



Eni Timor Leste

BICUDA 2D SEISMIC SURVEY [DRAFT] ENVIRONMENTAL MANAGEMENT PLAN



Pacific Titan

TL-HSE-PL-001 (Rev 0)

MAY 2008

[English Version]

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<p>Eni Timor Leste</p> <p>BICUDA 2D SEISMIC SURVEY [DRAFT] ENVIRONMENTAL MANAGEMENT PLAN</p>					
Abstract:					
<p>Eni Timor Leste S.p.A (Eni) plans to undertake a two-dimensional (2D) Seismic Survey in Production Sharing Contract (PSC) Blocks S06-01 (A), S06-02 (B) and S06-05 (H) in the Timor Sea off the south coast of Timor-Leste. This Draft 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 seismic survey 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>
MMO	Marine Mammal Observer
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
MZA	<i>Maritime Zones Act 2002</i> , Government of Timor-Leste
NGO	Non-government Organisation
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



0. EXECUTIVE SUMMARY

Eni Timor Leste SpA (Eni) has been awarded a number of Production Sharing Contracts (S06-01 (A), S06-02 (B) and S06-05 (H)) by the Government of Timor-Leste which allows Eni to conduct a range of scheduled petroleum exploration activities. Eni is planning an offshore two-dimensional (2D) seismic survey commencing late July 2008, for 30 to 40 days. The survey will be conducted by CGGVeritas (the seismic survey contractor) using the *Pacific Titan*.

An Environmental Screening Document (ESD) was submitted to DNSMA on 5 July 2007 regarding the Bicuda survey. In the ESD, Eni proposed that the 2D Survey should be assessed as a Category B activity, thus requiring the submission and approval of an Environmental Management Plan (EMP). National Directorate of Environmental Services (DNSMA) accepted this proposed level of assessment on 6 August 2007.

This EMP is submitted to the 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 Bicuda 2D survey will be managed to comply with Eni's Health, Safety and Environment (HSE) Policy.

The scope of the EMP is all operational activities relating to the Bicuda 2D Seismic Survey in the PSC Blocks. The EMP describes:

- the activities of the seismic survey and the environment in the vicinity of the survey area;
- the potential environmental effects, risks and measures designed to minimise and/or mitigate actual and potential risks of the survey;
- Eni's Environmental Performance Objectives, Standards and Criteria for the survey; 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 Bicuda 2D survey area 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.

There were 20 risks identified, with no High risks, 5 Moderate and 15 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 Bicuda 2D survey include responsibilities, training, reporting frameworks, mitigation and response activities and monitoring and auditing procedures. Commitments associated with these, listed in Table 0.1, 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 CGGVeritas individual responsibilities listed.



Table 0.1: Key commitments checklist

Item	Topic	Commitment	Responsibility	Target Date
1	Waste segregation and disposal	Waste segregated on the seismic and chase vessels into clearly marked bins for incineration or appropriate disposal. Environmentally acceptable materials chosen where possible. No waste disposal of in Timor-Leste.	Eni and CGGVeritas	Throughout survey
2	Refuelling	Dry-break couplings used as standard.	Eni and CGGVeritas	Throughout survey
3	Spills and incidents	Wastes not to be discharged via deck drains. Seismic contractor and vessel have accepted reporting and recording procedures. Shipboard Oil Pollution Emergency Plan (SOPEP) in place. Ensure that shipboard oil spill equipment is well maintained. Record all incidents and report to DNSMA all spills >80L.	Eni and CGGVeritas	
4	Environmental awareness of crew	Environmental inductions undertaken prior to mobilisation to maximise awareness . Marine mammal identification information sessions undertaken by marine mammal expert .	Eni	Prior to and during survey
5	Introduced pests	Fresh water used as ballast water. Recent hull inspection conducted.	Eni and CGGVeritas	Prior to mobilisation
6	Coral reefs/ intertidal habitats	Bathymetric survey (using side scan sonar and echo sounder) conducted by chase vessel two weeks prior to seismic vessel being on location, producing detailed bathymetric maps that will be consulted during the survey. Minimum water depth of 10m for seismic operations in areas where bathymetric surveys have been undertaken and confirmed there are no reefs or intertidal shoals (otherwise the minimum water depth is 15m). 500 m exclusion zone observed between any part of the <i>Pacific Titan</i> or its streamer and any reef or intertidal shoal.	Eni and CGGVeritas	Prior to mobilisation and throughout survey



Item	Topic	Commitment	Responsibility	Target Date
7	Fishing community interaction	<p>Conduct public meetings with communities in Suai and Betano regarding the survey, during the public engagement period.</p> <p>Produce Information Notices for distribution to communities adjacent to the survey areas, including coastal <i>sucos</i>, explaining the survey and its timing.</p> <p>Regular communication with the DNSMA and DNPA staff in Dili, Suai and Same.</p> <p>Indonesian speaker on chase vessel to liaise with fishing vessels ahead of the <i>Pacific Titan's</i> course.</p>	Eni and CGGVeritas	
8	Marine mammal interactions	<p>Follow <i>EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales</i>.</p> <p><i>Observation zone</i> 3+km radius from acoustic source: whales monitored to determine if they are approaching the low power zone.</p> <p><i>Low power zone</i> 2km to 500m radius from acoustic source: if whales enter this zone, the acoustic source should immediately power down to low setting.</p> <p><i>Shutdown zone</i> <500m radius from acoustic source: if whales enter this zone, the acoustic source shuts down.</p> <p>Soft start procedures over 30 min period: a sequential build-up of warning pulses at the start of each acquisition line to warn and deter marine mammals from approaching.</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 chase vessel observations 5km ahead of the seismic vessel's course.</p> <p>A dedicated marine mammal observer will be onboard the seismic vessel or chase vessel to ensure consistent and continual observation and recording.</p>	Eni and CGGVeritas	Throughout survey
9	Audits	<p>Conduct an environmental audit of the seismic vessel whilst in port in Dili, observed/assisted by DNSMA personnel.</p> <p>All audit reports and non-conformance reports forwarded to DNSMA.</p>	Eni, CGGVeritas and DNSMA	Prior to and during survey
10	Communications with DNSMA	<p>Weekly emails from <i>Pacific Titan</i> Vessel Master to DNSMA detailing:</p> <ul style="list-style-type: none"> - the seismic array's actual course for the previous week; - predicted course for the forthcoming week; and - marine mammal observations. 	CGGVeritas	Throughout survey



1. INTRODUCTION

1.1 BACKGROUND INFORMATION

Eni Timor Leste S.p.A. (Eni) has been awarded Production Sharing Contracts (PSC) by the Government of Timor-Leste to conduct petroleum exploration in designated Contract Areas. Eni is planning to undertake an offshore two-dimensional (2D) seismic survey known as the "Bicuda" survey, in PSC Blocks S06-01 (A), S06-02 (B) 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. In the Timor Sea, Eni has activities in the Joint Petroleum Development Area (JPDA) as well as the five PSCs in Timor-Leste.

Eni is committed to achieving the highest practicable standard of environmental protection and this commitment is documented in the Eni Health, Safety and Environment (HSE) Policy (Appendix A). All aspects of the Bicuda 2D seismic survey will be managed to comply with this Policy. Key features of Eni's HSE 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.

In January 2008, Eni's HSE Integrated Management System achieved certification with *ISO 14001:2004 Environmental Management Systems* for its seismic survey activities. This certification provides audited assurance of a best-practice environmental management system based on continual improvement.

1.3 SCOPE AND OBJECTIVES OF THIS EMP

The scope of this EMP is all operational activities relating to the Bicuda 2D Survey, 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.

An Environmental Screening Document (ESD) was submitted to DNSMA on 5 July 2007 regarding the Bicuda survey. In the ESD, Eni proposed that the 2D Survey should be assessed as a Category B activity, thus requiring the submission and approval of an EMP. DNSMA accepted this proposed level of assessment on 6 August 2007.



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 4);
- outline Eni’s Environmental Performance Objectives, Standards and Criteria for the proposed activity (Section 5); and
- describe the management measures and strategies to be used in implementing the best practice requirements and commitments made in this EMP (Section 6).

1.4 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. 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 Bicuda 2D survey program. Industry best practice guidelines and international agreements, such as the *International Convention for the Prevention of Pollution from Ships, 1973*, were also used to formulate this document.

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 Bicuda 2D seismic survey

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</i> on Public Engagement
<i>DNSMA Guideline #6</i> on Environmental Screening
<i>DNSMA Guideline #7</i> on Preparation of an Environmental Management Plan
Indonesian Legislation and Regulations in effect on 25 October 1999
<i>Law 23/1997</i> on Environmental Management



Reg. 20/1990 on Control of Water Pollution
Reg. 51/1993 on Environmental Impact Assessment
International Agreements
<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>Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal</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>
Other Best-Practice Documents
<i>APPEA Code of Environmental Practice 1996: This provides guidance on recommended minimum standards for Australian 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>
<i>EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales</i> Produced by the Australian Government’s Department of the Environment, Water, Heritage and the Arts. (DEW), this details procedures that should be followed by all seismic vessels operating in Australian waters so as to avoid interference with marine mammals.

1.5 PUBLIC ENGAGEMENT AND CONSULTATION

Public engagement and consultation is a crucial component of the Bicuda 2D Survey. The engagement process follows DNSMA Guideline #5 on Public Engagement and has been discussed with and endorsed by DNSMA. The engagement program has been initiated by public notices inviting stakeholder participation, followed by notification letters sent to identified key stakeholders with an interest in the seismic survey.

Table 1.2 details the public engagement activities that have and/or will be undertaken for the Bicuda 2D survey.

Table 1.2: Public engagement program for the Bicuda 2D Seismic Survey.

Date	Activity
12-14 May 2008	Preliminary consultation regarding the environmental approvals process undertaken with the following government stakeholders: <ul style="list-style-type: none"> • DNSMA; • National Directorate of Oil and Gas (DNPG); • National Directorate of Fisheries and Aquaculture (DNPA); and • Timor Sea Designated Authority (TSDA).
13 & 15 May 2008	Public notices in English, Portuguese, Tetum and Indonesian published in <i>Timor Post</i> and <i>Suara Timor Lorosae</i> newspapers. These notices (see Appendix B) invited interested stakeholders to contact Eni for consultation about the survey.
19 May 2008	Notification letters sent to pre-identified stakeholders inviting them to contact Eni for consultation about the Bicuda 2D survey.
23 May 2008	Eni submits this Draft EMP (Rev 0) to DNSMA in English, followed by Portuguese, Tetum and Indonesian translations approximately one week later. The draft EMP is made publically available by publishing on the DNSMA or DNPG website. Subsequently, DNSMA to distribute copies of the Draft EMP (including translations) to communities adjacent to the survey area, including Suai (Cova Lima), Betano (Manufahi) and coastal <i>sucos</i> .
June 2008	Public consultation meetings occur, including: <ul style="list-style-type: none"> • community meetings in Suai (Cova Lima) and Betano (Manufahi), organised by DNSMA regional officers; • meetings with Non-government Organisations (NGOs) through the NGO Forum; • meetings with Timor-Leste government agencies; and • meetings with other stakeholders as required.
4 July 2008	End of DNSMA assessment period for the draft EMP.
Early July 2008	Eni and DNSMA collate the responses received during the public engagement period. Eni prepares a final (Revision 1) EMP in response to these comments, for submission to DNSMA for approval.
Two weeks prior to the commencement of the survey	Information notices regarding the exact timing of the Bicuda 2D Survey are distributed by DNSMA and DNPA district officers to communities adjacent to the survey area, including Suai (Cova Lima), Betano (Manufahi) and coastal <i>sucos</i> , in English, Portuguese, Tetum and Indonesian.



DNSMA will be overseeing the consultation process, and as such a DNSMA representative will be in attendance at all consultations during the public engagement process. Meetings minutes and attendance will be recorded at each public engagement activity and an interpreter will be present for communication in English, Portuguese, Tetum and Indonesian.

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. 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.

2D seismic surveys are similar to 3D seismic surveys that have previously been considered by DNSMA. Energy waves generated by air guns are discharged every few seconds, with reflected signals recorded by hydrophones embedded in a streamer that is towed behind the vessel, 5 to 12 m below the sea surface (Figure 2.1). Streamers maintain buoyancy through either solid buoyancy devices or kerosene.

However unlike 3D surveys, where a vessel typically tows 6 to 10 streamers, in 2D surveys the vessel tows only one streamer. 2D surveys are designed to capture and process data of single slices of substrate to produce a cross section of its inferred composition, whereas 3D surveys process multiple data to produce a 3D model.

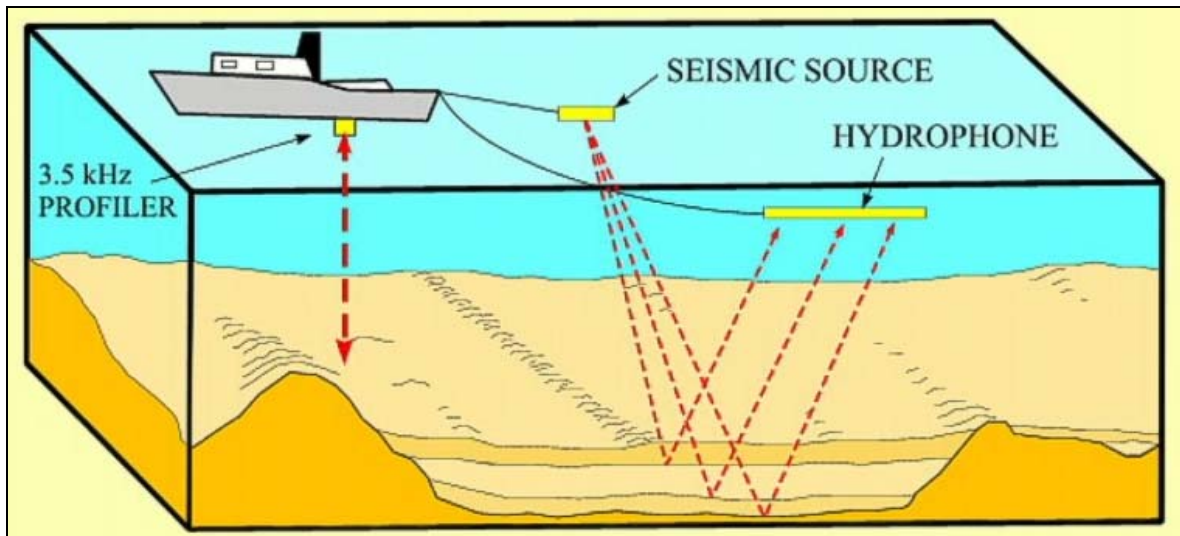


Figure 2.1: Seismic exploration techniques

2.2 PROJECT LOCATION AND TIMING

The Bicuda 2D survey is proposed to be conducted in the PSC Blocks S06-01 (A), S06-02 (B) and S06-05 (H), which are located in Timor-Leste territorial waters in depths ranging from approximately 100m to over 2,000m (Figure 2.2). Eni proposes to begin the Bicuda 2D survey late July 2008, and the survey will last for between 30 to 40 days. Eni will produce information notices regarding the exact timing of the survey, for distribution to communities adjacent to the survey area, including Suai (Cova Lima), Betano (Manufahi) and coastal *sucos*, in English, Portuguese, Tetum and Indonesian.

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 vertex of its streamer in tow.

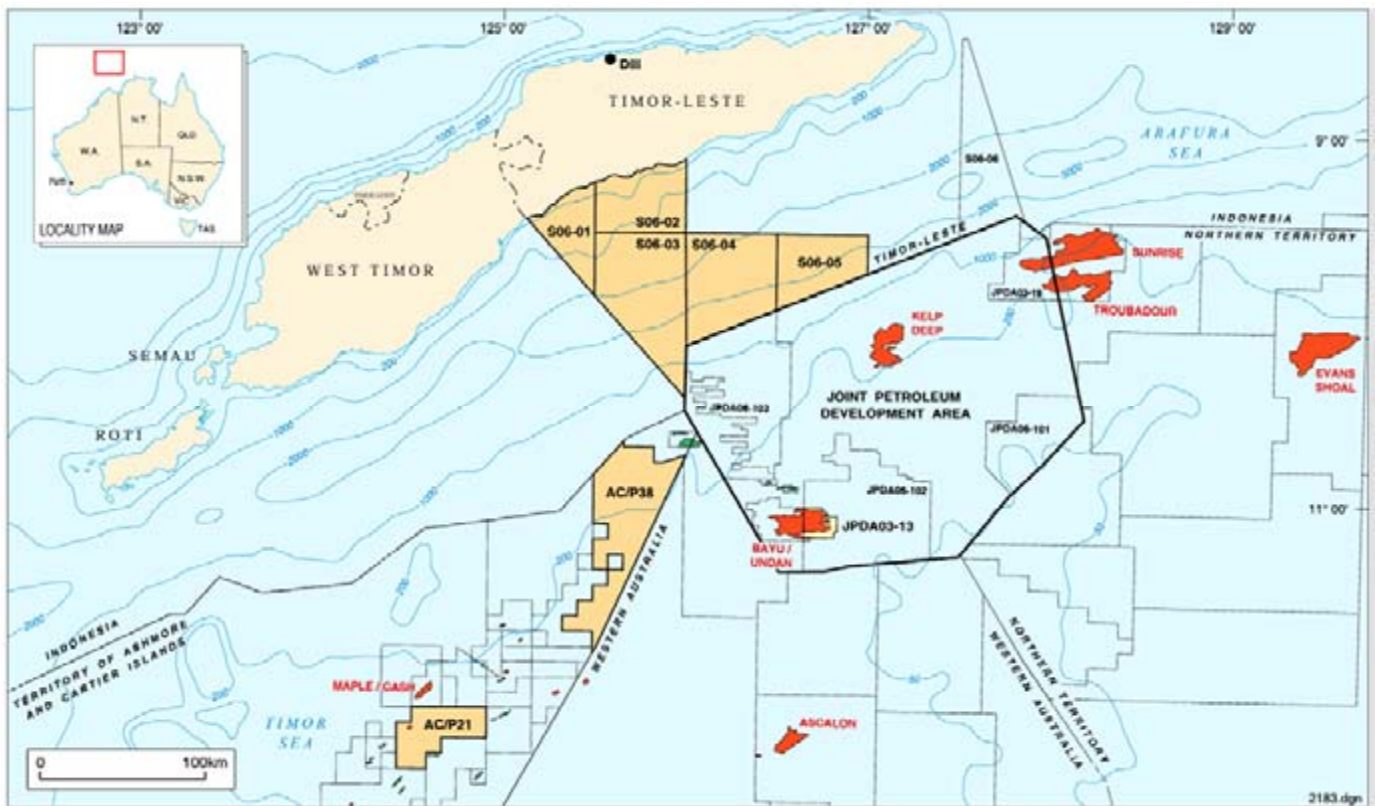


Figure 2.2: PSC Blocks location map

2.3 PROPOSED SEISMIC PROGRAMME

The proposed Bicuda 2D survey will be conducted by the seismic survey contractor CGGVeritas using the vessel *Pacific Titan*. The *Pacific Titan* is 64.5m in length and is equipped with a helideck for emergency helicopter support.

The proposed 2D Survey will use one streamer cable which will extend 8,000m behind the vessel and be towed around 6m below the sea surface. The proposed acquisition lines are indicated in Figure 2.3. The PSCs for Blocks S06-01 (A), S06-02 (B), and S06-05 (H) require 3,150 km of 2D survey lines to be acquired.

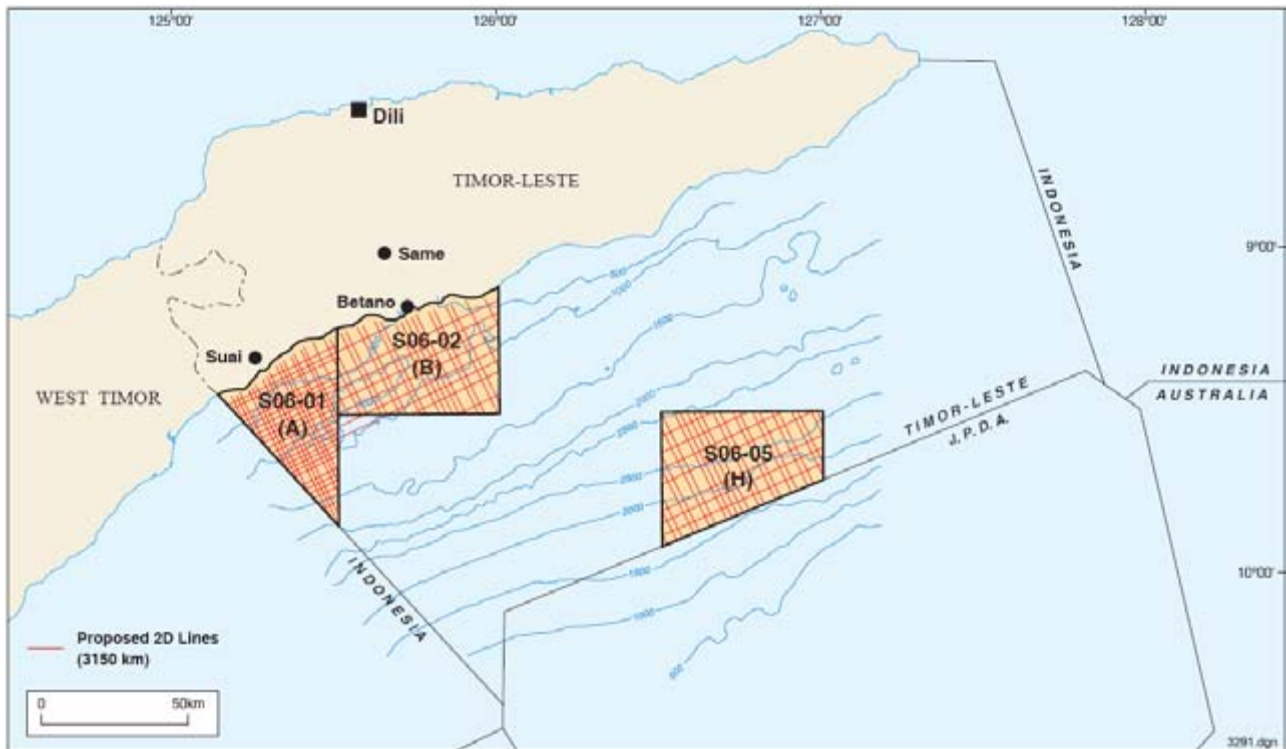


Figure 2.3: Eni’s Bicuda 2D Seismic Survey acquisition lines

The north-western ends of the 2D lines in Blocks S06-01 (A) and S06-02 (B) are in the shallowest part of the survey and the closest to the coast. The actual distance from the coast and water depths at the end of these lines will be determined after a bathymetric survey is conducted (using side scan sonar and echo sounder techniques) prior to the seismic vessel being on location. The *Pacific Titan* can operate in minimum water depths of 10m in areas where bathymetric surveys have been undertaken and confirmed there are no reefs or intertidal shoals (otherwise the minimum water depth is 15m). Eni and CGGVeritas will apply an exclusion zone of 500 m between any part of the seismic vessel and its streamer and any reef or intertidal shoal.

It is relevant to note that the proposed Bicuda 2D survey overlaps previous seismic surveys shot in 2005 and from 1970 to 1980 (Figure 2.4). These previous surveys went as close, or closer, to the coast than the indicative lines of the proposed Bicuda survey.

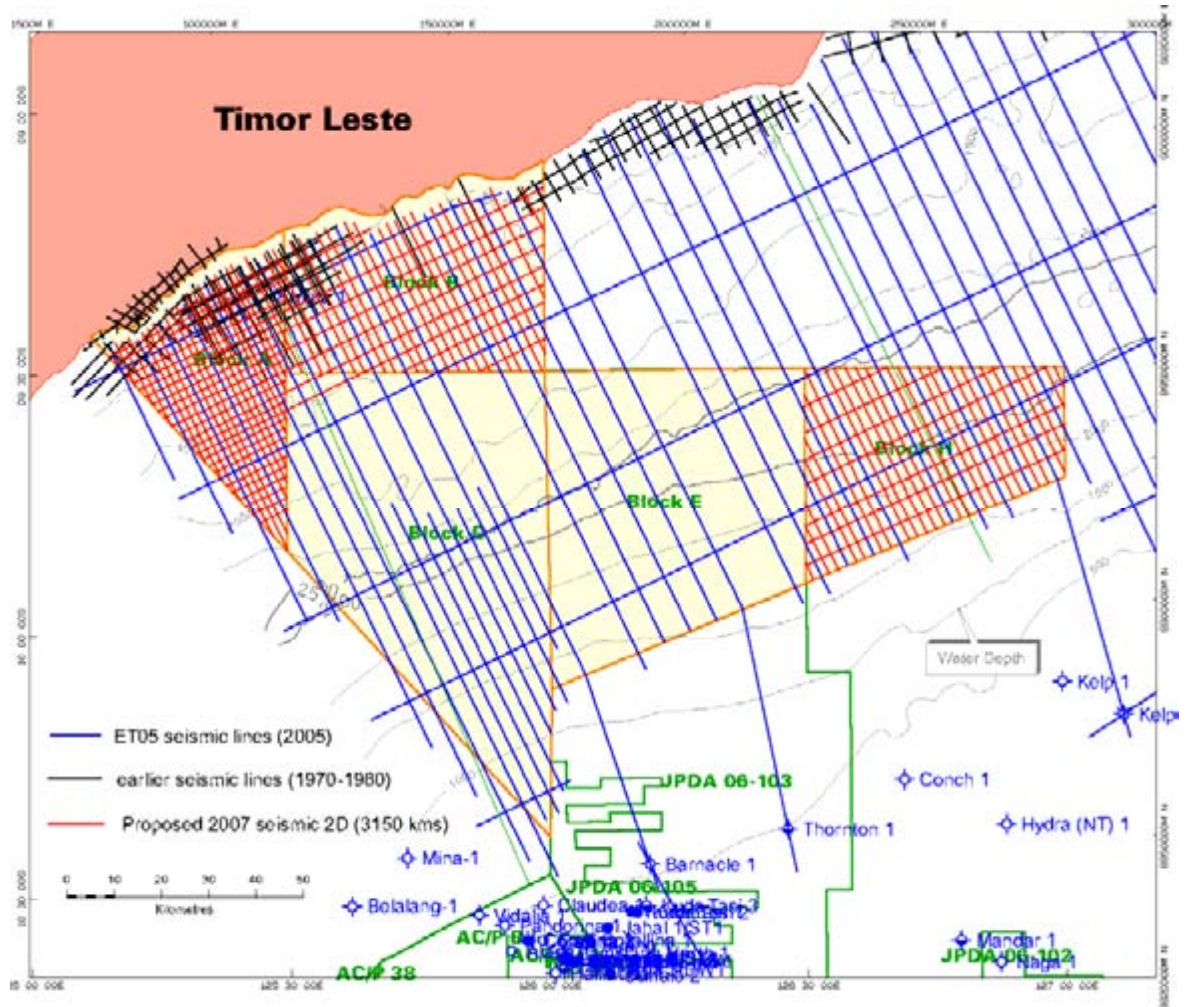


Figure 2.4: Proposed Bicuda 2D seismic lines compared with historical 2D lines from 2005 and 1970-1980

The *Pacific Titan* operates on Marine Distillate Fuel (DMA-ISO 8217:2005F). The vessel will bunker (refuel) in Dili immediately prior to commencing the Bicuda survey area and no at-sea bunkering is anticipated during the survey. Potential spills will be managed under the vessel’s Shipboard Oil Pollution Emergency Plan (SOPEP).

The *Pacific Titan* will be supported by one chase vessel during the Bicuda survey. The chase vessel will survey the bathymetric conditions of the survey area and liaise with fishing vessels encountered during the survey. Crew change and resupply of fresh provisions will occur when the vessel is in port in Dili, before and after the Bicuda survey. Eni staff will mobilise via the company’s Timor-Leste office in Dili. Emergency support for the survey will be provided by helicopters based at Dili International Airport.



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 1,770mm (Heyward et al. 1997).

Mean air temperatures recorded at the Jabiru Floating Production, Storage and Offloading (FPSO) vessel, approximately 180nm 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 5m/s to 12m/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 5m/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 5m/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 80km/h. Severe cyclones, with wind speeds exceeding 100km/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 50km to the south of the Bicuda 2D survey area), are semidiurnal, with a typical tidal range of 4.0m at springs and 1.8m at neaps (Australian National Tide Tables - Echo Shoals). Tidal transformations for the Laminaria FPSO facility, to the south-east of the Bicuda 2D survey, 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 100m 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 0.6m/s (springs), and 0.2m/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 0.1m/s and 0.4m/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 150m (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 Bicuda 2D survey area are: Jaco Island Marine Park, at the eastern end of Timor-Leste (approximately 130km north-east); the Australian Ashmore Reef National Nature Reserve (approximately 370km south-west); and the Indonesian Teluk Kupang/Pulau Kera Marine Recreation Park (approximately 220km 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 (20m 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).

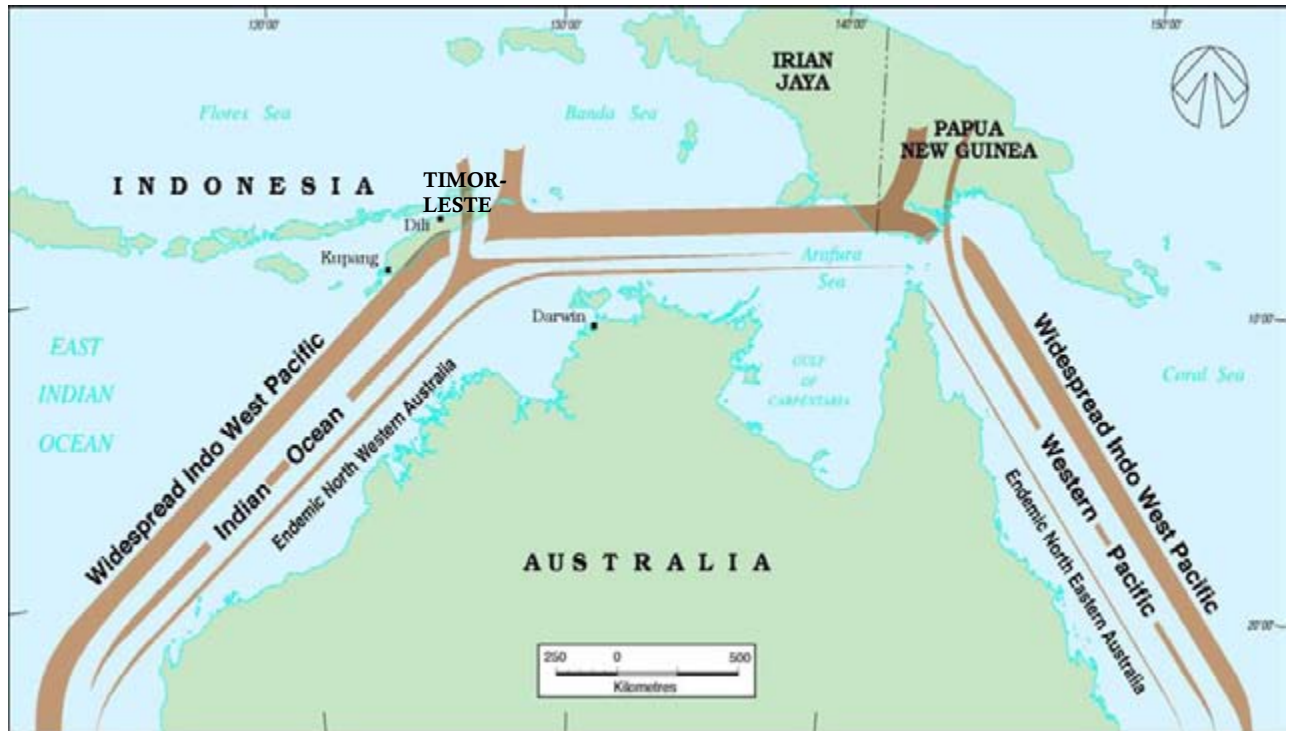


Figure 3.1: Indo-West Pacific biogeographical province (Wilson & Allen 1987).

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 Coral reefs and intertidal areas

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). Intertidal reefs and islands occur along the south coast of Timor-Leste, adjacent to the Bicuda 2D survey area. Wyatt (2004) surveyed a small area of the nearshore coastal marine environment on the south coast. 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.

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.

Examination of a map from the US Army Corps of Engineers (1963) shows nearshore bathymetry and the intertidal habitats of the survey area in PSC Blocks S06-01 (A) and, S06-02 (B). Most of the coastline adjacent to the survey area is identified as "sand", with two coral reef communities present (as shown in Figure 3.2):

- a coral reef zone extending 10km east from Betano; and
- reef immediately around the point at Suai.

The location of Suai and Betano relative to the survey area is shown in Figure 2.3. Aerial observations of the south coast coral reefs, during helicopter transfers as part of Eni's Albacora 3D survey, indicate that the fringing reefs do not extend further than 100m from shore. An aerial photograph of the reefs west of Betano is shown in Figure 3.3.

3.4.5 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).

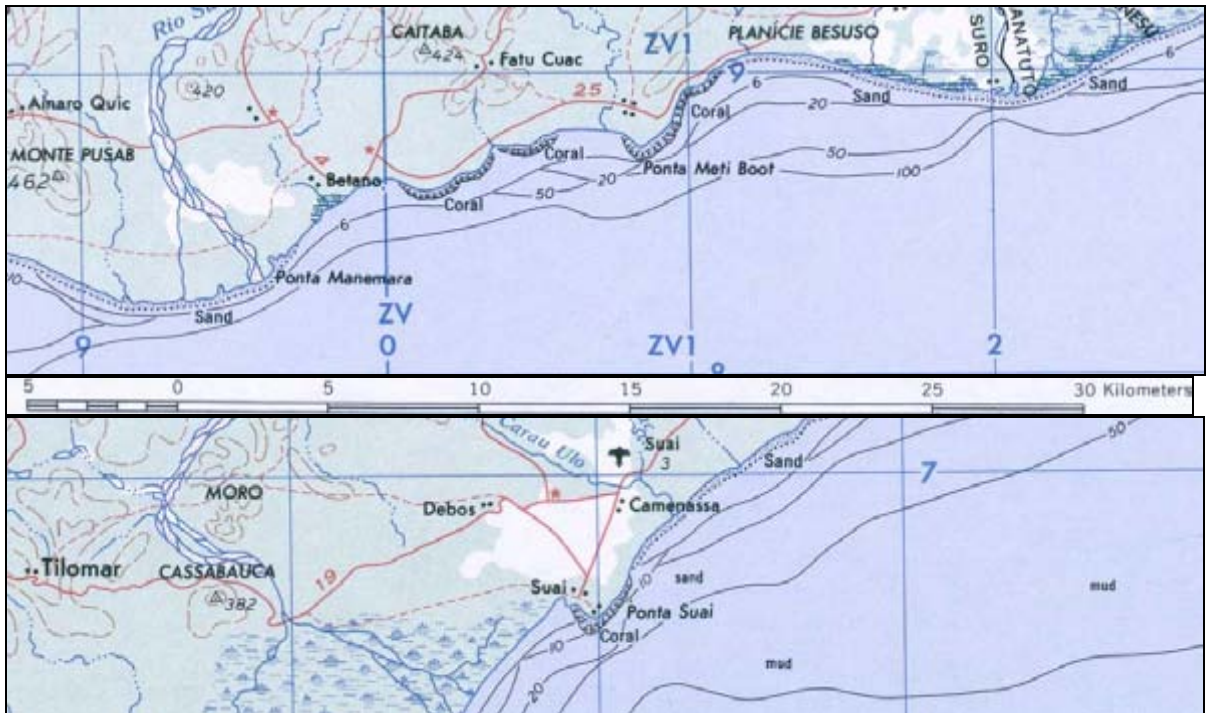


Figure 3.2: Insets from Map SC 51-8 (US Army Corps of Engineers, 1963), showing the two identified coral reef zones adjacent to the Bicuda 2D survey area, around Betano (top) and Suai (bottom). Note: depths in fathoms



Figure 3.3: Aerial photograph of fringing coral reefs east of Betano.



3.4.6 Marine Mammals

A number of whale, dolphin and porpoise species are likely to be encountered during the Bicuda 2D survey, with the Timor Trench providing an important flow-through of species connecting the Pacific and Indian Oceans. Of these, a number of whale species are considered endangered or vulnerable (Table 3.1). A number of dolphins may occur within the Bicuda 2D survey 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, in protected areas coinciding with sizeable seagrass beds.

Marine mammal observations from Eni's Albacora 3D seismic survey (2007) by dedicated Marine Mammal Observers (MMO) provide an important insight into the distribution of whales and dolphins in the Timor Sea. In September 2007, observations were made over 22 days, recording a total of 23 sightings of cetaceans comprising approximately 96 individuals (Western Whale Research 2007). These included 13 pods of Pygmy blue whales, *Balaenoptera musculus brevicauda*, and 8 pods of unidentified large whales (most likely to be Pygmy blue whales). Two pods of unidentified dolphins totalling 70 individuals were also observed. Given the large survey coverage over deep water (up to 2500m) and short observation duration of 22 days (with excellent weather) this number of sightings is considered to be high and of very high importance to marine science.

In contrast, the MMO effort for the 3D Seismic Survey in December 2007 observed relatively low numbers of sightings in the Timor Sea (Western Whale Research 2008). Over 13 days, a total of four sightings of cetaceans comprising 16 individuals were recorded. These included one unidentified whale, one sighting of two Fraser's dolphins and two pods of unidentified dolphins. An explanation of the low numbers may be the different seasonal conditions (from Winter/Spring to Spring/Summer) and a change in surveying area from predominantly deep to shallower water (500m).

Marine mammal observations from the Bicuda 2D survey, conducted by a dedicated MMO onboard the vessel, will add to this knowledge regarding marine mammal species in the Timor Sea.

3.4.7 Marine Reptiles

Turtles

There are no turtle nesting sites or other critical habitat (eg breeding or feeding sites) identified within the Bicuda 2D survey 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). During Eni's Albacora 3D Survey in 2007, the seismic vessel encountered Olive Ridley turtles trapped in discarded fishing net, which were subsequently rescued by the seismic crew.

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 likely to occur within area	Vulnerable, Migratory
Blue Whale	<i>Balaenoptera musculus</i>	Species or species habitat likely to occur within area	Endangered, Migratory
Bryde's Whale	<i>Balaenoptera edeni</i>	Species or species habitat likely to occur within area	Migratory
Sperm Whale	<i>Physeter macrocephalus</i>	Species or species habitat likely to 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

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)

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 (Ross 1998). The saltwater crocodile may be encountered during the seismic acquisition lines close to the coast. The saltwater crocodile is listed as Low Risk, Least Concern in the International Union for Conservation of Nature (IUCN) Red List.

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 Bicuda 2D MSS.

3.4.8 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).

3.4.9 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

3.4.10 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 Bicuda 2D 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 National Context

Timor-Leste is 15,400 km² in land area, consisting of the Eastern part of the Island of Timor; Oecusse, an enclave in West Timor (Indonesia); and the island of Atauro. The Democratic Republic of Timor-Leste achieved formal independence on 20 May, 2002. Today the population of Timor-Leste is just over one million people and is one of the fastest growing in the world, at around 4 per cent per annum. The predominant religion is Roman Catholic and the official languages of Timor-Leste are Portuguese and Tetum. Indonesian and local languages are also spoken, such as the Malayo-Polynesian language Mambai, spoken in the district of Manufahi. The government system at a regional level is organised into districts, sub-districts and *sucos* (local councils).

Despite significant increases in revenue due to receipts from petroleum and coffee exports, it is still the poorest country in the Asia-Pacific region and has been ranked 150 of 177 countries in the 2007 UN Human Development Index. Around 75% of the population lives in rural areas, engaged in agriculture, mostly at the subsistence level. The overall literacy rate in Timor-Leste is around 50%.



Despite this, the country has made significant progress in building an institutional framework to support economic development and promote macroeconomic stability. The National Development Plan identifies governance, poverty reduction and improved food security as development priorities. Timor-Leste has established an internationally-acclaimed Petroleum Fund to manage its petroleum revenues transparently and sustainably.

3.5.2 Communities adjacent to the survey area

The coastal section of the Bicuda 2D seismic survey borders the districts of Cova Lima (population 53,000), Ainaro (52,500) and Manufahi (45,000). Within these districts, there are seven sub-districts and around seventeen *sucos* along the coast bordering the Bicuda 2D survey area. Small towns and villages are spread throughout these *sucos*, usually located a few kilometres inland from the coast. The two largest population centres on the coast adjacent to the survey area are Suai (population 23,000), capital of Cova Lima district, and Betano, a coastal village in Manufahi.

3.5.3 Traditional Fishing

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 1,600t in 2002 (Jasarevic 2002).

The main vessel for traditional fishing is the pirogue, a small, flat-bottomed boat often propelled by paddles, although outboard motors are becoming increasingly common. Traditional fishing uses both gill net and handlines, and fishing activities usually do not extend more than 2 nm (<4 km) from the coast.

3.5.4 Commercial Fishing

The Government of Timor-Leste issued four commercial fishing licences for the Timor Sea in 2006. These were operated in 2007, but DNPA have advised that these are not currently operated in 2008. Illegal fishing is also known to occur in the waters south of Timor-Leste.

3.5.5 Shipping

A large number of vessels may transit through the deeper waters of the Timor Sea and thus Block S06-05 (H) of the seismic survey, 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, there were up to 173 ship transits through Eni's Timor-Leste PSC Blocks. Generally, vessels transiting through this area include bauxite and coal carriers and container vessels servicing Australian terminals



3.5.6 Heritage

There are no known significant marine heritage or archaeological sites in the vicinity of the Bicuda 2D Seismic Survey.

The Australian destroyer HMAS *Voyager* ran aground at Betano in 1942, during World War II. The vessel was abandoned and later destroyed by demolition charges, but fragments of the wreck can be seen close to the beach at Betano.



4. ENVIRONMENTAL RISK ASSESSMENT

4.1 ENVIRONMENTAL RISK ASSESSMENT MATRIX

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 part of Eni's HSE Integrated Management System, the company's ISO 14001-certified risk management procedure (Eni (2007a)) was used as the basis for the ERA. 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. Table 4.1 presents Eni's Risk Matrix, defining the likelihood, (environmental) consequence and resulting risk used to determine the level of risk for each event (Eni 2007a).

In order to carry out an ERA of seismic activities on the Timor Sea it is necessary to employ a methodology that:

- identifies the activity and the source of the risk;
- defines the potential environmental effects of the activity;
- identifies the safeguards or risk management measures in place;
- with such safeguards in place, identifies the residual levels of likelihood and consequence;
- determines residual environmental risk of the activity, using the risk matrix.

Using this model, an environmental risk analysis workshop was conducted on 30 April 2008 to identify potential environmental hazards from the Bicuda 2D survey activities. The workshop took into consideration risks associated with previous seismic surveys undertaken in the area. There were 20 risks identified, with no High risks, 5 Moderate and 15 Low risks. The potential risks are related to mobilisation, survey operations and the potential for accidental discharges.

Table 4.2 presents a summary of the environmental risk assessment for the Bicuda 2D survey.



Table 4.1: Eni Risk Matrix

Consequence					Increasing Annual Frequency					
Severity	People	Environment	Assets	Reputation	0	A	B	C	D	E
					Could happen in E&P industry	Heard of in E&P industry	Has occurred at least once in Company	Has occurred several times in Company	Happens several times/y in Company	Happen several times / y in one location
1	Slight health effect / injury (not applicable)	Slight impact No sensitive impact on ground/air/water	Slight damage No disruption to operations/business	Slight impact Minor and short lived impact in the locality	<i>Continuous Improvement</i>					
2	Minor health effect / injury (not applicable)	Minor impact Impact on localised ground	Minor damage Possible short disruption of operations/business: repair cost: <200,000	Minor impact Some loss of reputation in the area, which should be recovered						
3	Major health effect / injury 1 or more than 1 Lost Time Accident; up to 30 days off for any single injury. ¹	Local impact Regional stakeholder concern or 1-2 years for natural recovery or 1 week for clean-up. Spill <100m ³	Local damage The unit has been repaired/replaced to resume operations: repair cost <2,500,000. Loss damage to public domain.	Local impact Significant potentially long lived damage to the regional reputation	<i>Risk Reduction Measure Required</i>					
4	PTD or 1 fatality Serious permanent disability or death	Major national impact National stakeholder concern or 2-5 years for natural recovery or up to 5 months for clean-up or threatening to biodiversity or impact on interesting areas for science. Spill < 1000m ³	Major damage Long time/Major change to resume operations/business: repair cost < 25,000,000. Interruption of public services.	Major national impact Serious / permanent damage to the ability of the Company to sustain business position in the location, some broader implications for the Company						
5	Multiple fatalities From an accident or occupational illness (e.g. chemical asphyxiation or cancer or epidemic diseases)	Major international impact International stakeholder concern or >2-5 years for natural recovery or > 5 months for clean-up or reduction of biodiversity or impact on special conservation areas. Spill > 1000m ³	Extensive damage Total loss of operations/business: repair cost > 25,000,000. Extensive damage to public domain	Major international impact Potential loss of future business position in the location / region and / or lasting significant damage to broader Eni image	<i>Intolerable Risk</i>					

Table 4.2: Summary of environmental risk associated with the Bicuda 2D Seismic Survey

Source of Risk	Potential Environmental Effects	Safeguards or Risk Management Measures	Likelihood of Consequences Being Realised	Consequence	Risk
Mobilisation					
Environmental Awareness	Rubbish, interference with wildlife, impacts on sensitive environments	<ul style="list-style-type: none"> All crew to undertake environmental inductions 	A	2	Low
Ballast Water	Displacement of native species	<ul style="list-style-type: none"> Fresh water used as ballast water during the Bicuda 2D Survey, therefore no ballast water risk 	B	1	Low
Hull Fouling	Displacement of native species	<ul style="list-style-type: none"> Recent hull inspections conducted 	B	2	Low
Equipment/ Personnel Transfer	Introduction of vermin, weeds and pests	<ul style="list-style-type: none"> Personnel and equipment to be transferred through Dili 	B	2	Low
General Operations					
Waste/emissions	Deck drainage – impact on water quality	<ul style="list-style-type: none"> Appropriate deck drains and bunds on seismic vessel Deck drainage flows to oil/water separation device that is regularly checked for functionality Recovered oil is transferred to Australia for disposal 	C	2	Moderate
	Domestic waste – impact on water quality	<ul style="list-style-type: none"> <i>Pacific Titan</i> waste management procedures Check functionality of waste water treatment system regularly Effluents treated to MARPOL 73/78 standards prior to discharge overboard Chase vessel complies with MARPOL 73/78 regulations Record sewage treatment and discharge in waste logs 	E	1	Low



Source of Risk	Potential Environmental Effects	Safeguards or Risk Management Measures	Likelihood of Consequences Being Realised	Consequence	Risk
	Solid waste – impact on water quality	<ul style="list-style-type: none"> • <i>Pacific Titan</i> waste management procedures • No solid waste disposed of overboard • Solid waste stored appropriately and transported to disposal facility in Australia (no waste disposal in Timor-Leste) • Food and cardboard waste incinerated • Eni to ensure that onshore disposal of wastes is to approved (ie licensed) facilities 	A	3	Low
	Hazardous waste – impact on water quality	<ul style="list-style-type: none"> • Hazardous waste is documented, tracked and segregated from other waste streams • Hazardous materials stored onboard for onshore disposal in Australia (no waste disposal in Timor-Leste) • Transfers of hazardous wastes recorded in seismic vessel waste logs 	A	3	Low
	Cooling water – elevation of water temperature	<ul style="list-style-type: none"> • High dilution rates result in no change in salinity detectable outside a localised area • Cooling water will be discharged at less than 2°C above ambient sea surface temperature • Water discharged above sea level (allows for cooling and oxygenation as it falls to sea level) 	E	1	Low
	Atmospheric emissions – localised impact on air quality and greenhouse gas emissions	<ul style="list-style-type: none"> • Engines and incineration equipment maintained at peak efficiency 	B	2	Low
	Artificial Light – attraction of fauna	<ul style="list-style-type: none"> • Preferential use of fluorescent lights, that meet required safety standards 	E	1	Low



Source of Risk	Potential Environmental Effects	Safeguards or Risk Management Measures	Likelihood of Consequences Being Realised	Consequence	Risk
Interference with Other Users	Commercial Fishing/Shipping	<ul style="list-style-type: none"> Timor-Leste Government Authorities notified, including DNPA Use navigation lighting on the seismic vessel to ensure visibility at night Safety zone gazetted around seismic vessel Regular communication with the DNPA staff in Dili, Suai and Same. Indonesian speaker on chase vessel to liaise with fishing vessels ahead of the <i>Pacific Titan's</i> course 	B	2	Low
	Traditional Fishing	<ul style="list-style-type: none"> Conduct public meetings with communities in Suai and Betano regarding the survey, during the public engagement period. Use navigation lighting on the seismic vessel to ensure visibility at night Produce Information Notices for distribution to communities adjacent to the survey areas, including coastal <i>sucos</i>, explaining the survey and its timing. Use navigation lighting on the seismic vessel to ensure visibility at night Regular communication with the DNPA staff in Dili, Suai and Same. Indonesian speaker on chase vessel to liaise with fishing vessels ahead of the <i>Pacific Titan's</i> course. 	B	3	Moderate



Source of Risk	Potential Environmental Effects	Safeguards or Risk Management Measures	Likelihood of Consequences Being Realised	Consequence	Risk
Noise	Discharge of acoustic source - disturbance to marine mammals (whales, dolphins etc)	<ul style="list-style-type: none"> Follow EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales. <i>Observation zone</i> 3+km radius from acoustic source: whales monitored to determine if they are approaching the low power zone. <i>Low power zone</i> 2km to 500m radius from acoustic source: if whales enter this zone, the acoustic source should immediately power down to low setting. <i>Shutdown zone</i> <500m radius from acoustic source: if whales enter this zone, the acoustic source shuts down. Soft start procedures over 30 min period: a sequential build-up of warning pulses at the start of each acquisition line to warn and deter marine mammals from approaching. 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 chase vessel observations 5km ahead of the seismic vessel's course. A dedicated marine mammal observer will be onboard the seismic vessel or chase vessel to ensure consistent and continual observation and recording 	C	2	Moderate
	Vessel noise - disturbance to marine fauna (cetaceans, turtles, seabirds, fish, etc)	<ul style="list-style-type: none"> Short duration of survey (30-40 days) Marine biologist onboard the seismic vessel or chase boat Observations by crew of <i>Pacific Titan</i> and chase vessel 	E	1	Low
Disturbance to Marine Fauna & Habitats	Damage to coral reefs/ intertidal habitats	<ul style="list-style-type: none"> Bathymetric survey (using side scan sonar and echo sounder) conducted by chase vessel two weeks prior to seismic vessel being on location, producing detailed bathymetric maps that will be consulted during the survey. Minimum water depth of 10m for seismic operations in areas where bathymetric surveys have been undertaken and confirmed there are no reefs or intertidal shoals (otherwise the minimum water depth for operation is 15m). 500 m exclusion zone observed between any part of the <i>Pacific Titan</i> or its streamer and any reef or intertidal shoal. 	B	3	Moderate

Source of Risk	Potential Environmental Effects	Safeguards or Risk Management Measures	Likelihood of Consequences Being Realised	Consequence	Risk
Accidental Discharges					
Leakage from Machinery	Impact on water quality/marine flora/fauna	<ul style="list-style-type: none"> • Drip trays and sumps placed under all engines • Collected waste oil stored in containment tanks prior to shipping onshore • Seismic vessel maintenance and inspection procedures • Seismic vessel has an approved SOPEP • Record and report all spills >80L to DNSMA 	B	2	Low
Streamer Damage or Loss	Streamer buoyancy fluid - impact on water quality/marine flora/fauna	<ul style="list-style-type: none"> • Seismic vessel uses solid streamer without any buoyancy fluid. • Minimal amounts of buoyancy fluid used in front and rear "stretch" assemblies only (<250L) • Bathymetric survey (using side scan sonar and echo sounder) conducted by chase vessel two weeks prior to seismic vessel being on location, producing detailed bathymetric maps that will be consulted during the survey. • Minimum water depth of 10m for seismic operations in areas where bathymetric surveys have been undertaken and confirmed there are no reefs or intertidal shoals (otherwise the minimum water depth for operation is 15m). • 500 m exclusion zone observed between any part of the <i>Pacific Titan</i> or its streamer and any reef or intertidal shoal. 	B	2	Low
Bunkering (refuelling)	Impact on water quality/marine flora/fauna	<ul style="list-style-type: none"> • Refuelling to be undertaken in port in Dili, commencing in daylight hours, suitable weather and steady sea-state conditions • Refuelling only to occur at the discretion of the vessel masters • Dry -break couplings used as standard • Seismic vessel has an approved SOPEP • Record and report all spills >80L to DNSMA 	C	2	Moderate



Source of Risk	Potential Environmental Effects	Safeguards or Risk Management Measures	Likelihood of Consequences Being Realised	Consequence	Risk
Vessel Collision	Collision resulting in oil and/or diesel spill - impact on water quality/marine flora/fauna	<ul style="list-style-type: none">• Timor-Leste Government Authorities notified• Safety zone gazetted around seismic vessel• Interaction between seismic vessel and chase vessel at discretion of the vessel masters• Record and report all spills >80L to DNSMA	A	3	Low



4.2 DETAILED DISCUSSION ON ENVIRONMENTAL RISKS AND THEIR MITIGATION

4.2.1 Environmental Aspects during Mobilisation

Introduced Pests

Exotic marine pests may be introduced into the PSC Blocks via spores or larvae in ballast water, or via hull fouling. These originate from vessels coming from other seas where the exotic species occur naturally. Because the *Pacific Titan* will use vessel-generated fresh water in its ballast water system, there is no risk of ballast water issues for the Bicuda 2D survey. A hull inspection of the *Pacific Titan* was undertaken in Singapore in February 2008, with no evidence of hull fouling.

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. Prior to Eni's survey, the *Pacific Titan* has a port call in Darwin, Australia, followed by crew changes in Dili before and after the Bicuda survey. Thus there is minimal risk of such circumstances. In addition, national customs and quarantine regulations will be applied.

4.2.2 General Environmental Aspects of Survey Operations

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 (Darwin) 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 10000L/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 25mm diameter prior to discharge, in accordance with industry best-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 from domestic waste discharge, as a result of the low volumes involved, the moving seismic survey vessels, oceanic currents and high biodegradability/low persistence of the wastes.

Solid and Hazardous Waste

Solid wastes will be segregated into waste streams. A maximum amount of segregated waste will be incinerated on board the *Pacific Titan*. Other solid waste will be compacted and held 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 will not be discharged to the marine environment, no adverse environmental impacts are anticipated.

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, CGGVeritas screen all products for their technical and environmental qualities and performance. Where technically practicable, the most environmentally acceptable options will be preferentially selected.

Transport, storage, handling and disposal of hazardous materials will be in accordance with the seismic vessel procedures and the Material Safety Data Sheets (MSDSs). Hazardous waste will be stored on board the *Titan* during the survey and unloaded when the vessel returns to Darwin at the end of survey. For the Bicuda 2D survey, hazardous wastes will be disposed of by an approved agent in Australia, Europe or USA. There will be no waste disposal in Timor-Leste.

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

Atmospheric emissions from seismic operations arise from propulsion and power generation, with the *Pacific Titan* using Marine Distillate Fuel (ISO 8217:2005F (DMA)). Emissions will also be released through the incineration of waste products.

Most of the 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.

Where possible, emissions from engines and power generators will be minimised by means of optimising fuel efficiency and conducting regular maintenance and checks.

Artificial Lights

The survey vessel will be well lit at night and during times of poor visibility, to ensure safe operations of the survey. Use of fluorescent lights that meet required safety standards are aimed to decrease the attraction of the vessel light to fauna.

4.2.3 Interference with Other Users

Disturbance to Traditional Fishing

When the seismic acquisition is occurring close (within 4km) of the south coast, the Bicuda 2D survey is likely to cause some disturbance to the traditional fishing practices. However, any disruption will be of a relatively short duration as the seismic survey is constantly moving, and the total time the *Titan* will be near shore should be less than 20 days. A chase vessel will be present during the survey, with a specific role of liaising with fishing vessels ahead of the *Pacific Titan's* course, and navigation lighting will be used on the vessels at night.

The *Pacific Titan* Vessel Master will maintain regular communications regarding its course with DNSMA, who will notify DNPA in Dili, Suai and Same so as to minimise interference with fishers in the area. During the public engagement program associated with this EMP document, public meetings will be conducted in communities in Suai and Betano and Information Notices will be distributed to sucos adjacent to the survey areas just prior to commencement of the survey.

Disturbance to Commercial Fishing and 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, the presence of the survey is not anticipated to have any significant impact on commercial fishing and shipping activity.

4.2.4 Seismic and Vessel Noise

Seismic surveys use acoustic sources to create sound waves. These waves can lead to 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 (Swan et al 1994). 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 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.

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 Western Australia. 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.

The Bicuda 2D seismic survey will 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, relative to free-swimming organisms. This allows such organisms in the survey path to clear the area. Impacts on cetaceans will be minimised by following protocols based on industry best practice and *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales*. These measures include:

- *Observation zone* 3+km radius from acoustic source: whales monitored to determine if they are approaching the low power zone.
- *Low power zone* 2km to 500m radius from acoustic source: if whales enter this zone, the acoustic source should immediately power down to low setting.
- *Shutdown zone* <500m radius from acoustic source: if whales enter this zone, the acoustic source shuts down.
- Soft start procedures over 30 min period: a sequential build-up of warning pulses at the start of each acquisition line to warn and deter marine mammals from approaching..
- 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 chase vessel observations 5km ahead of the seismic vessel's course.
- A dedicated marine mammal observer will be onboard the seismic vessel or chase vessel to ensure consistent and continual observation and recording, using specific forms (Appendix C)

It is not possible for the survey's seismic source 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.

Vessel noise is considered to be an insignificant risk because of its common occurrence – other vessels regularly pass through the area.

4.2.5 Disturbance to Coral Reefs and Intertidal Habitats

Fringing coral reef communities exist near Suai and Betano, adjacent to the nearshore sections of the survey area (as discussed in Section 3.4.4). The likelihood of the vessel or its streamer snagging on intertidal habitats is considered low – a number of mitigation measures will be in place for the nearshore sections of the survey:

- a bathymetric survey (using side scan sonar and echo sounder) will be conducted by the chase vessel two weeks prior to seismic vessel being on location, producing detailed bathymetric maps that will be consulted during the survey;
- minimum operational water depth of 10m in areas where bathymetric surveys have been undertaken that confirm there are no reefs or intertidal shoals (otherwise the minimum water depth for operation is 15m);
- 500 m exclusion zone observed between any part of the *Pacific Titan* or its streamer and any reef or intertidal shoal.

4.2.6 Accidental Discharges

General Hydrocarbon Spills

Should any hydrocarbon spill occur during the Bicuda 2D survey, the impacts associated with such a spill will be managed by implementation of the *Pacific Titan'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. For small spills, the *Pacific Titan's* oil spill response equipment would be employed to contain and absorb the spill. For larger spills further from the coast, it may be environmentally-preferable to allow the spilled fuel to weather naturally until it disappears. During this weathering period, the location of the slick would be regularly monitored and the need for intervention assessed.

Once Marine Distillate Fuel or other hydrocarbon enters the sea it undergoes spreading and weathering. 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.

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.

Streamer Fluid Leakages

The seismic survey streamers could be damaged by a number of events ranging from shark bites penetrating the streamer to snagging on intertidal habitats. The *Pacific Titan* uses a solid streamer without any buoyancy fluid, with only minimal amounts (<250L) of isoparaffinic hydrocarbon (kerosene) fluid used in the front and rear “stretch” assemblies of the seismic array. Safeguards discussed in Section 4.2.5 are relevant to this environmental aspect and result in a low environmental risk assessment.

Bunkering (refuelling) incidents

All refuelling of the *Pacific Titan* is planned to be undertaken in port in Dili. Spills caused by fuel handling mishaps are rare, but because of the number of times fuel is handled 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 with the following safeguards as standard:

- 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.

Vessel Collision

A release of Marine Distillate Fuel from a vessel collision is highly unlikely. A worst case scenario would be up to 275m³ of distillate fuel lost, which would have a generic leak frequency assessment estimated at approximately 1.1×10^{-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 chase vessels at all times;
- regular updates on weather forecasts from local weather bureaus; and
- offloading of chase vessels only in suitable weather.



5. PERFORMANCE OBJECTIVES, STANDARDS AND CRITERIA

Section 4 identified the environmental risks associated with the survey; 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 5.1.

Table 5.1: Performance Objectives, Standards and Measurement Criteria.

Performance Objectives	Standards	Criteria
MOBILISATION PHASE		
Environmental sensitivities and requirements of the area	Eni HSE Policy	Evidence of environmental inductions given to all crew. Key personnel familiar with environmental requirements, guidelines and procedures outlined in EMP and evidence that they are being followed.
Ballast water discharge	Indonesian <i>Law 23/1997</i> on Environmental Management APPEA Code of Environmental Practice, 1996	Evidence of fresh water used in ballast system, or recent deballasting if seismic vessel uses sea water balast
Introduction of exotic species from personnel/equipment	Best practice	Vessel hulls have been inspected prior to entering region
GENERAL OPERATIONS PHASE		
Minimise poor water quality (ie 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
Avoid/minimise impact on water quality from discharge of domestic wastes	MARPOL 73/78 Annex V: Prevention of Pollution by Garbage from Ships Indonesian <i>Law 23/1997</i> on Environmental Management (Article 20)	Waste logs show compliance with MARPOL 73/78 and <i>Pacific Titan'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



Performance Objectives	Standards	Criteria
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 <i>Law 23/1997</i> on Environmental Management (Article 20 & 21) Basel Convention	Solid and/or hazardous wastes stored appropriately and transported onshore Waste logs show compliance with MARPOL 73/78 and <i>Pacific Titan's</i> Waste Management Procedures. Solid and hazardous waste disposal records available showing disposal fate of all waste (no waste disposal in Timor Leste) Combustible waste incinerated
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 APPEA Code of Environmental Practice, 1996	Fuel consumption recorded and greenhouse gas emissions calculated Engines and equipment maintained regularly
Minimise acoustic disturbance to marine fauna	EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales APPEA Code of Environmental Practice, 1996	Soft starts always undertaken Power downs when marine mammals in shutdown zone Marine Mammal Observer onboard vessel Marine mammal observation log kept, and supplied to DNSMA
Minimise disturbance to marine habitats such as reefs and intertidal shoals No leakage of kerosene from streamer array	Indonesian <i>Law 23/1997</i> on Environmental Management APPEA Code of Environmental Practice, 1996	Evidence of bathymetric survey undertaken, such as bathymetric maps on board. Evidence that vessel has not operated in water depth less than 10m, or 15m in areas where no survey was undertaken.
Minimise attraction of fauna to seismic survey lighting	APPEA Code of Environmental Practice, 1996	Fluorescent lights observed on board.
Minimise disturbance to traditional fishing and communities	DNSMA Guideline #5 on Public Engagement Indonesian <i>Law 23/1997</i> on Environmental Management Eni HSE Policy	Evidence of public engagement program – meeting minutes, attendance lists etc. Evidence of email communication with DNSMA Evidence of Information Notices distributed to adjacent coastal communities.
ACCIDENTAL DISCHARGES		
Avoid and minimise mortality of sensitive fauna from leakage from machinery	MARPOL 73/78 Annex I: Prevention of Pollution by Oil Indonesian <i>Law 23/1997</i> on Environmental Management APPEA Code of Environmental Practice, 1996 <i>Pacific Titan</i> SOPEP	Compliance with seismic vessel procedures Operational oil/water separator, maintained regularly All releases of hydrocarbon >80L reported to DNSMA Compliance with SOPEP Amount of waste oil removed from seismic vessel recorded



Performance Objectives	Standards	Criteria
Prevent spills of diesel, either from refuelling operations or vessel collision	MARPOL 73/78 Annex I: Prevention of Pollution by Oil Indonesian <i>Law 23/1997</i> on Environmental Management <i>Pacific Titan</i> SOPEP APPEA Code of Environmental Practice, 1996 Vessel refuelling standards	<i>Pacific Titan</i> refuelling procedures followed If refuelling required at sea (not anticipated), vessel masters to undertake refuelling in daylight hours, suitable weather and steady sea-state conditions Safety zone gazetted around seismic survey SOPEP followed and oil spill equipment in place Spills of oil >80L reported to DNSMA Seismic vessel has navigation lighting and is visible at night Watch has been kept at all times
REPORTING		
Record of all incidents and non-conformances	Indonesian <i>Law 23/1997</i> on Environmental Management Eni <i>Procedure: Hazard & Incident Reporting & Investigation</i> (Eni 2007b)	Eni incident reporting procedure followed. All reporting has been undertaken according to implementation strategy and DNSMA notified



6. IMPLEMENTATION STRATEGY

6.1 INTRODUCTION

This section details the environmental management systems and implementation strategies that will be in place for the Bicuda 2D survey. These include responsibilities; training; reporting frameworks; mitigation and response activities; and monitoring and auditing procedures, which are intended to minimise environmental risk and to ensure that environmental performance criteria are met.

6.2 SYSTEMS, PRACTICES AND PROCEDURES

The project will be implemented under the umbrella of the Eni's HSE Policy (Appendix A), which the seismic survey contractor, CGGVeritas 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, certified to *ISO 14001:2004 Environmental Management Systems*;
- 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).

Two Eni representatives will be onboard the seismic vessel for the duration of the survey. All seismic vessel crew will receive an environmental induction at the commencement of the seismic survey. This induction will address the issues and actions identified within this EMP.

CGGVeritas as the seismic contractor has day-to-day control of the survey, and has formal, written management system, practices and procedures for HSE management of its activities. This system and its components have been reviewed by Eni and determined to be acceptable and consistent with Eni's HSE Integrated Management System and the commitments detailed in this EMP. CGGVeritas HSE documentation includes:

- Project HSE Plan for Eni's Bicuda 2D Survey;
- *Pacific Titan* Medical Evacuation (Medevac) Plan for Eni's Bicuda 2D Survey;
- *Pacific Titan* Crew HSE Plan, detailing specific procedures of the seismic vessel including waste management and refuelling; and
- *Pacific Titan* SOPEP.

6.3 COMMUNICATION CHANNELS AND ROLES AND RESPONSIBILITIES

Generally, the principal communication channel regarding environmental aspects of the Bicuda 2D seismic survey 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 CGGVeritas 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 6.1 details preliminary contact information for key personnel involved in the survey, 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 survey.

Table 6.1: Contact Details – Bicuda 2D Seismic Survey

Title	Name	Telephone	Email
Eni Timor Leste SpA			
Eni Environmental Adviser	Tony Heynen	+61 8 9320 1505 (office) + 61 421 980 476 (mobile)	tony.heynen@eniaustralia.com.au
Eni Exploration Manager	Alessandro Trombetti	+61 8 9320 1138 (office) + 61 400 928 271 (mobile)	alessandro.trombetti@eniaustralia.com.au
Eni Chief Geophysicist	David Hearty	+61 8 9320 1174 (office) +61 412 937 733 (mobile)	david.hearty@eniaustralia.com.au
Eni Marine Mammal Observer	Chris Burton	+61 8 9754 4969 (office) +61 419 199 120 (mobile)	cb@it.net.au (Western Whale Research)
Eni Company Representative – Navigation/Quality	To be advised (TBA)	+61 8 9211 1188 (office)	TBA (RPS Energy)
CGGVeritas			
Pacific Titan Operations Manager	Serge Laigre	+65 6723 5599 (office) +65 9183 4109 (mobile)	serge.laigre@cggveritas.com
<i>Pacific Titan</i> Vessel Master	TBA	+881 631 852 021 (Iridium) +872 356304 510 (Inmarsat)	pacific.titan@swireships.com
<i>Pacific Titan</i> Party Chief Master	TBA	+47 51 40 76 14 (VSAT) FAX: +872 335 385 513 (Inmarsat B)	om.titan@cggveritas.com
Government of Timor-Leste			
DNSMA Director	Carlos Ximenes	+670 333 9119 (office) +670 723 0165 (mobile)	cximenes59@hotmail.com
DNSMA EIA Coordinator	António Lelo Taci	+670 333 9119 (office) +670 725 4802 (mobile)	anleomen2@yahoo.com
Secretary of State – Fisheries	Eduardo de Carvalho	+670 332 5121 (office)	
DNPG Acting Director	Jose Manuel Goncalves	+670 331 7143 (office)	mazarello11@yahoo.com
DNPG Adviser	Roger White	+670 331 7143 (office) +670 729 5164 (mobile)	rogerwhite_2000@bigpond.com

Table 0.1 in the Executive Summary summarises the commitments that Eni and CGGVeritas will comply with to ensure protection of the environment. Table 6.2 details the key roles and responsibilities for Eni and CGGVeritas personnel involved in the survey.

Table 6.2: Key EMP Roles and Responsibilities.

Eni Crisis Management Team Leader (Managing Director)
Responsible for resourcing and compliance with HSE 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 Manager
Eni Exploration Manager
Supervises the Eni Offshore Seismic Supervisor
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 and coordinates the environmental approvals process and public engagement program
Immediately notifies DNSMA of any spill of hydrocarbons of greater than 80L
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 incident
Pacific Titan Operations Manager
Develops a HSE Interface Plan detailing the interface between CGGVeritas and Eni HSE management systems, particularly in emergency response scenarios
Ensures the CGGVeritas Project HSE Plan is consistent with this EMP
Develops systems, practices and procedures that meet Eni HSE Integrated Management System requirements
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
Manages the HSE incident tracking system such that all identified actions are properly assigned and tracked to satisfactory closure



Pacific Titan Vessel Master and Party Chief
Ensures that the Eni HSE Policy and the CGGVeritas Environmental Policy are followed
Responsible for implementation of the CGGVeritas HSE Management System and associated documentation on the seismic vessel
Ensures understanding of the Eni and seismic contractor systems through a review of the relevant documentation
Develops operation-specific procedures where required
Communicates the operating policies and procedures to all personnel, ensuring their compliance
Communicates 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 Bicuda 2D seismic survey EMP
Maintains weekly email communication with DNSMA (EIA Coordinator) regarding trajectories of the seismic vessel and marine mammal observation records
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 – Navigation/Quality (onboard Pacific Titan)
Ensures that Eni requirements are being fulfilled onboard during the survey, including commitments detailed in the EMP
Provides supervision and technical direction to personnel involved in the execution of HSE studies
Eni Marine Mammal Observer (onboard Pacific Titan)
Maintains observations of marine mammals during the seismic survey
Records all marine mammal observations on recording forms
Ensures environmental commitments detailed in this EMP, particularly with respect to marine mammals, are implemented onboard the seismic vessel
Provide general environmental awareness and marine mammal training to the seismic crew.

6.4 TRAINING, AWARENESS AND COMPETENCE

Contractors and staff receive appropriate training on their environmental responsibilities in connection with the Bicuda 2D survey. All Eni and CGGVeritas personnel receive an environmental induction, which addresses the issues and actions identified within this EMP. Marine mammal training and general environmental awareness sessions are delivered to the crew of the *Pacific Titan* and its chase vessel by the Eni Marine Mammal Observer onboard.

6.5 MONITORING, AUDITING AND REPORTING

6.5.1 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.



6.5.2 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) or equivalent CGGVeritas procedure. Where the audit highlights areas of non-compliance, a review of practices will be conducted and corrective actions tracked in the seismic vessel action tracking register.

An environmental audit of the seismic vessel will be conducted immediately prior to the commencement of the Bicuda 2D survey, whilst the vessel is in port in Dili. The audit will be observed/assisted by DNSMA personnel, and focus on the environmental performance objectives detailed in Section 5 to ensure effective legislative compliance and management. Eni will prepare an audit report detailing the findings of the audit (including any non-conformances), which will be forwarded to DNSMA.

6.5.3 Incident Reporting

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

A reportable incident is defined as

- an incident mentioned in the EMP that has caused, or has the potential to result in, major or catastrophic environmental consequences, as categorised in the environmental risk assessment.
- the escape or discharge into the sea of more than 80L of petroleum liquid.

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

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

6.6 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 HSE POLICY

Eni Timor Leste

Health Safety & Environment Policy

In our hydrocarbon exploration and production activities, Eni Timor Leste and its associated companies have an overriding commitment to sustainable development: we aspire to the goal of zero harm to people, our host communities and the environment. We give Health, Safety and Environmental (HSE) considerations equal status with other core business objectives.

Eni Timor Leste is committed to:

- ❖ maintaining an Integrated Management System (IMS) certified to the international standard, ISO14001.
- ❖ continually improving our HSE performance.
- ❖ complying with all applicable laws, regulations and other requirements.
- ❖ applying responsible standards where laws and regulations do not exist.
- ❖ providing a safe and healthy work place.
- ❖ striving to eliminate all HSE incidents including work-related injuries and illnesses.
- ❖ identifying, evaluating and controlling risk.
- ❖ promoting HSE risk awareness and driving a positive HSE culture.
- ❖ assessing potential HSE effects before conducting new activities.
- ❖ ensuring contractors understand and adhere to our HSE procedures and standards.
- ❖ minimising greenhouse gas emissions, effluents and discharges that may have an adverse effect on the environment.
- ❖ respecting the interests of those who may be affected by our operations.
- ❖ the development and welfare of communities in which we work.

Application:

The Policy is implemented through the application, review and continual improvement of the HSE IMS, which is an integral part of Eni Timor Leste's overall management approach.

- ❖ We establish HSE objectives and targets in line with our commitments, which are subject to periodic monitoring and review.
- ❖ Line management has responsibility and accountability for managing HSE aspects of our business.
- ❖ We ensure that all employees and contractors are made aware of their HSE roles and responsibilities and are properly trained to undertake them.
- ❖ All Eni Timor Leste employees and 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 line management and requires the involvement and commitment of everyone at Eni Timor Leste.

Managing Director



Eros Agostinelli

Date

22/5/08



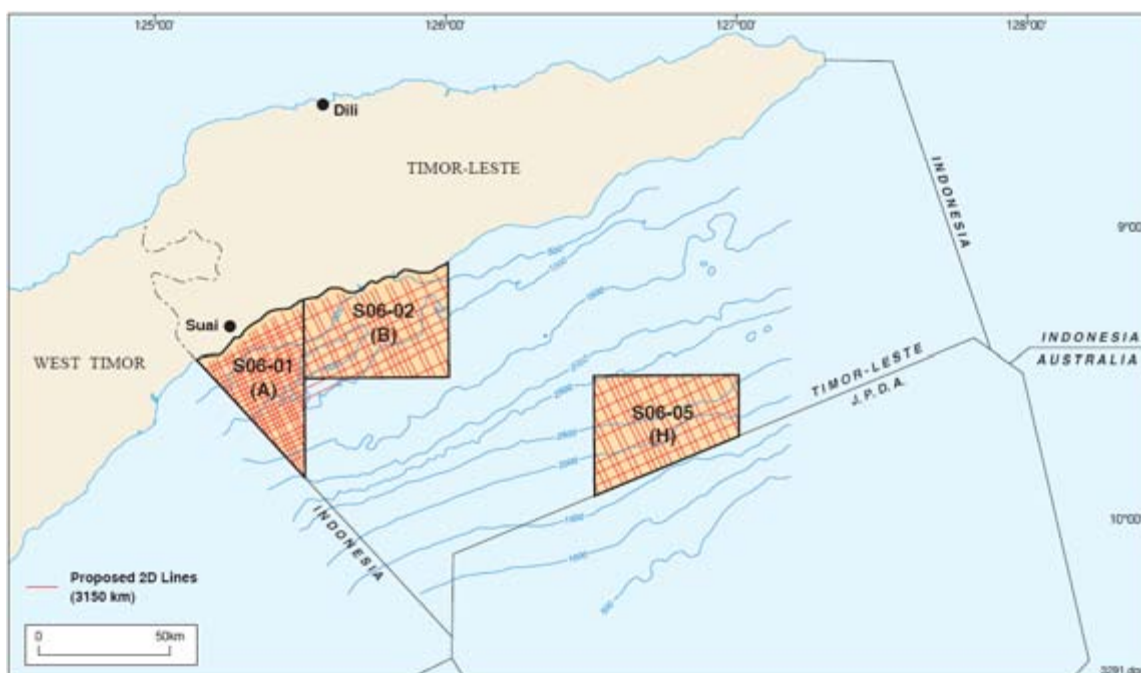


APPENDIX B: PUBLIC NOTICE



Public Notice

Eni Timor Leste plans to undertake a two-dimensional (2D) Marine Seismic Survey in Production Sharing Contract Blocks S06-01 (A), S06-02 (B) and S06-05 (H), in the Timor Sea off the south coast of Timor-Leste.



Eni Timor Leste seeks to consult with all interested stakeholders in relation to the environmental management of this activity.

Should you wish to be consulted about the Seismic Survey, please contact:

Sr Florencio Fernandes: (670) 731 2099, +61 438 102 302, or florencio.fernandes@eniaustralia.com.au

Eni Timor Leste SpA

PO Box 52, Dili, Timor-Leste.

Villa Verde Apartments, Rua D. Luis Dos Reis Noronha, Villa Verde, Dili.

Issued: 12 May 2008

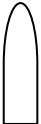


APPENDIX C: MARINE MAMMAL RECORDING FORM



MARINE MAMMAL RECORDING FORM – Effort and Sightings

Options in italics should be circled or underlined as appropriate

Date:	Day No.	Effort (no/day)	Time start:	Time end:	Sight time:
Ship Name:	Survey Name:	Company:	Observer Name:		
How did this sighting occur? <i>(please tick on mark or write):</i> While you were keeping a continuous watch for marine mammals – Spotted incidentally by you or someone else – Other (please specify) –					
Ship's position:			Depth (m):		
Latitude:			Beaufort		
Longitude:			Weather, Visibility		
Species:			Certainty of Identification:		
<i>Large Medium Small</i>			<i>Definite Probable Possible</i>		
Total number of animals:			Number of adults:		
			Number of juveniles:		
Description (include features such as overall size, shape of head, colour and pattern, position of dorsal fin height, direction and shape of blow). Sketch if possible:				Photograph or video taken? Yes / No	
				Image Nos: Direction of travel of animals in relation to ship (draw arrow): <div style="text-align: center;">  </div>	
Behaviour:			Direction of travel of ship: (compass heading)		
Activity of ship (on a line, turning, in transit, etc):		Airguns firing? Yes / No	Bearing to sighting:	Closest distance of animals from airguns (m) (Record even if not firing):	

Please continue on a separate sheet if required.