Island and Tutuala beach have been identified as turtle nesting sites (Nunes 2001) and other breeding sites may exist on the south coast of Timor-Leste where the appropriate conditions exist. There are six turtle species that may be encountered, particularly the Loggerhead turtle and the Green turtle (Table 3.2).



Saltwater Crocodiles

The distribution of the saltwater crocodile, *Crocodylus porosus*, encompasses Timor-Leste and the islands and coasts surrounding the Timor Sea. The animals usually inhabit territories within tidal river systems and estuaries, sometimes around coastal areas and in freshwater rivers or water bodies and are sometimes found long distances from shore (Ross 1998). The saltwater crocodile is listed as Low Risk, Least Concern in the International Union for Conservation of Nature (IUCN) Red List and may occur in the area of the Eni 3D MSS.

Sea Snakes

Sea snakes are very common in subtropical and tropical waters where they occupy a wide range of habitats and water depths, extending from the coast to the reefs and banks further offshore. Sea snakes are expected in the Timor Sea region, with as many as 15 species known to occur in northern Australian waters (Storr et al 1986). Sea snakes could be encountered during the course of the Eni 3D MSS.

Table 3.2: Marine turtles which may occur in the region, their conservation status, habitat and significance.

Common Name	Species Name	Status	Habitat and Significance to Area
Olive Ridley	<i>Lepidochelys olivacea</i>	Endangered Migratory	Shallow, soft bottomed habitats. Common in region, (recorded breeding sites on northern and eastern coasts of Northern Territory, Australia).
Loggerhead	<i>Caretta caretta</i>	Endangered Migratory	Coral reefs, bays and estuaries. Tropical and warm temperate waters. No large rookeries recorded in region.
Flatback	<i>Natator depressus</i>	Vulnerable Migratory	Shallow soft bottomed habitats away from reefs.
Hawksbill	<i>Eretmochelys imbricata</i>	Vulnerable Migratory	Tidal/ sub-tidal coral and rocky reef habitats. Tropical waters. Recorded breeding sites along eastern coast of Northern Territory, Australia.
Green	<i>Chelonia mydas</i>	Vulnerable Migratory	Seaweed rich coral reefs/ inshore seagrass pastures (tropical/ subtropical). May be seasonally common. Recorded breeding site northern coast of Northern Territory, Australia.
Leatherback	<i>Demochelys coriacea</i>	Vulnerable Migratory	Rare within its range. Probably only occasional visitors to tropical waters. No large rookeries recorded in region.

Source: Environment Australia (2003) and DEH (2004)



3.4.9 Fish

FishBase (2006) lists 144 marine fish species in 38 families for Timor-Leste waters, with one species, the bigeye tuna (*Thunnus obesus*) listed as Threatened, 18 of the species as being pelagic and 10 of the species as being deep water. Many of the species listed for Timor-Leste are found throughout the tropics and are important commercial species, such as the tunas, mackerels and snappers. Table 3.3 lists the families of the finfish species identified in the shoal areas covered by the Memorandum of Understanding between Australia and Indonesia (MOU74) (CSIRO 1999).

3.4.10 Sharks

The whale shark (*Rhincodon typus*) is listed in FishBase (2006) as occurring within Timor-Leste waters and is considered threatened. The Great White Shark (*Carcharodon carcharias*) may transit the region (Environment Australia 2002) and is considered to be vulnerable. There are at least 49 species of sharks identified as occurring within an area which encompasses Australian territorial waters within the Timor Sea (Last & Stevens 1994). The most prolific of the shark species in the Timor Sea region are the whalers, represented by at least twelve species.

Table 3.3: Composition of commercial and non-commercial finfish species identified from video transects in the MOU74 Box shoal areas (CSIRO 1999).

Category	Family	No. of species
Commercial	Balistidae	1
Commercial & Non-commercial	Serranidae	6
Commercial	Haemulidae	1
Commercial	Scaridae	1
Commercial	Lethrinidae	1
Commercial	Lutjanidae	1
Non-Commercial	Acanthuridae	1
Non-Commercial	Chaetodontidae	1
Non-Commercial	Pomacanthidae	1

3.4.11 Birds

Timor-Leste has approximately 224 species of birds of which 23 are endemic to the Timor island group (World Bank 2005). Of the known species that occur in Timor-Leste, two are listed as critically endangered and three are listed as endangered under the IUCN Red List. Of these birds only the Christmas Island Frigatebird, *Fregata andrews* is a seabird. Seabirds that may occur in the offshore Eni 3D MSS area includes various tern species, the silver gull (*Larus novaehollandiae*), the lesser frigate bird (*Fregata ariel*), the common noddy (*Anous stolidus*) and the migratory seabird, the streaked shearwater (*Calonectris leucomelas*).



CSIRO (1999) recorded over 10,000 seabirds from nine species on Ashmore Reef and at sea within the Timor MOU74 Box during a survey between September and October 1998. The species included: Crested Tern (*Sterna bergii*); Sooty Tern (*Sterna fuscata*); Roseate Tern (*Sterna dougalli*); Common Noddy (*Anous stolidus*); Brown Booby (*Sula leucogaster*); Masked Booby (*Sula dactylatra*); Bulwer's Petrel (*Bulweria bulwerii*); Matsudaira's Storm-Petrel (*Oceanodroma matsudairae*); and Leach's Storm-Petrel (*Oceanodroma leucorhoa*).

3.5 SOCIO-ECONOMIC ENVIRONMENT

3.5.1 Fisheries

Coastal communities along the 600km of Timor-Leste's coastline rely on a wide range of fish, including the large tunas, flying fish, coral reef fish and deepwater snappers for their livelihoods. The DNPA estimates that for over half the 20,000 fishermen of Timor-Leste, fishing is the main source of food and income. United Nations (UN) support since 1999 has helped re-establish the nation's fishing capacity, with the fish catch estimated to be 1,600 t in 2002 (Jasarevic 2002).

The Government of Timor-Leste issued four gill-net licences to Timor-Leste vessels in 2006 and a long-line licence issued to an Australian vessel in 2007. The licensed fishing area extends from 16nm offshore to the "median line" (located as per UNCLOS provisions) between Timor-Leste and Australian waters. The DNPA maintains daily communications with these vessels whilst operating in Timor-Leste waters. Illegal fishing is also known to occur in the waters south of Timor-Leste.

3.5.2 Shipping

A large number of vessels are expected to be transiting the area as it is an important shipping route and is adjacent to a major trade route (US 2000). Examination of 2004 Australian Maritime Safety Authority shipping data shows that for vessels that reported positions during 2004, there were up to 173 ship transits through each of the PSC Blocks in the Eni 3D MSS area. Generally, vessels transiting through this area include bauxite carriers servicing Australian terminals at Gove (NT) and Weipa (Queensland), and coal carriers and container vessels departing Queensland ports for destinations in the Middle East, Europe and South Africa (LDM 1997).

3.5.3 Heritage

There are no known significant heritage or archaeological sites, shipwrecks or marine heritage sites in the vicinity of the offshore Eni 3D MSS area.



4. DESCRIPTION AND ASSESSMENT OF ENVIRONMENTAL EFFECTS

4.1 POTENTIAL ENVIRONMENTAL EFFECTS

The activities associated with the proposed MSS which could result in significant environmental effects have been evaluated with respect to the legislative requirements, the receiving environment, and the likelihood and consequence of their occurring. These activities with potential to cause significant environmental effects can be broadly grouped as: mobilisation of the seismic vessel; operations of the seismic vessel; and accidental discharges.

4.2 MOBILISATION

4.2.1 Introduced Pests

Exotic marine pests may be introduced into the PSC Blocks or nearby Australian waters via spores or larvae in ballast water, or via hull fouling. These originate from vessels coming from overseas where the exotic species occur naturally. Because the *Geco Eagle* will be operating in offshore waters, ballast water issues will be of negligible risk for the Eni 3D MSS. Australian quarantine regulations require vessels coming into Australian waters to exchange their ballast water at sea prior to entering into Australia's EEZ. A hull inspection of the *Crest Supply 1* will take place in Singapore prior to mobilisation and quarantine regulations followed.

4.2.2 Personnel and Equipment Transfer

The main risk from the transfer of personnel and equipment is the introduction of vermin, weeds and diseases to terrestrial areas. The main supply vessel *Crest Supply 1* will travel to and from Darwin and Dili, thus there is a small risk of terrestrial organisms transfer between vessels in the seismic survey. National quarantine regulations will be applied.



4.3 GENERAL OPERATIONS

4.3.1 Wastes

Deck Drainage

The seismic vessel has designated containment and bunding zones where oil products are used or stored. Deck drainage and oily wastes are treated using separators and can be discharged overboard if within water quality boundaries. Minor deck spills will be washed with bio-degradable detergents and polluted deck drainage water will be collected in a settling tank for later disposal on shore. While no wastes will be routinely discharged via deck drains, washdown of the decks may result in minor quantities of chemical residues (such as oil and grease) entering the marine environment directly through overboard drains.

Used lubricants will be stored aboard the seismic vessel and subsequently transported ashore for recycling or disposal at approved locations. Minor oil/lubricant spills will be mopped up with absorbent materials that will be disposed of onshore as hazardous waste.

No significant environmental impacts from deck drainage during the seismic survey are anticipated because of the low concentration of contaminants, minor quantities of overboard discharges involved and the localised zone of effect of any impact.

Domestic Wastes

Operation of the seismic and support vessels will typically result in the generation of approximately 10000 L/d of sewage and wastes from the kitchen, shower and laundry area. This will be released to the marine environment after treatment in an extended macerator-aeration system. The wastes will be required to pass through a screen of less than 25 mm diameter prior to discharge, in accordance with best industry practice.

The discharge of domestic wastes may result in localised increases in nutrient levels, which may stimulate microbial activity and therefore act as a food source for scavenging birds and/or marine animals.

No significant impacts are likely to occur during the seismic survey, as a result of the low volumes involved, the moving seismic survey vessels, the remote area of discharge, depth of water, oceanic currents and high biodegradability/low persistence of the wastes.

Solid and Hazardous Waste

Solid wastes will be segregated into waste streams, stored on board in appropriate containers and transported back to Australia where they will be either recycled or disposed of at an approved landfill or other disposal site. As these wastes are not proposed to be discharged to the marine environment, no adverse environmental impacts are anticipated associated with the storage and handling of solid and hazardous wastes.



Solid and hazardous wastes that may be generated during the seismic survey include:

- equipment packaging materials – paper, cardboard, sacking, plastic, wood and metal;
- streamer buoyancy fluid;
- chemicals;
- domestic packaging (food and drink containers, etc); and
- fuel and lubricating oils.

Cooling Water

Seawater is pumped on board the seismic vessel, where it is deoxygenated and sterilised by electrolysis (by release of chlorine from the salt solution) and then circulated as coolant for various plant, including air conditioning condensers and air compressors. The heated water (up to 20°C above ambient) contains liberated chlorine at total free ion concentrations <2ppb. The water becomes reoxygenated and loses a substantial quantity of chlorine by vaporisation during its exit to the sea. The anticipated temperature at the sea surface will be in the vicinity of 3°C above ambient temperatures.

No significant adverse impact is expected from the discharge of cooling waters during the seismic survey given the rapid dilution of heated water and the relatively small volumes of seawater involved. The survey vessel will be moving which will also aid dilution.

Atmospheric Emissions

The main sources of atmospheric emissions from seismic operations arise from propulsion and power generation. The *Geco Eagle* uses Marine Gas Oil which has lower atmospheric emissions than traditional Heavy Fuel Oil. The *Geco Eagle* has two identical main engines and four smaller auxiliary engines.

Most of these gaseous emissions will be in the form of carbon dioxide (CO₂), although smaller quantities of other gasses, such as oxides of nitrogen (NO_x) and carbon monoxide (CO) will also be generated. Minimal quantities of sulphur dioxide (SO₂) will be generated due to the low sulphur content of the Marine Gas Oil. Emissions will also be released through the incineration of waste products.

Where possible, emissions will be minimised from fired machinery by means of optimising fuel efficiency.

Artificial Lights

There are several recognised shipping lanes in the Timor Sea. However, an exclusion zone will exist around the seismic vessel and streamer array during the survey. The survey vessels will be well lit at night and during times of poor visibility. The lights are not likely to have any impact on turtle hatchlings because the seismic survey is far from any turtle nesting sites. Other organisms are unlikely to be affected by artificial lighting.



4.3.2 Interference with other Users

The physical presence of the seismic vessel and streamer arrays may lead to disturbance of marine fauna or birds, disruption to commercial and/or recreational fishing vessels and to shipping and shipping routes.

During the seismic survey, a temporary safety exclusion zone will be declared, with a radius of 500m in front of the vessel and from the vertices of its streamers in tow. Due to the proximity of the Eni 3D MSS and supporting operations to Australian territorial waters, the Australian Maritime Safety Authority will be notified.

Disturbance to Commercial Fishing

The majority of effort from fisheries in the Timor Sea is focused inshore of the proposed Eni 3D MSS location. The seismic survey is likely to disturb some fishing vessels, however, any disruption will be of a relatively short duration as the seismic survey is constantly moving. A support observation vessel will be present during the survey, with a specific role of liaising with fishing vessels ahead of the *Geco Eagle's* course. The *Geco Eagle* Vessel Master will maintain regular communications regarding its course with DNSMA, who will notify DNPA so as to minimise interference with fishers in the area.

Interference with Commercial Shipping

The survey area is not located near to a major shipping route, although Australian Maritime Safety Authority data indicate that many vessels report passing through the area. Given the short temporal duration of the seismic survey, modern navigation equipment, radios and position reporting to Timor-Leste authorities and the Australian Maritime Safety Authority and the presence of the survey is not anticipated to have any significant impact on commercial shipping activity.

Interference with Recreational Vessels

No recreational fishing is known to occur in the deep water areas around the PSC Blocks subject to the MSS. The presence of the Eni 3D MSS is not anticipated to have any significant impact on recreational fishing vessels activity, which is normally of low intensity in this area.

4.3.3 Seismic and Vessel Noise

Seismic surveys use airguns which usually work in arrays and fire simultaneously to create shockwaves. These shockwaves can lead to the close range mortality of marine organisms, particularly smaller ones such as plankton and fish. Various seismic noise exposure levels have been tested for small organisms such as crustaceans, fish, fish eggs and larvae, with no observed organism damage occurring outside 10m from the source (WEL 2004). Given that the source is moving and marine organisms typically exhibit avoidance behaviour within 100-300m (McCauley et al. 1998), only animals that cannot swim away will receive damage. These animals are likely to be limited to plankton, fish eggs and larvae, that is, those that are not free-swimming.



Benthic organisms in the deep water in blocks S06-01, S06-02, S06-03, S06-04 and S06-05 are sparse because of the lack of sunlight that exists at these depths. The seismic noise will be of less intensity when it is received at the sea floor and thus they are unlikely to be effected by seismic noise (WEL 2004).

Cetaceans employ an extremely acute acoustic sense to monitor their environment and communicate. Seismic noise may interfere with the acoustic perception and communication of any cetaceans in the vicinity, and may have the potential to induce stress. The distance at which cetaceans react to seismic noise is variable because different cetaceans have different sensitivities. Baleen whales are sensitive to low and moderate frequency sounds, therefore they would be able to hear and respond to seismic surveys (McCauley 1994).

McCauley et al. (1998) studied the effects of seismic noise on Humpback Whales in the Exmouth Gulf region of WA. Localised avoidance behaviour was noted during the production of seismic noise and it was concluded that they are at low risk of physiological effects unless they are close (perhaps to within a few hundred metres) to the seismic airgun array (WEL 2004).

Seismic surveys use soft start-up procedures to induce localised avoidance behaviour before the onset of the full seismic noise. Once the survey is started, the firing of the airgun array is continuous and the seismic vessel will be slow moving. This allows free swimming organisms in the survey path to clear the area. The DEW (DEH 2001) and Australian Petroleum Production and Exploration Association (APPEA 1996) Guidelines for the observation of the cetaceans during the seismic survey will be followed and include the reporting of cetacean sightings using specific forms (Appendix B). A log of marine mammal observations will be compiled during the survey.

Vessel noise is considered to be an insignificant risk because of its common occurrence. Other vessels regularly pass through the area. When compared to the seismic noise, vessel noise is insignificant.

4.3.4 Disturbance to Marine Fauna and Habitats

There are a number of migratory species with distributions that are coincident with the offshore Eni 3D MSS area. These species are widely distributed oceanic species and hence may occur within the Eni 3D MSS area.

The offshore Eni 3D MSS is not likely to affect the general movement of any of these species through the area during their migratory or wandering paths. Impacts on cetaceans in particular will be minimised by following protocols based on industry best practice and DEH (2001) guidelines. Measures include:

- Soft start procedures: a sequential build-up of warning pulses over a period of 20 minutes will be made at the start of each acquisition line to warn and deter cetaceans from approaching the survey vessel.



- A support observation vessel to be present during the survey, with a specific role of observing and recording marine mammal movements (this is an Eni best-practice measure).
- Crew of both the support observation vessel and the *Geco Eagle* trained in marine mammal identification, behaviour and reporting by a marine mammal expert, onboard for two days.
- All marine mammal observations to be logged, with logsheets sent to DNSMA on a weekly basis. A heightened observation period for marine mammals in place between September and November, when there is an increased chance of migratory species being present in the survey area.
- A 2 km “heightened awareness zone” around the *Geco Eagle* and its seismic arrays. In the event of observed cetacean distress, the seismic arrays will power down. If there are no signs of distress, a 1 km cetacean exclusion zone will apply.
- In the event of three or more power-downs per day for large baleen whales (humpbacks, blues or southern rights), Eni/WesternGeco must demonstrate a low risk of encountering whales during night time operations through enhanced support vessel observations 5km ahead of the *Geco Eagle*'s course.

It is not possible for the seismic survey itself to be used to detect marine mammals – the frequencies used are designed to detect sub-surface conditions, not intermediate objects in the water column. Also, the concept of an additional sonar system to detect marine mammals is not practical because it would create interference with the seismic survey, and does not form part of DEH (2001) guidelines.

While some of the cetacean, fish and shark species may breed or feed in the region, there are no known features that are unique to the area as the conditions are widely represented elsewhere in the Timor Sea and broader tropics. There is no suitable habitat for turtle nesting in the immediate vicinity of the Eni 3D MSS area. The Eni 3D MSS is unlikely to interfere with the movement or migration of non-cetacean listed migratory species.

There are a number of threatened cetacean and non-cetacean oceanic species identified for this region. The proposal does not involve any processes that may interfere with the breeding, feeding or general migration of any of these listed species. The interference to cetacean threatened species can be minimised by following the protocols stated above.

A number of other marine species have been identified which are widely distributed such as the dugong, streaked shearwater, turtles and seasnake species. Many of these species may occur, feed and breed in the general area where there are appropriate habitats. Turtles may also occur in the area during oceanic migrations, however the offshore Eni 3D MSS is not likely to affect any local populations of these species, and does not involve any processes which threaten the species or significant populations.



Coral reef and intertidal communities exist near the northernmost section of the MSS area. Detailed bathymetric charts will be used by the *Geco Eagle* and there will be a 500 m exclusion zone between any part of the vessel and its streamers and intertidal communities. The likelihood of streamers snagging on intertidal habitats is thus considered low.

4.4 ACCIDENTAL DISCHARGES

4.4.1 Spills

Should any hydrocarbon spill occur during the Eni 3D MSS, the impacts associated with such a spill will be managed by implementation of the *Geco Eagle's* Shipboard Oil Pollution Emergency Plan (SOPEP). The selection of an appropriate response strategy for the control and treatment of a spill will depend on a number of factors, such as prevailing weather, size and type of spill. Given the location of Eni 3D MSS area, in most instances it is anticipated that the environmentally preferred strategy will be to allow the spilled fuel to weather naturally until it disappears. During this weathering period, the location of the slick will be regularly monitored and the need for intervention assessed. The time required for a slick to reach the nearest coast and/or islands will determine if an appropriate response method requires implementation.

Once Marine Gas Fuel enters the sea it undergoes spreading and weathering. Weathering processes include:

- evaporation;
- photo-oxidation;
- dissolution;
- emulsification;
- biodegradation; and
- sedimentation.

Marine Gas Oil (also known as No. 2 diesel fuel) is a middle distillate fuel with a typical American Petroleum Institute (API) gravity of between 30° to 32°. Diesels are generally light although they vary in their pour point and hence, volatility. Diesel spreads rapidly at sea and so, although classed as a 'persistent oil', any slick tends to break up quickly.

Weathering and dispersal rates depend on wind and sea state conditions. These factors have been described in a number of reports (Jones 1986; Kagi et al. 1988). Strong winds cause a slick to break up naturally. Small droplets of liquid hydrocarbon become entrained in the near surface part of the water column. This enhances natural biodegradation by increasing the surface area available to bacterial decomposition. Residues from weathered oil are subjected to further physical, chemical and biological degradation, which is enhanced in warm and oxygenated conditions such as the waters in the survey area.



Weathering tests simulating spills in tropical waters have been conducted on diesel and light Australian crude and condensate from northwest Australia (Kagi et al. 1988). These tests indicate that spreading and evaporation of spilt oil are both very rapid. Predicted spreading rates of diesel indicate that a 2t spill will spread out to <0.1mm thickness within three hours under tropical conditions, while a 200t spill takes approximately 12 hours to attain this thickness.

4.4.2 Leakage from Machinery

Leaks of hydraulic fluids from hoses and machinery lubrication oils could occur sometime during the project but are unlikely due to the safeguards in place, including preventative maintenance, manned operations and the presence of oil collection bunds. Further, there will be no open drains leading to the sea surface while operations are in process. Should such an event occur, spill volumes of hydraulic fluid would be very small.

4.4.3 Streamer Damage or Loss

Streamers may be damaged by a number of events ranging from shark bites penetrating the streamer to snagging on intertidal habitats. Each streamer section on the *Geco Eagle* is 100 meters long and contains 130 L of synthetic isoparaffinic hydrocarbon (kerosene) to assist the ballast and position of the streamer sections in the water. The sections are connected in sequence to form the seismic streamer which is 6km long, and are robust and designed to minimise kerosene spillage in the event of a hole or rupture through compartmentalisation of the streamer sections.

Detailed bathymetric charts will be used by the *Geco Eagle* and there will be a 500 m exclusion zone between any part of the vessel and its streamers and intertidal communities. This will reduce the likelihood of streamers snagging on intertidal habitats.

In the event of damage to or loss of a streamer, potential chemical/biological impacts on benthic, demersal and pelagic communities may arise from slow leakage of the streamer fluid. Because of the nature of the streamer fluid, expected weather and sea-state conditions, and the relatively small volumes likely to be released, spillages of kerosene are likely to disperse and weather very quickly. As a result of this, there will be limited opportunity for any adverse effects on biota in the area.

4.4.4 Hazardous Materials

A variety of potentially hazardous materials and chemicals may be stored on the seismic and support vessels, including batteries, flares, chemical solvents, paints, and used oil and filters. Many of these materials could potentially impact the marine environment if discharged in significant quantities. Therefore, WesternGeco screen all products for their technical and environmental qualities and performance. Where technically practicable, the most environmentally acceptable options will be preferentially selected. WesternGeco have also instigated development of a new lithium battery with much-improved charging intervals which, combined with a specialised recycling process in the USA, provides an enhanced material life cycle.



Transport, storage, handling and disposal of hazardous materials will be in accordance with the seismic vessel procedures and the Material Safety Data Sheets (MSDSs). For the Eni 3D MSS, hazardous wastes will be disposed of by an approved agent in Australia, Europe or USA. There will be no hazardous waste disposal in Timor-Leste.

4.4.5 Marine Gas Oil Transfer (refuelling)

The seismic vessel requires refuelling approximately every two weeks during the seismic survey, generally taking about two to three hours to complete. The *Geco Eagle* has specific procedures for refuelling operations that must be followed. Spills caused by fuel handling mishaps are rare, but because of the number of times fuel is handled at sea and the volumes involved, this is one of more common sources of spills. Causes include hose rupture, coupling failures, and tank overflow. A credible volume of fuel spilt as a result of one of these events has been estimated at 1m³. Quantities are minimised by shutdown of pumps and automatic closure of safety valves. Rupture of a fuel transfer hose typically leads to a spill of no more than 0.2m³. To minimise the risk of a spill, refuelling will be carried out using Eni approved procedures to minimise the risk of an accidental spill, including:

- vessel fuel transfer procedures;
- use of wire reinforced hoses;
- use of transfer hoses fitted with 'dry break' couplings;
- refuelling only during daylight hours and steady sea-state conditions; and
- the Master or First Officer of the vessel actively oversees the operation.

4.4.6 Vessel Collision

A release of Marine Gas Oil (diesel) from a vessel collision is highly unlikely. A worst case scenario would be up to 275m³ of diesel lost, which would have a generic leak frequency assessment estimated at approximately 1.1 x 10⁻⁶ (Apache 2001). The risk of vessel collisions is minimised by adhering to IMO regulations and specifically by:

- keeping watch at all times;
- having fuel tanks protected by ballast tanks;
- maintaining radio contact between seismic and supply vessels at all times;
- regular updates on weather forecasts from local weather bureaus;
- offloading of supply vessels only in suitable weather.



5. ENVIRONMENTAL RISKS AND MITIGATION

The potential environmental hazards included in this environmental risk assessment (ERA) are related to activities associated with mobilisation and conducting the seismic survey, as well as with general operations and accidental discharges as described in the previous section.

Environmental risk is defined as the chance of an event impacting the environment. It is measured in terms of likelihood and consequence, where consequence may be defined as the outcome of an event, and likelihood as a description of the probability or frequency of the event occurring. In order to carry out an ERA of seismic activities on the Timor Sea it is necessary to employ a methodology that:

1. identifies the activity and the environmental aspects associated with it;
2. defines the potential environmental effects of aspects identified in step one above;
3. identifies the values/attributes at risk within and adjacent to the survey area;
4. identifies the likelihood of occurrence;
5. identifies the consequences of potential environmental aspects; and
6. determines overall environmental risk using a likelihood and consequence matrix.

Table 5.1 presents Eni's Environmental Risk Matrix, defining the likelihood, consequence and resulting risk used to determine the level of risk for each event (Eni, 2007a). Table 5.2 presents a summary of the overall risk assessment for the Timor-Leste 3D MSS.



Table 5.1: Eni Environmental risk matrix

Severity	Risk Area	Probability				
	Environment	A	B	C	D	E
		Heard of in industry	Has occurred at least once in the Company or E&P industry	Has occurred several times in the Company	Happens several times per year in the Company	Happens several times per year in a location
5	Extensive damage International stakeholder concern <i>or</i> > 5 years for natural recovery <i>or</i> > 5 months for clean-up <i>or</i> reduction of biodiversity <i>or</i> impact on special conservation areas.					
4	Major effect National stakeholder concern <i>or</i> 2-5 years for natural recovery <i>or</i> up to 5 months for clean-up <i>or</i> threatening to biodiversity <i>or</i> impact on interesting areas for science.				Intolerable Risk (High)	
3	Localised effect Regional stakeholder concern <i>or</i> 1-2 years for natural recovery <i>or</i> 1 week for clean-up.					
2	Minor effect Impact on localised ground.			Risk Reduction Measures (Medium)		
1	Slight effect No sensitive impact on ground/air/water.	Continuous Improvement (Low)				



Table 5.2: Summary of environmental risk associated with the Albacora 3D MSS

Aspect/Source of Risk	Potential Environmental Effects	Likelihood	Consequence	Risk Ranking
Mobilisation				
Environmental Awareness	Rubbish; Interference with wildlife; Impacts on sensitive environments.	C	3	Medium
Ballast Water	Offshore – displacement of native species	B	2	Low
	Nearshore – displacement of native species	B	4	Medium
Hull Fouling	Displacement of native species	B	4	Medium
Equipment/ Personnel Transfer	Introduction of vermin, weeds and pests	A	4	Medium
General Operations				
Wastes/Emissions	Deck Drainage – impact on water quality	D	2	Medium
	Domestic – impact on water quality	E	2	Medium
	Solid & Hazardous – impact on water quality	A	3	Low
	Cooling Water – increased water temperature	E	1	Low
	Atmospheric Emissions – localised impact on air quality and greenhouse gas emissions	E	1	Low
	Artificial Light – attraction of fauna	E	1	Low
Interference with other users	Commercial fishing	B	3	Medium
	Shipping	D	2	Medium
	Recreational vessels	B	1	Low
Noise	Discharge of airgun array – disturbance to marine fauna (cetaceans, turtles, seabirds, fish, etc)	C	2	Medium
	Vessel noise – disturbance to marine fauna (cetaceans, turtles, seabirds, fish, etc)	E	1	Low
Disturbance to marine fauna and habitats	Interference with migration/feeding, etc of marine fauna, and damage to intertidal habitats.	E	2	Medium
Accidental Discharges				
Leakage from Machinery	Impact on water quality/marine flora/fauna (<100L)	C	2	Medium
Streamer damage or loss	Streamer buoyancy fluid – Impact on water quality/marine flora/fauna	B	2	Low
Hazardous Materials	Light oils/chemicals – Impact on water quality/marine flora/fauna (<100L).	B	3	Medium
Refuelling	Impact on water quality/marine flora/fauna (<1000L)	B	3	Medium
Vessel Collision	Rupture of fuel tank leading to diesel spill – Impact on water quality/marine flora/fauna	A	4	Medium
	Major collision resulting in oil and/or diesel spill – Impact on water quality/marine flora/fauna	A	4	Medium



6. PERFORMANCE OBJECTIVES, STANDARDS AND CRITERIA

Section 5 identified the environmental risks associated with the MSS; this section presents the environmental performance objectives that Eni has set, the standards that Eni has adopted to meet objectives, and the criteria by which Eni will measure its performance against their stated objectives. The following definitions are used:

- **Performance Objectives** are defined as: ‘overall goals for environmental performance as they relate to individual aspects’.
- **Standards** are defined as: ‘detailed performance requirements necessary to achieve the performance objectives’.
- **Criteria** are defined as: ‘factors that provide a measure, either direct or indirect, relating to the performance standards’.

The performance objectives, standards and criteria for high and medium risks associated with the seismic survey are detailed in Table 6.1.

Table 6.1: Performance Objectives, Standards and Measurement Criteria.

Objectives	Standards	Criteria
MOBILISATION PHASE		
Environmental sensitivities and requirements of the area.	Eni Australia HSEQ Policy.	All crew to undertake environmental inductions. All personnel familiar with environmental requirements, guidelines and procedures outlined in EMP and they are being followed.
Ballast water discharge.	Indonesian <i>Law 23/1997</i> on Environmental Management. APPEA Code of Environmental Practice, 1996.	Inspection certificate for recent deballasting if seismic vessel has just come from overseas.
Introduction of exotic species from personnel/equipment.	Best practice.	Vessel hulls have been inspected prior to entering region.
Minimise disturbance to marine fauna, commercial fishing, shipping and recreational vessels.	Indonesian <i>Law 23/1997</i> on Environmental Management. AMSA Notice to Mariners. DEW Cetacean guidelines. APPEA guidelines (1996).	Seismic vessel logs show AMSA Notice to Mariners issued. Seismic vessel logs show regular communication with Fisheries Directorate.
GENERAL OPERATIONS PHASE		
Minimise reduced water quality (i.e. hydrocarbons or chemicals) from deck drainage.	MARPOL 73/78 Annex I: Prevention of Pollution by Oil. APPEA Code of Environmental Practice, 1996.	Deck drainage flows to oil/water separation device that is regularly checked for functionality. Recovered oil is being transferred to mainland for disposal.



Objectives	Standards	Criteria
Avoid/minimise impact on water quality from discharge of domestic wastes.	MARPOL 73/78 Annex V: Prevention of Pollution by Garbage from Ships. Indonesian Law 23/1997 on Environmental Management (Article 20).	Waste logs show compliance with MARPOL 73/78 and <i>Geco Eagle's</i> Waste Management Procedures. Waste logs show sewage is treated onboard seismic vessel prior to discharge. Waste water treatment system is checked for functionality prior to commencement of activity.
Minimise waste volumes of industrial and hazardous wastes released to the marine environment.	MARPOL 73/78 Annex V: Prevention of Pollution by Garbage from Ships. APPEA Code of Environmental Practice, 1996. Indonesian Law 23/1997 on Environmental Management (Article 20 & 21).	Waste logs show compliance with MARPOL 73/78 and seismic vessel Waste Management Procedures. No solid and/or hazardous waste disposed of overboard. Solid and/or hazardous wastes stored appropriately and transported onshore.
Elevation of water temperature from cooling water discharge.	ANZECC (2000) water quality guidelines, <2°C above ambient.	Water being discharged above sea level (allows for cooling and oxygenation as it falls to sea level).
Minimise atmospheric emissions of exhaust gases and CO ₂ .	Greenhouse Challenge Plus reporting requirements. NPI reporting requirements. APPEA Code of Environmental Practice, 1996.	Fuel consumption recorded and greenhouse gas emissions calculated. Engines and equipment maintained regularly. Waste incinerated.
Minimise acoustic disturbance to marine fauna.	DEW Cetacean Interaction Guidelines. APPEA Code of Environmental Practice, 1996.	Cetacean Interaction Guidelines followed. Soft start procedures adhered to. Exclusion zones applied. Support observation vessel present to observe marine mammals. Crew of <i>Geco Eagle</i> and support vessels trained by marine mammal expert. Marine mammal observation log kept, and supplied to DNSMA
Minimise disturbance to marine habitats.	Indonesian Law 23/1997 on Environmental Management. APPEA Code of Environmental Practice, 1996.	Detailed bathymetric charts on board. Evidence that trajectory of vessel and streamers has not entered 500 m exclusion zone around intertidal communities.
Minimise attraction of fauna to seismic survey lighting.	APPEA Code of Environmental Practice, 1996.	Preferential use of fluorescent lights.
Avoid interference with commercial fishing and shipping and recreational vessels.	Indonesian Law 23/1997 on Environmental Management. AMSA Notice to Mariners.	Log of support observation vessel liaison with fishing vessels. Consultation and regular communication with DNSMA/DNPA. Seismic vessel visible at night. Vessel logs show AMSA Notice to Mariners issued.



ACCIDENTAL DISCHARGES		
Avoid and minimise mortality of sensitive fauna from leakage from machinery.	MARPOL 73/78 Annex I: Prevention of Pollution by Oil. Indonesian Law 23/1997 on Environmental Management. APPEA Code of Environmental Practice, 1996. <i>Geco Eagle</i> SOPEP.	Compliance with seismic vessel procedures. Operational oil/water separator, maintained regularly with 15ppm limit. All releases of hydrocarbon reported. Compliance with SOPEP. Amount of waste oil removed from seismic vessel recorded.
Mortality of sensitive fauna due to release of hazardous materials into the marine environment.	MARPOL 73/78 Annex V: Prevention of Pollution by Garbage from Ships. APPEA Code of Environmental Practice, 1996.	<i>Geco Eagle</i> waste management procedures. No solid and/or hazardous waste disposed overboard. Solid and/or hazardous wastes stored appropriately and transported onshore.
Avoid the accidental loss of streamer buoyancy fluid.	Indonesian Law 23/1997 on Environmental Management. AMSA Notice to Mariners.	Consultation with DNPA and other commercial stakeholders undertaken. <i>Geco Eagle</i> has navigation lighting and is visible at night. AMSA Notice to Mariners issued. Detailed bathymetric charts on board. Evidence that trajectory of vessel and streamers has not entered 500 m exclusion zone around intertidal communities.
Prevent spills of diesel, either from refuelling operations or vessel collision.	MARPOL 73/78 Annex I: Prevention of Pollution by Oil. Indonesian Law 23/1997 on Environmental Management. <i>Geco Eagle</i> SOPEP. APPEA Code of Environmental Practice, 1996. AMSA Notice to Mariners. Vessel refuelling standards.	<i>Geco Eagle</i> refuelling procedures followed. Vessel masters to undertake refuelling in daylight hours, suitable weather and steady sea-state conditions. Safety zone gazetted around seismic survey. SOPEP followed and checked by Eni. Spills of oil >80L reported to Eni immediately and within 2 hours of occurrence to DNSMA. Seismic vessel has navigation lighting and is visible at night. Seismic vessel logs show AMSA Notice to Mariners issued. Eni incident reporting system followed (HSE-PR-03). Watch has been kept at all times.
REPORTING		
Record of all incidents and non-conformances.	Indonesian Law 23/1997 on Environmental Management. <i>Eni Procedure: Hazard & Incident Reporting & Investigation</i> (Eni, 2007b).	All reporting has been undertaken according to implementation strategy and DNSMA notified.



7. IMPLEMENTATION STRATEGY

7.1 INTRODUCTION

This section details the environmental management strategies and procedures that will be in place for the Eni 3D MSS. These include responsibilities, training, reporting frameworks, mitigation and response activities and monitoring and auditing procedures which are intended to reduce environmental risk to ALARP and to ensure that environmental performance criteria are met.

7.2 SYSTEMS, PRACTICES AND PROCEDURES

The project will be implemented under the umbrella of the Eni Australia HSEQ Policy (Appendix A), which the seismic survey contractor must abide by. Eni will ensure that its personnel and contractors comply with all regulatory controls under relevant legislation and guidelines, as listed in Table 1.1, and with the commitments within this EMP. Key aspects of Eni's environmental management strategies include:

- HSE Integrated Management System and supporting documentation;
- Emergency Response Plan covering Eni's activities in Timor-Leste;
- use of personnel with area experience; and
- compliance with APPEA Codes of Environmental Practice (1996).

An Eni representative will accompany the seismic vessel for the duration of the survey. All Eni and WesternGeco personnel will receive an environmental induction prior to the commencement of the seismic survey. This induction will address the issues and actions identified within this EMP.

WesternGeco as the seismic contractor has day-to-day control of the MSS, and has formal, written systems, practices and procedures for HSEQ management of its activities. WesternGeco operates under its parent company Schlumberger's HSEQ management system. This system and its components will be reviewed and determined to be acceptable by Eni prior to commencement of operations.

Onboard the *Geco Eagle*, operational procedures exist for all aspects of its operations, including waste management and refuelling. The *Geco Eagle's* Emergency Response Plan and SOPEP cover emergency and oil spill response, respectively, and an interface plan will be prepared to bridge between WesternGeco and Eni HSE systems.

Table 7.1 summarises the management actions that Eni and WesternGeco will undertake to ensure protection of the environment.



Table 7.1: Summary of Management Actions.

Environmental Hazard	Management Actions	Responsibility
MOBILISATION PHASE		
Introduced pests from contaminated ballast water or hull fouling	Flush ballast water prior to entering region.	WesternGeco
	Hull inspections prior to entering region.	WesternGeco
Personnel and equipment transfer	Personnel and equipment to be transferred through Darwin.	Eni
Physical presence	Timor-Leste, Australian Government authorities notified, AMSA Notice to Mariners issued.	Eni and WesternGeco
GENERAL OPERATIONS PHASE		
Deck drainage	Ensure appropriate deck drains and bunds on seismic vessel.	WesternGeco
	Oil transfer register kept, complies with international shipping regulation.	WesternGeco
	Ensure that waste handling is in strict accordance with the seismic vessel waste management procedures.	WesternGeco
	Transfer recovered oil to mainland for disposal and recycling.	WesternGeco
	Confirm that deck drainage does flow to oil/water separation device that is regularly checked for functionality.	WesternGeco
Domestic wastes	Check waste water treatment system for functionality in accordance with the manufacturers operating specifications prior to survey.	WesternGeco
	Ensure effluents will be treated to MARPOL 73/78 standards prior to discharge overboard.	WesternGeco
	Ensure that <i>Geco Eagle</i> waste management procedures.	Eni and WesternGeco
	Ensure support vessels comply with MARPOL 73/78 regulations.	WesternGeco
	Record sewage treatment and discharge in waste logs.	WesternGeco
Industrial and hazardous wastes	Ensure segregated waste and appropriate handling, storage and waste disposal methods followed.	WesternGeco
	Ensure onshore disposal of industrial or hazardous wastes is to approved (i.e. licensed) facilities.	Eni
	Ensure that seismic vessel Waste Management Plan followed.	Eni and WesternGeco
Cooling water	Cooling water will be discharged above sea level (to allow for cooling and oxygenation as it falls to sea level).	WesternGeco
Atmospheric emissions	Maintain equipment at peak efficiency.	WesternGeco
	Record fuel consumption.	WesternGeco
Noise	Compliance with APPEA cetacean interaction guidelines and industry best practice, including using soft-start procedures, exclusion zones and night time operation conditions.	Eni and WesternGeco
Artificial lights	Preferential use of fluorescent lights (that meet required safety standards).	WesternGeco



Environmental Hazard	Management Actions	Responsibility
Seismic vessel and streamers (physical presence)	Timor-Leste and Australian Government Authorities notified, AMSA Notice to Mariners issued.	Eni and WesternGeco
	Consultation with stakeholders undertaken.	Eni
	Use navigation lighting on the seismic vessel to ensure visibility at night.	WesternGeco
	Safety zone gazetted around seismic vessel.	WesternGeco
	Weekly reporting of trajectory of seismic survey to DNSMA.	WesternGeco
	500 m exclusion zone between any part of the vessel and its streamers and intertidal communities.	WesternGeco
ACCIDENTAL DISCHARGES		
Leakage from engines or machinery	Drip trays and sumps placed under all engines.	WesternGeco
	Collected waste oil stored in containment tanks prior to shipping onshore.	WesternGeco
	Seismic vessel maintenance and inspection procedures	WesternGeco
	Seismic vessel has an approved SOPEP.	WesternGeco
	Record and report all spills >80L to DNSMA.	Eni
Hazardous materials	Ensure hazardous waste is documented, tracked and segregated from other waste streams.	WesternGeco
	Ensure hazardous materials stored onboard for onshore disposal.	WesternGeco
	Record all transfers of hazardous wastes in seismic vessel waste logs.	WesternGeco
Spillage of diesel fuel (during refuelling from transfer hoses or on board tanks, or rupture of seismic vessel or support vessel fuel tank)	Ensure refuelling procedures in place.	Eni
	Ensure refuelling procedures are followed.	WesternGeco
	Refuelling only during suitable weather and sea-state conditions.	WesternGeco
	Refuelling only to occur at the discretion of vessel masters.	WesternGeco
	Hose and couplings checked for integrity prior to refuelling.	WesternGeco
	Seismic vessel has an approved SOPEP.	WesternGeco
	Record and report all spills >80L to DNSMA.	Eni
Vessel collision	Timor-Leste and Australian Government Authorities notified, AMSA Notice to Mariners issued.	Eni and WesternGeco r
	Safety zone gazetted around MSS.	Eni
	Interaction between seismic vessel and supply vessel at discretion of the vessel masters.	WesternGeco
	Record and report all spills >80L to DNSMA.	Eni
GENERAL		
Incident Reporting	Report any environmental incidents to DNSMA..	Eni
Operational Environmental Awareness	Crew Inductions to include regulatory requirements and environmental considerations/ procedures. Training provided in marine mammal observation.	Eni and WesternGeco



7.3 COMMUNICATION CHANNELS AND ROLES AND RESPONSIBILITIES

Generally, the principal communication channel regarding environmental aspects of the MSS will be between DNSMA, through the EIA Coordinator, and Eni, through the company’s Environmental Adviser. This includes incidents, non-conformances and auditing requirements. DNSMA will have direct contact with WesternGeco in a number of situations, including communication on trajectories of the survey and marine mammal logsheets. All email communications with the DNSMA EIA Coordinator should CC the DNSMA Director. Table 7.2 details preliminary contact information for key personnel involved in the MSS, including representatives of the Government of Timor-Leste. An up-to-date contact list will be distributed to all parties at the beginning of the MSS.

Table 7.2: Contact Details - Albacora 3D MSS

Title	Name	Telephone	Email
Eni Timor Leste SpA			
Eni Environmental Adviser	Tony Heynen	+61 8 9320 1505 (direct) + 61 421 980 476 (mobile)	tony.heynen@eniaustralia.com.au
Eni Exploration Manager	Alessandro Trombetti	+61 8 9320 1138 (direct) + 61 400 928 271 (mobile)	alessandro.trombetti@eniaustralia.com.au
Eni Chief Geophysicist	David Hearty	+61 8 9320 1174 (direct) +61 412 937 733 (mobile)	david.hearty@eniaustralia.com.au
Marine Mammal Adviser	RPS Ecos	To be advised (TBA)	TBA
Eni Company Representative	John Stanton, RPS Energy	+61 8 9211 1188 (direct) +61 438 007 508 (mobile)	stantonj@rpsgroup.com.au
WesternGeco			
WesternGeco Marine Vessel Manager	Vinh Quoc Ly	+61 8 9420 4668 (direct) +61 434 601 159 (mobile)	vly@kuala-lumpur.westerngeco.slb.com
<i>Geco Eagle</i> Vessel Master	TBA	TBA	TBA
Government of Timor-Leste			
DNSMA Director	Carlos Ximenes	+670 333 9119 (office) +670 723 0165 (mobile)	cximenes59@hotmail.com
DNSMA EIA Coordinator	António Lelo	+670 333 9119 (office) +670 725 4802 (mobile)	anleomen2@yahoo.com
DNPA Director	Lourenço Dos Reis Amaral	+670 332 5121 (office) +670 723 8304 (mobile)	amarallourenco@yahoo.com
DNPG Director	Amândio Gusmão Soares	+670 331 7143 (office) +670 727 7880 (mobile)	amandio_gusmao@yahoo.com.au
DNPG Adviser	Roger White	+670 331 7143 (office) +670 729 5164 (mobile)	rogerwhite_2000@bigpond.com

Table 7.3 details the key roles and responsibilities for Eni and WesternGeco personnel involved in the MSS.



Table 7.3: Key EMP Roles and Responsibilities.

Eni Crisis Management Team Leader (Managing Director)
Responsible for resourcing and compliance with HSEQ policy.
Facilitates an emergency response strategy in the event of an incident.
Facilitates communication with company personnel, government and the media in the event of an incident.
Ensures overall compliance with the Eni EMP with advice from the Eni HSE Team Leader.
Eni Exploration Manager
Supervises the Eni Offshore Seismic Supervisor.
Immediately notifies DNSMA of any spill of hydrocarbons of greater than 80L.
Assists the Crisis Management Team Leader in the event of an emergency.
Liaises with the Eni Operations Manager.
Eni Chief Geophysicist
Verifies that seismic contractor’s management commitments are enacted.
Assists the Crisis Management Team Leader in the event of an emergency.
Reports incidents to the Eni Exploration Manager.
Eni Environmental Adviser
Prepares the EMP.
Reviews the seismic contractor HSE documentation for acceptability and ensures compliance with the Eni EMP.
Reviews seismic contractor environmental audits and conducts Eni independent audits to ensure compliance with the agreed environmental performance conditions.
Provides advice in the event of an oil spill or other environmental incidents.
WesternGeco Marine Vessel Manager
Develops a HSE Interface Plan detailing the interface between WesternGeco and Eni HSE management systems, particularly in emergency response scenarios.
Ensures the WesternGeco Operations HSE Management Plans are consistent with the Eni EMP.
Developing systems, practices and procedures that meet Eni HSE Management System requirements.
Ensures that the HSE resourcing is adequate for the needs of the seismic survey.
Identifies HSE requirements and communicates these to personnel.
Manages and, where appropriate, executes vessel HSE activities.
Ensures that the HSE effort and resourcing is consistent with vessel needs.
Liaises with external bodies as appropriate (e.g. AMSA).
Manages the HSE Tracking System (HSE Issues and Concerns Register) such that all identified actions are properly assigned and tracked to satisfactory closure.
Geco Eagle Vessel Master
Ensures that the Eni HSEQ Policy and the Schlumberger QHSE Policy are followed.
Responsible for implementation of the seismic contractor HSE Management Plans on the seismic vessel.
Ensuring understanding of the Eni and seismic contractor systems through a review of the relevant documentation.
Developing operations-specific procedures where required.
Communicating the operating policies and procedures to all personnel and ensuring their compliance.
Communicating the operational hazards and risks to the workforce and the importance of following good



work practices.
Monitors the performance against relevant environmental procedures, legislative requirements, commitments and conditions applicable to the MSS EMP.
Maintains weekly communication with DNSMA (trajectories) and DNPA. Supply daily GPS coordinates to DNSMA if required.
Email marine mammal logsheets to DNSMA (EIA Coordinator) on a weekly basis.
Reports incidents to Eni Environmental Adviser and Eni Chief Geophysicist.
Assists with the conduct of an environmental audit of the seismic vessel and provides the results of this audit to the Eni Environmental Adviser.
Eni Company Representative
Ensures that Eni requirements are being fulfilled onboard during the MSS, including commitments detailed in the EMP.
Provides supervision and technical direction to personnel involved in the execution of HSE studies.

7.4 TRAINING, AWARENESS AND COMPETENCE

Contractors and staff receive appropriate training on their environmental responsibilities in connection with the Eni 3D MSS. All Eni and WesternGeco personnel receive an environmental induction. The induction follows induction procedures and addresses the issues and actions identified within this EMP. Marine mammal training is also given to the crews of the *Geco Eagle* and its support vessels.

7.5 MONITORING, AUDITING AND REPORTING

7.5.1 Monitoring

The discharge of domestic wastes will be periodically monitored to ensure that the performance standards in place for the activity are met. All solid and hazardous wastes stored onboard and sent onshore for disposal will be recorded in a waste manifest. Volumes of fuel used during operations will also be recorded on daily logs.

7.5.2 Auditing

Auditing will ensure that the monitoring has been undertaken and the results of the audit will be used to review environmental targets and monitoring effectiveness. Audits will include routine operations of the seismic contractor aboard the seismic vessel. Audits will be in accordance with Eni's *Procedure: HSE Auditing* (Eni, 2007c). Where the audit highlights areas of non-compliance, a review of practices will be conducted and will be incorporated into future seismic contractor Operations HSE Management Plan and other standard operating systems and procedures.

An initial audit of the seismic vessel will be conducted before it arrives at the survey location to ensure that it complies with the requirements in this EMP. An Eni representative will lead the audit team. Audits at three, six and nine months into MSS will include the participation of an DNSMA representative and focus on the environmental performance objectives detailed in Section 6 to ensure effective legislative compliance



and management of the high and medium risks. Eni will take the lead role in conducting audits and will establish an audit schedule, detailing audit scopes, frequencies and audit team members. DNSMA will be notified of non-conformances arising from audits.

In addition, DNSMA will be able to observe the vessel practices of the *Crest Supply 1* when the vessel is in port in Dili. This will be arranged by DNSMA directly with Timor-Leste Customs.

7.5.3 Reporting

All environmental incidents or deviations from this EMP will be reported in accordance with Eni's *Procedure: Hazard & Incident Reporting & Investigation* (Eni, 2007b).

Reportable Incidents

A reportable incident is defined as an incident mentioned in the EMP that has caused, or has the potential to result in, moderate to catastrophic environmental consequences, as categorised in the environmental risk assessment.

DNSMA will be notified of all reportable incidents within two hours. Further, a written report must be given to DNSMA within three days.

Mandatory reporting requirements for the escape, or ignition, of petroleum and other material include:

- a discharge into the sea of a mixture of petroleum and water in which the average petroleum concentration was greater than 30 mg/L during any 24 hour period;
- the escape or discharge into the sea of more than 80 L of petroleum or base oil, not being the above; and
- the uncontrollable escape or ignition of petroleum or any other flammable or combustible material causing a potentially hazardous situation.

Additional regulatory reporting includes any non-conformance with the Performance Objectives detailed in this EMP.

7.6 MANAGEMENT AND REVIEW OF THE EMP

This EMP will be reviewed:

- if any significant new environmental risk arises; and/or
- before the commencement of any new activity or significant modification to processes described in this EMP.

Any significant incident occurring during operations would also trigger a review of the EMP.



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APPENDICES



APPENDIX A: ENI'S HEALTH, SAFETY, ENVIRONMENT AND QUALITY POLICY

Eni Australia HSEQ Policy

Eni Australia considers that achieving a high standard of Health Safety and Environmental performance is a primary objective and the company gives this equal status with its other core business objectives.

Eni Australia is committed to:

- ❖ establishing and maintaining International Standards Organisation (ISO) 14001 certification.
- ❖ applying the highest practical occupational health, safety, environmental, quality and risk standards by fully integrating AS 4801, ISO 14001, ISO 9001 and ISO 17776.

Objectives:

In fulfilling this policy Eni Australia will as a minimum:

- ❖ Comply with all applicable laws and regulation and strive for higher standards.
- ❖ Apply responsible standards where laws and regulations do not exist.
- ❖ Provide a safe and healthy work place.
- ❖ Strive to eliminate all work related injuries and illnesses.
- ❖ Strive to eliminate all health, safety and environmental incidents.
- ❖ Promote hazard awareness and drive a positive health, safety and environmental culture.
- ❖ Assess potential health, safety and environmental effects before conducting new activities.
- ❖ Participate actively with industry and government in the development of appropriate legislation and regulation.
- ❖ Ensure contractors understand and adhere to Eni Australia HSE policies and standards.
- ❖ Minimise greenhouse gas emissions, effluents and discharges that may have an adverse effect on the environment.
- ❖ Respect the interests of those who may be affected by its operations such as neighbours and local communities.

Application:

The Policy is implemented through the application of the HSEQ Management System, which is an integral part of the Eni Australia overall management approach.

- ❖ All managers are expected to demonstrate that these objectives are being met by employee and contractors.
- ❖ These objectives will be subjected to periodic auditing and assessment.
- ❖ The management team provides the driving force behind the implementation of this Policy.
- ❖ The company will ensure that all employees and contractors are made aware of their HSEQ roles and responsibilities and properly trained to undertake them.
- ❖ All Eni Australia employees and its contractors are required to understand and act in accordance with this policy.

As Managing Director, I have ultimate responsibility for the implementation of this Policy. This responsibility is delegated through the management team, such that each department manager is responsible for monitoring its effectiveness within his or her area of responsibility.

Managing Director

Eros Agostinelli

Date 30/5/06





APPENDIX B: WHALE AND DOLPHIN SIGHTING REPORT



Whale and Dolphin Sighting Report

National Cetacean Sighting Program

Wildlife Impact and Protection Section
Department of the Environment and Heritage
GPO Box 787
Canberra ACT 2601 AUSTRALIA



Approvals and Wildlife Division

DO NOT approach whales/dolphins closer than 100 metres

Date Time (local) Sighting from Location
 land / vessel air / on platform

Please return to:

Latitude ' S Longitude ° ' E

SPECIES DETAILS

Species (as close as possible eg long-finned pilot whale/pilot whale/toothed whale/whale)

Animal/s length biggest/smallest How did you estimate length? Your distance (min/max) from animal
 Total number of whales/dolphins Behaviour of whales/dolphins (eg swimming-north, breaching, resting)
 Number of calves

How sure are you? (please circle)
 very sure -- sure -- not sure

Please draw the shape and features you observed (eg. flipper, tail, back and head. Mark in the colour/s and draw colour patterns and any unusual markings injuries, scars etc)

WEATHER/SEA CONDITIONS

Beaufort Sea State (please circle)
 0-----1-----2-----3-----4-----5-----6-----7+
 mirror moderate white caps very rough
 calm
 Weather (eg sunny, clear, light rain)
 Cloud cover → /8
 Wind direction Wind speed
 Sea temperature (°c)

Other animals present (including fish, birds, etc...)

Other notes / sketches (eg. what did you use to identify the whale/dolphin)

Were there any photographs taken Y/N

Your Name and Address

Species guide

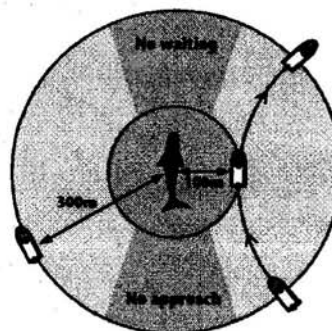
Species	On Surface	Diving	Other Characteristics	Length
Southern right				up to 17 metres
Blue				23 to 27 metres
Humpback				11 to 16 metres
Minke				about 9 metres
Sperm				12 to 18 metres
Killer				8 to 10 metres

NB: for guidance only, not all species are shown here

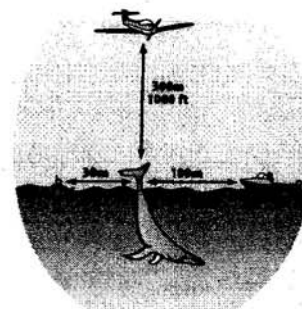
Whale watching guidelines

- Vessels should approach whales or dolphins as in A .
- Within 300 metres of a whale move at a constant slow speed no faster than the slowest whale or at idle, 'no wake' speed.
- Avoid sudden or repeated changes in speed or direction
- Do not approach closer than 100 metres in a boat (B)
- Stopping? allow the motor to idle (1 minute) before turning off
- No more than three vessels should attempt to watch a whale or group of whales at one time
- Do not allow the whales to become boxed in, cut off their path or prevent them from leaving.
- Do not approach mothers with young calves.

Move away slowly at idle, 'no wake' speed to at least 300 metres from the closest whale



A



B

Species

Blow

Surfacing

Diving

Other characteristics

Southern right

Blue

Fin

Sei

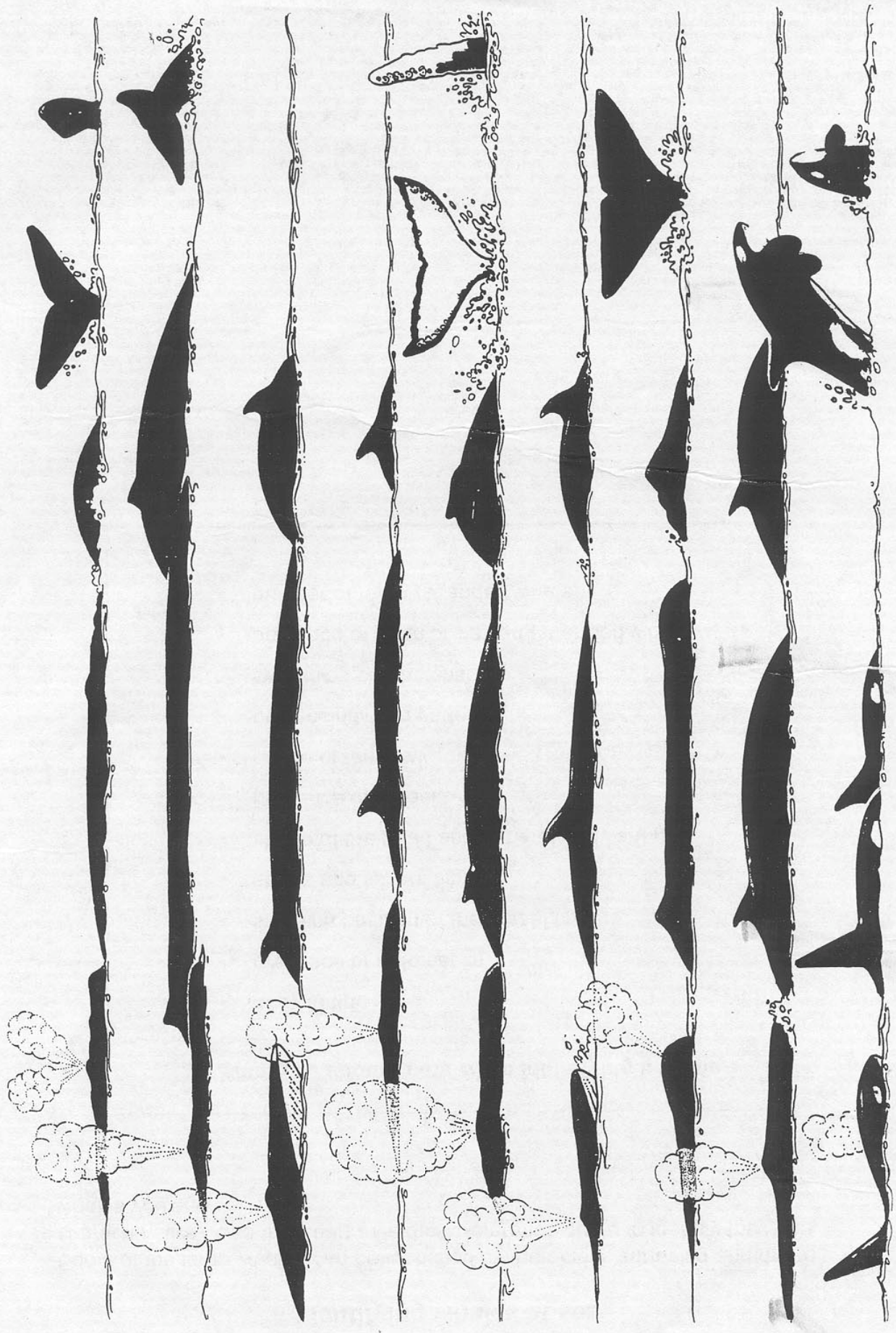
Humpback

Bryde's

Sperm

Minke

Killer



Identifying Whales at sea

Some of the large whales can be identified by their blow, surfacing and diving characteristics. Use this chart as a quick reference guide to identify the large whales you see.

What you should note when identifying a whale

- body length
- presence of a dorsal fin
- size and position of the dorsal fin
- shape and size of flippers
- shape of the head and general body shape
- presence of a beak
- shape of the blow
- body colour and patterns
- swimming characteristics
- presence of teeth or baleen (stranded whale)
- number of teeth (stranded whale)