2D Seismic Survey in Block AD-10, Offshore Myanmar

Initial Environmental Examination

02 December 2015

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2D Seismic Survey in Block AD-10, Offshore Myanmar

Initial Environmental Examination

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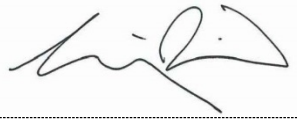
Environmental Resources Management

ERM-Hong Kong, Limited
16/F, Berkshire House
25 Westlands Road
Quarry Bay
Hong Kong
Telephone: (852) 2271 3000
Facsimile: (852) 2723 5660

http://www.erm.com

Client:	Project No:
Statoil Myanmar Private Limited	0267094
Summary: This document presents the Initial Environmental Examination (IEE) for 2D Seismic Survey in Block AD-10, as required under current Draft Environmental Impact Assessment Procedures	Date: 02 December 2015 Approved by:  Craig A. Reid *Partner*

Revision	Description	By	Checked	Approved	Date
1	Addressing MOECAF Comments, Final for MOGE	RS	CAR	CAR	02/12/2015
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Distribution

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CONTENTS

ACRONYMS AND ABBREVIATIONS

Acronym	Definition
%	Percentage
2D	Two-dimensional
ALARP	As Low As Reasonably Possible
BANCA	Biodiversity and Nature Conservation Association
CH4	Methane
CITES	Convention on International Trade of Endangered Species
cm	Centimetres
CM	Chief Minister
CO	Carbon monoxide
CO_2	Carbon dioxide
CPUE	Catch per unit effort
dB	Decibels
DoF	Department of Fisheries
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERM	Environmental Resource Management
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FLO	Fisheries Liaison Officer
ft.	Feet
GAD	General Administration Department
GIIP	Good international Industry Practise
GRM	Grievance Redressal Mechanism
HES	Health, Environment and Safety
HF	High Frequency
Hz	Hertz
IA	Impact Assessment
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for the Conservation of Nature
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
km	Kilometres
km^2	Square kilometres
LNG	Liquefied Natural Gas
m	Metres
m^3/day	Cubic metres per day
MARPOL	International Convention for the Prevention of Pollution from Ships
MCS	Monitoring, Control and Surveillance

Acronym	Definition
MDO	Marine Diesel Oil
MFA	Myanmar Fisheries Association
MFF	Myanmar Fisheries Federation
MGO	Marine Gas Oil
MIC	Myanmar Investment Commission
MODIS	Moderate Resolution Imaging Spectrometer
MOECAF	Ministry of Environmental Conservation and Forestry
MOGE	Myanma Oil and Gas Enterprise
MOH	Ministry of Health
MPRL	Myanmar Petroleum Exploration and Production
ms^{-1}	Metres per second
MSDS	Material Safety Data Sheets
NGO	Non-Governmental Organisation
NMHC	Non-Methane Hydrocarbons
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen oxides
Pa	Pascal
PAPs	Project Affected Populations
ppm	Parts per million
PSC	Production Sharing Contract
PTS	Permanent Threshold Shift
REM	Resource and Environment Myanmar
SIA	Social Impact Assessment
SO_2	Sulphur dioxide
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
sq. km	Square kilometres
TTS	Temporary Threshold Shift
UKOOA	United Kingdom Offshore Operators Association
UNDP	United Nations Development Programme
UNEP	United National Environment Programme
UNEP-WCMC	United National Environment Programme - World Conservation Monitoring Centre
USD	United States Dollar
USEPA	United States Environmental Protection Agency
WBG	World Bank Group

1 EXECUTIVE SUMMARY

1.1 PURPOSE AND EXTENT OF THE IEE REPORT

Statoil Myanmar Pte Ltd (Myanmar Branch) (Statoil) is planning to undertake an exploratory campaign by means of a two-dimensional (2D) seismic survey in Block AD-10, which was awarded to Statoil in 2014 as part of the Myanmar Government's 2013 Offshore Bid Round. This campaign will provide information that will be basis for future decisions on if, and where, to drill exploration wells. Statoil signed the Production Sharing Contract (PSC) with the Myanma Oil and Gas Enterprise (MOGE) on the 30th April 2015. The location of the Block is shown in *Figure 1.1*.

As per the draft Environmental Impact Assessment (EIA) Procedures, the Project requires an Initial Environmental Examination (IEE) as the appropriate level of assessment. Statoil has commissioned **Environmental Resources Management** (ERM), supported by local specialists **Resource and Environment Myanmar** (REM), to undertake the IEE Study. More details on the project overview, justification and purpose are provided in *Chapter 2* of the IEE Report (1).

A Project Proposal Report was submitted to the Ministry of Environmental Conservation and Forestry (MOECAF) on 3rd October 2014. The Report provided the Screening Study for the Project, including a discussion on the potential impacts and likely mitigation. The Report allowed the MOECAF to determine what type of assessment was required. Under Section 7 of the Environmental Conservation Law (2012) and Articles 52 and 53 of the Environmental Conservation Rules (2014) of the Republic of the Union of Myanmar, it was determined that Statoil is required to undertake an Initial Environmental Examination (IEE) and to obtain an Environmental Compliance Certificate (ECC) in accordance with the *Environmental Impact Assessment (EIA) Procedures* ("*the Procedures*").

The Project Proposal Report allowed a Terms of Reference (ToR) to be created for the Project which served as the basis for the determination of the scope of the IEE Report and the Environmental and Social Management Plan (ESMP). The ToR is important to ensure that the Project proponent has allocated sufficient time to conduct the IEE Study. The new *EIA Administrative Guidance* (July 2015) provided by MOECAF to ERM in August 2015 was also followed to create the IEE Report, the Executive Summary and the ESMP.

(1) The Final IEE Report will be available on Statoil's website: **http://www.statoil.com**

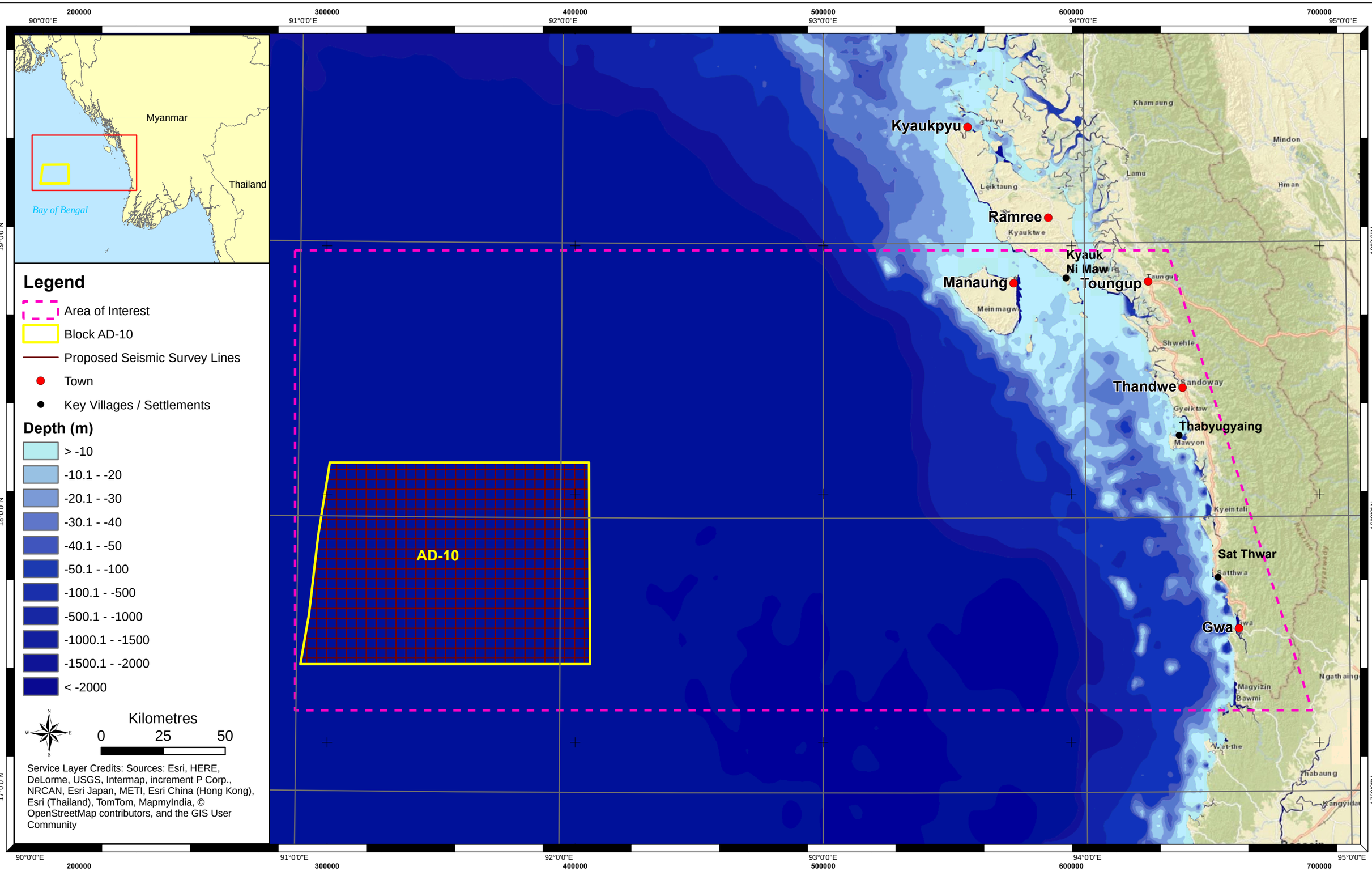

Figure 1.1

Block AD-10 and Area of Interest

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1.2 SUMMARY OF THE ACTIVITIES UNDERTAKEN DURING THE IEE STUDY

The Project commenced with a screening and scoping phase under which the Project identified potentially affected stakeholders, Project Area of Interest (1), potential impacts and gathered baseline data. The Project also conducted consultations with a number of government bodies, scientific organisations and NGOs in order to collect data. This information fed into the Project Proposal Report. In addition, a Scoping Report was prepared for internal use at Statoil in order to define the study limits and the key potential impacts from the Project.

After the initial screening and scoping phase, the environmental and social impact assessment (ESIA) phase commenced. The ESIA phase included stakeholder consultations in Nay Pyi Taw, Sittwe, Thandwe and Gwa. Thandwe and Gwa were selected for the public consultations as they are the closest townships to the Project. These consultations were undertaken in order to present the Project information, present Statoil, discuss the currently known baseline conditions and potential impacts and gather comments, concerns or queries from stakeholders to be included in the impact assessment and development of mitigation measures for the IEE Report. This also involved a literature review using online resources to help gain understanding of the biological, physical and social environment. This baseline information was then verified to the extent possible through consultations within Rakhine with a variety of stakeholders during the public consultations.

1.3 PROJECT ALTERNATIVES

Consideration of Project alternatives was undertaken as part of the IEE study in order to attempt to avoid or reduce any adverse environmental and social impacts and maximise or enhance any potential project benefits.

The different options included:

- The type of streamer to be used; it was suggested that solid or gel-filled streamers would be preferential as they do not leak when damaged, and are less sensitive to weather and wave noise.

- The project would be located as far as possible from any key sensitive receivers. In this instance, the Project is over 150 km from the coastline of Manaung Island where there are key coastal sensitive habitats (e.g. coral habitat); and

- The navigational safety zone during seismic operations was selected to be mobile (i.e. around the seismic vessels and equipment), instead of covering the whole Block, in order to reduce impacts on other marine users.

(1) The Project Area of Interest was defined as the area within Block AD-10 as well as its immediate surroundings. As the Block is located over 200 km from the mainland coast, the immediate surroundings would not encompass the adjacent nearshore waters and coasts of Rakhine State mainland.

The "No Project" alternative was considered (i.e. no seismic survey would be conducted). This would mean that no further exploration activity could be conducted in this Block; such as drilling exploration wells. This would in turn mean that no further oil and gas development would be able to be undertaken. The exploration for oil and gas in this Block is required to help stimulate the economy of Myanmar. No Project would result in fewer opportunities for gas supply to the domestic market and could lead to less employment opportunities and less economic growth.

A description of the project activities is provided in *Chapter 4* of the IEE Report and is summarised below.

The Selected Project Alternative

Marine geophysical seismic surveys are used to define sub-seabed deposits and geological structures. A specialized seismic survey vessel is used which tows an impulse emitting sound source. High energy low frequency sounds are produced by the sound source and these sound waves bounce off the sub-surface rock formations and return to the surface where the seismic energy is collected by an array of receivers (hydrophones) fixed onto streamers behind the vessel. The acquired data is then recorded by on-board computers for subsequent processing to produce profiles of the sub-seabed geology for interpretation by geophysicists. The principles behind marine seismic survey operations are illustrated in *Figure 1.2*.

Vessels

A specialized seismic survey vessel and an appropriate number of chase vessels (typically one to three) will be utilised for the survey. Chase vessels will scout ahead for obstructions and safely warn-off any vessels in the path of the survey. The vessels will be re-supplied with provisions from a port via a support vessel; however, there is no significant onshore component of this Project.

Typical seismic vessels are shown in *Figure 1.3* and the layout of the seismic vessel and equipment is shown in *Figure 1.4*. The different components of this figure are discussed below.

Airguns

The seismic sound source is created when a bubble of compressed air is discharged into water from airguns and the bubble subsequently collapses. The sound travels through the water column beneath the vessel to penetrate the subsurface rocks. Each gun is proposed to be towed by the vessels at a water depth of 8 m, using a firing interval of 10 seconds.

Streamer

The receivers (hydrophones) will be encased in a long cable or "streamer" towed behind the seismic vessel. For a 2D seismic survey there is just one

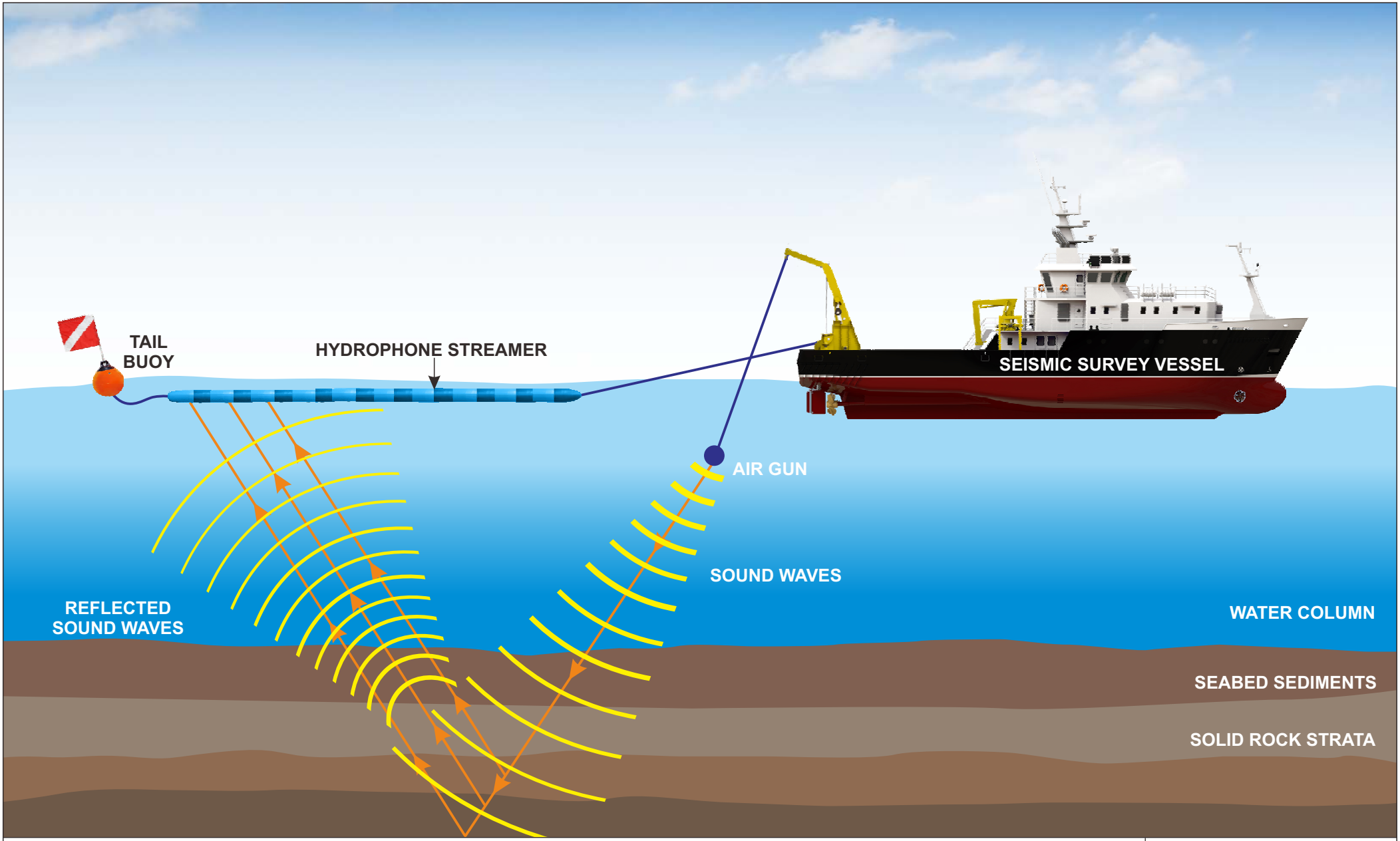

Figure 1.2

Schematic of Marine Seismic Survey

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The seismic survey vessel is purposely built for towing the airguns and streamers for conducting the seismic surveys.

Indicative seismic survey vessel specifications

Parameter	Specification *
No. of personnel onboard (POB) (crew + survey personnel)	40 – 60
Length	50 – 90 m
Width	15 – 20 m
Draft	5 – 6 m
Fuel consumption	9 – 15 tonnes/ day
Minimum operating depth	~ 10 m
Maximum load speed	Up to 15 Knots
Survey speed	4-5 knots

** Indicative only*

Typical Seismic Vessel

Typical Seismic Vessel

Figure 1.3

Illustrative Example of Seismic Survey Vessels

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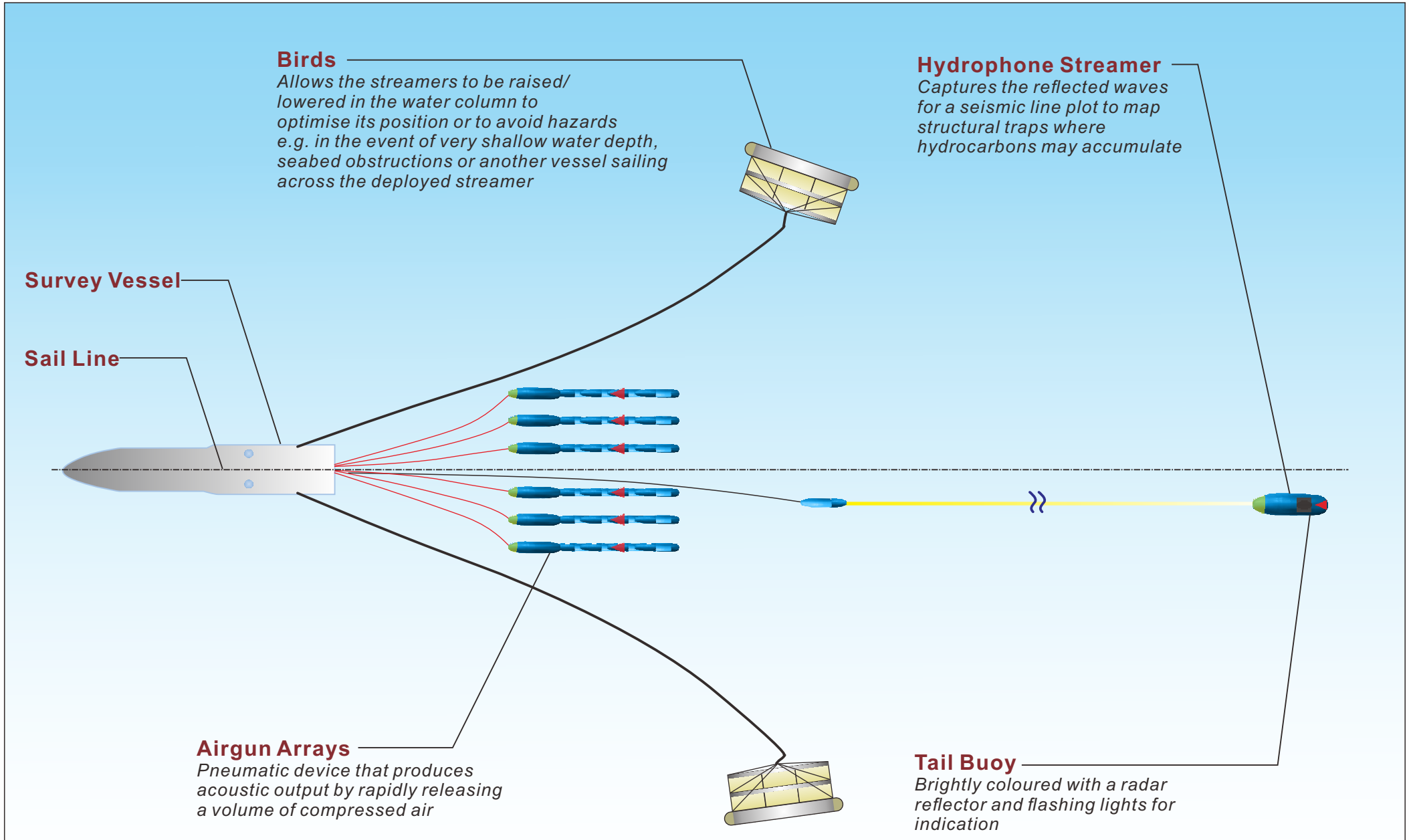

Figure 1.4

Illustrative Arrangement of Seismic Survey Equipment

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streamer, which will be 10 km in length, and towed at a water depth of 12 m. The acquired data is recorded by on-board computers for processing.

Emissions

Vessels will be required to follow International Convention for the Prevention of Pollution from Ships (MARPOL) requirements with regards to handling of waste, wastewater, air emissions and effluents.

Programme and Seismic Survey Area

Block AD-10 is located in the Rakhine Basin, offshore Myanmar and covers an area of about 9,000 km^2. The 2D seismic survey is planned to take place during April/May2016 (1), for a period of about 45 days.

1.4 DESCRIPTION OF THE ENVIRONMENT TO BE AFFECTED BY THE PROJECT

The review of baseline conditions within the Area of Interest has identified that shallow nearshore waters off the Rakhine coast host habitats with enhanced biological productivity and higher biodiversity (such as coral habitats, seagrass beds, mangroves). However, the areas of coral habitat encompassing Manaung Island that are the closest to the Block are still located over 150 km (90 miles) away (*Figure 1.5*).

Of the fish identified to species level, one is listed as species of conservational concern (vulnerable or above) on the IUCN Red List (narrow barred Spanish mackerel (*Scomberomorus commerson*)). The most common marine mammal species observed in Myanmar waters during a survey in 2015 were dwarf spinner dolphin (*Stenella longirostris roseiventris*) and Bryde's Whale (*Balaenoptera edeni*). Given that many different species of marine mammal have been recorded during a seismic survey close to Block AD-10, it can be assumed that marine mammals will be present during the survey. Marine mammal species in Rakhine waters are shown in *Figure 1.6*. There are five species of marine turtle listed as present in the offshore waters of Rakhine State (*Figure 1.7*), all of which are listed as species of concern on IUCN Red List. The green, hawksbill and olive ridley turtle are also known to nest along the Rakhine coast from September to March with peak nesting in December and January. As such, turtles could be migrating through Block AD-10 to their nesting beaches in the Rakhine State during the survey period.

The main sources of livelihood in Rakhine State are agriculture, fisheries and livestock holdings. More than 50 percent of the population is dependent upon agriculture for their livelihood, while 13 percent engage in fishing, and 10 percent in livestock farming. The coastal areas in Rakhine are characterised by fishing and agriculture as the two main livelihood opportunities, followed by tourism and sale of timber.

(1) To be confirmed when the contract is awarded

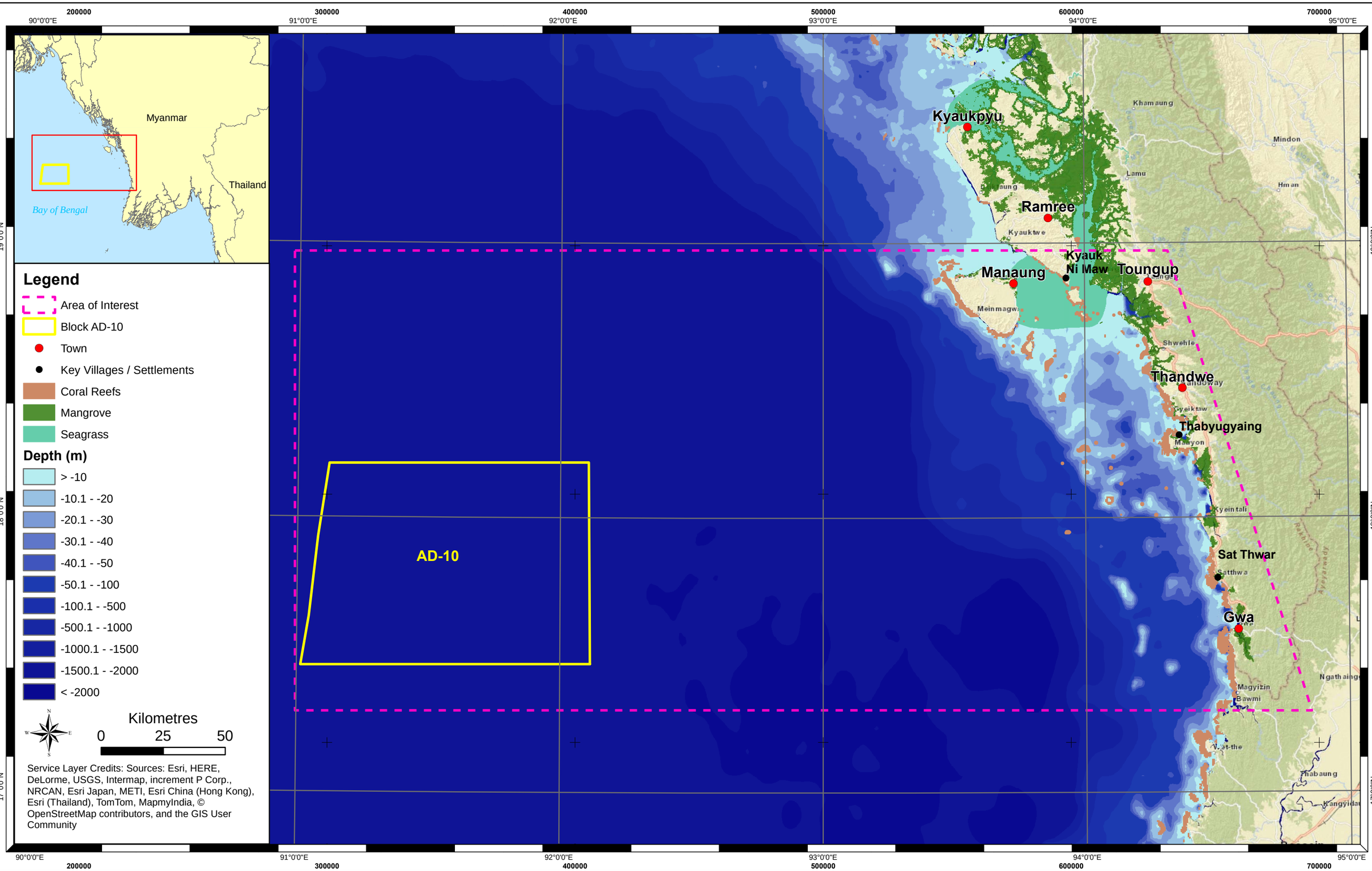

Figure 1.5

Locations of Coral, Seagrass and Mangroves

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Common Name	Latin Name	IUCN Red List
Baleen Whales		
Bryde's whale	*Balaenoptera edeni*	Data Deficient
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Least Concern
Toothed Whales		
Blainville's beaked whale	*Mesoplodon densirostris*	Data Deficient
Dwarf sperm whale	*Kogia sima*	Data Deficient
False killer whale	*Pseudorca crassidens*	Data Deficient
Killer whale	*Orcinus orca*	Data Deficient
Melon-headed Whale	*Peponocephala electra*	Least Concern
Pygmy killer whale	*Feresa attenuata*	Data Deficient
Pygmy sperm whale	*Kogia breviceps*	Data Deficient
Short-finned pilot whale	*Globicephala macrorhynchus*	Data Deficient
Sperm Whale	*Physeter macrocephalus*	Vulnerable
Porpoise and Dolphins		
Dwarf Spinner Dolphin	*Stenella longirostris roseiventris*	Data Deficient
Indo-pacific bottlenose dolphin	*Tursiops aduncus*	Data Deficient
Indo-pacific finless porpoise	*Neophocaena phocaenoides*	Vulnerable
Indo-pacific humpbacked dolphin	*Sousa chinensis*	Near Threatened
Irrawaddy dolphin	*Orcaella brevirostris*	Vulnerable
Pantropical spotted dolphin	*Stenella attenuata*	Least Concern
Rissos dolphin	*Grampus griseus*	Least Concern
Spinner dolphin	*Stenella longirostris*	Data Deficient
Striped dolphin	*Stenella coeruleoalba*	Least Concern
Sirenian		
Dugong	*Dugon Dugong*	Vulnerable

(Source: www.animal-kid.com)

(Source: www.tonywublog.com)

(Source: www.whale-watching.co.za)

(Source: www.whalesanddolphinsoftenerife.org)

(Source: www.arkive.org)

(Source: www.itsnature.org)

(Source: www.greatocean.com.au/)

(Source: uk.whales.org)

(Source: www.eoearth.org)

Figure 1.6

Marine Mammal Species Recorded in Myanmar Waters

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Latin Name	Common Name	Myanmar Name	IUCN Status	Potential Presence in Block AD-10
Lepoidochely olivacea	Olive ridley turtle	*Leik Lyaung*	Endangered	Reported to occur in Rakhine and have been observed by local fishermen. Known to be nesting in Rakhine State and likely to be present in Block AD-10.
Caretta caretta	Loggerhead turtle	*Leik Khway*	Endangered	Reported to occur in Rakhine and have been observed by local fishermen. Not known to nest on the Rakhine Coast.
Chelonia mydas	Green turtle	*Pyin Tha Leik*	Vulnerable	Reported to be nesting in Rakhine State and likely to be present in Block AD-10.
Eretmochelys imbricata	Hawksbill turtle	*Leik Kyet Tu Yway*	Critically Endangered	Reported to occur in Rakhine and have been observed by local fishermen. Known to be nesting in Rakhine State and likely to be present in Block AD-10.
Dermochelys coriacea	Leatherback turtle	*Leik Zaung Lyar*	Endangered	Have historically been recorded in Rakhine waters but are now considered rare.

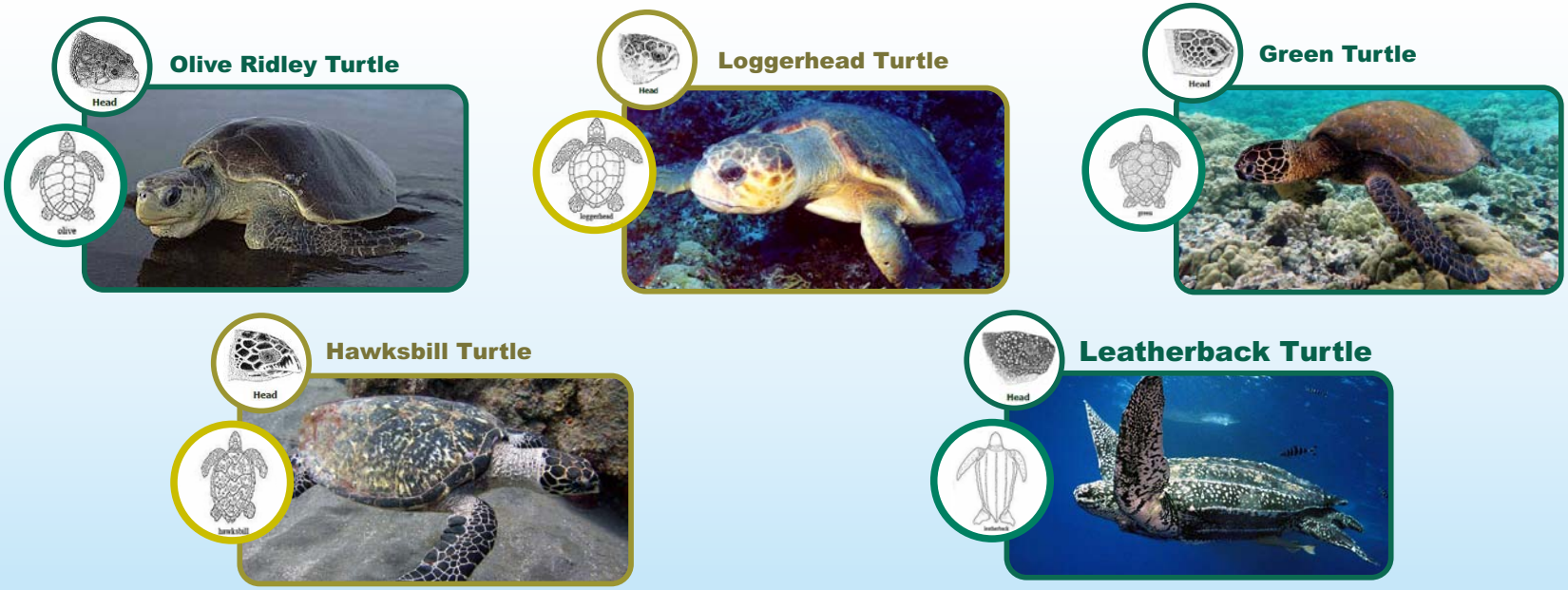

Figure 1.7

Marine Turtles in Rakhine waters

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The majority of offshore fishing in Rakhine State is undertaken within water depths of less than 100 m and up to 20 miles from the coast. Typical boats used for fishing are shown in *Figure 1.8*. A relatively small number of communities actively fish in the deep-water area (>200m of water depth) (*Figure 1.9*). It was stated in all meetings that there is no local Rakhine fishing activity in the vicinity of Block AD-10 as it is too far offshore. It was reported that fishing vessels from outside the Area of Interest may fish in the Block. It is anticipated that there may also be large commercial trawlers from outside Rakhine State. In general, deep-water fishermen suggested that November to May was the best season for fishing as better weather meant that fishing boats are able to travel greater distances from shore. However, larger vessels from Yangon or outside of Myanmar may continue to fish in deep water throughout the year.

1.5 SIGNIFICANT ENVIRONMENTAL IMPACTS

The key potential impacts associated with the project and required mitigation measures are summarised below and shown in *Table 1.1*:

- Potential increases in ambient underwater sound and generation of sound pressure levels from the operation of air guns. These activities have the potential to impact ecologically sensitive receivers, e.g. marine mammals, marine turtles and fish.
- Potential water contamination and related secondary impacts to biodiversity and fishing from accidental spills of chemicals or fuel (e.g. during offshore re-fuelling).
- Potential risk of entanglement with marine turtles by the operating seismic survey hydrophone streamers.
- Potential short-term disturbance to fishing activities.
- Potential risk of collisions with fishing vessels and other marine users and entanglement of fishing gear by the operating seismic hydrophone streamer.

Table 1.1 Summary of Potential Impacts and the Residual Impact Significance

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impact
Impacts from towed equipment by collision with or entrapment of marine turtles	• Install turtle guards on seismic survey tail buoys in order to reduce the risk of trapping turtles in the seismic equipment. • Implement JNCC Guidelines (1) including the alignment of Contractor operations with JNCC Guidelines. • In line with JNCC guidelines, implement a soft-start	**Moderate**

(1) The JNCC "Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys, 2010"

Small boats in Thabyugyaing

Ice delivery to large boats in Thabyugyaing

Large boats in Thabyugyiang

Boat size	Dimensions (length)	Distance offshore	Depth Range (m)	Trip Duration (days)	Nets used
Small	20 to 35 ft	Up to 18 km	Up to 50 m	1-7	Trawl Gill Net Traps
Large	50 to 90 ft	Up to 55 km	Up to 100 m	2-15	Drift Net Longline / Hook & line Trawl Surrounding Gear

Figure 1.8

Typical boats size and associated details in coastal villages of Rakhine

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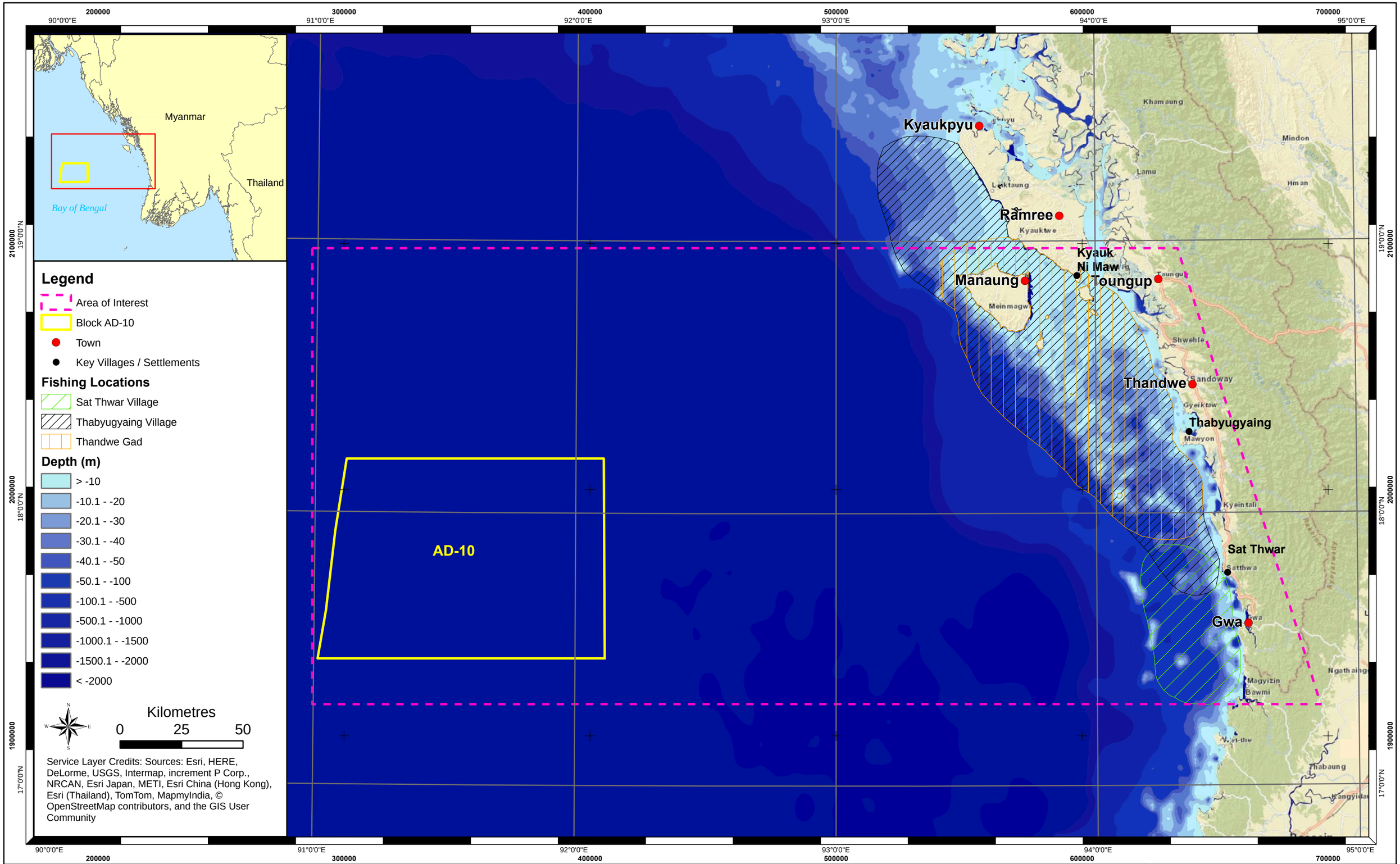

Figure 1.9

Locations of Fishing Areas

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Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impact
	procedure to allow adequate time for marine fauna to leave the area). • As an enhancement measure, all sightings of marine mammals / turtles should be recorded and reported to MOECAF following survey completion.	

Impacts from underwater sound on marine fauna	• Optimum airgun configurations to ensure that the lowest possible sound level of airguns is selected.
	• Implement JNCC Guidelines (1) including alignment of Contractor operations with JNCC Guidelines.
	• In line with JNCC guidelines:
	  • Implement a soft-start procedure to allow adequate time for marine fauna to leave the area,
	  • Dedicated Marine Mammal Observers will be on-board to undertake pre-shooting search
	  • the vessel to postpone start-up if mammals observed within 500 m and
	  • Passive Acoustic Monitoring (PAM) will be used to detect marine mammals in the vicinity of the seismic vessel during night time or low visibility operations.
	• To ensure protection of certain marine mammal species, the soft-start procedure will be extended to between 20-30 minutes duration.
	• As an enhancement measures, all sightings of marine mammals / turtles should be recorded and reported to MOECAF following survey completion.
		Minor (for fishes)
		Moderate (for marine mammals and turtle)

Impacts from unplanned spills on marine fauna	• Accepted industry good practice operating procedures will be implemented, including an offshore re-fuelling plan. • Contingency plans will be prepared and implemented, e.g. vessel Shipboard Oil Pollution Emergency Plans (SOPEPs).	**Negligible**
Impacts on marine users, fisheries and fishing communities from physical presence of seismic vessel, and equipment, unplanned collisions and underwater sound	• A mobile navigational safety zone will be implemented around the seismic vessel and equipment. • An appropriate number of chase vessels that will liaise with fishermen and other mariners. • The chase vessel(s) will have Myanmar speaking Fishing Liaison Officers on-board. • Survey vessels will comply with international standards of navigational safety. • A Stakeholder engagement plan will be developed to ensure timely sharing of information on the movement of survey vessels. Although this measure does not affect the impact significance, a grievance mechanism for the Project will be disclosed and implemented and timely investigation of any grievances will be conducted.	**Negligible** (shipping, fishing activities) and livelihoods)

1.6 *THE PUBLIC CONSULTATION AND PARTICIPATION PROCESS*

Statoil undertook public consultation in Rakhine State in June 2015 in order to raise awareness for the project, collect baseline data and to receive opinions on the Project to feed into the IEE study, development of mitigation measures and the ESMP. The public consultation was conducted in the two townships closest to the Block; Thandwe and Gwa.

The stakeholder consultation meetings were structured to introduce the Project and Statoil, allow for the public to raise any comment, queries or concerns on the proposed Project and to collect environmental and social baseline data. The consultation materials used included a 2 page flyer explaining the project activities that was provided to all meeting attendees, a poster / presentation and questionnaires to collect information on the villages and townships visited. Information requested related to the profile of the village, fishing activities including locations, methods and type of catch and environmental questions on species present and locations of key habitats. This information was used to verify the secondary baseline data collected.

A summary of the public consultation, including information on date and venue, is provided in *Table 1.2*. Photos taken during the consultations showing the participants and meeting locations are provided in *Figure 1.10*.

Table 1.2 Summary of Consultation Meetings undertaken as part of the IEE process

Date	Location
11th June 2015	Chief Minister Meeting
15th June 2015	Thandwe Township Meeting
16th June 2015	Thabyugyaing Village Meeting
17th June 2015	Gwa Township Meeting
18th June 2015	Sat Thwar Village Meeting

Some of the key concerns and expectations of the stakeholder groups identified during the consultation meetings included: social investment and the likely benefits to local people and/or Rakhine State from the Project, the potential impacts of the Project on the fishing activities in offshore areas and impacts from future operations such as drilling. Drilling impacts will be covered in a future separate environmental and social impact assessment, if relevant. It should be noted that in general very few questions were asked regarding the proposed Project as it was generally felt that the coastal fishing activities would not overlap and therefore would not be impacted by Project activities.

1.7 SUMMARY OF THE EMP

An Environmental and Social Management Plan (ESMP) is provided for this Project separately. This plan discusses the mitigation measures adopted by the Project in order to ensure that all potential impacts are minimised and reduced as far as practicable during the operation of the seismic survey.

This ESMP provides the procedures and processes applied to the Project activities to check and monitor compliance and effectiveness of the mitigation measures to which Statoil has committed. The ESMP provides details of all the mitigation measures mentioned above and lists the reporting and monitoring requirements relevant to the Project. Some of the key points of the ESMP are summarised below.

A program will be developed to monitor for compliance with relevant regulatory standards to ensure that subcontractors are meeting contractual

Photo 1: Consultations in Sat Thwar

Photo 2: Consultations in Thabyugyaing

Photo 3: Q&A session at Sat Thwar

Photo 4: Secondary School in Sat Thwar

Photo 5: Meeting Hall in Sat Thwar Village

Photo 6: Meeting Hall in Thabyugyaing

Figure 1.10

Photo Records of Stakeholder Consultation

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obligations with respect to work practices and design specifications (e.g. Project emission standards). Supervision of subcontractor activities will be conducted by the seismic contractor and monitored by the Statoil on-board Health, Safety, Security and Environment (HSSE) representative.

Statoil will also submit an Environmental Monitoring Report to MOGE and MOECAF within 60 days after completion of the Project. The report will include the following information collected during the geophysical data acquisition program: safety record, waste record and marine mammals observation report.

1.8 CONCLUSIONS AND RECOMMENDATIONS OF THE IEE REPORT

The disclosure process will include disclosure of the executive summary of the IEE study in Myanmar language in the townships visited; Thandwe and Gwa. The IEE Report disclosure will also be advertised in two newspapers; one national and one local Rakhine. The project will also disclose information about the grievance mechanism for the project and information regarding movement of the seismic survey vessel to stakeholders. Detailed plans for disclosure will be developed prior to the commencement of the Project.

The engagement activities thus far, were undertaken as part of the IEE process. However, stakeholder engagement is understood to be a continuous process to be undertaken throughout the life of the Project, in this case during the duration of the seismic survey. Statoil will develop a Stakeholder Engagement Plan (as indicated in the *Section 7* of the IEE Report) to manage this ongoing consultation, address concerns if new stakeholders emerge and monitor stakeholder feedback.

The IEE Study for the 2D seismic survey in Block D-10 was conducted to comply with the requirements of the MOECAF draft *EIA Procedures*. The IEE demonstrates the proponent understands the environment and social setting in which they are operating and has properly assessed the key potential environmental and social impacts associated with the proposed Project. A project-specific, dedicated Environmental Social Management Plan (ESMP) has been developed and presented as a tool to manage impacts associated with the Project and ensure legislative compliance and standards of good practice during the execution of the survey in Block AD-10. Provided that the recommended mitigation measures are properly implemented, it is expected that the environmental and social impacts of the proposed seismic survey at Block AD-10 would be managed by Statoil in a professional and acceptable manner. As such, the IEE concludes that **no Major** impacts on the environment and people are anticipated from this Project and all impacts have been properly mitigated to be as low as reasonably practical.

2 INTRODUCTION

2.1 PROJECT OVERVIEW

Statoil Myanmar Pte Ltd (Myanmar Branch) (Statoil) is planning to undertake an exploratory campaign by means of a two-dimensional (2D) seismic survey in Block AD-10, which was awarded to Statoil in 2014 as part of the Myanmar Government's 2013 Offshore Bid Round. This campaign will provide information that will be basis for future decisions on if, and where, to drill exploration wells. Statoil signed the Production Sharing Contract (PSC) with the Myanma Oil and Gas Enterprise (MOGE) on the 30th April 2015. The location of the Block is shown in *Figure 2.1*.

2.2 PROJECT PROPONENT

The proponent of the Project is Statoil Myanmar Pte Ltd (Myanmar Branch) (Statoil). Statoil is an international energy company with operations in 37 countries. It is headquartered in Norway, with 23,000 employees worldwide. Statoil's equity production is 1.927 million barrels of oil equivalent (boe) per day (in 2014) and they build on 40 years' experience from oil and gas exploration and production on the Norwegian Continental shelf, where it is the largest operator. Further information about the company is available at the website **http://www.statoil.com**.

Contact details of the company's country manager and contact for the Project are provided below:

Name: Helge Gabrielsen
Positon: Statoil Country Manager Myanmar - Exploration
Address: Sakura Tower 12th floor, 339 Bogyoke Aung San Road, Kyauktada Township, Yangon, Myanmar
Phone: 09262954950
Email: **gm_mmaoffice@statoil.com**

2.3 THIS INITIAL ENVIRONMENTAL EVALUATION (IEE)

A Project Proposal Report was submitted to the Ministry of Environmental Conservation and Forestry (MOECAF) on 3rd October 2014. The Report provided the Screening Study for the Project, including a discussion on the potential impacts and likely mitigation. The Report allowed the MOECAF to determine what type of assessment was required. Under Section 7 of the Environmental Conservation Law (2012) and Articles 52 and 53 of the Environmental Conservation Rules (2014) of the Republic of the Union of Myanmar, it was determined that Statoil is required to undertake an Initial Environmental Examination (IEE) and to obtain an Environmental Compliance Certificate (ECC) in accordance with the *Environmental Impact Assessment (EIA) Procedures* (the "*EIA Procedures*"). In addition, under the Production Sharing Contract (PSC) with the Ministry of Energy (MOE), Statoil is also required to undertake a social assessment as part of the IEE process.

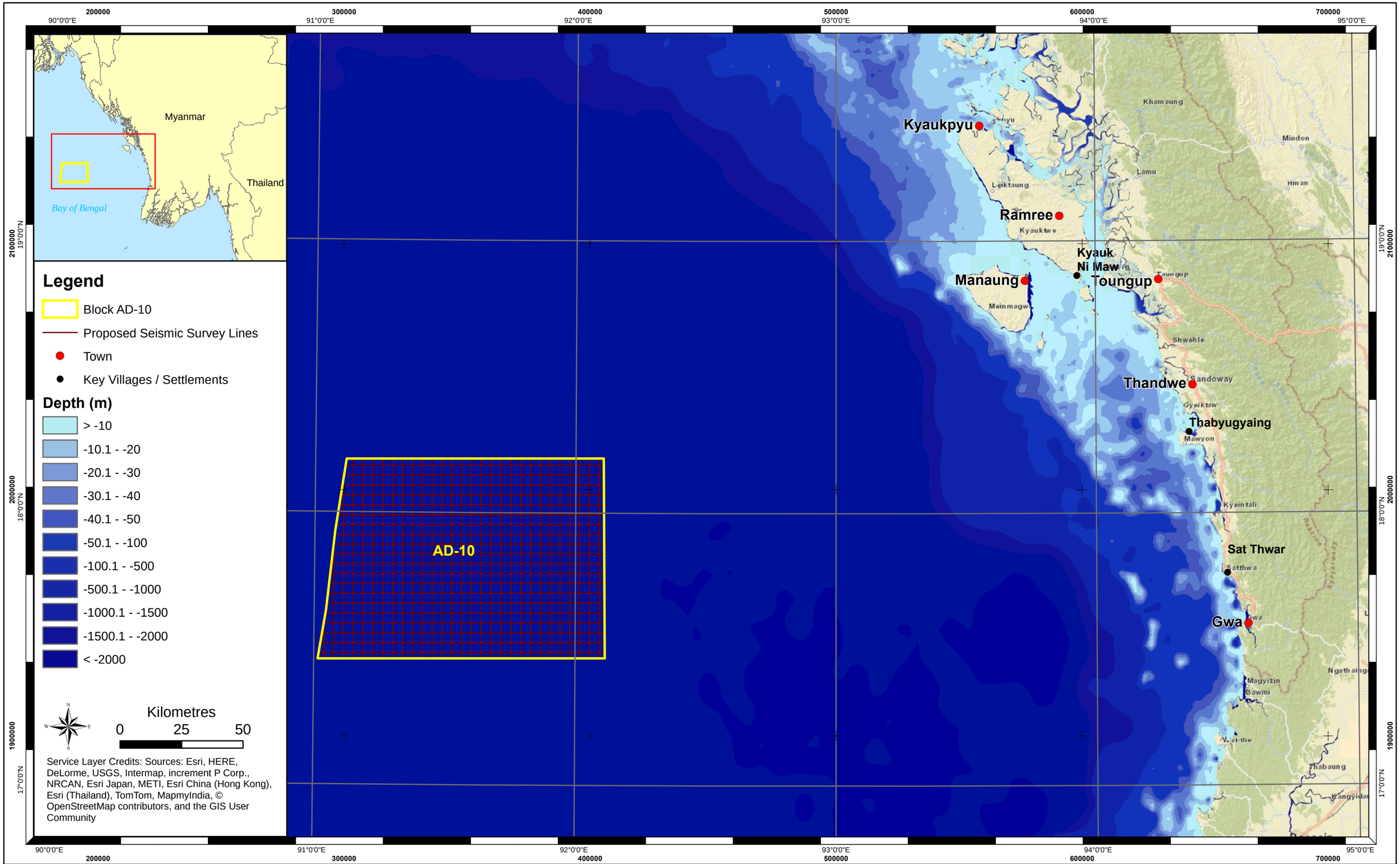

Figure 2.1

Location of Project Area

File: T:\GIS\CONTRACT\0267094\Mxd\Report\0267094_Location_of_Project_Area_AD10.mxd
Date: 30/7/2015

Environmental Resources Management

ERM

In relation to the above, Statoil has commissioned **Environmental Resources Management** (ERM), supported by local specialists from **Resource and Environment Myanmar** (REM), to undertake an environmental and social impact assessment ("the IEE Study") for the planned 2D seismic survey in Block AD-10 in accordance with the *EIA Procedures*. This IEE Report has been prepared for Statoil by ERM and REM and presents the objectives, methodology and outcomes of the IEE Study.

2.4 *IEE OBJECTIVES*

As discussed in the previous section, the overall purpose of the IEE Study is to complete a robust environmental and social assessment to meet requirements of the *EIA Procedures* for the IEE to be approved by the MOECAF.

Specifically, the objectives of the IEE are:

- To review the proposed Project activities with respect to their potential to interact with environmental and social receptors and resources;
- To identify the potentially vulnerable environmental and social components of the baseline within the Study Area (1);
- To identify and evaluate potential environmental and social impacts arising from the Project;
- To recommend mitigation or enhancement measures to remove, reduce or avoid potential adverse impacts;
- To provide an environmental and social management plan (ESMP) including an approach for monitoring; and
- To summarise public consultation and disclosure of the Project.

2.5 *STUDY LIMITATIONS*

This IEE Report is based on the Project description obtained from Statoil at the time of the IEE Study. Any future changes to the Project description, upon which this report is based or additional relevant information revealed as Project design, equipment and service procurement proceed may affect the analysis, assessment and conclusions contained in this report. Should significant changes occur, they would be the subject of further study to verify that the conclusions of this IEE Report do not change and to determine whether any additional mitigation, management or monitoring measures are warranted.

(1) The Study Area is the area in which any potential impacts from the Project (direct or indirect) could occur. The Study Area is further defined under the baseline section (*Section 4*) of this IEE Report in terms of the physical, biological and socio-economic environment.

2.6 ENVIRONMENTAL AND SOCIAL EXPERTS

The key environmental and social experts deployed for the Project are presented in *Table 2.1*; CVs for the experts are provided in ***Annex 2.1***.

Table 2.1 Environmental and Social Experts for the Project

Team	Name	Role	Organisation	Academic Experience	Years' Experience
Project Management Team	Craig A. Reid	Project Director	ERM	BSc	17
Project Management Team	Dr Jasmine Ng	Project Manager	ERM	PhD	10
Advisory Team	Dr Robin Kennish	EIA / EMP Expert	ERM	PhD	19
Advisory Team	Neena Singh	SIA Expert	ERM	M.phil / M A	20
IEE and ESMP Technical Team	Becky Summons	Marine Specialist	ERM	MSc	6
IEE and ESMP Technical Team	Manish Singh	SIA Specialist	ERM	M.A	10
IEE and ESMP Technical Team	Nicci Ng	GIS Specialist	ERM	MSc	8
Local Team	Dr Win Naing Tun	Local Specialist	REM	M.A, M.Res	9
Local Team	Dr Soe Thura Tun	Local Specialist	REM	MSc	9
Local Team	Dr Khin Ohnmar Htwe	Local Specialist	REM	M.A	9
Local Team	Nan Thazin Oo	Social Specialist	REM	B.A	3
Local Team	May Thu Htet	Social Specialist	REM	A.GTI, BSc	3

The company that will undertake the IEE studies in Myanmar is Resource and Environment Myanmar (REM).

2.7 *REPORT STRUCTURE*

The remainder of this IEE Report is structured as follows:

- *Section 3* defines the institutional framework for the Project including a summary of legislation, guidelines and standards applicable to the Project;
- *Section 4* presents the Project description;
- *Section 5* presents a summary of environmental and social baseline conditions within the Study Area;
- *Section 6* presents the impact assessment methodology and the findings of the assessment of potentially significant impacts to environmental and social receptors and resources and proposed mitigation measures;
- *Section 7* presents a summary of the public consultation and disclosure carried out for the Project; and
- *Section 8* presents the main conclusions of the IEE report, and any recommendations of future actions to be taken.

A separate Environmental and Social Management Plan has been prepared for this Project following the EIA Procedure guidance.

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This section sets out the relevant legal and policy context in Myanmar and documents the environmental and social standards with which the Project will achieve compliance as well as the international standards that the Project will follow. Specifically, this section summarises the following:

- Statoil's Corporate Sustainability Policy;
- Policy and Legal Framework; including draft EIA Legislation in Myanmar, relevant Myanmar legislation and international conventions, standards and guidelines relevant to the Project;
- Institutional Framework of the Project Proponent and Myanmar ; including the requirements of the Production Sharing Contract (PSC); and
- Environmental and/or Health standards related to the Project.

Specific benchmarks used to assess individual impacts are also summarised under each assessment topic in *Section 6.*

3.1 CORPORATE ENVIRONMENTAL POLICY OF THE PROJECT PROPONENT

Statoil has adopted a comprehensive Health, Social and Environmental (HSE) Management System. This system is an important and integral part of the company's overall management system, which includes Corporate Policies on Safety, Security, Sustainability, People, Communication, Risk Management, Finance and Control, Procurement, Ethics, and Managing Information.

Statoil defines "Sustainability" as responsible social, environmental and economic performance enabling business resilience. Statoil aims to be recognized as the most carbon efficient oil and gas producer, committed to creating lasting value for communities.

Statoil Sustainability Policy

Our approach:

We contribute to sustainable development through our core activities wherever we work. We use natural resources efficiently, and provide energy which supports sustainable development.

We are committed to:

- *Integrating sustainability in the way we do business.*
- *Contributing to the development of sustainable energy systems and technology.*
- *Making decisions based on the way they affect our interests as well as the interests of the societies and the ecosystems in which we operate.*

- *Respecting human rights and labour standards.*

- *Ensuring anti-corruption and transparency on all sustainability issues and active engagement with stakeholders.*

- *Contributing to local content by developing skills and opportunities in the societies in which we operate.*

How we work:

- *We identify and manage environmental and social risks and opportunities based on stakeholder dialogue, as well as risk and impact assessments.*

- *We apply clean and efficient technologies to reduce the negative environmental impact of existing operations.*

- *We work to limit greenhouse gas emissions.*

- *We respect international labour standards and the rights of indigenous peoples.*

- *We promote transparency through support for international industry standards, and by publishing our income, expenditures and taxes in all the countries in which we operate.*

- *We hire and develop local people and promote local sourcing.*

- *We ensure that local suppliers comply with applicable laws and meet our expectations and standards.*

- *We work with others to help establish sustainable local enterprises and support the efforts of our suppliers to close gaps in order to meet our standards.*

- *We exchange experience with national partners and support education and skill building in oil- and gas-related disciplines to build lasting capacity.*

- *We undertake sustainable social investment projects in affected communities so that they can share in the benefits provided by our activities.*

Focus areas

Statoil's sustainability actions are focused on:

- *Balance reliable energy supply and climate impact.*

- *Aim for outstanding resource efficiency.*

- *Prevent harm to local environments.*

- *Create local opportunities.*

- *Respect human and labour rights.*

- *Be open and transparent.*

3.2 POLICY AND LEGAL FRAMEWORK

3.2.1 Draft EIA Legislation in Myanmar

Legislation related to environmental assessment, conservation and protection in Myanmar is currently within a development phase. Presently, the MOECAF is drafting both *EIA Procedures* and *EIA Guidelines*, along with the supporting of an EIA Review Team Committee comprising the members of relevant union ministries, union attorney general's office, three city development committees and NGOs and technical support by experts from the Asian Development Bank Greater Mekong Region – Environment Operations Centre (ADB GMS-EOC). Although the guideline are still draft, the approach of this Project has been aligned with the latest draft (*Version 6*) which was made publically available in 2015.

Under *Section 7* of the *Environmental Conservation Law (2012)* and *Articles 52, 53* and *55* of the *Environmental Conservation Rules (2014)* of the Republic of the Union of Myanmar, there is a requirement for the undertaking of an IEE or an EIA in order to obtain an ECC for certain development projects. The process as outlined in the draft *EIA Procedures (Version 6)* is described in the following sections.

Screening

The process starts with Screening and MOECAF has the exclusive authority to define screening criteria for a project. This screening criterion is provided in the draft *EIA procedures*. The MOECAF determines whether the project requires an IEE, an EIA, or is exempt from (not required) to undertake any environmental assessment. If an IEE or an EIA is required, Statoil would be obliged to prepare an IEE / EIA and obtain approval as well as prepare and implement an appropriate Environmental Management Plan (EMP).

Statoil was required to submit a Project Proposal Report to the Environmental Conservation Department (ECD) of MOECAF for screening. This Report was submitted by Statoil in October 2014 after which MOECAF determined that the Project would require an IEE i.e. categorised as "Offshore Oil and Gas Seismic Surveys (all sizes)" according to *Annex I* of the draft *EIA Procedures* (version dated 27 June 2015). Therefore, Statoil has followed the IEE Type Project route of the draft *EIA Procedures*.

Initial Environmental Examination and Report Preparation

In accordance with the draft *EIA Procedures*, Statoil has prepared this IEE Report which properly addresses all adverse physical, biological, social, economic and cultural impacts (including land use, resources use, and ownership of and rights to land and other resources) with appropriate mitigation measure proposed.

This IEE Report includes the results of public consultations and takes into account public concerns when assessing impacts, designing mitigation measures and selecting monitoring parameters. After completing all

investigations and public consultation, Statoil will submit the IEE Report to the MOECAF.

Statoil should, within 15 days after submission, disclose the IEE Report (to civil society, Project Affected Populations (PAPs), concerned government organisations and other interested stakeholders). Statoil will disclose the Executive Summary of this IEE Report in Myanmar at the township offices in Thandwe and Gwa and will advertise in one national and one local (Rakhine) newspaper. The full IEE Report (in English) will be available from **www.statoil.com**. All comments and recommendations received will be collected and reviewed by the MOECAF prior their final decision on approval of the IEE Report.

The MOECAF should deliver its final decision within 60 days of receipt of the IEE Report. Upon completion of its review of the IEE Report, the MOECAF will issue an ECC or inform Statoil that the Project is required to undergo the EIA process (as impacts are larger than was anticipated during the screening / scoping phase) and publically disclose its decision.

3.2.2 Relevant Legislation in Myanmar

Myanmar Legislation Relevant to the Project

Laws related to environmental and social issues and hence relevant to the IEE process for this seismic survey are included in *Table 3.1*. The following legislation has been considered and Statoil have adopted the relevant project mitigation and management measures deemed appropriate to the predicted impacts; please refer to the ESMP for a full list of all mitigation and management measures.

Table 3.1 Myanmar Legislation and Relevance to Project

Legislation	Description	Relevance to the Project
Environmental Conservation Law, 2012 (No. 9/ 2012) and Environmental Conservation Rules 2014	Defines MOECAF responsibilities.	The Project shall carry out an impact assessment including an EMP.
Foreign Investment Law (2012) and Rules (2013)	Regulates certain activities and may only permit these activities with the permission of the Union Government.	The Project shall obtain relevant government permissions.
The Protection of Wildlife and Conservation of Natural Areas Law, 1994 (No. 6/94) (and Rules on Protection of Wildlife, and Protected Area Conservation Law (2003)	Aims to implement a governmental policy for wildlife protection and determine which habitats and species are protected under Myanmar Law. Outlines penalties for "*causing water and air pollution, causing damage to a water-course or putting poison in the water in a natural area.*	The Project shall not cause water or air pollution.

Legislation	Description	Relevance to the Project
Myanmar Marine Fisheries Law, 1990 (amended in 1993)	Deals with fishing license applications, payment of duties and fines, registration of fishing vessels, and determination of fishing grounds. Also defines water pollution: "*No person shall dispose of living aquatic creatures or any material into the Myanmar Marine Fisheries Waters to cause pollution of water or to harass fishes and other marine organisms.*"	The Project shall not cause water pollution.
Environmental Impact Assessment Procedure (6th Draft)	Outlines the EIA requirements, methodology and monitoring.	The Project will align with the draft EIA Procedure.
Draft EIA Administrative Guidance	Provides the format and contents of the report.	Provides the order and structure of the report.
The Oil Fields Act, 1918	Provides the Government of Myanmar with the power to define and alter limits of any notified oilfield and make rules for all oil and gas activities. Provides guidance for preventing oil and gas wastes, reporting of fires, accidents and other occurrences and for regulating the collection and disposal of both oil and gas.	Not relevant to the Project. Relevant to government.
The Petroleum Act 1934 (The State Peace and Development Council Law No. 33/ 2010)	Regulates the production, storage and transport of oil so as not to cause pollution and fire.	Not relevant to the Project as no production, storage or transport of oil.
Territorial Sea and Maritime Zones Law 1977 (Law No. 3)	Defines responsibilities and jurisdiction of Myanmar within territorial waters and maritime zones.	Not relevant to the Project. Relevant to government.
The Law Amending the Territorial Sea and Maritime Zone Law (2008)	Inserts clause in Annex to specify the longitude and latitude of Preparis Island and Co Co Islands	Not relevant to the Project. Relevant to government.
The Law Amending the Ports Act 2008 (The State Peace and Development Council Law No. 5/2008)	Provides information on fines and penalties for discharge of ballast, rubbish or other wastes at ports.	Not relevant to the Project as there will be no port use in Myanmar.
Prevention from Danger of Chemical and Associated Material Law (No. 28/2013)	Aims to prevent damage to the environment and resources from chemicals and associated materials. Aims to provide systematic control of businesses using chemicals and associated materials in accordance with government approvals.	The Project will implement Statoil's Chemical Assessment and Selection Process.

Legislation	Description	Relevance to the Project
The Burma Wildlife Protection Act 1936 and The Burma Wildlife Protection Rules 1941 (Burma Act No. VII of 1936.)	Makes provision for the establishment of sanctuaries (game sanctuaries). Provides for the protection of a number of named species outside sanctuaries and reserved forests.	Not relevant to Project as no sanctuaries within or near to AD-10.
The Protection and Preservation of Cultural Heritage Region Law 1998 (The State Peace and Development Council Law No. 9/98)	Aims to protect the cultural heritage of Myanmar by placing restrictions on the construction and renovation of Buddhist structures.	Not relevant to Project as no cultural heritage sites within or near AD-10.
The Conservation of Water Resources and Rivers Law 2006 (The State Peace and Development Council Law No. 8/2006)	Aims to conserve and protect the water resources and rivers system and to prevent serious environmental contamination.	Not relevant to Project as no rivers near to AD-10 and no impact anticipated on water resources.
The Law On Standardization (2014)	Aims to establish and oversee adoption of standards in Myanmar	Not relevant to the Project. Relevant to government.
National Sustainable Development Strategy (2009)	Aims to develop and implement strategies in line with international standards to meet United Nations Millennium Development Goals and ensure environmental and social impacts of development projects are mitigated	Project aligns with principles of environmental and social impact assessment procedure
National Environmental Policy (1994)	Aims to establish sound environmental policies in utilization of water, land, forest, mineral resources, and other natural resources in order to conserve the environment	Not relevant to the Project. Relevant to government
Myanmar Insurance Law (1993)	Requirement that insurance is held against any accident that may be harmful to the environment	Relevant to insurance matters for the Project
Myanmar Agenda 21 (1997)	Outlines programmes and activities for sustainable consumption and/or production patterns. Guidelines are also included on the following issues: - increasing energy and material efficiency in production processes; - reducing wastes from production and promoting recycling; - promoting use of new and renewable sources of energy - using environmentally sound technologies for sustainable production; - reducing wasteful consumption; - increasing awareness for sustainable consumption.	Relevant to sustainability goals for the Project

Legislation	Description	Relevance to the Project
Myanmar Investment Commission, Notification No.1/2013 and No. 50/2014	Requirement that environmental and social impact assessment is required for the exploration and production of oil and gas and pipeline excavation, laying and construction.	Not relevant to the Project. Relevant to government

Myanmar Rules and Regulations pertaining to Fisheries

The fisheries sector in Myanmar is governed by a number of laws and policies; those of relevance to the Project are mentioned above. These laws were put in place after the repealing of the 1954 Fisheries law. However, there may be certain other guidelines or circulars from time to time, and such information may not be readily available in the public domain. Apart from these key laws and policies, the following notifications of relevance to the Project were issued for the management of the fisheries sector:

- **Fisheries notification on prohibition of fish importing**: this notification lists the fish species that may not be imported, exported, sold or kept in captivity without permission of the Department of Fisheries (DoF);
- **Notification for control of endangered fish species**: this notification lists all the species of fish and mammals that are protected, including dugong, whale, whale shark, dolphin, giant clam and turtle, and included in the list of endangered species in the Convention on International Trade of Endangered Species (CITES); and
- **Notification 2/2001**: This notification forbids the catch, harassment, killing, possession, sale, purchase, export or transport of whale shark anywhere in Myanmar waters.

3.2.3 International Standards and Guidelines

In addition to national legislation, a range of international standards, including IFC Performance Standards (IFC PS) and the World Bank Guidelines have been applied to the Project. These standards are set to complement and reinforce national legislation and ensure the Project is conducted under best practices in a way that minimises risks, impacts and ensures compliance and fair practices. The IFC PS and the World Bank Guidelines provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate and manage risks and impacts. The wording of the PSC signed by Statoil states that the Project should be carried out in accordance with the applicable provisions of the IFC PSs, the World Bank Group Environmental, Health and Safety Guidelines for Offshore Oil & Gas Development (2015) and other good international industry practices. The standards also encourage doing business in a sustainable way and include

stakeholder engagement and disclosure obligations of the Project Proponent in relation to project-level activities (1) (2).

Statoil's policies (as mentioned in *Section 3.1*) and the PSC (*Section 3.3.2*) are aligned to international best practice. As such, Statoil's approach is broadly consistent with the following international guidelines and standards:

- IFC Performance Standards (IFC PS) (2012): The IFC PS represent the 'policy framework' for the ESIA and sustainable social and environmental management for the Project, whereas the World Bank Group's EHS Guidelines provide guidance on general and industry best practice as well as recommended numerical limits for emissions to the atmosphere, noise, liquid and solid wastes, hazardous wastes, health and safety, and other aspects of industrial facilities and other types of development projects;

- World Bank Group (WBG) Environmental Health and Safety (EHS) General Guidelines (2007): The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs;

- WBG EHS Guidelines for Offshore Oil and Gas Development (2015): These latest guidelines for offshore oil and gas development (June 2015) consider industry-specific impacts and management relevant to the environment, occupational health and safety and community health and safety, as well as the development of performance indicators and monitoring programs. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of the environmental assessment; and

- United Nations Environment Program (UNEP) Guidelines on Environmental Management for Oil and gas Exploration and Production (1997): This document provides an overview of the environmental issues and the technical and management approaches to achieving high environmental performance in the activities necessary for oil and gas exploration and production.

Other good international industry practice guidelines from organisations such as the International Maritime Organisation (IMO), American Petroleum Institute (API), International Petroleum Industry Environmental Conservation Association (IPIECA) and International Association of Oil and Gas Producers (IOGP) has been considered for the Project including:

(1) IFC Performance Standards on Environmental and Social Sustainability, January 2012, International Finance Corporation, World Bank Group.

(2) Environmental, Health and Safety (EHS) Guidelines – General EHS Guidelines: Introduction, April 2007, International Finance Corporation, World Bank Group

- International Association of Geophysical Contractors (IAGC) - Recommended Mitigation Measures For Cetaceans during Geophysical Operations (June 2011);

- UK Joint Nature Conservation Committee (JNCC) - Guidelines for minimizing the risk of injury and disturbance to marine mammals from seismic surveys (August 2010);

- Joint OGP/ IAGC position paper - Seismic Surveys & Marine Mammals (2004);

- International Petroleum Industry Environment and Conservation Association (IPIECA) - the Oil and Gas Industry: Operating in Sensitive Environments (2003);

- International Association of Oil and Gas Producers (OGP) - Environmental Management in Oil and Gas Exploration and Production (1997);

- OGP Waste Management Guidelines (1993); and

- International Cable Protection Committee (ICPC) - Procedure to be followed whilst Offshore Seismic Survey Work is undertaken in the vicinity of Active Submarine Cable Systems (ICPC Recommendation No.8).

3.2.4 International Conventions

Relevant international treaties to which Myanmar is a signatory, include those related to waste management, biodiversity conservation as well as labour conventions. International conventions of relevance to the Project include:

- The International Convention for the Prevention of Pollution from Ships (MARPOL), which regulates waste and emission discharges from vessels; and

- The International Convention for the Safety of Life at Sea (SOLAS) which ensures that ships flagged by signatory States comply with minimum safety standards in construction, equipment and operation.

3.3 INSTITUTIONAL FRAMEWORK OF THE PROJECT PROPONENT AND MYANMAR GOVERNMENT

3.3.1 Administrative Structure of Myanmar

Health, Safety and Environmental Requirements

Matters pertaining to HSE requirements are generally under the jurisdiction of the ministries and state-owned enterprises in the oil and gas sector. Key ministries, agencies and state-owned enterprises that have jurisdiction over HSE matters in oil and gas operations include the following:

- **Ministry of Environmental Conservation and Forestry (MOECAF):** The Environmental Conservation Department (ECD) of MOECAF has ultimate responsibility in the review and approval, or otherwise, of submissions under the EIA process.

- **Myanma Oil and Gas Enterprise (MOGE):** MOGE is the state-owned enterprise responsible for working together with oil and gas companies (local and international) in Myanmar and oversees the PSCs in cooperation with foreign oil companies. MOGE involves in direct communication and coordination with various levels of different government agencies for HSE related issues.

- **Ministry of Energy (MOE**): MOE jointly works with MOGE in managing HSE issues of oil and gas operators in Myanmar, in which MOE encourages operators to establish an HSE Management System and prepare their own EIA/SIA for their project.

- **Myanmar Investment Commission (MIC):** MIC is a government agency responsible for coordinating with ministries (such as the MOE) and other state entities to facilitate foreign investment in Myanmar. The MIC is also responsible for granting MIC permits which enable foreign investors to carry out business activities under the Foreign Investment Law (1998). The Law specifies MIC shall "*take consideration on the facts such as financial credibility, economic justification of the business, appropriateness of technology and protection and conservation of environment in scrutinizing the proposals of investment*".

Fisheries Organizations

The key organizations involved in the governance of the fisheries sector are discussed in the section below.

Department of Fisheries

The Department of Fisheries (DoF), under the Ministry of Livestock and Fisheries, is the main institutional body which governs the fishing ground, methods and catch volume for the fishing rights operations. The DoF is responsible for the all-round development of the fisheries sector and management of the commercial fisheries activities including exports. The head office dedicates fisheries administrations to the provincial offices in States and Divisions.

The DoF is responsible for the following:

- Issuing of licenses for fisheries/gear/vessels/sites and aquaculture sites/ventures;

- Advise the Ministry of Livestock and Fisheries and the Divisional and State Government on fisheries and aquaculture matters;

- Act as regulatory body for the correct and proper conduct of fisheries and aquaculture;
- Facilitating the technical needs and equipment of the marine sector;
- Undertaking research and development activities; and
- Training and extension.

Myanmar Fisheries Federation

The Myanmar Fisheries Federation (MFF) was formed in 1998 from the Myanmar Fishery Association. It is a Non-governmental Organization (NGO) that deals with the fisheries industries. It was formed as part of the ASEAN Fisheries Federation.

The organization operates at a local and national level, with most of the larger fish farmers being members of the local MFF branch. The MFF is governed by a Central Executive Committee which plays a coordinating role and supported by office holders. The roles of the MFF are as follows:

- Support applications made by its members to DoF for the license to undertake fisheries and aquaculture activities;
- Support applications to the Livestock and Fisheries Bank for loan applications;
- Raise issues of collective importance to their members with the DoF, such as accessing initial investment, raw materials for feeds, negotiating with local authorities to change use of land;
- Assist in the negotiation of selling and harvesting, working collectively;
- Assist in the transferring of technology to farmers; and
- Assist in the communication and cooperation with trans-boundary organization.

3.3.2 Production Sharing Contract (PSC) Requirements

More specifically, the planned operations at Block AD-10 are governed by the PSC. Included in this are the requirements that the Contractor (i.e. Statoil) shall:

- *" …be responsible to conduct environmental impact assessment (EIA) and social impact assessment (SIA) and to development of Environmental Management Plan (EMP) and implementation for the environmental protection and management in the Contract Area in accordance with the laws, rules, regulations, directive and notifications of the Republic of the Union of Myanmar in conformity with international petroleum industry's practices with respect to the environment protection and mitigation;*

- *be responsible for execution of Work Programme which shall be implemented in a work-manlike manner and CONTRACTOR shall take such precautions for protection of navigation and fishing and CONTRACTOR shall be responsible to conduct Petroleum Operations in accordance with the applicable provisions of the International Financing Corporation Performance Standards (2012), the World Bank Group Environmental, Health and Safety Guidelines for Offshore Oil & Gas Development (2007), good international petroleum industry practices and the laws, regulations and directives of the Republic of the Union of Myanmar with respect to Environmental and Social protection. The steps to carry out these obligations shall be instituted into the Work programme. It is also understood that the execution of the Work Programme shall be exercised so as not to conflict with the laws of the Republic of the Union of Myanmar as they exist as of the Effective Date."*

3.4 ENVIRONMENTAL AND/OR HEALTH STANDARDS RELATED TO THE PROJECT

The Project will apply the IFC Performance Standards (IFC PS) and the World Bank Guidelines. As mentioned in *Section 3.2.3*, Statoil's policies and the PSC are aligned to Good International Industry Practise (GIIP). More information on the applicable environmental and social standards is provided in the sections above.

The specific emission limit values and environmental quality standards that are relevant to the Project are shown in *Table 1.1* of the ESMP.

The Project is currently being undertaken to follow international standards mentioned in this Section. However, should Myanmar national standards come into force prior to commencement of Project operations, the Project will as a minimum adopt the most stringent of these standards.

4 PROJECT DESCRIPTION AND ALTERNATIVES

This section provides the detailed description of the proposed offshore seismic survey to be conducted across Block AD-10. Information provided in this section is based on data made available during preparation of this IEE Report.

4.1 PROJECT BACKGROUND AND OBJECTIVES

Statoil signed the PSC for Block AD-10 in April 2015. Block AD-10 is located in the Bay of Bengal, offshore Myanmar. The location of Block AD-10 is shown in *Figure 2.1*.

Statoil intends to undertake a 2D seismic survey in Block AD-10 over the course of 45 days. Following the seismic survey, a number of exploration wells may be drilled in Block AD-10. These wells are not included in the scope of this IEE Study, and will be subject to separate environmental and social assessment in the future prior to commencement of those activities.

The alternatives to the Project are discussed in more detail in *Section 4.3*.

The tentative schedule of the proposed seismic survey is presented in *Table 4.1*. The 2D seismic survey is planned to start in early 2016, for a period of about 45 days.

Table 4.1 Tentative Schedule for the Seismic Survey in Block AD-10

Phase	Schedule
Preparation / Mobilisation	Early 2016
Seismic Survey	April/May 2016[1]
Close-out	2nd Quarter 2016

4.2 PROJECT LOCATION

Block AD-10 is located in the Rakhine Basin, offshore Myanmar and covers an area of about 9,000 km^2. The Block is in water depths of about 2,000 m and is over 200 km from the mainland coast. The location of the Block and tentative locations of the seismic survey lines are shown in *Figure 2.1*. The seismic survey will cover the whole block, acquiring a total of 5,000 km seismic survey lines in a 4 km x 4 km grid.

4.3 ALTERATIVE SELECTION AND COMPARISON

Consideration of Project options and alternatives is a fundamental requirement in the planning of any project as a means of avoiding or reducing adverse environmental and social impacts and maximising or enhancing project benefits.

(1) To be confirmed when the contract is awarded

Several options that have been / are considered for the Project include the following:

- Streamer: it is preferred to use solid or gel-filled streamer rather than kerosene-filled streamer as these solid cables, which are constructed of extruded foam, are robust and resistant to damage, do not leak when damaged either on the vessel or in the sea, and are less sensitive to weather and wave noise. Gels are known to be inert.

- Sensitive receiver: the proposed seismic survey area should be sited away from key sensitive receivers as far as practicable to avoid disturbance to the environmental and social sensitive receptors; and

- Operational safety zone: the safety zone during seismic operations should be mobile depending on the survey vessel instead of restricting the whole block as far as practicable to minimise disturbance to nearby marine operators, such as fishing vessels.

- No Project alternative: The "No Project" alternative considered would mean that no seismic survey would be undertaken which in turn, means no exploration activity in this Block. Should there be no exploration activity, no further oil and gas development would be able to be undertaken. The exploration is required to help stimulate the economy of Myanmar. No Project would result in fewer opportunities for gas supply to the domestic market and could lead to less employment opportunities and less economic growth.

Many of these options are of relevance to the assessment of potential impacts. Therefore, as the Project options will not be finalised until the tendering process has been completed the relative impacts of each option will be considered where possible in the impact assessment. Where this is not possible a conservative approach will be taken to undertake the subsequent impact assessment as outlined in further in *Section 6*.

4.4 DESCRIPTION OF SELECTED ALTERNATIVE

4.4.1 Seismic Survey Operations

General Principles of Seismic Surveys

Marine geophysical seismic surveys are an integral component of offshore oil and gas exploration activities and are used to define sub-seabed deposits and geological structures. During a marine seismic survey, a slow moving survey vessel (typically steaming at about 4 to 6 knots) tows an impulse emitting sound source (array of airguns). High energy low frequency sounds (termed shots) are produced by the airguns and directed downwards at the seabed and underlying sub-seabed geology. These sound waves bounce off the sub-surface rock formations and return to the surface where the seismic energy is collected by an array of receivers (hydrophones). The acquired data are then recorded by on-board computers for subsequent processing to

produce profiles of the sub-seabed geology for interpretation by geophysicists. The principles behind marine seismic survey operations are illustrated in *Figure 4.1*.

When using the marine streamer seismic method, the receivers (hydrophones) are encased in a long cable (streamer), which is towed or "streamed" behind the seismic vessel. The marine seismic survey operations are to be conducted by a specialized seismic survey vessel, which is typically supported by one, or more, smaller vessels referred to as "chase vessels" (*Figure 4.2*). The role of the chase vessels is to scout ahead for obstructions (e.g. static fishing gear, fish traps) and to approach and warn-off any shipping that might be ignoring radio warnings to avoid the survey area.

A 2D seismic survey involves acquiring seismic data using a single streamer to detect the reflected seismic energy. It provides data through a two-dimensional, or 2D, vertical cross section of the subsurface geology.

Seismic Survey Programme

The survey programme will include the following main activities:

- Mobilisation of seismic and support vessel;
- Deployment of towed equipment (i.e. airgun array, streamers);
- Data acquisition, comprising the bulk of the programme; and
- Retrieval of equipment and demobilisation.

The survey itself will cover the entire area of the Block, and consist of approximately 5,000 km of seismic lines. At present the seismic line plan is still being finalised. The seismic vessel will sail down pre-plotted lines running North – South and East-West, forming a 4 x 4 km grid that covers the block.

Airguns

Airguns are the standard marine seismic energy source. The seismic energy pulse is created when a bubble of compressed air is discharged into the water. An airgun array comprises a number of different sized airguns which helps to attenuate the residue bubble pulse and enhance the signal level. Illustrative examples of seismic survey airguns are presented in *Figure 4.3*.

For the proposed seismic survey in Block AD-10, seismic activities will use several individual airguns, ranging in size from 20 - 250 cubic inches, with a total airgun array volume around 4,000 cubic inches. Each gun is proposed to be at a water depth of 8 m, using a firing interval of 10 seconds and a shot point interval of 25 m. The airgun array is configured to ensure that guns are positioned as such to direct the sound towards the seabed and minimise horizontal spreading.

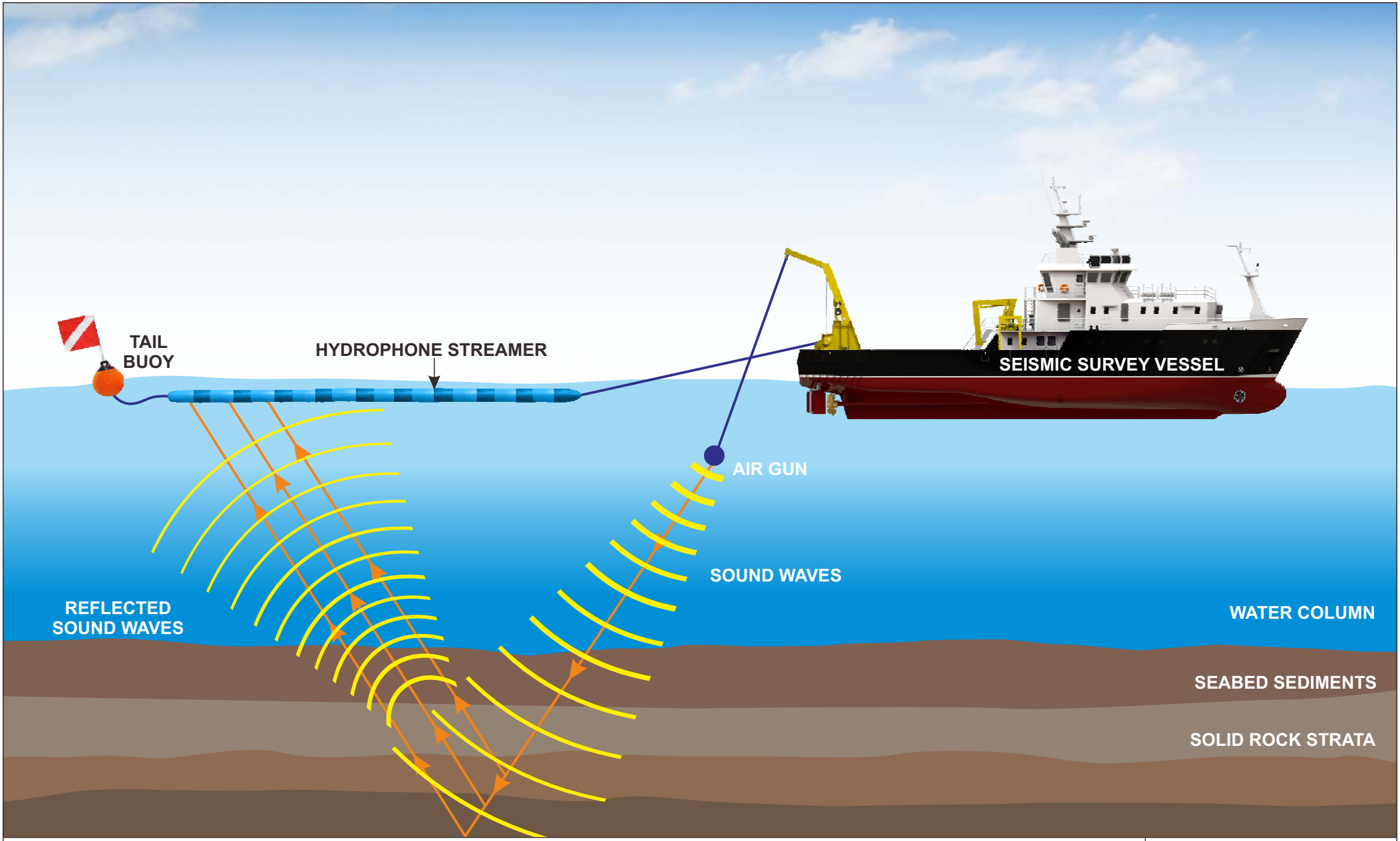

Figure 4.1

Schematic of Marine Seismic Survey

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The seismic survey vessel is purposely built for towing the airguns and streamers for conducting the seismic surveys.

Indicative seismic survey vessel specifications

Parameter	Specification *
No. of personnel onboard (POB) (crew + survey personnel)	40 – 60
Length	50 – 90 m
Width	15 – 20 m
Draft	5 – 6 m
Fuel consumption	9 – 15 tonnes/ day
Minimum operating depth	~ 10 m
Maximum load speed	Up to 15 Knots
Survey speed	4-5 knots

** Indicative only*

Typical Seismic Vessel

Typical Seismic Vessel

Figure 4.2

Illustrative Example of Seismic Survey Vessels

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An airgun is a pneumatic device that produces acoustic output by rapidly releasing a volume of compressed air.

(Source:www.stamfordadvocate.com)

Sizes of airguns vary greatly and there is no "standard" size. The individual guns are suspended in the water from a float system. Airgun arrays are composed of sub-arrays, each suspended from its own float to maintain the specified operating depth. Typical information on airgun arrays is provided in the table on the right.

Indicative Airgun Specifications

Parameter	Specification *
Number of airguns per sub-array	6 - 7 per sub-arrays
Array size	4000 – 5000 cubic inches
Operating pressure	2000 psi
Operational depth	4 - 10 m below sea surface
Array width	16 - 36 m
Array length	14 - 21 m
Firing interval	7 - 10 seconds
Distance behind vessel	100 - 200 m

** Indicative only*

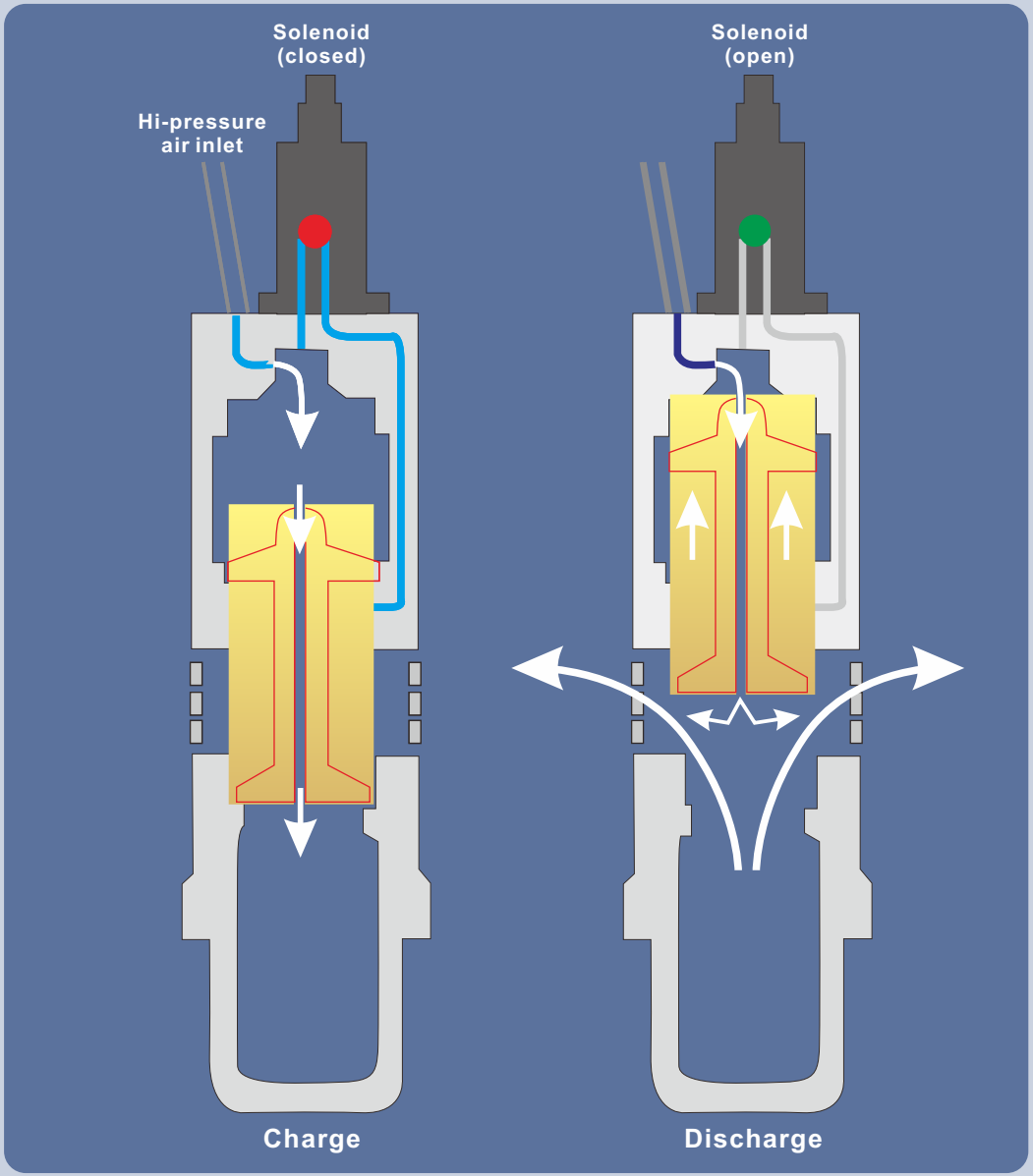

Figure 4.3

Illustrative Example of Airguns for Use in Marine Seismic Surveys

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Streamer

For the Block AD-10 survey it can be expected that the receivers (hydrophones) will be encased in long cable, which is towed or "streamed" behind the seismic vessel at a depth of 12 m below the sea surface. The streamer will be around 10 km in length and only one streamer will be used. Hydrophones will be evenly spaced along the streamer to provide the required sub-surface information. Recordings captured by the hydrophones are several seconds long and will be sampled every 1 – 2 milliseconds (thousandths of a second). A tail buoy will be fitted to the end of the streamer and will be brightly coloured and filled with a radar reflector and strobe light. More information on streamer equipment is provided in *Figure 4.4* and *4.5*. A solid/gel-filled streamer is preferred, but there is also an option that the survey will be conducted with a liquid-filled streamer. The overall layout of the seismic equipment is provided in *Figure 4.6*.

Seismic Survey Vessel

For Block AD-10 a specialized survey vessel will be selected for the actual seismic survey. At the time of writing, the contracting process for the seismic contractor is still in progress so the specific details of the survey are not known. The information provided is thus based on standard seismic survey techniques and methods. An illustrative example of a typical seismic survey vessel is presented in *Figure 4.2*. It can be assumed that the following vessel specifications may be followed (*Table 4.2*).

Table 4.2 Potential Seismic Survey Vessel Specifications for Block AD-10

Typical Seismic Vessel	Specification
No. Personnel on Board (POB)	40-60 people
Length	80 m
Beam	16 m
Max Draft	8.0 m
Gross Tonnage	4,000 GT
Fuel consumption	16 metric tons per day

All survey operations will be conducted in accordance with the vessels' standard operating procedures, which detail the manner in which all operations are to be conducted. These procedures also detail the responses and actions to be taken in case of incidents and unplanned events.

The survey vessel will be equipped with extensive navigation, radio/satellite communication equipment as well as dual radar systems. Regular warning messages will be broadcast advising other vessels in the area of the proposed operations.

Support (Chase) Vessels

Typically either one or two chase vessels will be provided by the seismic survey contractor. The chase vessels will maintain an operational perimeter around the survey vessel to keep the area clear of obstructions (e.g. static fishing gear or floating debris) and to approach and warn-off any shipping

Birds

Birds

Radar Reflector on Bird

Streamer systems are provided with electronic cable levelling / depth control devices (adjustable fins/ hydroplanes also known as “birds”). These allow the streamer to be raised/ lowered in the water column to optimise its position or to avoid hazards.

Tail Buoys

Tail Buoy (Source: www.seamap.com)

A tail buoy is connected to the far end of each streamer to provide positional information and also warn of presence of the submerged towed streamer both (especially at night). A deivce known as a “turtle guards” will be installed on the tail buoys for preventing sea turtles from becoming fatally entrapped in the gaps in the tail buoys undercarriage.

The tail buoys are usually brightly coloured and are provided with a radar reflector and flashing lights; if required an audible warning device can also be fitted.

Figure 4.4

Illustrative Example of Tail Buoy and Birds

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Streamer

A typical streamer cable is approximately 50 – 80 mm in diameter and 3 – 10 km in length. It houses the following five principal components :

- Hydrophones, usually spaced 1 m apart but electrically coupled in groups of 12.5 or 25 m in length;
- Electronic modules, which digitise and transmit the seismic data;
- Stress members, steel or Kevlar, that provide the physical strength required, allowing the streamer to be towed in rough weather.
- An electrical transmission cabling system, for power to the streamer electronic modules and periphery devices, and for data telemetry; and
- A plastic sheath in which all the above are housed.

Streamers are comprised of individual isolated sections (typically 50 – 150 m long) such that any damaged section can be individually replaced.

Streamer Tracking

Streamers are equipped with automatic flotation devices which trigger when the streamer is detached and starts to sink.

The streamers are accurately positioned/ tracked by GPS and acoustic positioning systems. A real time digital display of the streamer footprint is available on board the seismic vessel. This allows the vessel navigators to constantly monitor the vessel and streamer position relative to other vessels and surface obstructions.

Streamer buoyancy

To provide buoyancy, some streamers can be filled with cable oil. Indicative physical properties for potential cable oil streamers are presented in the table below.

Indicative Properties of Cable Oil used in Streamers

Parameter	Specification *
Chemical	Synthetic isoparafinic hydrocarbon (aliphatic hydrocarbon)
	0.79
Specific gravity	<0.01% wt. (@ 77 deg. F)
Solubility in water	Negligible

** Indicative only*

Streamer Cable on Reel

Some newer cables do not contain buoyancy fluids but instead are filled with a polymer for flotation so cable breaks do not result in a loss of fluid. Solid cables are becoming more popular to use. They are constructed of extruded foam, are robust, do not leak when damaged, and are less sensitive to weather and wave noise. The streamers are stored in reels on board the survey vessel. They are then deployed over the back and/ or sides of the vessel and towed directly behind the survey vessel for acquisition operations.

Figure 4.5

Illustrative Example of Seismic Streamer

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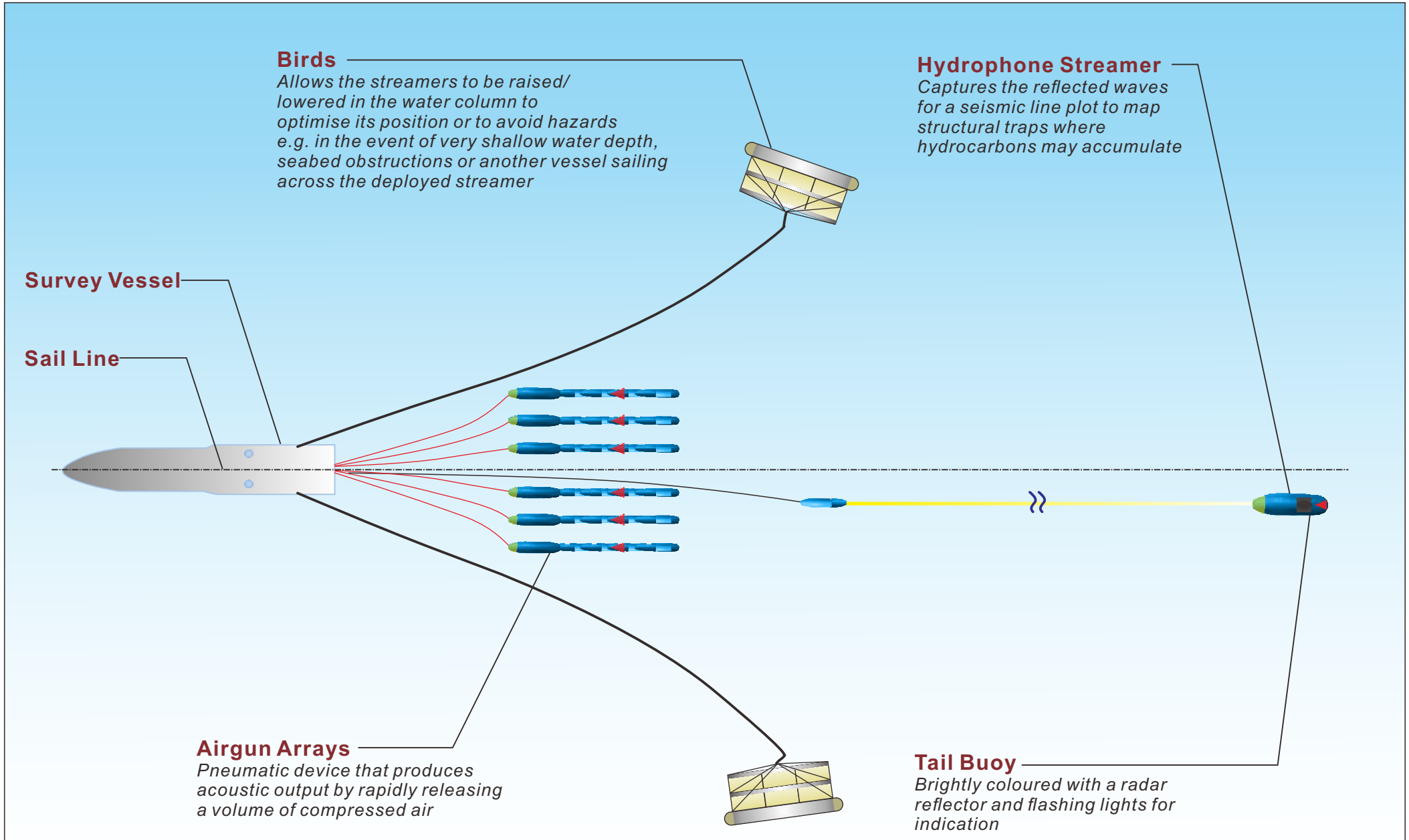

Figure 4.6

Illustrative Arrangement of Seismic Survey Equipment

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that might be ignoring radio warnings to avoid the survey area. Chase vessels will normally sail approximately several hundred meters in front, at both sides and at the back of the survey vessel to provide sufficient support. There will also be a separate supply vessel which supports the survey vessel with fuel and consumables.

Statoil will ensure that all vessels are capable for the operation. Contractor personnel are well-trained in terms of their job responsibilities, health and safety, and environment requirements. In addition, prior to vessel mobilization, Statoil personnel will conduct a full technical and HES audit on the vessel, its crew, operational procedures and equipment.

The seismic survey vessel and the support vessel(s) are expected to have crew of around 40-60 and 6-10 people on board, respectively. Statoil will provide On-board Representatives during the seismic survey to monitor and control the performance of the survey contractor in order to ensure that all operations are in full compliance with the seismic acquisition programme.

4.4.2 Materials, Supplies, Labour & Logistics

Refuelling and resupplying during the seismic survey will be undertaken with a supply vessel to port. The seismic vessel will be refuelled at sea and crew changes will be undertaken at sea via helicopter or in port. The likely port (supply base) would be located at Yangon or in Rakhine State, but will be decided when contractor is in place. For more advanced requirements, possible shore support will utilise Thailand or Singapore. Transfers from supply vessel to the survey and chase vessels will be offshore. All offshore transfer operations will be undertaken to the required MARPOL standards.

The survey vessel's engines will use either Marine Gas Oil (MGO) or Heavy Fuel Oil (HFO), depending on final choice of contractor and vessel. Fuel consumption rate for the survey vessels is up to 30 tons per day. All electrical demands for operations undertaken on the survey vessel are provided by batteries and/or diesel generators. Fresh water will be produced on board the seismic survey vessel for consumption at about 400 L per person per day.

An emergency response plan and medevac plan will be prepared for the campaign.

Given the nature of the work required, only people with specialised experience of conducting seismic surveys for oil and gas projects will be employed.

4.4.3 Emissions, Discharges & Wastes

An inventory of the main emissions (sound and air pollutants), discharges to sea and wastes that may potentially be generated during the seismic survey in Block AD-10 is presented below. As the contracting process for the contractor is still in progress, the specific details of the survey are not known. However, the information presented has been drawn from relevant, publicly

available literature, government/authority information sources, internet research and databases, ERM in-house archives and the application of emission factors.

Importantly, all emissions, discharges and waste generation will comply with applicable government regulations in Myanmar.

Underwater Sound Emissions

The primary source of underwater sound associated with seismic surveys is the towed airgun arrays. The sound levels produced by the airguns depend on the number of guns used, their sizes (total gas volume), the air pressure level and the depth of their deployment.

Marine seismic survey in Block AD-10 will use airgun arrays (high energy, low frequency sound sources). The sources will be simultaneously triggered at fixed period time intervals (10 seconds) while being towed behind the survey vessel. A range of airgun volumes will be used to increase the signal level, focus the signal downwards (limiting the unwanted spread of sound away from the target area) and to reduce seismic echoes.

As the final specifications of the airguns are not available at the time of writing this IEE, the sound exposure levels emitted cannot be confirmed. However, it is expected that such levels would be in the order of up to 230 dB at 1 m from a single airgun and up to 250 dB at 1 m for the array (NB: all dB values quoted for underwater noise are referenced to 1 micro Pascal (μPa). The fundamental frequencies are expected to fall within the range 0 - 300 Hz. Rapid attenuation of the sound energy levels with distance from the sound source is expected such that 180 dB is expected at a radius of 100 to 300 m and 160dB at a radius of 750 to 3,500 m.

Emissions to Air

The principal atmospheric emissions during the exploration survey activities will be from the marine seismic survey operations and will comprise exhaust emissions, primarily carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_X), sulphur dioxide (SO_2) and methane (CH_4) with small quantities of un-burnt hydrocarbons and smoke/particulates discharged from propulsion and power generation equipment on the vessels. Exhaust emissions from vessels are directly related to fuel consumption rates as well as the sulphur content of the fuel (SO_2 emissions).

Potential quantities of each pollutant are estimated based on United States Environmental Protection Agency (USEPA) AP-42 Emission Factors and fuel consumption of vessels (1). An estimation of typical exhaust emissions during a seismic operation is presented in *Table 4.3,* assuming vessels running on Marine Gas Oil. Heavy fuel oil would typically have higher sulphur content (4.5% vs. 0.5% in MGO) and consequently higher SO_2 emissions.

(1) UKOOA (1999) *Guidelines for the Compilation of an Atmospheric Emissions Inventory – Transportation Fuel Consumption Emissions Factors: Vessels*

Table 4.3 ***Indicative Air Emissions by Vessels during the Block AD-10 Seismic Survey***
(Source: USEPA)

Sources	Daily Marine Gas Oil Consumption (metric ton) [1]	Indicative Daily Emission Rate (metric ton of individual substance) [2]					
		CO_2	CO	NOx	SO_2	CH_4	NMHC
USEPA AP-42 Emission Factor		*3.2*	*0.008*	*0.059*	*0.01*	*0.00027*	*0.0024*
Seismic Survey Vessel	10	32	0.08	0.59	0.1	0.0027	0.024
Chase/ Support Vessel	1.5	4.8	0.012	0.0885	0.015	0.000405	0.0036

[1] Indicative only; daily MGO consumption typically ranges from 9 – 15 metric ton for streamer survey vessels and 1 – 2 metric ton for chase/ support vessel
[2] Assuming 0.5% wt sulphur fuel content

Other air emissions will include negligible volumes of fugitive hydrocarbons from fuel/ oil storage and handling as well as fugitive releases of refrigerants from on-board air conditioning/ chiller/ refrigeration equipment.

The survey is anticipated to last for around 45 days, the total air emissions for the survey are provided in *Table 4.4*.

Table 4.4 ***Estimated Total Air Emissions during the Block AD-10 Seismic Survey***

Sources	Daily Marine Gas Oil Consumption (metric ton) [1]	Total Days of Survey	Total Emission Volume (metric ton of individual substance) [2]					
			CO_2	CO	NOx	SO_2	CH_4	NMHC
USEPA AP-42 Emission Factor			*3.2*	*0.008*	*0.059*	*0.01*	*0.00027*	*0.0024*
Seismic Survey Vessel	10	45	1,440	3.6	26.55	4.5	0.1215	1.08
Chase/ Support Vessel	1.5	45	216	0.54	3.983	0.675	0.0182	0.162
TOTAL			1,656	4.14	30.533	5.175	0.1397	1.242

[1] Indicative only; daily MGO consumption typically ranges from 9 – 15 metric ton for streamer survey vessels and 1 – 2 metric ton for chase/ support vessel
[2] Assuming 0.5% wt sulphur fuel content

Some seismic survey vessels are also provided with on-board incineration systems for disposing of domestic/ combustible waste. If such a vessel is utilised for the survey in Block AD-10 then the use of this system will give rise to intermittent combustion product emissions.

Vessels will be in compliance with applicable MARPOL 73/78 Regulations for the prevention of air pollution from ships (Annex VI).

Effluent Discharges

The principal effluents discharged to the marine environment during survey operations will comprise domestic wastewater (grey water – laundry/ shower discharges and other wash water) and sewage (black water – human body wastes) with small quantities of drainage water (from both non-contaminated and contaminated areas e.g. bilge and machinery spaces) and service water/ cooling water system discharge.

An estimation of domestic wastewater and sewage discharged during the proposed seismic operation in Block AD-10 is presented in *Table 4.5*.

Table 4.5 Indicative Effluent Discharges from Vessels during the Block AD-10 Seismic Survey

Sources	Indicative No. of personnel on board (POB) [1]	Daily domestic wastewater discharges to sea (m^3/day)	Daily sewage discharges to sea (m^3/day)
		Approximately 0.12 m^3 per person per day [2]	Approximately 0.08 m^3 per person per day
Seismic Survey Vessel	50	6	4
Chase/ Support Vessel	15	1.8	1.2

[1] Indicative only; POB typically ranges from 30 – 100 for seismic survey vessel and 10 – 20 for chase/ support vessel

[2] Domestic wastewater generation rate = 80% of water consumption (0.15m^3)

Seismic survey vessel would be expected to have an on-board sewage handling and treatment system in compliance with the requirements of MARPOL 73/78 Annex IV (*Prevention of Pollution by Sewage from Ships*; The Convention for the Prevention of Pollution from Ships, 1973 as amended by the 1978 Protocol). The vessel's compliance will be documented via a Sewage Pollution Prevention Certificate.

Seismic survey vessel would also be expected to fully comply with the requirements of MARPOL 73/78 Annex I (*Prevention of Pollution by Oil*). The vessel compliance will be documented via Oil Record Book, International Oil Pollution Prevention (IOPP) Certificate, and the installation of an oily water separator for bilge and machinery space drainage and a slop oil tank. Discharges of bilge water or drainage from machinery spaces would therefore be expected to have been treated to a specification of 15 ppm oil content or lower prior to overboard discharge. The separated slop oil will be handled for disposal onshore by a licensed contractor.

Cooling water (typically a once through system) and surplus service water (e.g. from a potable water generation system) may also be discharged to the sea. Discharges from the service water system may contain residual chlorine (typically < 1 ppm).

Other effluents discharged during survey operations such as deck drainage (e.g. rainfall/ sea spray run-off) and effluents from deck wash down operations may contain trace quantities of lube oil, cable oil and fuel oil/ diesel.

Solid & Hazardous Waste Generation

Waste generated during seismic survey operations may comprise of:

- Non-hazardous industrial type solid wastes, which include general refuse (e.g. packaging materials, paper/ plastic bags and containers);
- Domestic food waste from the galleys on the vessels; and

- Small quantities of hazardous wastes, which include solvent, thinner, spent lubrication oil, hydraulic fluids, fluid, oily rags, lithium batteries, slop oil and oil contaminated materials (e.g. containers used to store lubricating fluids).

General refuse will not be disposed of to sea. Combustible wastes will be segregated and disposed by incinerator on-board, or returned to shore. Non-combustible and recyclable wastes will be stored in containers and returned to shore for disposal.

The disposal of non-combustible wastes will be the responsibility of the contractor, who will be required to have a Waste Management Plan in place as well as record all waste retained on-board or transferred to the supply vessel for transport to shore. This will include information on how/where wastes have been disposed.

The use of specific waste facilities in Myanmar has not been confirmed by the contractor at this stage. However, if any wastes are transferred to shore in Myanmar, it will be handled by the local port authorities and the contractor will retain waste transfer records which Statoil will check and inspect. No hazardous wastes would be transferred to shore in Myanmar for disposal in the absence of suitable disposal facilities. In such case, hazardous wastes would be kept on board until demobilisation back to Singapore (location to be confirmed when the contract is awarded). Statoil will collate and report waste volumes and disposal routes to MOECAF after the survey.

Seismic survey vessel would be expected to fully comply with the requirements of MARPOL 73/78 Annex V. Food waste will be macerated into smaller pieces (25 mm) prior to discharge overboard, if discharged less than 12 nautical miles from shore.

All hazardous wastes will be stored in appropriate containers with labels. Hazardous waste storage area will be designated in accordance with their Materials Data Sheet (MSDS). Hazardous wastes will be returned to shore and sent to a licensed disposal facility by a licensed waste contractor.

Control Measures and Built in Mitigation

A number of measures have been built-in to the design of the Project in order to ensure any potential impacts are avoided or reduced to the extent possible. These measures include: compliance with applicable international legislation (e.g. MARPOL) for reducing the impact from waste discharges, and the use of Fisheries Liaison Officers on-board vessels to communicate with any fishing vessels in the vicinity of the seismic vessel. A full list of all control measures is included in the ESMP.

5 BASELINE CONDITIONS

The following section describes the environmental and social setting of Block AD-10 as well as the Area of Interest for the Project. The information provided is based on a review of published information, supplemented with information collected from and provided by various stakeholders consulted as part of the Project, and through review of available Statoil, ERM and REM in-house literature. The consultation undertaken to inform the section is discussed in *Section 7* of this IEE Report.

The purpose of this review of baseline conditions is to present an understanding of the potential environmental and social sensitivities of Block AD-10 as well as the Area of Interest for the Project to make an informed judgement on the appropriate level of impact assessment.

5.1 SETTING THE STUDY LIMITS

For the purposes of this IEE Report, the Area of Interest is defined as the area within Block AD-10 as well as its immediate surroundings. As the Block is located over 200 km from the mainland coast, the immediate surroundings would not encompass the adjacent nearshore waters and coasts of Rakhine State mainland (refer to *Figure 5.1*). However, a brief summary of the environmental and social baseline of this area has been included in the discussion on the Area of Interest.

5.2 METHODOLOGY FOR DATA COLLECTION AND ANALYSIS

Data were collected through a variety of different means for the Project. Firstly, a literature review was undertaken using online resources to help gain understanding of the biological, physical and social environment. The Project also conducted consultations with a number of government bodies, scientific organisations and NGOs in order to collect data. Lastly, information collected was verified to the extent possible through consultations within Rakhine with a variety of stakeholders (refer to *Section 7* for more information on the stakeholders consulted). Questions were tailored in order to gather information on the baseline conditions and verify collected secondary data.

5.3 PHYSICAL COMPONENTS

This section provides an overview of the physical environment in the Area of Interest.

5.3.1 *Climate and Meteorology*

The weather and climate of Myanmar is primarily influenced by the Northeast and the Southwest Monsoons and the short transitional periods between them. The Southwest Monsoon (June to September), a period of consistent but sometimes strong wind from the Indian Ocean to the south west, is

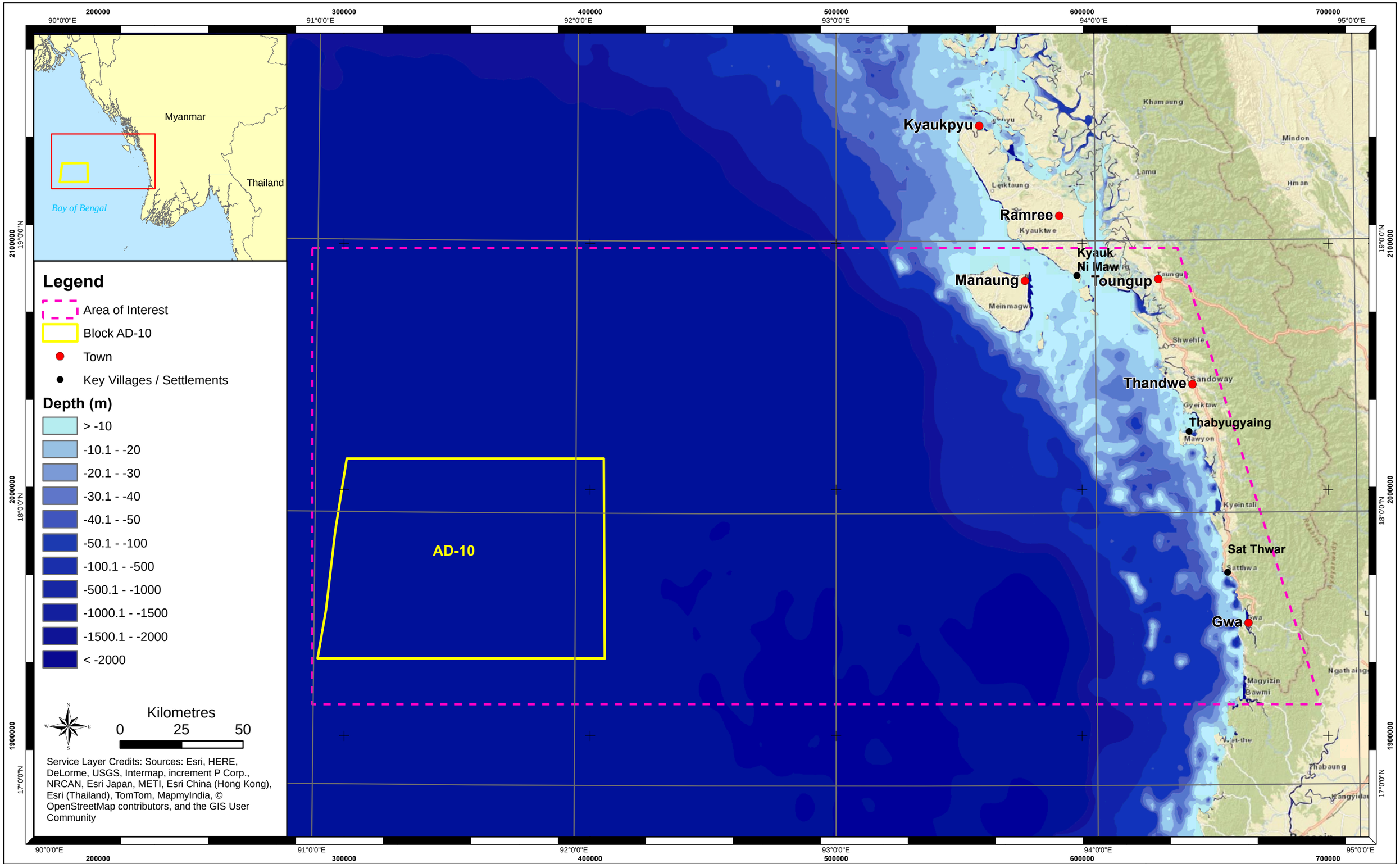

Figure 5.1

Block AD-10 and Area of Interest

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characterized by extensive cloud cover, light rain almost daily, interspersed with rain squalls or thunderstorms. The Northeast Monsoon (December to April), a period of winds from the continental interior to the north and east, brings less cloud, scant rainfall, mild temperatures and lower humidity.

The spring and autumn transition periods between the monsoons (April and May, October and November) are generally hot with very variable weather and heavy squalls. The transition periods are governed by the Inter-Tropical Convergence Zone (ITCZ) being overhead. This separates the main wind streams of the northern and southern hemispheres. The ITCZ moves seasonally over the area following the sun (northwards in spring and southwards in autumn).

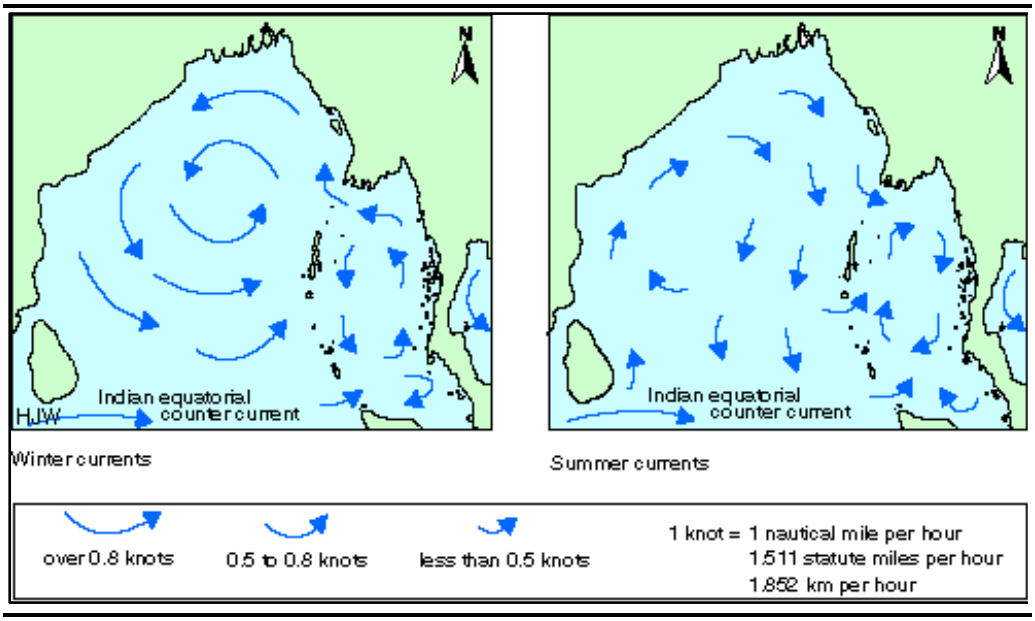
5.3.2 Storms and Cyclones

Gale force winds (17.2 ms^{-1} or over) are mainly associated with local rain squalls and with severe tropical storms or cyclones. The central region off the coast receives the worst buffeting during the summer monsoon. The threat of cyclones with winds above 32.7 m s^{-1} affects different areas at different times of the year, overall affecting all areas though the major tracks do not pass over the Andaman Sea. They are most frequent from mid-May to early December.

5.3.3 Currents and Tides

A generalised schematic of circulation pattern in the Bay of Bengal is shown in *Figure 5.2*. The surface circulation of the Bay of Bengal moves generally clockwise from January to July and counter-clockwise from August to December in accordance with the reversible monsoon wind systems. The flow is not constant and depends on the strength and duration of the winds. The effects of a strong wind blowing for a few consecutive days are reflected in the rate of flow. Currents to the northeast generally persist longer and flow at greater speed because of the stronger southwest monsoons. An important vertical circulation in the Bay of Bengal is a surge very similar to up-welling. In this process, sub-surface water is brought toward the surface.

Figure 5.2 Schematic of Seasonal Oceanic Currents in the Bay of Bengal



Tides in the Area of Interest are semi-diurnal with a tidal range of 4.2 m in the north of Ramree Island, 2.5 m at Manaung Island (the closest island to the Block) and 2.3 m at Andrew Bay at spring tides (on the mainland). At a local scale, there are strong tidal currents between the islands and islets of 0.5 to 1.0 knots. Where the tidal currents meet the more static bodies of oceanic water, or where the current runs against the prevailing winds, there are agitated areas of the sea known as overfalls. The tidal currents shape the bathymetry of shallow water areas and add energy to the sedimentary and biological environment in the near shore area in waters less than 25 m deep.

5.3.4 Seabed Topography

The seabed topography along the coast of Myanmar falls under two distinct types with the narrow continental shelf and deep water in the north, which is typical of the Bay of Bengal, and the wide continental shelf and shallow waters in the south, which is typical of the Andaman Sea and the Gulf of Martaban. Block AD-10 is in the abyssal plain with water depth in the block exceeding 2,000 m.

5.3.5 Seabed Composition

Seabed sediments are generally fine at offshore with sediments in deeper areas dominated by silts and muds.

5.4 BIOLOGICAL COMPONENTS

The secondary information on the marine environment in Rakhine waters is lacking in sufficient spatial and temporal data and very few studies have been conducted in this region. As such, the environmental baseline has been compiled based on this sparse information. An effort was made to validate the known information during the stakeholder consultations in 2015. In

many cases, this was useful in confirming information (e.g. turtle nesting times and species reported in secondary data were confirmed in the field by the local communities). The data gaps and assumptions associated with the environmental baseline in this report include:

- Limited spatial or temporal trends in the baseline are presented due to the lack of such data on most species and habitats;
- The description of the abyssal plain environment is based on sparse information and assumptions have been made on species composition;
- Very limited data are available on the distribution and abundance of birds, turtles, fish and marine mammals in Myanmar waters;
- Migration routes, breeding/spawning areas and species composition are not well understood; and
- As it is not known, it is assumed that fish, turtles and mammals pass through Block AD-10.

5.4.1 General

The Area of Interest, as defined in *Section 5.1*, encompasses both shallow and deep water habitats as well as coastal and nearshore habitats such as mangroves, coral habitat and seagrasses around Manaung Island and along the Rakhine mainland coastline. However, the focus of the baseline description is for the deep water habitats in which Block AD-10 lies (i.e., those exceeding 2,000 m).

Locations of coral habitats, mangroves and seagrass have been recorded based on compiled database records from numerous sources collected by and provided by consultation with various stakeholders, including the United Nations Environment Programme (UNEP), as well as in-house literature of Statoil, ERM and REM. These areas were ground-truthed where practicable during consultations with stakeholders in June 2015. For more information on the stakeholder consultations, refer to *Section 7*.

The Area of Interest is characterised by a narrow continental shelf extending from the mainland coast to the east of Manaung Island. The shelf break is located as close as approximately 10 km from the coast. Beyond the shelf break, the seabed steeply descends down the continental slope reaching a depth of 500 m within around a distance of approximately 10 km. Areas beyond the 200 m isobath constitute deep water habitat where deep-sea communities are likely to exclusively rely on settling organic detritus as a food source (1) . Despite the extensive area in which these deep water areas occur, little is known about the habitat and associated species composition.

(1) Gage JD and Tyler PK 1992. Deep sea biology: a natural history of organisms at the deep sea floor. Cambridge University Press, Cambridge UK, 504 pp.

5.4.2 *Coral Habitats*

In shallow waters, coral areas have been identified from secondary data sources. UNEP satellite analyses show coral habitats (usually fringing or patch reefs in Myanmar) occur along the coast of Rakhine State. Potential coral reef and coral habitat areas in the Area of Interest are shown in *Figure 5.3*.

Hard and soft corals are known to occur in nearshore waters in the Area of Interest and the prevalence of rocky substrate in shallow waters indicates favourable conditions for the growth of coral communities (1). Over 25 confirmed hard coral species (likely reflecting the most common species) are reported along the northeast coast of Myanmar though this is very likely an underestimate of diversity with more than 200 species recorded from Myanmar overall.

Coral habitat around Manaung is estimated to be up to water depths of around 20 m based on both local information collected during the stakeholder consultations in 2015 and existing secondary data. This is the closest potential coral habitat to Block AD-10, however; this is located over 150 km away. Given the distance between coral habitats and the Block, coral is unlikely to be sensitive to the proposed Project activities.

5.4.3 *Mangroves*

There are well developed mangrove areas within the Area of Interest with extensive mangrove areas occurring along the shores surrounding the sheltered lee side of Ramree Island and river mouths and inland areas fringing the tidal creeks of rivers. Sheltered areas along the coast also support stands of mangrove (2). The distribution of mangrove areas within the Area of Interest based on literature reviews and primary observations in the field is illustrated in *Figure 5.3*. Mangroves are important areas for fish, including coral reef species which use the mangroves as nursery grounds (3) (4). They are also important to help prevent coastal erosion and provide natural protection against extreme events such as tsunamis and cyclones (5).

Representative photographs of mangrove habitats recorded during stakeholder consultations in Rakhine State are shown in *Figure 5.4.*

5.4.4 *Seagrass*

Seagrass beds typically occur in shallow (usually < 20 m (65 feet) of water depth), sheltered intertidal or sub-tidal areas and are recognised as areas of

(1) Spalding MD, Ravilious C and Green EP 2001. World Atlas of Coral Reefs. UNEP-WCMC. pp436.

(2) UNEP-WCMC 2011. Global Distribution of Mangroves USGS (2011). Viewed at: http://marine-portal.unepwcmc-001.vm.brightbox.net/datasets/21

(3) Instituto Oikos and BANC. 2011. Myanmar Protected Areas: Context, Current Status and Challenges.

(4) Honda K, Nakamura Y, Nakaoka M, Uy WH, Fortes MD (2013) Habitat Use by Fishes in Coral Reefs, Seagrass Beds and Mangrove Habitats in the Philippines. PLoS ONE 8(8): e65735. doi:10.1371/journal.pone.0065735

(5) Holmes, K.E.,Tint Tun and Kyaw Thinn Latt 2013. Marine Conservation in Myanmar --- The current knowledge of Marine systems and recommendations for research and conservation. Yangon WCS and MSAM. 204 pp.

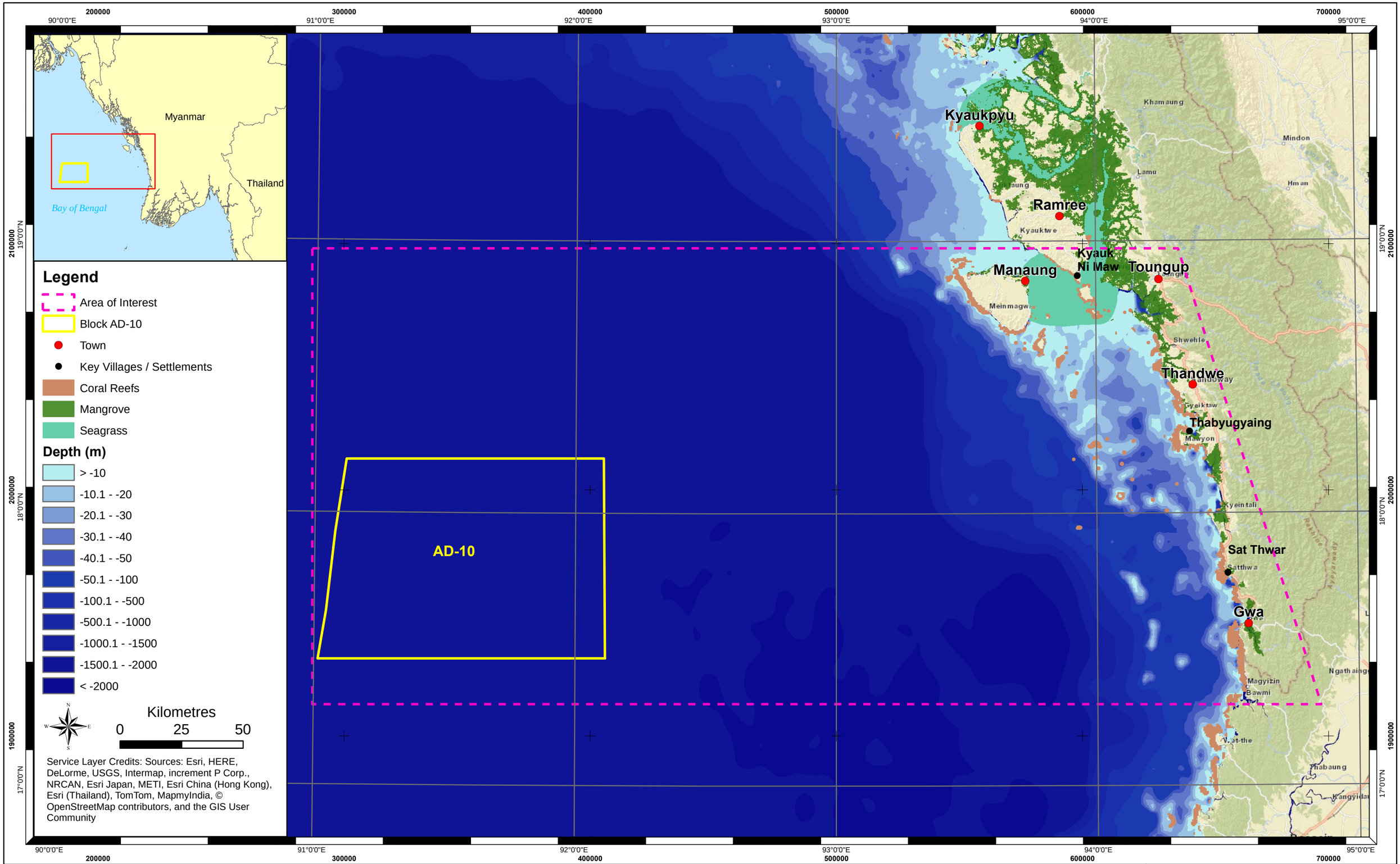


Figure 5.3

Locations of Coral, Seagrass and Mangroves

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Figure 5.4

Photos of Mangroves Recorded in Rakhine State

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high biological productivity and support more diverse invertebrate communities [1]. Sheltered nearshore waters surrounding the southern part of Ramree Island extending as far as Manaung Island within the Area of Interest provide suitable conditions and are expected locations for seagrass habitat and growth[2]. The potential seagrass habitats in the Area of Interest are shown on *Figure 5.3*.

In waters around the Rakhine State, seagrass beds are expected to serve as nurseries and habitats for fish and invertebrates, and may also provide a food source for grazing animals including green turtles (*Chelonia mydas*), hawksbill turtles (*Eretmochelys imbricata*) and dugongs (*Dugong dugon*), which are species of international conservation interest (refer to the Marine Turtles; *Section 5.4.9* for further information on these fauna).

Around Ngapali on the mainland coast in Thandwe (*Figure 4.3*), seagrass species *Halophila decipiens*, *Halodule pinifolia*, *Cymododocea serrulata* and *Syringodium isoetifolium* have been observed [3]. All four of these species are classified as Least Concern on the International Union for the Conservation of Nature (IUCN) 2015 Red List of Threatened Species which means in terms of survival of individual seagrass species, they are not recognized as a species of conservation concern. Secondary data has seagrass beds within the 20 m (65 feet) water depth contour. However, Block AD-10 is located over 150 km from the Manaung coastline.

5.4.5 Plankton

Block AD-10 spans deep open ocean waters. Moderate Resolution Imaging Spectrometer (MODIS) Aqua satellite datasets[4] from the area within and surrounding Block AD-10 show that chlorophyll *a* concentrations and inferred phytoplankton standing crop levels in the surface layer are higher in the Northeast Monsoon (November to March) than in Southwest Monsoon season (June to September). Highest chlorophyll levels ranging up to 10 mg/m^3 occur closest to the coast which is likely due to nutrient inputs from the land such as from rivers.

There are limited data on the species composition, abundance and distribution of plankton within the Area of Interest. Some studies have been undertaken in the wider Bay of Bengal which showed that phytoplankton communities were dominated by diatoms (Bacillariophyceae) followed by dinoflagellates (Dinoflagellata) in terms of abundance in different survey areas (north, west and east). The composition, abundance and distribution of phytoplankton

(1) Short FT, Coles RG and Pergent-Martini C 2001. Global Seagrass Distribution in Short, FT, Coles RG and Elsevier Science BV (eds) Global Seagrass Research Methods. pp 5-30.

(2) U. Soe-Htun, U San-Tha-Htun, Daw Mu-Mu-Ayel, Daw Ni-Ni-Win, Daw ei-Lei-Wln And Masao Ohno 2001. Notes on Seagrasses along Myanmar Coastal Regions. Bull. Mar. Sci. Fish., Kochi Univ. No. 21, pp. 13-22,

(3) U. Soe-Htun, U San-Tha-Htun, Daw Mu-Mu-Ayel, Daw Ni-Ni-Win, Daw ei-Lei-Wln And Masao Ohno 2001. *Op. cit.*

(4) NOAA 2015. Giovanni Ocean Color Radiometry - Water Quality Portal. Viewed at: http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=WaterQuality

species was recorded in November 2007 (1) during the Northeast Monsoon period (the period in which the proposed seismic survey will be undertaken). During this survey, the northern part of the Bay of Bengal (located offshore of the waters of Myanmar between Myanmar and India) was found to be the most productive area with high phytoplankton densities recorded, likely associated with nutrient-rich discharges from large rivers on the north coast. Phytoplankton in this northern area were found to dominated by the diatoms *Pseudonitzschia pseudodelicatissima* (2) and *Chaetoceros messanensis* which were the main contributors to 'massive' phytoplankton blooms of this area at the time of sampling.

Given the limited scope to impact plankton concentrations or abundance, plankton is not considered to be particularly sensitive to the proposed Project activities.

5.4.6 Benthic Invertebrates

Given the lack of data on the deep water habitats (e.g. continental slope and abyssal plain) within the Area of Interest and the wider Bay and Bengal, the composition of benthic invertebrates is not known. However, common deep water species such as polychaetes, sponges, molluscs and echinoderms are expected to inhabit the soft bottom habitat within the block. As the water depth of the proposed survey area is exceeding 2,000 m and the seismic survey equipment will likely be deployed at a depth of not more than 30 m from the surface, the deep sea benthos is unlikely to be sensitive to the Project activities.

5.4.7 Fishes

Fish communities in the Area of Interest occupy a range of habitats from coral, rocky and seagrass habitats in shallow waters to deep-water habitats below the sun-lit euphotic zone (>200 m or 650 feet) in open ocean as well as the open water pelagic zone. Recent trawl surveys to look at fisheries composition were conducted by the R.V. Dr. Fridtjof Nansen in 2013 which covered 41 fishing stations in Rakhine State and west coast of the Ayeyarwaddy Division as well as other parts of Myanmar waters. The 2013 surveys were conducted using trawls to depths of up to 200 m (650 feet) or 1000 m (3,280 feet) with the results showing a total of 235 fish taxa collected in the area, and a total catch of 4,172 kg for the up to 200 m trawls and 4,130 kg for the 1,000 m trawls (3). However, the Catch Per Unit Effort (CPUE) data indicated that the deeper waters were more productive with a CPUE of 225 kg/hr for the 1,000 m trawls versus 60 kg/hr for the up to 200 m trawls. These catches were compared with similar trawls conducted in 1979-1980 which showed a CPUE of 609 kg/hr for up to 200 m trawls. The findings

(1) Booonyapiwat, S., Nasiruddin Sada, Md, Mandal, J.M., and Sinha, M.K. Species Composition, Abundance and Distribution of Phytoplankton in the Bay of Bengal. The Ecosystem-Based Fishery Management in the Bay of Bengal.

(2) This diatom species is a potentially harmful species that can produce a neurotoxin (domoic acid) linked to amnesic shellfish poisoning.

(3) Results have been extracted from a Poster prepared by Yin Yin Moe, Deputy Director, Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development.

were summarised as showing that pelagic marine fishery resources have significantly decreased, tenfold for this sample example, in Rakhine between 1980 and 2013, which was attributed to exploitation by fisheries.

Consultations were undertaken in June 2015 along fishing villages in the Rakhine State in order to gather information from local fishermen on the type of species caught within Rakhine Waters. Local markets had a variety of fish species including scad, catfish, sardines, eel, groupers, mackerel and mullet. During consultation, it was also noted that June to August (the rainy season) is considered to be the fish spawning season. It is not known when or where the majority of fish in Rakhine waters spawn as no data are available and fishermen do not seem to target any spawning aggregations.

The fish species in Rakhine waters can be categorised into three types (*Figure 5.5*):

- Pelagic – species which inhabit the open ocean, neither near the seabed nor the coast;
- Demersal – species which live on or near the seabed; and
- Reef associated / coastal– species which live in coral reefs or coastal areas.

Pelagic species inhabit open water areas and generally undertake large migrations between feeding grounds and spawning areas throughout the year. The family Clupeidae (herring, anchovy, and shad) are pelagic species and as such could potentially be present in Block AD-10. This family is known to be sensitive to underwater sound generation as they are classified as "hearing specialists". This means that they have the ability to hear underwater sound as they have a connection between their swim bladder and their hearing apparatus and they can thus be sensitive to pressure changes (i.e. underwater sounds). Also, the family Scombridae (mackerel) is pelagic and has one species which is considered of potential international conservation concern (*Table 5.1*). The assessment of Project activities with regards to impacts on fish species will focus on these hearing specialists and identified species of conservation concern. More information on fish sensitivity and the assessment of potential impacts is presented in *Section 6*.

Demersal species are associated with the seabed. They generally feed on the invertebrates and other organisms living with the seabed. Demersal species may be present in Block AD-10, however, on the abyssal plain (>2,000 m water depth) where information on species composition is not well known. It can be assumed that common deep water fish species such as grenadiers (rat tails) are likely to be present.

Coastal or reef species are range restricted species and generally inhabit rocky, coral or coastal areas for the majority of their life cycles, using these areas as both feeding and spawning grounds. During consultations in June 2015, it was noted that coastal / reef species such as grouper and snapper were regularly caught in shallow waters. However, coastal / reef associated species are located at least 150 km from Block AD-10.

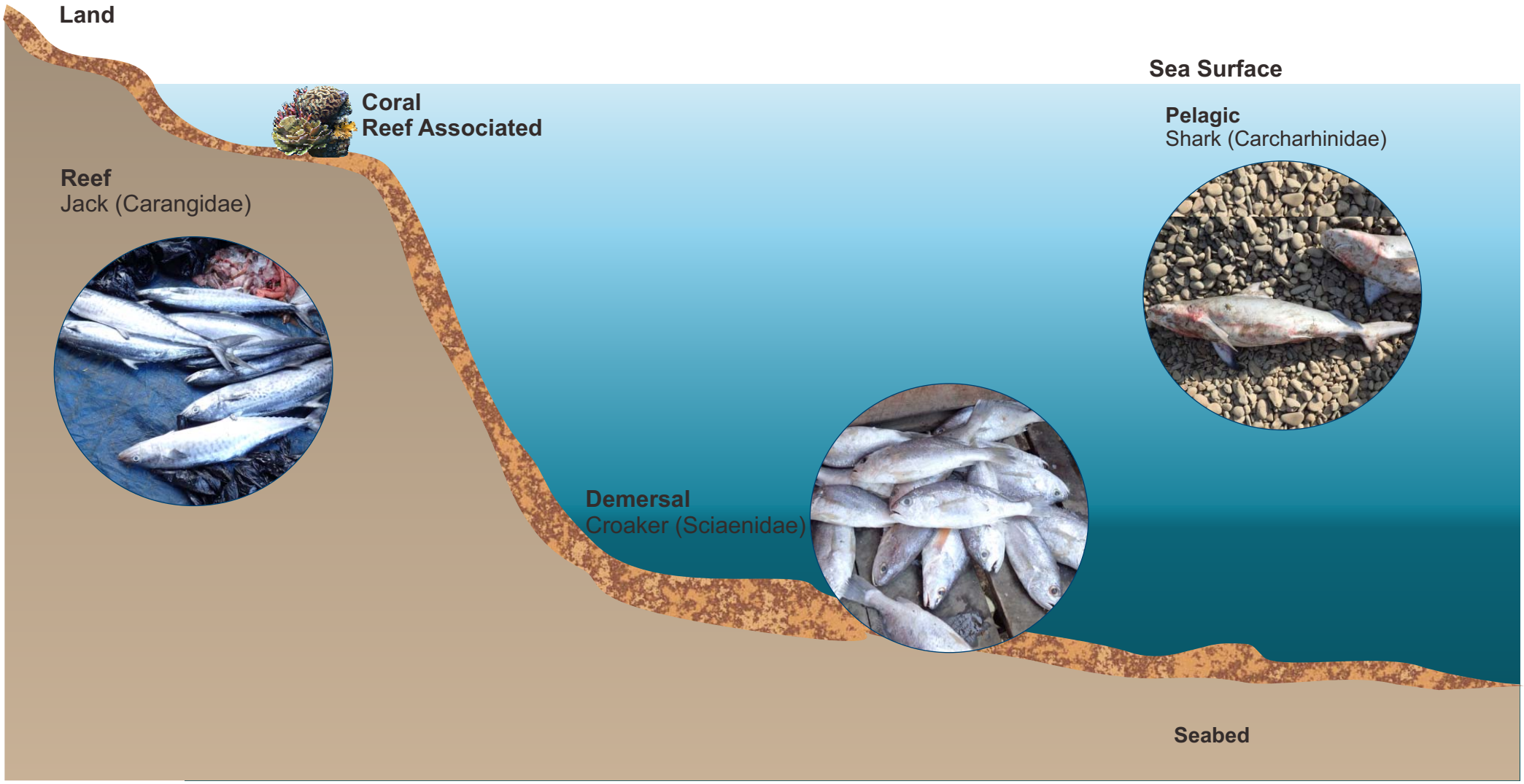

Figure 5.5

Fish Types in Rakhine Waters

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The main pelagic commercial fish species in Rakhine waters are shown in *Table 5.1*. The coastal / reef associated and demersal fish species caught have not been included as these are caught in much shallower depths (up to 200 m water depth maximum). This list was compiled from information from the Myanmar National Report (1) and a handout provided by the Kyaukphyu Department of Fisheries.

Table 5.1 Main Pelagic Commercially Important Fish Species Reported to occur in Rakhine Waters

Latin name	Common Name	IUCN Status
CLUPEIDAE	**Herring/Shad/Sardine**	
Anodontostoma chacunda	Chacunda gizzard shad	Not yet assessed
Dussmieria acuta	Rainbow sardine	Not yet assessed
Encrasicholina heteroloba	Shorthead anchovy	Not yet assessed
Hilsa ilisha	Elongate ilisha	Not yet assessed
Opisthopterus tardoore	Tardoore	Not yet assessed
Sardinella gibbosa	Gold stripe sardinella	Not yet assessed
Tenualosa ilisha	Hilsa shad	Least Concern
EXOCOETIDAE	**Flying Fish**	
Exocoetidae sp.	Flying fish	-
LATIDAE	**Perch**	
Lates calcarifer	Barramundi	Not yet assessed
SCOMBRIDAE	**Mackerels**	
Katsuwonus pelamis	Striped tuna (skipjack)	Least Concern
Rastrelliger brachysoma	short bodied mackerel	Data Deficient
Rastrelliger kanagurta	Indian mackerel	Data Deficient
Scomberomorus guttatus	Indo-pacific Spanish mackerel	Data Deficient
Scomberomorus lineolatus	Streaked Spanish mackerel	Least Concern
Scomberomorus commerson	Narrow barred Spanish mackerel	Near Threatened
Scomberomorus maculatus	Spanish mackerel	Least Concern
TRICHIURIDAE	**Hair tail / Ribbon fish**	
Trichiurus lepturus	Largehead hairtial	Not yet assessed

Of the species most commonly caught in Myanmar waters, one is considered as species of conservation concern on the IUCN 2015 Red List (narrow barred Spanish mackerel (*Scomberomorus commerson*)). Mackerel are caught in open water areas and could potentially be found within Block AD-10. However, this species were caught in shallower water depths (up to 200 m). Accurate data on the species composition are not available from the Area of Interest.

Whale sharks (*Rhincodon typus*) are listed as vulnerable on the IUCN 2015 Red List. This cosmopolitan species is highly migratory occurring in both tropical and temperate waters, though there is a general lack of knowledge on many aspects of whale shark biology, including definitive migration patterns (2). The species normally has an oceanic distribution but can occur in coastal

(1) Myint Pe undated. National Report of Myanmar on the Sustainable Management of the Bay of Bengal Large Marine Ecosystem (BOBLME) GCP/RAS/179/WBG.

(2) Colman JG 1997. A review of the biology and ecology of the Whale Shark. Journal of Fish Biology 51: 1219-1234.

waters. In the Bay of Bengal, whale sharks have been recorded in the northern area of Bengal (off the Bangladesh coast) from December to March (1).

Photos of commonly commercial pelagic fish species recorded during stakeholder engagement in Rakhine are provided in *Figure 5.6*.

5.4.8 Marine Mammals

A total of 21 cetaceans (whale and dolphin) and one (1) sirenian species have been reported from Myanmar waters. Two marine mammals, the Irrawaddy dolphin (*Orcaella brevirostris*) and dugong (*Dugong dugon*), have been protected under the Myanmar Protection of Wildlife and Conservation of Natural Areas Law since 1994 under the category "completely protected". These marine mammal species are shown in *Figure 5.7*.

Cetaceans (Whales and Dolphins)

Of these, most are far-ranging migratory oceanic species while several others are coastal species with closer affinities to shallow water habitat areas and estuarine areas. IUCN-listed threatened cetacean species in Myanmar waters are oceanic species that typically inhabit deep offshore open waters, namely the blue whale (*Balaenoptera musculus*) (Endangered), fin whale (*Balaenoptera physalus*) (Endangered) and sperm whale (*Physeter macrocephalus*) (Vulnerable). The blue whale and the fin whale are also listed as endangered species recognized as of prime importance to the region and deserving special attention under the ASEAN Agreement on the Conservation of Nature and Natural Resources (2). Other common deeper water species such as humpback whale (*Megaptera novaeangliae*) and bryde's whale (*Balaenoptera edeni*) are known to occur in offshore waters in Myanmar, however, these are listed as Least Concern and Data Deficient on IUCN Red List, respectively.

There are limited data on distribution, abundance, habitat utilization and seasonality of marine mammals in Myanmar due to only a handful of scientific surveys conducted and stranding information. Recently collected data (2015) on species observed to be in offshore Rakhine waters are presented in *Table 5.2* (3). Bryde's whales were found to be the most commonly sighted cetacean. Some of species of marine mammal could not be identified. Of the species recorded, none are listed as species of conservational concern by the IUCN Red List (refer to *Figure 5.7*).

(1) Rowat, D., (2007). Occurrence of whale shark (Rhincodon typus) in the Indian Ocean: A case for regional conservation. Fisheries Research 84 (2007) 96–101.

(2) ASEAN Agreement on the Conservation of Nature and Natural Resources. Kuala Lumpur, 9 July 1985

(3) Data provided by Ophir Energy Plc for the purpose of this IEE. Sighting information was collected in March to June 2015 from Block AD-03 located in shallower waters to the east of Block AD-10.

Squid (cephalopod)

Prawn (Penaeus)

Catfish (Ariidae)

Tuna (Scombridae)

Figure 5.6

Commonly Caught Commercial Fish Species in Rakhine State

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Common Name	Latin Name	IUCN Red List
Baleen Whales		
Bryde's whale	*Balaenoptera edeni*	Data Deficient
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Least Concern
Toothed Whales		
Blainville's beaked whale	*Mesoplodon densirostris*	Data Deficient
Dwarf sperm whale	*Kogia sima*	Data Deficient
False killer whale	*Pseudorca crassidens*	Data Deficient
Killer whale	*Orcinus orca*	Data Deficient
Melon-headed Whale	*Peponocephala electra*	Least Concern
Pygmy killer whale	*Feresa attenuata*	Data Deficient
Pygmy sperm whale	*Kogia breviceps*	Data Deficient
Short-finned pilot whale	*Globicephala macrorhynchus*	Data Deficient
Sperm Whale	*Physeter macrocephalus*	Vulnerable
Porpoise and Dolphins		
Dwarf Spinner Dolphin	*Stenella longirostris roseiventris*	Data Deficient
Indo-pacific bottlenose dolphin	*Tursiops aduncus*	Data Deficient
Indo-pacific finless porpoise	*Neophocaena phocaenoides*	Vulnerable
Indo-pacific humpbacked dolphin	*Sousa chinensis*	Near Threatened
Irrawaddy dolphin	*Orcaella brevirostris*	Vulnerable
Pantropical spotted dolphin	*Stenella attenuata*	Least Concern
Rissos dolphin	*Grampus griseus*	Least Concern
Spinner dolphin	*Stenella longirostris*	Data Deficient
Striped dolphin	*Stenella coeruleoalba*	Least Concern
Sirenian		
Dugong	*Dugong dugon*	Vulnerable

(Source: www.animal-kid.com)

(Source: www.tonywublog.com)

(Source: www.whale-watching.co.za)

(Source: www.whalesanddolphinsoftenerife.org)

(Source: www.arkive.org)

(Source: www.itsnature.org)

(Source: www.greatocean.com.au/)

(Source: uk.whales.org)

(Source: www.eoearth.org)

Figure 5.7

Marine Mammal Species Recorded in Myanmar Waters (1)

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Table 5.2 ***List of Marine Mammals Species Observed in Offshore Rakhine Waters (2015)***
(Source: Ophir Energy Plc, unpublished data provided to Statoil for the purposes of this IEE)

Common Name	Scientific Name	Count
Baleen Whales		
Bryde's Whale	*Balaenoptera edeni*	53
Humpback Whale	*Megaptera novaeangliae*	2
Unknown Baleen Whale	-	7
Toothed Whales and Dolphins		
Rissos Dolphin	*Grampus griseus*	4
Spinner Dolphin	*Stenella longirostris*	10
Indo-Pacific Bottlenose Dolphin	*Tursiops aduncus*	1
Common Bottlenose Dolphin	*Tursiops Truncatus*	1
Pantropical Spotted Dolphin	*Stenella attenuata*	1
Dwarf Spinner Dolphin	*Stenella longirostris roseiventris*	31
Unknown Dolphin	-	30
Sperm whale	*Physeter microcephalus*	3
Short-finned Pilot Whale	*Globicephala macrorhynchus*	1
False Killer Whale	*Pseudorca crassidens*	2
Unknown Beaked Whale	-	3
Unknown toothed whale	-	2
Unknown Dolphin	-	49
Unknown		
Unknown Large Whale	-	4
Unknown Small Whale	-	1
Unknown Cetacean	-	1
TOTAL	-	**206**

Larger species have been recorded in offshore deeper waters which would be in line with their typical life histories. Limited information on sightings of marine mammal species is presented in *Figure 5.8* (1).

Dugongs

Dugongs (*Dugong dugon*) are migratory species with factors governing movements including food availability. Dugongs rely on seagrass for nutrition and therefore typically inhabit shallow and sheltered coastal waters, though individuals occasionally may occur many kilometres from the coast. In Myanmar, these herbivorous mammals are rare and their distribution mainly extends in areas to the west of the Ayeyarwaddy Delta and northwards along the Rakhine State coast with records from Manaung Island appearing to be the most northerly extent of recorded individuals along the coast (2).

Dugongs have been reported to occur in Rakhine waters (3). As previously discussed (refer to seagrass habitats section; *Section 5.4.4*), seagrass meadows are not likely to be present on the coasts of Manaung Island nearest to Block AD-10 (western coasts). From stakeholder consultations undertaken in

(1) Data collected from 1. Tun T, Langakoon AD, PE MT (2010) Dugong in Man Aung Water, Myanmar. Preceedings of the 5th International Symposium on SEASTAR 2000 and Asian Bio*logging Science (The 9th SEASTAR2000 workshop): 63 * 66 and Smith BD, Thant UH, Lwin JM and Shaw CD (1997) Investigation of cetaceans in the Ayeyarwady River and northern coastal waters of Myanmar. Asian Marine Biology (14): 173 * 194

(2) Tint Tun and Anouk D. Ilangakoon (2007) Assessment of Dugong (Dugong dugon) Occurrence and Distribution in an extended area off the Rakhine Coast of Western Myanamar. Report to the Society for Marine Mammalogy.

(3) Tint Tun and Anouk D. Ilangakoon (2007) *Op. cit.*.

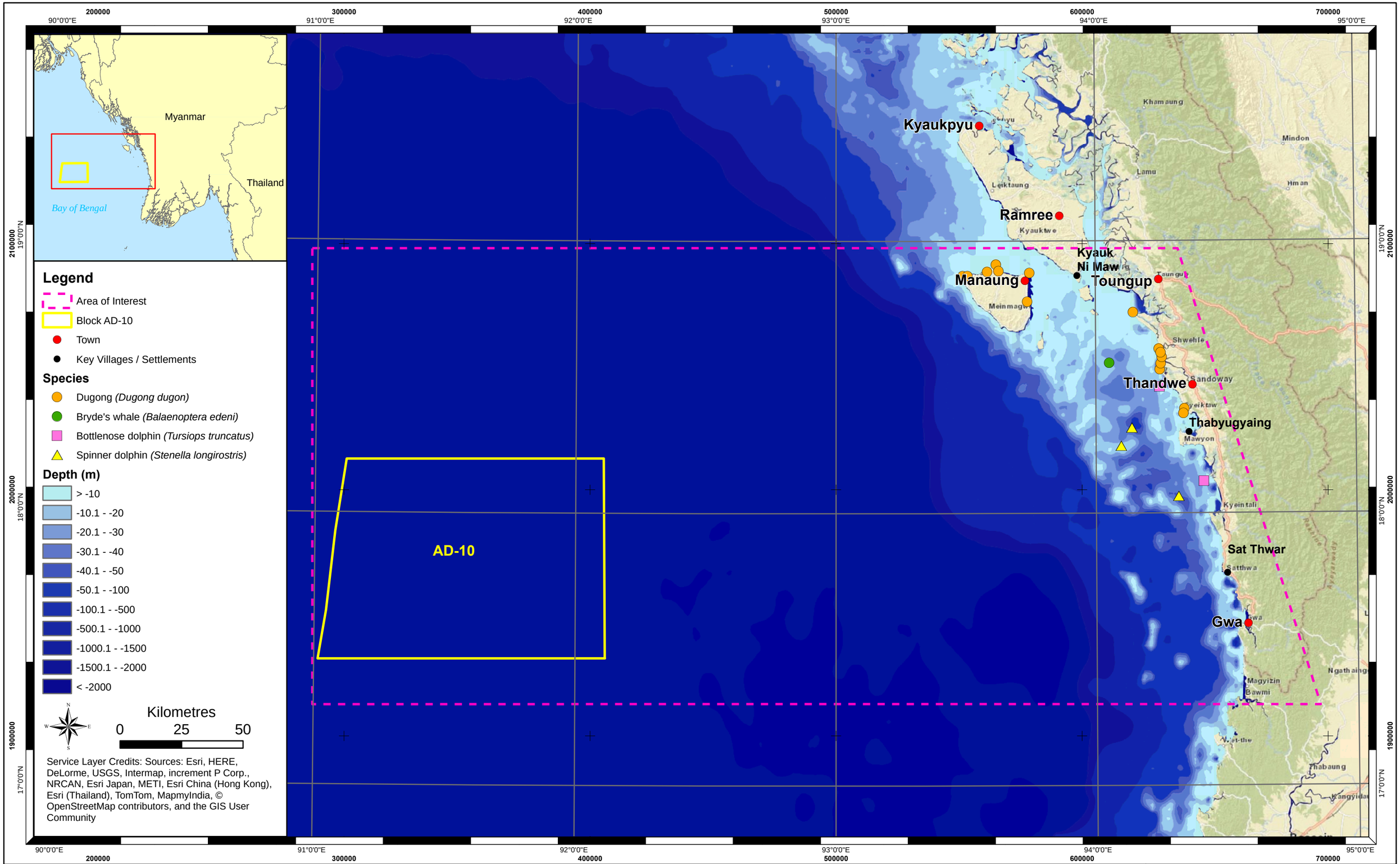

Figure 5.8

Marine Mammal Sightings / Recordings in the vicinity of Block AD-10

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Rakhine in June 2015, it was noted that dugongs have rarely been seen in the waters of Rakhine in recent years and in some cases (i.e., reported by fishermen in Thabyugyaing) they have not been seen in the region in decades. Historically dugongs have been incidentally caught in fishing nets and are also sensitive to coastal development or coastal anthropogenic activity causing habitat depletion. Although dugong are a nationally protected species, given the distance of suitable dugong habitat from Block AD-10 (>150km), dugong are unlikely to be sensitive to the proposed Project activities. Historic locations of dugong sightings are provided in *Figure 5.8*.

5.4.9 Marine Turtles

The waters adjacent to Rakhine State host five (5) species of marine turtles, all of which are IUCN-listed threatened species. These turtles are shown in *Figure 5.9*.

All five species share similar life cycle characteristics, which include migration from foraging areas to mating (inter-nesting) and nesting areas(1). In general, mature adult turtles (approximately 30 to 50 years old) undertake the migration from their coastal shallow benthic foraging areas to shallow water inter-nesting areas waters near nesting beaches every two to eight years. On arrival, turtles mate and females may nest multiple times at about two week intervals before returning to foraging areas. Eggs hatch after 8 to 10 weeks of incubation with hatchings dispersing into the open ocean surface waters where they forage for the next 5 to 20 years. The hawksbill turtle and leatherback turtle have been occasionally reported by fishermen from some parts of Rakhine coastal area and Green Turtle have been sighted by some fishermen in offshore waters. UNEP data suggest sandy shore habitat along Ramree Island, Manaung Island and adjacent small coastal islands are nesting sites for green, olive ridley and hawksbill turtles.

Data on marine turtle's sightings in Rakhine waters has been recently collected (2015) and are presented in *Table 5.3* (2). Twenty-five (25) sea turtles were observed from March to June 2015, of these most were not identified to species level.

Table 5.3 List of Sea Turtle Species Observed in Offshore Rakhine Waters (2015) (Source: Ophir Energy Plc, unpublished data provided to Statoil for the purposes of this IEE)

Common Name	Scientific Name	Count
Loggerhead Turtle	*Caretta caretta*	2
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	2
Green Sea Turtle	*Chelonia mydas*	1
Unknown Sea Turtle	-	20
TOTAL	-	**25**

(1) Miller JD 1997. Reproduction in sea turtles, In: Lutz, P, and Musick, JA (eds), The Biology of Sea Turtles, pp. 51-82, Boca Raton, CRC Press Inc

(2) Data provided by Ophir Energy Plc for the purpose of this IEE. Sighting information was collected in March to June 2015 from Block AD-03 located in shallow waters to the east of Block AD-10.

Latin Name	Common Name	Myanmar Name	IUCN Status	Potential Presence in Block AD-10
Lepoidochely olivacea	Olive ridley turtle	*Leik Lyaung*	Endangered	Reported to occur in Rakhine and have been observed by local fishermen. Known to be nesting in Rakhine State and likely to be present in Block AD-10.
Caretta caretta	Loggerhead turtle	*Leik Khway*	Endangered	Reported to occur in Rakhine and have been observed by local fishermen. Not known to nest on the Rakhine Coast.
Chelonia mydas	Green turtle	*Pyin Tha Leik*	Vulnerable	Reported to be nesting in Rakhine State and likely to be present in Block AD-10.
Eretmochelys imbricata	Hawksbill turtle	*Leik Kyet Tu Yway*	Critically Endangered	Reported to occur in Rakhine and have been observed by local fishermen. Known to be nesting in Rakhine State and likely to be present in Block AD-10.
Dermochelys coriacea	Leatherback turtle	*Leik Zaung Lyar*	Endangered	Have historically been recorded in Rakhine waters but are now considered rare.

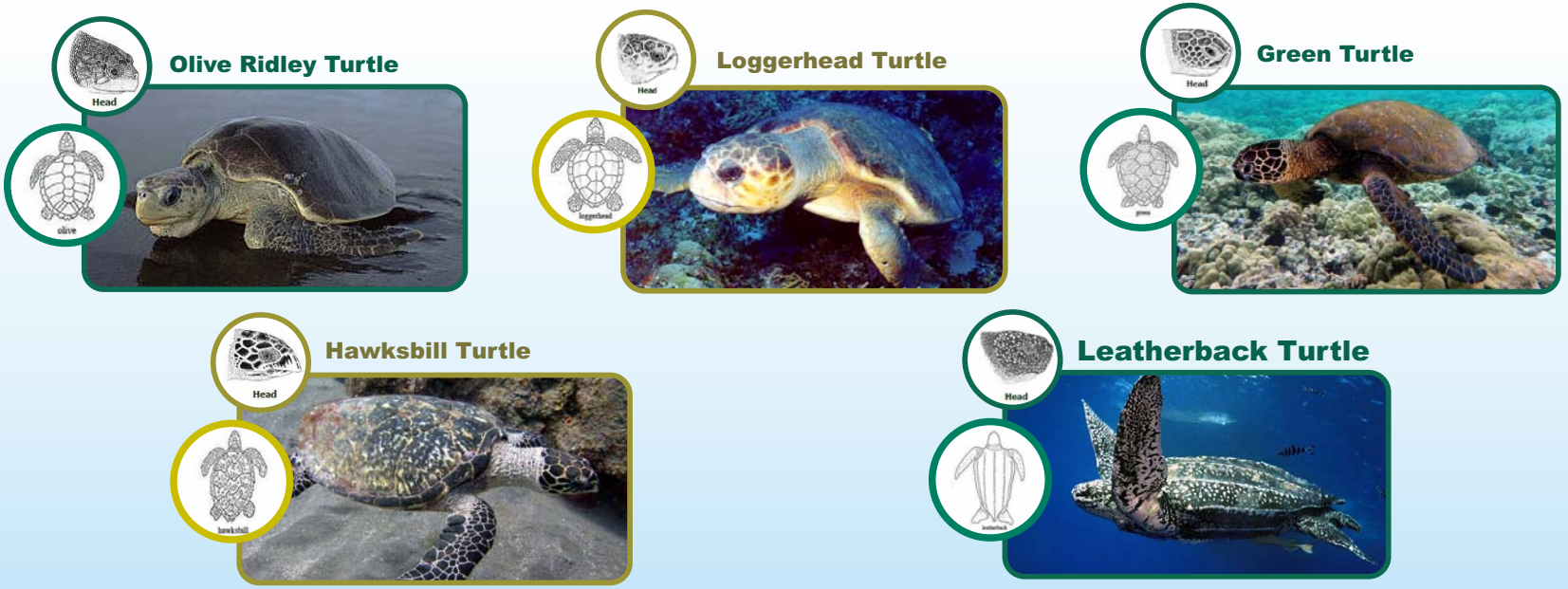

Figure 5.9

Marine Turtles in Rakhine waters

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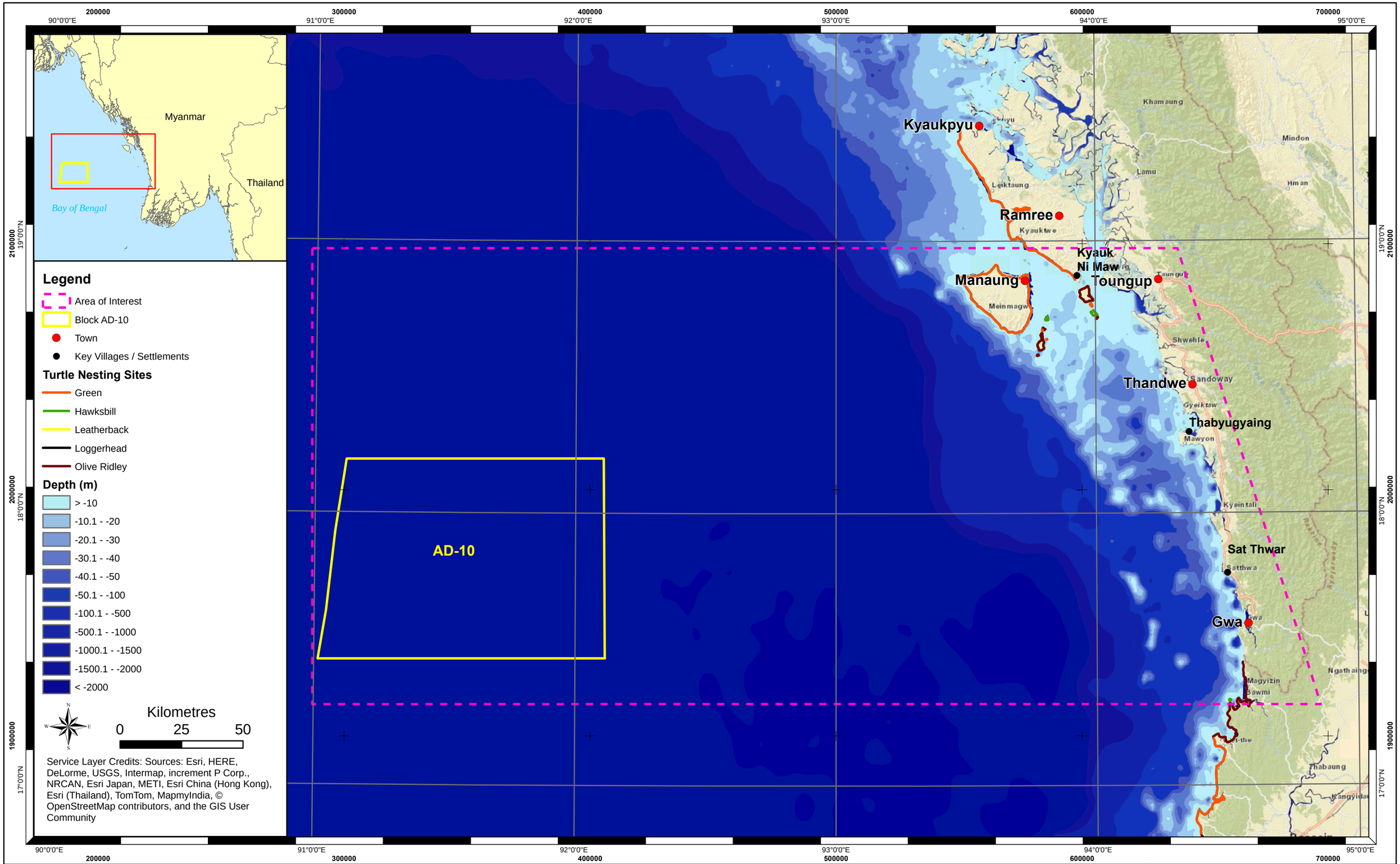

Figure 5.10

Locations of Turtle Nesting Sites in Rakhine Waters

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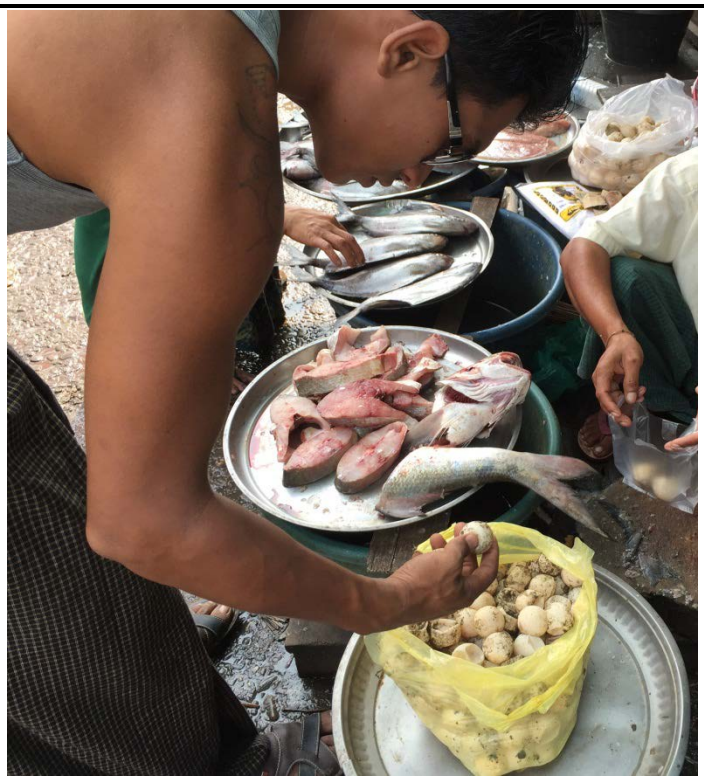
Annual turtle nesting activity in Rakhine waters is reported to occur between September and March with the peak period of activity occurring from December to January. During stakeholder consultations, local fishermen confirm that turtles nest on beaches near to Thabyugyaing and also near Manaung Island between October and January. Reported turtle nesting locations are shown in *Figure 5.10*.

No information is available on the numbers of turtles nesting annually but anecdotal information from fishermen suggests that low numbers of nests (<10) are encountered at certain beaches annually. Like other countries, Myanmar has a long tradition of turtle egg collection for human consumption, which is one of the main threats to turtle populations in the region (1) (2). During visits for stakeholder consultations, evidence of this continued practice was observed in food markets (*Figure 5.11*).

Given the location of Block AD-10 in relation to know nesting beaches, the presence of marine turtles within the Block cannot be ruled out. As nesting occurs from September to March, turtles are likely to be mating in offshore waters from August to March prior to nesting on the coasts. Turtles will nest one or more times during their nesting period and therefore are likely to be present in the area during the proposed seismic activity. However, the importance of these areas to turtle populations is unknown.

Figure 5.11 Marine Turtle Eggs for Human Consumption on Display for Sale



(1) Thorbjarnarson JB, Platt SG and Saw Tun Khaing 2000. Sea turtles in Myanmar: Past and Present. Marine Turtle Newsletter 88:10-11. Available at: http://www.seaturtle.org/mtn/archives/mtn88/mtn88p10.shtml

(2) Shanker K and Pilcher NJ 2003. Marine turtle conservation in south and southeast Asia: Hopeless cause or cause for hope? Marine Turtle Newsletter 100:43-51. Available at :http://www.seaturtle.org/mtn/archives/mtn100/

5.4.10 Seabirds

The most abundant group of seabirds in offshore Myanmar are the terns, of which 13 species regularly occur. Other seabirds which may use these waters include gulls, storm petrels, Jaegers (also known as Skuas), tropic birds, boobies, noddies and frigatebirds. Seabird species tend to be highly migratory, far ranging and widely distributed away from breeding areas. Offshore Myanmar waters are used by seabirds for foraging and loafing (resting). Islands and islets can also be used for roosting, resting and moulting.

Only two species, the little tern (*Sterna albifrons*) and the brown booby (*Sula leucogaster*), are reported to have breeding colonies in Myanmar. Isolated islets in the Area of Interest, such as those in waters depths of less than 50 m to the south of Manaung Island, are expected to be potential suitable nesting sites for individuals of these species though this is not confirmed by observation. However, no Important Bird and Biodiversity Areas (1) are reported from the Area of Interest. Although not within the Area of Interest there is an Important Bird Area in shallower waters to the south of the Block known as Nantha Island. This area is designated due to the presence of wintering grounds of the spoon billed sandpiper, *Calidris pygmaea*, a critically endangered species on the IUCN Red List. This species migrates from breeding grounds in arctic Russia to wintering around the coasts of South-East Asia, including Nantha Island. In 2013, 35 individuals were observed to be wintering in this area (2).

The distribution range of one IUCN-listed threatened seabird species, the Christmas Island Frigatebird (*Fregata andrewsi*) (Critically Endangered) extends as far as Myanmar waters. However, Myanmar waters are at the outer limit of its range. Given this and its rarity, the potential for the occurrence of this seabird in the block is considered low.

Of the seabird species that occur in the Area of Interest, only species of seabird that spend large quantities of time underwater while foraging for food, either underwater swimmers or aerial divers, are considered potentially vulnerable to underwater sound impacts. Feeding by seabirds involves snatching prey items from or below the water surface (terns, noddies, tropic birds, frigate birds, gulls), by paddling (petrels) and mainly kleptoparasitism (i.e. taking from others) (jaeger). Of the species potentially present, only boobies feed by aerial diving.

Although detailed data on distribution, abundance, habitat utilisation and seasonality of seabirds specific to the Area of Interest are limited at present, noting the above it can be conservatively assumed that seabirds may be expected to occasionally pass within or close by Block AD-10.

(1) An Important Bird and Biodiversity Area (IBA) is an area recognized by Birdlife International as being globally important habitat for the conservation of birds populations.

(2) Birdlife international, Sites - Important Bird and Biodiversity Areas (IBAs). Nantha Island. Available from http://www.birdlife.org/datazone/sitefactsheet.php?id=31569

5.4.11 Protected and Environmentally Sensitive Areas

Information from the Istituto Oikos and BANCA (2011) reported a total of 43 designated or proposed protected areas with IUCN categories existing in Myanmar. It should be noted that some of the locations are proposed as protected area without authorized designation (i.e. "soft" designation). It is important to note that none of these protected or environmentally sensitive areas lie within Block AD-10.

There are two restricted fishing areas within the Area of Interest which are based on the Department of Fisheries Fishing Blocks A10 and A20. The Sittwe Department of Fisheries stated that these Blocks were restricted for fishing activity for the conservation of species (e.g. fish, dugong, turtles, dolphin, shark, whale and coral). The areas are restricted during the rainy season (June to August). The following gears are prohibited; trawl, surrounding net, stow net and long line as well as small engine boats. Although this ban is in place it is unlikely as to the level of enforcement. During the stakeholder consultations in June 2015, local fishermen mentioned that a new restriction on fishing may be brought into effect. This new ban is not yet in effect but would cover all fishing types (large scale commercial to local artisanal) and would encompass all marine waters of Myanmar. No further details on this ban are available at the time of writing.

The locations of known protected areas and restricted fishing areas are shown in *Figure 5.12*. Limited data are available on the designations of these protected areas. The Wunbaik protected area is located to the north of Kyaukphyu and designated as "reserved forest" and has been set up for the protection on mangroves around offshore islands. Wunbaik covers an area of 229 km^2. The Rakhine Yoma Elephant Range was designated in 2002 and is 1,755 km^2. It is categorised by IUCN as Category II, which means that it is designated for the conservation of a particular species or habitat; in this case it was designated for elephants. There is very limited information on the Taungup pass / Thandwe Chaung. This area does not appear to be designated and is categorised as IUCN Category IV; a large natural or near-natural area set aside to protect large scale ecological processes. No information on the rationale for designation or the size of the area is available. It should be noted, however, that none of these protected areas are within the Area of Interest.

5.4.12 Seasonality of Sensitivities

The sensitivity of the Rakhine State marine environment appears to vary at different times of the year and in different areas depending on seasonality of sensitive marine species. Turtles are nesting from September to March and will be present in the Area of Interest during this time travelling to and from nesting beaches. Marine mammals are common offshore during the winter but this could potentially be an artefact of the increased presence of fishermen reporting sightings during this time.

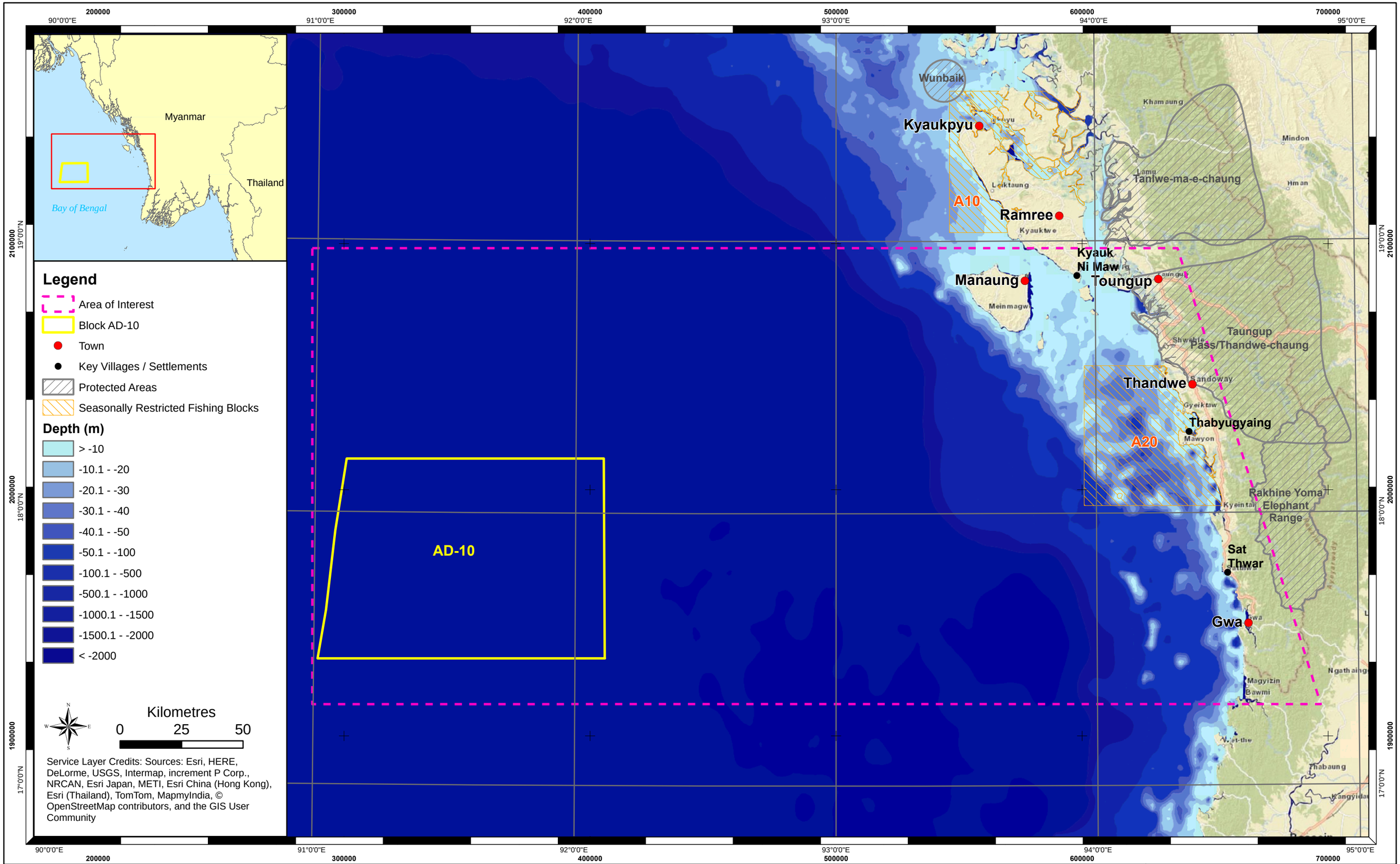


Figure 5.12

Protected Areas and Restricted Fishing Areas in Rakhine State

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5.5 SOCIO-ECONOMIC COMPONENTS

5.5.1 Introduction and Area of Interest

Given that the Block is located approximately 200 km from the mainland coast, an appropriate baseline understanding of local fishing activities in and around Block AD-10 is vital to understanding social and health impacts, if any, on communities. To confirm whether there was any potential interaction between Project and local Rakhine State fishing activity the stakeholder engagement in June 2015 focused on the potential fishing in the open water environment (i.e. in water depths of over 1,000 m). Consultation indicated that fishers active in these offshore waters were likely to come from: outside of Rakhine State, such as Yangon, where larger, commercial vessels can be found. It was also noted that there is potential for international vessels to be fishing in the offshore waters of Rakhine State.

This baseline is structured to provide:

- An overview of the social setting largely based on secondary information, providing a high-level social context for Rakhine State and the coastal communities;
- An overview of fishing activity in and around the Block based on data collected during consultations. It should be noted that this consultation confirmed that there are unlikely to be any fishing vessels from Rakhine State within the Block and information collected is provided as an overview of the fishing practices in Rakhine State only. An overview of the approach to consultation and data collection is provided in *Chapter 7*;
- An description of regional oil and gas exploration; and
- An overview of shipping and navigation in the area.

5.5.2 Social Context

Introduction

This section provides an overview of the social context at the national level, Rakhine State and the specific Area of Interest to the extent possible. It should be noted that secondary literature on Myanmar is limited (although improving) and the social context is a shifting picture which means a degree of caution is necessary to extrapolate from secondary data to a local baseline. Nevertheless, the data provide an idea of the potential level of vulnerability of the communities potentially impacted by the Project.

National Overview and Administrative Structure

Myanmar is divided administratively into seven regions, six self-administered zones and seven states which are segregated on the basis of the presence of a major ethnic group different from the majority Burman group. Rakhine State, with its capital situated in Sittwe, is one of the seven states in Myanmar.

States are divided into districts, which are further divided into townships, village tracts and finally villages.

The World Bank states that Myanmar is in transition building a democratic governance structure following the establishment of a civilian government in 2011 and opening its economy to foreign investment as sanctions are eased. The potential for economic growth is deemed significant by a number of international financial institutions (including the World Bank Group, ADB and IMF (1)) due to the low starting base, abundance of natural resources and economic reforms the government has made since 2011. Whilst prospects appear hopeful, the World Bank also notes that most social indicators at the national level are low with Myanmar currently in the low human development category of the UN Human Development Index (150 out of 187 countries).

Myanmar is a multi-ethnic country and there has been a history of tension and conflict between ethnic groups in some states, including Rakhine. Recently tensions have increased between the majority Buddhists and Muslim minorities. The Government has taken steps in the last four years to negotiate peace for the long-term with a number of states, especially those with international borders; nevertheless conflict resolution represents another area of transition for the country.

These multiple fronts of transition contribute to significant uncertainty in establishing a social baseline and highlight the importance of monitoring in order to improve understanding of baseline characteristics on an ongoing basis.

Physical Characteristics and Land Use

Rakhine (formerly known as Arakan) State is located in Western Myanmar, and is bordered by the Chin State in the North, Magway, Bago and Ayeyarwady Division in the east, the Bay of Bengal in the west and Chittagong Division of Bangladesh in the Northwest. It is the eighth largest region in the country, and has a total land area of 36,780 km^2. The area is characterised by a long coastline along the Bay of Bengal, with a number of islands being located within the state's boundaries. It is also a mountainous territory which is difficult to access and separated from the rest of Myanmar by the Arakan Yoma Mountain range (2).

The land use in the region is characterised by a dominance of forests, with approximately 44 percent of the total land area being covered by evergreen forest, while 7 percent of the area is covered by deciduous forest. The eastern boundary of the state is mostly covered by deciduous forest (3). Apart from forest cover, the main land use in the region is agriculture, with twenty-eight

(1) **https://www.imf.org/external/np/speeches/2013/120713.htm** **http://www.worldbank.org/en/country/myanmar/overview** and **http://www.adb.org/countries/myanmar/economy**

(2) UNICEF Rakhine State: A snapshot of Child Wellbeing

(3) UNDP Multi Hazard Risk Assessment in the Rakhine State of Myanmar: Final Report, 2011

percent of the land being categorised as agriculture land. Agricultural land is an important resource for the local community for livelihood purposes.

The area occupied by settlements is only one percent of the total land area. The settlement area density is higher in the northern part of the state, than in the south. The capital, Sittwe, situated in the north, covers approximately 10 percent of the total land classified as settlements (1).

Administrative Structure

Rakhine State is divided into four districts and 17 townships of which five are located entirely on islands and several more have parts of their territory on islands (2). *Figure 5.13* maps the administrative divisions of the state. The four districts and the number of townships and village tracts within them are shown in *Table 5.4*; the townships that form the Area of Interest are highlighted.

Table 5.4 Administrative Structure of Rakhine State

District	Township	Number of Village Tracts
Kyaukphyu	Ann	30
	Kyaukphyu	54
	Manaung	37
	Ramree	52
Maungdaw	Buthidaung	79
	Maungdaw	98
Sittwe	Kyauktaw	80
	Minbya	64
	Mrauk-U	95
	Myebon	52
	Pauktaw	54
	Ponnagyun	93
	Rathedaung	89
	Sittwe	28
Thandwe	Gwa*	34
	Thandwe*	64
	Toungup	55

**Area of interest. Source: UNDP Multi Hazard Risk Assessment in the Rakhine State of Myanmar: Final Report, 2011*

Demographics

Rakhine State is the eighth largest and the second most populous state (after Shan State), characterised by a population density of 87 individuals per square kilometre and a positive sex ratio of 1,114 women per thousand men (1). Most of the population is concentrated around the coast and in the northern townships; the populations in the eastern, hilly forests of the State having particularly small populations. Among the 17 townships, Sittwe is the most densely populated (3). An overview of demographics for the state is provided in *Table 5.5* with a population data for the townships in the Area of Interest

(1) UNDP Multi Hazard Risk Assessment in the Rakhine State of Myanmar: Final Report, 2011

(2) UNDP Myanmar: Local Governance Mapping: The State of Local Governance: Trends in Rakhine

(3) UNDP Multi Hazard Risk Assessment in the Rakhine State of Myanmar: Final Report, 2011

Figure 5.13

Overview of Rakhine Region

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provided in *Table 5.6* both highlight that the vast majority of the population resides in rural areas – a reflection of the dependency on agricultural livelihoods.

Table 5.5 Demographic Profile of the Rakhine State

Attribute	Rakhine
Total Population	3,188,963
Area (sq. km)	36,780 sq. km
Population Density (persons per sq. km)	87
Population between 0-14 years	1,039,134
Sex Ratio	1,114 females per 1,000 males
Rural Population %	84.2%
Urban Population %	15.8%

Source: UNDP Myanmar: Local Governance Mapping: The State of Local Governance: Trends in Rakhine and Republic of Myanmar, The Population and Housing Census of Myanmar, 2014: Provisional Results

Table 5.6 Overview of the Demographics of the Area of Interest

Township	Population Figures			Persons / sq km
	Total	Urban	Rural	
Manaung	64,296	5,362	58,934	123
Ramree	112,186	9,733	102,453	85
Kyaukphyu	171,724	41,025	130,699	98
Thandwe	123,145	18,488	104,657	89

Source: Township Health Profile 2011, Department of Health Planning, MOH

Like many parts of Myanmar, the state has a diverse ethnic population. The majority of the state's population (60 percent) is comprised of Rakhine, followed by Muslims who comprise 30 to 35 percent of the population. The other main ethnic groups in the region are Chin, Mro, Bamar, Khami (1).

Violence between the Rakhine Buddhists and Muslims erupted in mid-2012 and again in late 2012. The violence is reported to have resulted in a number of deaths, damage to infrastructure and the displacement of thousands of people, mostly Muslims (2), who are now residing in camps in the north of the state. Tension still remains between the majority Buddhists and the Muslim population.

Livelihood and Economy

Rakhine State is rich in natural resources including the scenic beauty of coastal beaches with high potential for tourism, unexplored potential for oil and natural gas, coastline to support fisheries, and lands supporting rice production and plantation. The main sources of livelihood are agriculture, fisheries and livestock holdings, small businesses and the service industry.

(1) UNDP Myanmar: Local Governance Mapping: The State of Local Governance: Trends in Rakhine and Republic of Myanmar, The Population and Housing Census of Myanmar, 2014: Provisional Results, UNDP Multi Hazard Risk Assessment in the Rakhine State of Myanmar: Final Report, 2011

(2) Source: Conflict Mapping: Rakhine-Rohingya Conflict in Myanmar LB 5525: Conflict Analysis, Northern Rakhine State, June 2010, Conflict and Violence in Arakan (Rakhine) State, Myanmar (Burma), Arakan Human Rights and Development Organization, 2013

More than 50 percent of the population is dependent upon agriculture for their livelihood, while 13 percent engage in fishing, and 10 percent in livestock farming. The remaining 25 percent of the population is dependent upon the service industry, small businesses and other activities (1). Small amounts of inferior-grade crude oil are produced from basic, shallow, hand dug wells. In recent years there has been significant investment in the tourism sector. However, issues such as poor infrastructure, particularly road infrastructure, weak connectivity to the rest of the country, lack of electricity, poor communication facilities, the mountainous terrain and social conflict amongst ethnic groups have resulted in major challenges for the state's socio-economic development (2).

The coastal areas in Rakhine are characterised by fishing and agriculture as the two main livelihood opportunities, followed by tourism and sale of timber. The main crop produced is paddy, which is cultivated across approximately 85 percent of the total cultivated land in the region. Apart from paddy, the main crops are rubber, pepper, pigeon pea, beans, sunflower, mustard and oil seeds. Fishing constitutes a quarter of Rakhine's estimated economic value with several studies by independent organisations (Oliver *et.al.* 2014) indicating that around 43 percent of the population in the state relies either on fishing or a combination of fishing/agriculture. The fishing sector also employs a number of landless coastal households (3).

The fisheries sector plays a critical role in terms of employment (4); it is estimated that in the Rakhine region, almost 600,000 individuals are involved in capture fisheries and/or aquaculture, while 150,000 individuals are involved in other stages of the value chain, including processing, wholesale and export (this figure however only includes 489 registered fish traders and more traders may be involved on an informal basis). The fisheries sector is also important for casual labour, with 24 percent of the casual labour workforce in Myanmar reporting the fisheries sector as the first source of income.

Fishing and related activities are present all along the coastline. Key species captured in the Area of Interest include tiger prawn and pomfret (the most valuable catch), herring, tuna, groupers, mackerel, mullet, red snapper, catfish, squid, anchovy, sardines, shark, eel, lobsters, mahi mahi, scad, and sea bass.

Agricultural activities (predominantly paddy cultivation and groundnut with minor proportion of maize, pulses, wheat and soybean (5) are observed in the coastal areas in Kyaukphyu, Ramree and Manaung. Agricultural activity varies in coastal communities depending on access to land. Some coastal

(1) UNDP Multi Hazard Risk Assessment in the Rakhine State of Myanmar: Final Report, 2011

(2) UNDP Myanmar: Local Governance Mapping: The State of Local Governance: Trends in Rakhine

(3) Joffe, O., Fishery Value Chain Analysis in Rakhine State Assessment for village level interventions. Available from **http://www.researchgate.net/publication/263320043_Fishery_Value_Chain_Analysis_in_Rakhine_State_Assessment_for_village_level_interventions**

(4) Oxfam, Fishery Value Chain Analysis in Rakhine State: Assessment for village level interventions, February 2014

(5) **http://www.fao.org/docrep/011/ai478e/ai478e00.htm#3**

communities have limited access to land and are highly dependent on fishing for income and subsistence.

Social Indicators

UNICEF (2013) (1) reports that Rakhine State is characterised by high malnutrition, generally low enrolment and completion in primary education, and poor access to clean water and sanitation. It is also prone to natural hazards such as storms and floods increasing the vulnerability at the community level. It is reported that the inter-community violence in 2012 led to a worsening of social indicators with thousands displaced, suffering from food insecurity, interrupted livelihoods and education, as well as a lack of access to markets.

Literacy levels and access to educational infrastructure in Rakhine Sate are reported to be significantly lower than the national averages. Rakhine State has the lowest pre-school attendance among children aged three to five years in the country at five percent, in comparison to the national average of twenty-three percent. Only about a third of children enrolled at primary school complete their education on time.

A World Bank analysis of 2014 household survey data suggests that Rakhine State, with a poverty rate of 78 percent (national average is 38 percent) may be the poorest region in the country. This is of particular concern given the high level of poverty at the national level and suggests that the population of Rakhine State may be particularly vulnerable.

5.5.3 Fishing Activity in and around Block AD-10

Introduction and Approach to Data Gathering

This section starts with a general understanding of the administration of fishing in Rakhine and then provides details of potential fishing activity in and around the Block AD-10, based on identified fishing patterns of local communities within the Project's social Area of Interest.

The section is based on data gathered through consultation with government agencies, including the Department of Fisheries (DoF) at various levels, district and township administrations, as well as with a sample of fishing communities along the coast bordering Block AD-10. The sample was agreed with the State Government covering two townships with specific villages:

- Thandwe Township: Thabyugyaing village; and
- Gwa Township: San Thwar village.

The details of the consultation with the various stakeholders are covered in detail in *Chapter 7*.

(1) A snapshot of child wellbeing Unicef 2013

The social Area of Interest is focused on those townships where there is potential for fishing communities to interact with the Project. The sample of communities from across the townships was agreed with stakeholders during the scoping process in order to provide a more detailed understanding of those that may be impacted by the Project. This baseline provides a description of this purposive sample selected in order to provide specific information on those fishers more likely be active in deep-water areas (more than 200m of water depth).

It is however important to note that fishing is undertaken by communities along the entire coastline and that the majority of fishing activity takes place in the nearshore (within 10 nautical miles from the coast) shallow-water areas (up to 50m of water depth), and continental slope (50-200m of water depth) that will not be impacted by the Project.

Data Gaps and Assumptions

While the sample of villages included in this baseline is representative of the general fishing patterns in the Area of Interest, various data gaps remain:

- Fishing patterns cannot be extrapolated to give an exact description and quantitative indication of fishing activity; and
- Not all the information provided by community members could be verified and may be inaccurate (such as the depth or distance from shore).

Administration of Fisheries

Myanmar has a total land area of 676,577 km^2 and a coastline of ~3,000 km. The country's continental shelf is up to 200 m deep and covers an area of ~230,000 km^2, while the Exclusive Economic Zone (EEZ) (1) covers ~486,000 km^2. Myanmar's coastline can be divided into three regions:

- Rakhine State (~740 km of coastline);
- Ayeyarwady and Gulf of Mottama Region (~460 km of coastline); and
- Tanintharyi Region (~1,200 km of coastline).

For the purpose of administration and monitoring of fishing activities, the marine territorial waters are divided into 140 grid blocks of fishing grounds, with each block covering an area of 30 x 30 nautical miles (*Figure 5.14*) (2).

The Department of Fisheries (DoF) at the national level controls offshore fishing activities and licences, while inshore licenses are granted at the state level. At the village level fishing associations manage membership of fishers

(1) An Exclusive Economic Zone (EEZ) is a concept adopted at the Third United Nations Conference on the Law of the Sea (1982), whereby a coastal State assumes jurisdiction over the exploration and exploitation of marine resources in its adjacent section of the continental shelf, taken to be a band extending 200 miles from the shore. (Source: OECD Glossary of Statistical Terms **https://stats.oecd.org/glossary/detail.asp?ID=884**)

(2) FAO (2003) and (2006) Myanmar Aquaculture and Inland Fisheries

from the village. The organisational capacity and level of activity of these associations varies from village to village.

The management and development of the fisheries resources is undertaken by the DoF under the Ministry of Livestock and Fisheries. The DoF has established a legal framework with strategies and policies for sustainable development and management of marine fisheries. These include licensing, prescription of exploitable species, designation of environmental friendly fishing gears and methods, and the imposition of closed areas and seasons.

One mechanism for the management of the fisheries resources is the Monitoring, Control and Surveillance (MCS) programme for fishery management. This programme is aimed at providing effective and efficient scientific data for fish stock evaluation and management of fisheries in Myanmar. It is also aimed at providing the basis of effective monitoring and control of fisheries enforcement activities in order to ensure that only authorised or licence holding fishing vessels operate within the designated areas in the EEZ. Some of the key management measures implemented for the control of fishing activities are discussed below (1):

- *Surveillance of fishing activities*: government departments such as the Myanmar Navy, Myanmar Coastal Guard, DoF, Myanmar Customs Department and Myanmar Police Force are involved in the monitoring and surveillance of fishing activities. Of these, the Myanmar Navy is responsible for the coordination of surveillance efforts.

- *Closed fishing areas*: as part of the management of fishing activities, commercial fishing vessels such as trawlers and fish purse seiners are prohibited from fishing less than 10 nautical miles from the shore. Nearshore waters (<10 nautical miles from the coast) can be used as nursery grounds for juveniles of fish and shrimp. In addition to this, restricted fishing areas have been identified, protected and managed to ensure survival of the juveniles of commercially important fish species. These areas, comprising two fishing grounds in Rakhine State, four fishing grounds in Ayeyarwady, two in Mon and Tanintharyi Region each, are declared as closed fishing areas for three months (June to August) annually. However, enforcement of these closed areas can be a challenge.

- *Licensing and Management Zones:* through the system of annual licensing, two fishing zones have been identified by DoF on the basis of specific fishing gear, classes of fishing vessels and ownership. These fishing zones are designed to allow equitable allocation of resources and reducing conflicts between traditional and commercial fishers.

  Fishing Zone I is designated for coastal fisheries and extends from the shoreline to ten nautical miles (11.5 miles). Fishing Zone II extends from the outer limit of Fishing Zone I to the EEZ limit.

(1) Myanmar Aquaculture and Inland Fisheries, FAO, 2003 and 2006

- *Controls on size and power of fishing vessels:* any change in tonnage or engine power of fishing vessels or construction of fishing vessels requires permission from the Director General of DoF and approval from the respective authority.

- *Registration of Fishers:* any new individual entering the industry is required to be registered and anybody working and living on a fishing vessel must have a fishers' registration card.

- *3 months prohibition on fishing:* Fishing is banned in coastal areas for three months during the rainy season under Government directives. Fishing is these areas in banned for the conservation of species, including and coincides with the spawning season of fish. However, this ban is not enforced and subsistence fishing continues. More information on these restricted fishing areas in provided in *Section 5.4.11*. These restricted fishing areas are shown in *Figure 5.14*.

Fishing Activity and Practices

In order to understand the potential for interaction between the Project and fishing activity, the assessment has sought to understand the fishing activity and practices of communities who may interact with the Activity Area of the Project. Data collected at the sample villages highlights the large diversity in fishing practices by these communities; the following elements appear to be significant variables in fishing activity by these communities.

- size of vessel and trip duration;

- fishing locations;

- fishing gear and type of catch – including hook and line, trawl and drift nets, longline, purse seine; and

- seasonality - weather and species.

The majority of fishing was undertaken within water depths of less than 100 m and up to 20 miles from the coast. A relatively small number of communities actively fish in the deep-water area (>200m of water depth). Examples of fishers active in the deep-water area were identified in Kyauk Ni Maw (mentioned in Thabyugyaing village), but deep-water fishing does not appear to be practiced by all. However, it was mentioned that even fishermen from Kyauk Ni Maw (who were stated to be fishing in the deepest waters) would not be fishing in the Block as it was too far offshore. It was stated in all meetings that there is no local Rakhine fishing activity in the vicinity of Block AD-10 as it is too far offshore. This supports DoF records for 2012-13, which report that ten percent of the fishing population in the coastal region were working on deep-water offshore vessels and sixty-seven percent were working on nearshore fisheries (i.e. within 10 nautical miles of the mainland coast). As such, local artisanal fishing vessels from Rakhine State are not likely to be present in the waters of Block AD-10 and as such, are not likely to be impacted by Project activities.

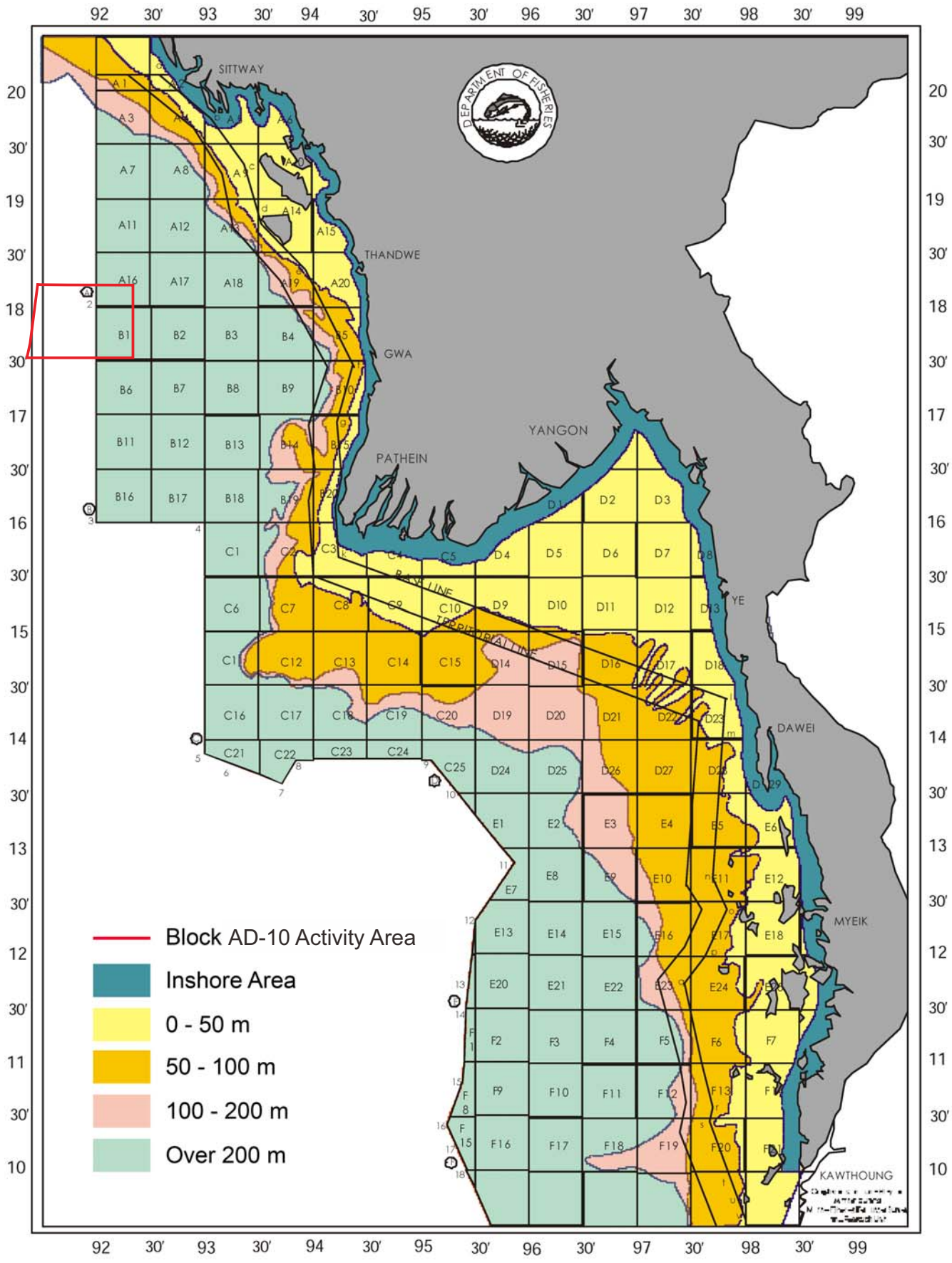

Figure 5.14 Fishing Grounds and Landing Sites in Myanmar

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It was reported that fishing vessels from outside the Area of Interest may fish in the Block. It is anticipated that there may also be commercial vessels from outside Rakhine State. These vessels are mostly large commercial trawlers.

In general, deep-water fishermen suggested that November to May was the best season for fishing as better weather meant that fishing boats are able to travel greater distances from shore. However, larger vessels from Yangon or outside of Myanmar may continue to fish in deep water throughout the year.

Fishing vessels and trip duration

The dimensions of the fishing vessels recorded can be spilt into two categories. Photos of the type of boats encountered in the Area of Interest are provided in *Figure 5.15*:

- Small: This category covered a variety of boats from small canoe type boats (up to 20 ft. in length) used for inshore or river fishing, to small marine fishing vessels which were up to 35 ft. in length; and

- Large: The boats within this category were much more standardised and consisted of "small trawler" boats which ranged between 50 and 90 ft. in length. This size class included vessels from larger ports in Rakhine State such as Thabyugyaing and commercial vessels from outside of Rakhine State (such as Yangon and international vessels).

The large boats are the only boats relevant to the baseline as they are capable of fishing in deeper waters (over 200 m). The small size class of boats fish in the shallower waters of the continental shelf and slope located approximately 100 km from the Block.

Fishing Locations

Fishing locations were verified by depth range in which vessels operate and the estimated distance from the coast the vessels fished in. In addition, the usage of the type of net gear can also dictate the fishing locations and water depth at which fishing can be undertaken.

Most of the smaller-sized boats fished in water depths up to 100 m (330ft) and travel a maximum of 20-30 miles (30 to 50 km) from the mainland Rakhine coast. These are not within or near to Block AD-10 and at the closest point are located at least (90 miles) 150 km away.

Fishermen in Thabyugyaing noted that fishermen from a village in Ramree (Kyauk Ni Maw) are fishing in the deep waters and fish further out than villagers from Thandwe however, they stated that these boats do not go as far out as the Block. From consultation with the fishermen, DoF and the Myanmar Fisheries Association, it was noted that limited fishing could occur in Block AD-10 by larger commercial vessels from outside Rakhine State. This is either by fishermen from Yangon and other states in Myanmar or international commercial fishing vessels.

Small boats in Thabyugyaing

Ice delivery to large boats in Thabyugyaing

Large boats in Thabyugyiang

Boat size	Dimensions (length)	Distance offshore	Depth Range (m)	Trip Duration (days)	Nets used
Small	20 to 35 ft	Up to 18 km	Up to 50 m	1-7	Trawl Gill Net Traps
Large	50 to 90 ft	Up to 55 km	Up to 100 m	2-15	Drift Net Longline / Hook & line Trawl Surrounding Gear

Figure 5.15

Typical boats size and associated details in coastal villages of Rakhine

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A summary of fishing activity within the townships consulted is provided in *Figure 5.16.*

Seasonality

Dry winter season and Summer Season (November to beginning of May): Fishermen across villages suggested that November to the end of February was the best season for fish catch (in terms of monetary value), as better weather meant that fishing boats are able to travel greater distances from shore. Fishing can be undertaken during this season in deeper waters as the sea state is calmer than other times during the year.

Rainy Season (mid-May to end of October): In contrast, fishing during the rainy season is difficult for many, due to poor weather conditions, especially in the deeper waters. Many fishermen reported fishing closer to shore during the rainy season. However, larger commercial vessels from outside Rakhine State can continue to fish all year round in the deep-water and could be present in the Block.

Fishing Gear and Type of Catch

This section will focus on the gear used by the large fishing vessels. Fishermen used a variety of nets to target different species; the most common method was trawling for prawn. Deep water fishing was undertaken for pelagic species using surrounding gears (purse seines and encircling gill nets) and floating gear (gill nets) and long line and hook & lines. These gears targeted tuna, mackerel, anchovy, and sometimes mahi mahi were caught. Mackerel was the main target species. Commercial deep-water fishing vessels from outside Rakhine State use trawl nets, purse seines, drift nets and gill nets.

Fishing value chain

As mentioned above, local fishing activity in Rakhine State is unlikely to be impacted by the Project activities as no fishing occur within or near to Block AD-10. Therefore, only a limited baseline on the Rakhine Fishing activity and livelihood is presented below, including a description of:

- Landing sites and the fish market;
- Dependency on Fishing and Food Security;
- Information and Communication with Fishermen.

Landing Sites and Market

The main wholesale fish markets are located in Yangon, namely the Sanpya Fish Market, Pazuntaung Naungdan Fish Market and Annawa Fish Market, with a number of local markets being located in the states and regions (1).

(1) FAO (2003) and (2006) *Op. cit.*

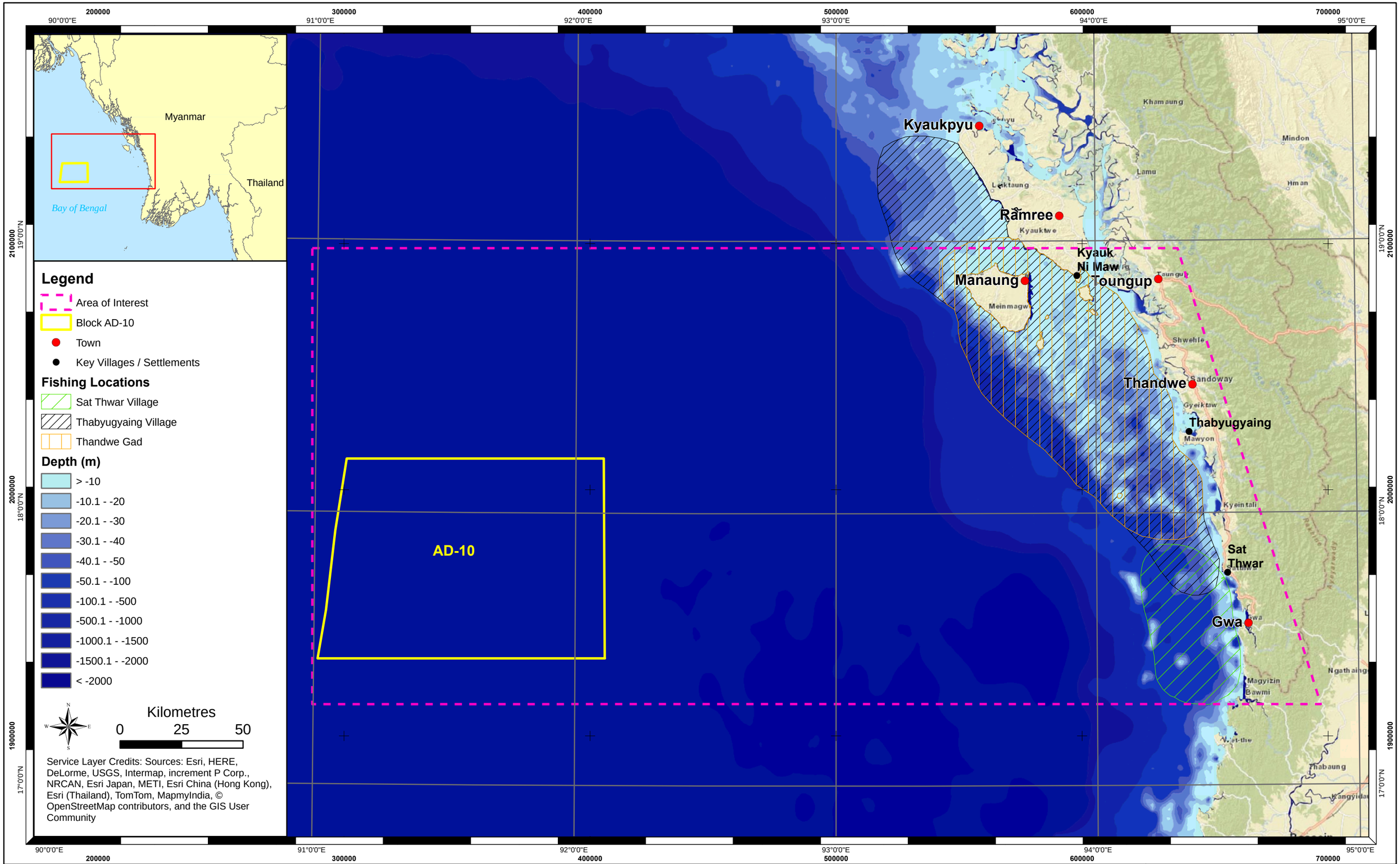

Figure 5.16

Locations of Fishing Areas

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Consultations and site visits suggested that there are buying centres near most fishing villages, which are linked to Thandwe or Yangon by road. Depending upon the quality of the fish, it is either processed for animal feed (lowest quality), salted, iced (best quality) or dried.

Drying of fish is reserved for certain species like anchovies and squid or as a fall back option, if the market price for fish is too low or the catch could not be sold. The demand for the fresh and most valuable fish comes primarily from village buying centres.

Dependence on fishing (including Food Security)

Agriculture is the cornerstone of livelihood in Rakhine State, supplemented by fishing; however, the major coastal fishing villages visited as part of the consultation rely more on fishing for their livelihood than agriculture.

In the Area of Interest some households are totally dependent on fishing and it was observed that in many villages around 80 to 90 percent of households are engaged in fishing. Other livelihood activities also depend on fishing including fish processing (often undertaken by women), transportation of ice (in larger settlements such as Thabyugyaing in Thandwe) and wage labour on vessels.

Fish accounts for a part of local diet in the fishing villages. Fish, rice and vegetables were reported to be the staple diet so fish is an important source of nutrition. Feedback from consultations in the villages suggests that food scarcity has not been a challenge for coastal fishing communities. However dependence on rice and fish was highlighted in all the communities consulted.

Information and Communication Systems

Consultation with fishermen suggests that larger boats from Thabyugyaing also use radio and have Global Positioning System (GPS) and echo-sounding equipment, and navigational charts.

For information, fishermen in Thabyugyaing call upon the fishing association or Village Tract Leader whilst offshore or when in the village. In San Thwar, it was noted that they only have limited contact with the Department of Fisheries and there is no fishing association in the village. Information is provided by the Village Tract Leader. Information is usually provided by the Department of Fisheries (DoF) to Village Tract Leaders and then passed on to the fishermen through various means including use of loudspeaker in the village. Information is also received through Skynet TV, MRTV and FM Radio channel, where these are locally accessible.

Appropriate channels for reaching fishermen may vary between villages. The preference for receiving information at the village level is dependent on people's accessibility and the level of engagement with fishing associations, village tract leaders, township office and the DoF office.

Communication and Management of Grievances

Consultations across the villages on access to grievance mechanisms suggested that fishermen use a variety of mechanisms to lodge and resolve grievances. In some cases, grievances related to fishing activity are resolved at the village level, with the fishing association leader or village tract leader playing a mediating role. In other cases, complaints are taken directly to the township Department of Fisheries, who invites aggrieved parties to the Department of Fisheries office, and helps to negotiate and resolve concerns.

5.5.4 *Regional Oil and Gas Exploration*

With the lifting of international sanctions, licensing has begun on a number of onshore and offshore oil and gas License Blocks in Myanmar. In 2014, the Ministry of Energy announced that 10 shallow water and 10 deep water Blocks had been awarded in Myanmar waters (1) (*Figure 5.17*). The recently awarded license Blocks within Rakhine waters are listed in *Table 5.7*.

Table 5.7 License Blocks in Rakhine Waters

Block	Operators
Shallow water	
A-4	BG Group and Woodside Energy (Myanmar)
A-5	Chevron (Unocal Myanmar Offshore Co. Ltd.)
A-7	BG Group and Woodside Energy (Myanmar
Deep Water	
AD-02	BG Group and Woodside Energy (Myanmar)
AD-03	Ophir Energy PLC
AD-05	BG Group and Woodside Energy (Myanmar)
AD-09	Shell Myanmar Energy and MOECO
AD-10	**Statoil**
AD-11	Shell Myanmar Energy and MOECO

Within Blocks A-1 and A-3 to the north of Block AD-10 is the Shwe Natural Gas Project. This development consists of the Shwe, Shwe Phyu and Mya offshore gas fields. Production started in the Mya Field in August 2013 in the Mya Field and in January 2014 from the Shwe gas field. Production by the end of 2014 was expected to reach 500 million cubic feet of gas a day until 2020 (2).

5.5.5 *Shipping and Navigation*

From available ship frequency tracking data, the Bay of Bengal has relatively limited shipping activity with lightly used shipping lanes from ports in the north (Kolkata, Chittagong etc.) heading to the southern tip of India and the Straits of Malacca in the south. Block AD-10 is located outside of the main shipping route from Chittagong and therefore there is a low potential for encounters (*Figure 5.18*). In addition, vessels encountered will be equipped to

(1) Oil and gas Journal, online. Myanmar awards exploration blocks. Available at **http://www.ogj.com/articles/2014/03/myanmar-awards-exploration-blocks.html**

(2) Offshore Technology, online. Shwe Natural Gas Project, Myanmar. Available at: **http://www.offshore-technology.com/projects/shwe-natural-gas-project/**

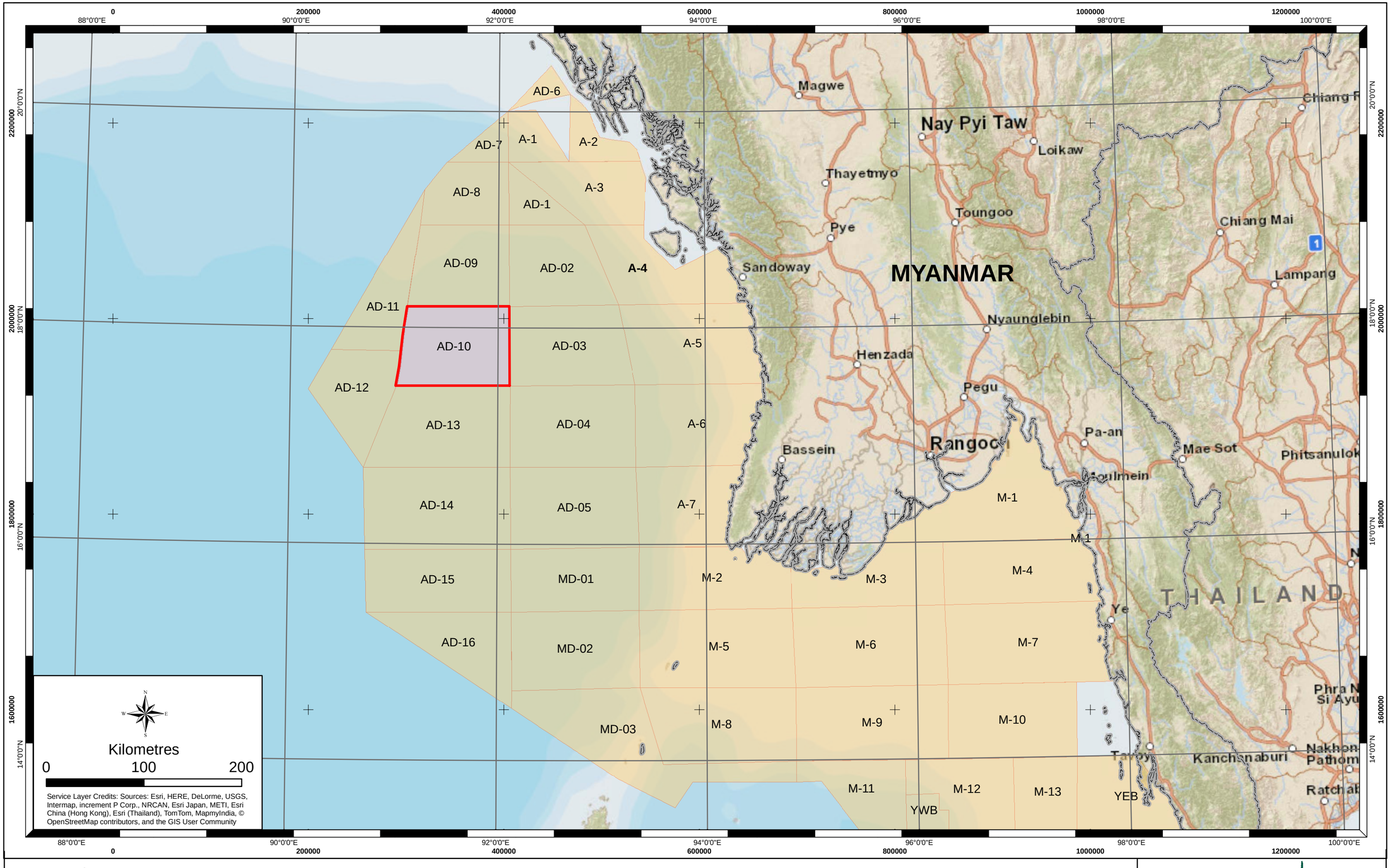

Figure 5.17

Offshore Oil and Gas Blocks within Rakhine Waters

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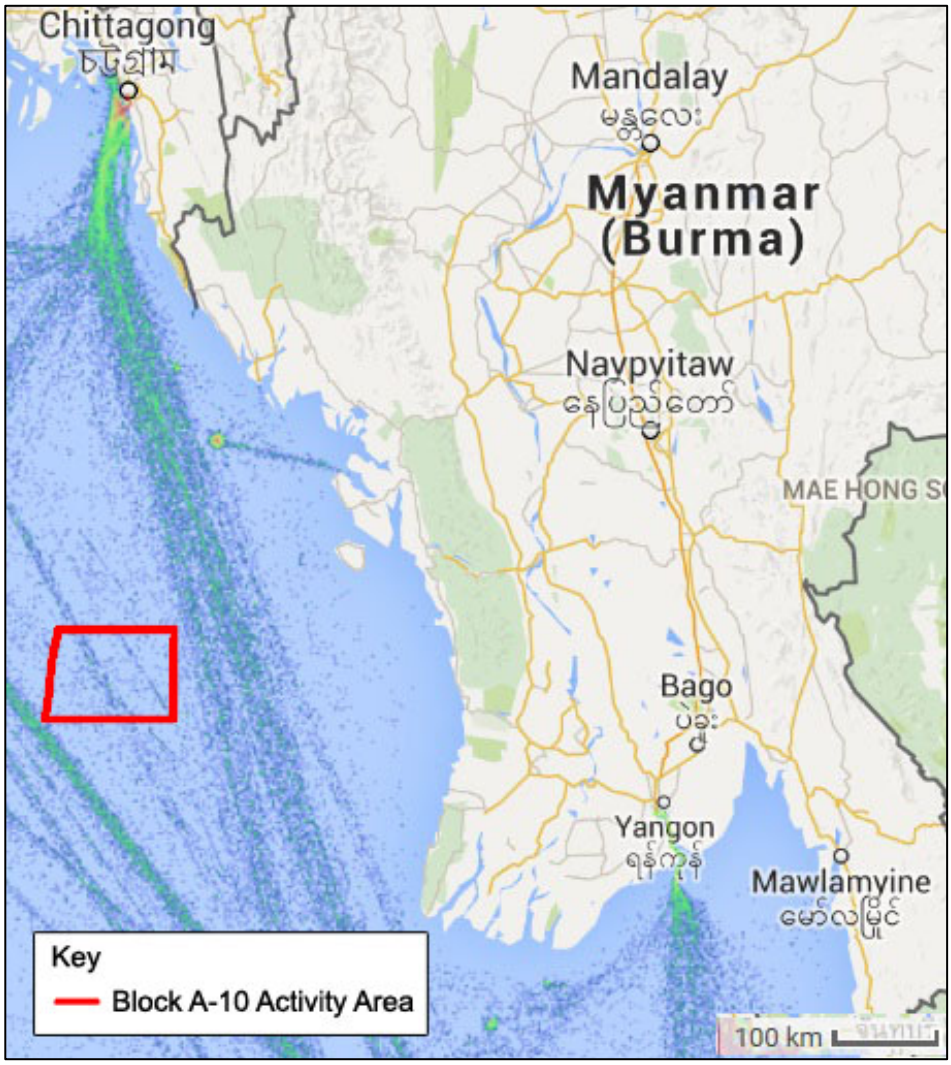
help manage any concerns. On *Figure 5.18*, the high density of shipping observed from Kyaukphyu to the offshore is associated with the Shwe Natural Gas project.

Figure 5.18 Shipping Routes in Rakhine Waters



Source: **http://marinetraffic.com/**

There are a number of domestic shipping and ferry lanes within shallow waters in Rakhine State. In the Area of Interest, these link Sittwe with Kyaukphyu, Ramree, Manaung, and Toungup. However, none of these cross the Block.

5.6 CULTURAL COMPONENTS

No known offshore culture heritage was identified in the Block AD-10 or in the waters of offshore Rakhine.

5.7 VISUAL COMPONENTS

Given that the Project is located over 150 km from the nearest coastline (Manaung Island), there are unlikely to be any visual impacts from the Project.

Given the Project location of Block AD-10 being located ~ 200 km offshore with seabed depth of ~2,000 m, the physical properties of the Project's Area of Interest is not considered to be particularly sensitive and would be expected to be relatively homogenous in nature. The seabed is expected to be characterised by soft mud. The review of baseline conditions within the Area of Interest has identified that shallow nearshore waters of the Rakhine waters host habitats with enhanced biological productivity and higher biodiversity (such as coral habitats, seagrass beds, mangroves). However, Block AD-10 is confined to open deeper waters where typically lower ecological value habitats occur. The areas of coral habitat encompassing Manaung Island are the closest to the Block but are still located over 150 km (90 miles) away. Of the fish identified to species level, one is listed as species of conservational concern (vulnerable or above) on the IUCN Red List (narrow barred Spanish mackerel (*Scomberomorus commerson*)). In addition, the whale shark (*Rhincodon typus*) could be present within Block AD-10. The most common marine mammal species observed in Myanmar waters during a survey in 2015 are dwarf spinner dolphin (*Stenella longirostris roseiventris*) and Bryde's Whale (*Balaenoptera edeni*). Given that many different species of marine mammal have been recorded from survey close to Block AD-10, it can be assumed that marine mammals will be present during the survey. There are five species of marine turtle listed as present in the offshore waters of Rakhine State, all of which are listed as species of concern on IUCN Red List. The green, hawksbill and olive ridley turtle are also known to nest along the Rakhine coast from September to March with peak nesting in December and January. As such, turtles could be migrating through Block AD-10 to their nesting beaches in the Rakhine State during the survey period.

The main sources of livelihood in Rakhine State are agriculture, fisheries and livestock holdings. More than 50 percent of the population is dependent upon agriculture for their livelihood, while 13 percent engage in fishing, and 10 percent in livestock farming. The coastal areas in Rakhine are characterised by fishing and agriculture as the two main livelihood opportunities, followed by tourism and sale of timber. The majority of offshore fishing in Rakhine State is undertaken within water depths of less than 100 m and up to 20 miles from the coast. A relatively small number of communities actively fish in the deep-water area (>200m of water depth). It was stated in all meetings that there is no local Rakhine fishing activity in the vicinity of Block AD-10 as it is too far offshore. It was reported that fishing vessels from outside the Area of Interest may fish in the Block. It is anticipated that there may also be large commercial trawlers from outside Rakhine State. In general, deep-water fishermen suggested that November to May was the best season for fishing as better weather meant that fishing boats are able to travel greater distances from shore. However, larger vessels from Yangon or outside of Myanmar may continue to fish in deep water throughout the year.

5.9 KEY SENSITIVE RECEPTORS

Coral reefs, mangroves and seagrass habitats are not considered to be sensitive to project activities as they are located over 150 km away (for those near Manaung Islands) and over 200 km away (mainland). Similarly for social receptors, all of the fishing in Rakhine State is undertaken in waters up to approximately 100 m water depth and is located approximately 150 km from the Block.

The key sensitive receptors, which may interact with the Project activity and result in impacts, are:

- Fish are considered sensitive receptors as they can be impacted by underwater sound. However, fish are highly mobile and can avoid areas of temporary disturbance. The commonly caught commercial species are not typically of conservation concern;

- All sea turtles in Myanmar waters are species of conservation concern (internationally protected). Turtles can be sensitive to underwater sound as they hear in low frequencies. Turtles are also considered sensitive to the project as they are more slow moving that fish or marine mammals and are at more risk of becoming entangled in the seismic equipment;

- Marine mammals in Myanmar waters include some species of international and national importance (e.g. blue whale, dugong). Marine mammals are sensitive to underwater sound as they use sound to echolocate and communicate. As with fish, marine mammals are highly mobile and can avoid areas of increased sound; and

- Fishermen in the deep-water area that may interact with exploration survey activities which are the large commercial fishermen from outside Rakhine State.

- Shipping vessels using the shipping routes close to the Block.

6 IMPACT ASSESSMENT

This section presents the methodology and results of the impact assessment for the potential environmental and social impacts from the proposed Project on sensitive receptors and resources. Mitigation measures are recommended where appropriate to alleviate potential impacts in order to safeguard the environmental and social performance of the Project.

The impact assessment methodology used in this IEE Report provides a basis to characterise the potential environmental and social impacts of the Project. The methodology is based on models commonly employed in impact assessment and takes into account international best practices.

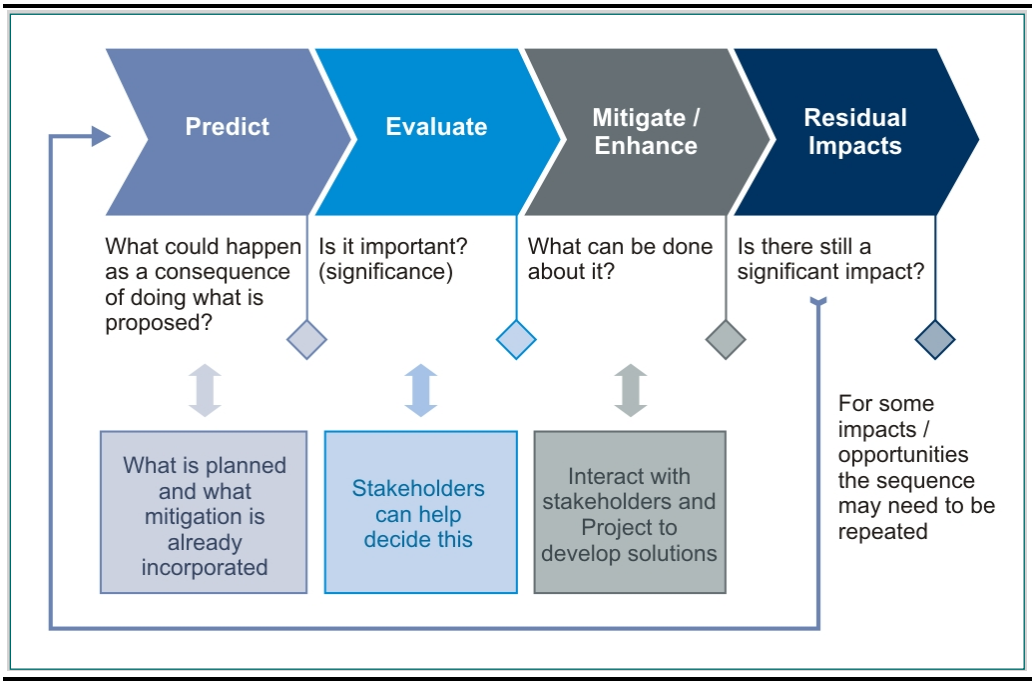
Potential impacts arising from both planned (routine and non-routine) activities and unplanned events are assessed. Unplanned events are those not anticipated to occur during the normal course of Project activities, for example, a vessel collision that may lead to a spill of fuel or damage to a fishing boat.

6.1 IMPACT ASSESSMENT METHODOLOGY AND APPROACH

Impact identification and assessment starts with scoping, which was conducted for the Project Proposal Report submitted on the 3rd October 2014, and continues through the remainder of the impact assessment process. The principal impact assessment steps are summarized in *Figure 6.1* and comprise:

- Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.
- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude or likelihood of occurrence (for unplanned events), and the sensitivity, value and/or importance of the affected resource/receptor.
- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 6.1 Impact Assessment Process



6.1.1 *Prediction of Impacts*

Prediction of impacts is essentially an objective exercise to determine what could potentially happen to the environmental and social sensitive receptors/resources as a consequence of the Project and its associated activities. This is essentially a repeat of the process undertaken in scoping, however, at this stage these potential interactions are updated based on additional Project and baseline information. From these potential interactions, the potential impacts to the various resources/receptors are identified and are elaborated to the extent possible. The diverse range of potential impacts considered in the assessment process typically results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques.

6.1.2 *Evaluation of Impacts*

Once the prediction of impacts is complete, each impact is described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in *Table 6.1.*

Table 6.1 Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	Direct Indirect Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.).	Local Regional International

Characteristic	Definition	Designations
Duration	The time period over which a resource / receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value]

The definitions for the *type* designations are shown in *Table 6.2*. Definitions for the other designations are resource/receptor-specific and are discussed in *Section 6.3*.

Table 6.2 Impact Type Definitions

Designations (Type)	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., sound emitted from the survey leading to behavioural changes in marine fauna).
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., reduction in water quality from waste discharges leading to toxic effects in marine fauna).
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is *likelihood*. The *likelihood* of an unplanned event occurring is designated using a qualitative scale, as described in *Table 6.3*.

Table 6.3 Definitions for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

6.1.3 Impact Magnitude, Receptor/Resource Sensitivity and Impact Significance

Once an impact's characteristics are defined, the next step is to assign each impact a 'magnitude'. Magnitude is a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration

- Scale
- Frequency

Additionally, for unplanned events only, magnitude incorporates the 'likelihood' factor discussed above.

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. The magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a *positive* impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient to indicate that the Project is expected to result in a *positive* impact, without characterising the exact degree of positive change likely to occur.

The magnitude designations themselves are universally consistent; however, the definitions for these designations vary on a resource/receptor-by-resource/receptor basis. The impact magnitude for marine species, marine habitats and water quality impacts is provided in *Table 6.4*, *Table 6.5* and *Table 6.6* respectively. The impact magnitude criteria for the social impact assessment are provided in *Table 6.7*.

Table 6.4 Impact Magnitude for Marine Species

	Extent / Duration / Scale / Frequency
Large	May affect an entire population or species in sufficient magnitude to cause a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.
Medium	May affects a portion of a population and may bring about a change in abundance and/ or distribution over one or more generations, but does not threaten the integrity of that population or any population dependent on it.
Small	May affect specific group of localised individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

Table 6.5 Impact Magnitude for Marine Habitats

	Extent / Duration / Scale / Frequency
Large	May affect the integrity of an area or region, by substantially changing, in the long term, its ecological features, structures and functions, across its whole area, that enable it to sustain the habitat, complex of habitats and/or population levels of species that makes it important.
Medium	May affect some, if not all, of the area's ecological features, structures and functions in the short or medium term. The area or region may be able to recover through natural regeneration and restoration.
Small	May cause some minor impacts of limited extent, or to some elements of the area, are evident but easy to recover through natural regeneration.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

Table 6.6 Impact Magnitude for Water Quality

	Extent / Duration / Scale / Frequency
Large	Change in water quality over a large area that lasts over the course of several months with quality likely to cause secondary impacts on marine ecology; and/or Routine exceedance of benchmark effluent discharge limits.
Medium	Temporary or localised change in water quality with water quality returning to background levels thereafter and/or Occasional exceedance of benchmark effluent discharge limits.
Small	Slight change in water quality expected over a limited area with water quality returning to background levels within a few metres and/or Discharges are well within benchmark effluent discharge limits.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

Table 6.7 Impact Magnitude for Local Communities, Fishermen and Other Marine Users

	Extent / Duration / Scale / Frequency
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community.

In addition to characterising the magnitude of impact, the other principal impact evaluation step is definition of the sensitivity (including vulnerability and importance) of the impacted resource/receptor. There are a range of factors to be taken into account when defining the sensitivity of the resource/receptor, which may be physical, biological, cultural or human. Other factors may also be considered, such as legal protection, government policy, stakeholder views and economic value.

As in the case of magnitude, the sensitivity designations themselves are universally consistent, however, the definitions for these designations vary on

a resource/receptor basis. The universal sensitivity/vulnerability/importance designations are:

- Low
- Medium
- High

The receptor sensitivities for marine species, marine habitats and water quality are provided in *Table 6.8, Table 6.9,* and *Table 6.10*, respectively. The receptor sensitivity criteria for the social assessment are provided in *Table 6.11.*

Table 6.8 Receptor Sensitivity for Marine Habitat

Category	Designation / Importance / Vulnerability
High	A habitat that has designated conservation status at an international scale (e.g. IUCN). Areas of particular biodiversity importance that may support populations of restricted range, endemic or endangered species, or is in itself unique or threatened.
Medium	A habitat that has designated conservation status at a national or regional scale. Areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
Low	A habitat not protected by law. Areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.

Table 6.9 Receptor Sensitivity for Marine Species

Category	Designation / Importance / Vulnerability
High	A species population that has designated conservation status at an international scale (e.g. IUCN). A species that is globally rare. A keystone species fundamental to the functioning of the ecosystem.
Medium	A species population that has designated conservation status at a national or regional scale. A species common globally but rare locally. Important to ecosystem functions or under threat or population in decline.
Low	A species not protected by law. Not critical to other ecosystem functions (e.g. as prey to other species or as predator to potential pest species) or common / abundant locally.

Table 6.10 Receptor Sensitivity for Marine Water Quality

Category	Designation / Importance / Vulnerability
High	Existing water quality is already under stress and/ or the ecological resources it supports are very sensitive to change (secondary ecological or health impacts are likely).
Medium	Existing water quality already shows some signs of stress and/ or supports ecological resources that could be sensitive to change in water quality.
Low	Existing water quality is good and the ecological resources that it supports are not sensitive to a change in water quality.

Table 6.11 ***Receptor Sensitivity for Local Communities, Fishermen and Other Marine Users***

Category	
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project.
Medium	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project.
Low	Minimal vulnerability; consequently with a high ability to adapt to changes brought by the Project and opportunities associated with it.

Once impact magnitude and resource/receptor sensitivity have been characterised, the significance can be assigned for each impact. Impact significance is designated using the matrix shown in *Figure 6.2*.

Figure 6.2 ***Impact Significances***

		Resource/Receptor Sensitivity		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	**Negligible**	**Negligible**	**Negligible**
	Small	**Negligible**	**Minor**	**Moderate**
	Medium	**Minor**	**Moderate**	**Major**
	Large	**Moderate**	**Major**	**Major**

The matrix applies universally to all resources/receptors as well as all impacts, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity designations that enter into the matrix. *Box 6.1* provides a context for what the various impact significance ratings signify.

Box 6.1 ***Context of Impact Significances***

An impact of **negligible** significance is one where a resource/receptor will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

It is important to note that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the impact assessment process). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. This avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

6.1.4 Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, the following mitigation hierarchy has been adopted:

- **Avoid at Source; Reduce at Source**: avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
- **Abate on Site**: add something to the design to abate the impact (e.g., pollution control equipment).
- **Abate at Receptor**: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., fencing to prevent animals straying onto the site).
- **Repair or Remedy**: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- **Compensate in Kind; Compensate Through Other Means**: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the

associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

6.1.5 Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the residual impact significance is identified (i.e. a repeat of the impact assessment steps discussed above). In some cases, it may only be possible to reduce the impact to a certain degree such as where an impact could not be completely avoided. All residual significant impacts are described in this report with commentary on why further mitigation is not feasible.

The degree of significance attributed to residual impacts is related to the weight that should be given to them in reaching a decision on the Project:

- Residual impacts of **Major** significance are considered to warrant substantial weight in the Project decision making process. Conditions should be imposed to ensure adverse impacts are strictly controlled and monitored;

- Residual impacts of **Moderate** significance are considered to be of reducing importance to decision-making, however, still warrant careful attention to ensure best available techniques are used to keep adverse impacts to as low as is technically and financially feasible;

- Residual impacts of **Minor** significance should be brought to the attention of the decision-maker but are identified as warranting little if any weight in the decision; and

- Not significant residual impacts are those that, after assessment, are found not to be significant to the decision making about the Project.

6.1.6 Management and Monitoring

The final stage in the impact assessment process is definition of the management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

A summary of all actions which the Project Proponent has committed to are included in an Environmental and Social Management Plan (ESMP) in the ESMP. The ESMP includes mitigation measures, compensatory measures and offsets and management and monitoring activities.

6.1.7 *Cumulative Impact Assessment*

While the impacts of an individual project may be judged to be acceptable, there is also a need to consider the potential for a project's impacts to interact with impacts associated with other developments – "cumulative" impacts. IFC PS 1 (1) defines cumulative impacts as:

"Impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted".

A cumulative impact assessment considers the residual impacts reported for the Project and evaluates these alongside potential impacts from other projects/activities that may affect common resources and receptors. The ultimate goal of this analysis is to capture the total effects of many actions over time that would be missed by evaluating each action individually.

The cumulative impacts assessment will define the geographic and temporal boundaries to identify other relevant projects or activities which could interact with the Project. The cumulative assessment will be the same as the IA process and once the initial impact assessment is performed, mitigation and management measures will be developed for all significant impacts and the residual impact will be calculated for each relevant receptor. The cumulative impact assessment is presented in *Section 6.3.6*.

6.2 *IDENTIFICATION OF IMPACTS*

For the proposed Project, potential impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors.

The results from the scoping process for the Project are presented in the Scoping Matrix in *Table 6.12*. The Scoping Matrix displays Project activities against resources/receptors, and supports a methodological identification of the potential interactions between activities and resources/receptors within the Area of Interest for the Project.

(1) IFC (2012) Performance Standard 1 - Assessment and Management of Environmental and Social Risks and Impacts. http://www.ifc.org/wps/wcm/connect/3be1a68049a78dc8b7e4f7a8c6a8312a/PS1_English_2012.pdf?MOD=AJPERES

Table 6.12 Scoping Matrix for Geophysical Data Acquisition Program of Block AD-10

Resource/ Receptors / Project Activity	Physical				Biological						Socio-Economic			
	Sediment Quality	Seabed Features/ Profile	Marine Water Quality	Air Quality	Marine Mammals	Fish & Pelagic Communities	Planktonic Communities	Benthic Habitats & Communities	Marine Reptiles	Seabirds	Fishing Community/ Fisheries	Shipping (Navigation etc.)	Subsea Infrastructure	Public Health & Safety
2D Seismic Survey														
Marine Traffic (Transit/ Anchoring/ Operations)					■	■		■	■		■	■	■	
Air Emissions				■										
Vessel Operational Discharges to Sea			■		■	■	■		■					■
Airgun Noise					■	■	■		■	■	■			
Waste Generation & Disposal			■											
Unplanned Event														
Accidental Spills/ Leakage	■		■		■	■	■		■	■	■	■		■
Dropped Objects/ Lost Equipment		■						■					■	
Towed Equipment (streamers & airguns)					■				■		■	■		

Key

- Interaction not reasonably expected
- Non-Significant Impact
- Potentially Significant Impact

6.2.1 Key Potential Impacts

The scoping of impacts indicates that the majority of identified potential impacts are not expected to be significant (i.e. those scoped out above). For activities predicted to have no significant impact (i.e. those in white in the Matrix), no detailed quantification or further assessment will be conducted in this IEE Report.

For activities where possible significant effects could occur, these interactions will be assessed in more detail within this IEE Report. Those interactions include:

Environmental Impacts of Planned Activities

- Increases in ambient underwater sound and generation of sound pressure levels from the operation of air guns leading to disturbance of or injury to potentially ecologically sensitive receptors, e.g. marine mammals, marine turtles and fish.

Social Impacts of Planned Activities

- Potential short-term disturbance to deep water fishing activities and potential temporary loss of access to fishing grounds within and nearby Block AD-10.

Unplanned Events

- Potential risk of collisions with fishing vessels and other vessels and entanglement of fishing gear with seismic vessel and equipment.
- Potential risk of entanglement between marine turtles and the hydrophone streamers.
- Potential water contamination and secondary impacts to biodiversity and fishing from accidental spills of chemicals or fuel (e.g. during offshore re-fuelling).

Drawing on the outcomes of scoping, the following *Section 6.3* presents the detailed assessment of the key potential environmental and social impacts associated with the seismic survey.

6.2.2 *Scoped Out Impacts*

A scoping exercise was undertaken as part of preparing the Project Proposal Report [1]. Some of the predicted impacts on receptors from the proposed Project activities were deemed not to be significant and therefore are not considered in the more detailed impact assessment phase. The rationale for scoping out impacts associated with the seismic survey is provided in *Table 6.13*.

Table 6.13 Scoped Out Impacts and Rationale for Seismic Survey

Impact	Rationale for scoping out of Assessment
Environmental	
Impacts from presence of vessels on marine habitats and species (excluding turtles)	The seismic vessel and equipment will be located on or near to the sea surface while the water depth of the proposed survey area is in 2,000 m. As such, there is no potential for impact on marine benthic habitats from the presence of the vessel and equipment. The potential for the vessel to collide with marine fauna (especially mammals) is not expected to be significant given vessel type (hull displacement vessels), small number of vessels (3-5) and slow speeds (4 to 6 knots during survey and 10 to 12 knots en route). Impacts from vessel noise are expected to be temporary and transient and are not expected to be significant. Presence of vessels will represent a small and insignificant incremental increase in vessel traffic and the survey will be temporary; lasting for around 45 days.
Impacts from exhaust emissions on ambient air quality	Fuel combustion to power engines and electrical generators on-board vessels are the main sources of air emissions. These emissions may affect air quality in the area. However, as the exhaust emissions from the seismic vessel will be temporary and small in volume, significant impacts to air quality are not considered likely. In addition, as the vessels will be in compliance with MARPOL 73/78 Regulations for the prevention of air pollution from ships (Annex VI), no significant impacts on ambient air quality are anticipated.

(1) 2D Seismic Survey in Block AD-10, Offshore Myanmar. Project Proposal Report. Submitted to MOECAF on 3rd October 2014.

Impact	Rationale for scoping out of Assessment
Environmental	
Physical impacts from towed airguns on marine habitats and species	Airguns will be towed behind the seismic vessel at a water depth of 8 m. Given that airgun arrays will be towed at slow speeds (4 to 6 knots) and relatively close to the vessel (typically 100-200 m from the vessel), no significant risk of collision with, or entrapment of, marine mammals and marine turtles are expected. It is not expected that the towed airgun will be in contact with the seabed habitat given the water depths in which the vessel will operate (> 2,000 m).
Impacts from vessel discharges on marine habitats	Sensitive marine habitats are found in shallow waters, generally less than 20 m water depth. As the survey will not be undertaken in these areas, the potential for vessel discharges to impact these habitats is considered to be extremely low. In addition, waste discharges to the marine environment from vessels will comply with MARPOL 73/78 Regulations hence impacts are reduced to as low as reasonably practicable and no significant impacts are expected to occur.
Impacts from the introduction of invasive species	Project vessels can inadvertently introduce invasive alien species by ballast water or as fouling organisms on the vessels hull. However, the vessel used on this Project is unlikely to exchange ballast water during the survey. Therefore no significant impacts are expected.
Impacts from dropped objects on marine habitats	Accidental incidents involving objects dropped over board from vessels during the survey have the potential to disturb the seabed. However, given operations will be undertaken in accordance with approved plans and procedures such events are unlikely to occur and considered to be insignificant. In addition, the marine benthic habitats within the Block are considered to be of low sensitivity and would most likely consist of sandy or muddy seabed sediment.
Impacts from underwater sound on marine invertebrates and corals	Impacts from underwater sound are not anticipated on marine invertebrate species or coral reefs given that coral habitats are located over 150 km from the Project. Although without sensory organs to perceive sound pressure, some invertebrates can detect the particle motion component of sound via mechanoreceptors and hairs and in this way can detect seismic sound source at close ranges (within 20 meters). However, as these invertebrates are associated with the seabed and as the survey is being conducted in water depth in excess of 2,000 m there is very limited potential for invertebrates to detect and have a response to the airgun which will be deployed near the sea surface.
Impacts from underwater sound on sea snakes (reptiles)	There is little research on the effects of underwater sound on sea snakes. However, sea snakes rely on vision and olfaction and do not have good hearing abilities in comparison to those of other reptiles. It is not known whether there are any sea snakes within the Area of Interest. If sea snakes are present, it could be expected that they would be located in shallower waters and are hence unlikely to be present in Block AD-10. As such, there is unlikely to be any adverse impact on sea snakes from the proposed Project.

Impact	Rationale for scoping out of Assessment
Environmental	
Impact of underwater sound on dugongs and coral reef fish species	While dugongs have a small potential to be present in nearshore waters (outside the Block), it can be anticipated that the airgun sound will not be as significant as lower frequency cetaceans to these species given their high frequency hearing range (1 to 18 kHz). In addition, the closest dugong habitat is located over 150 km from Block AD-10. As such, no impacts on dugong in the Area of Interest are anticipated. The coral reef fish species identified to be present in the Area of Interest (such as groupers and snappers) are not considered as sensitive to underwater sound. Reef species are range restricted as they spend the majority of the life associated with coral habitats and use these habitats as both feeding and spawning grounds. However in the Area of Interest, coral habitats are located over 150 km away and impacts are thus not anticipated.
Social	
Impacts on oil and gas activity and shipping vessels from routine activity	There is little overlap between the exploration survey activity and other oil and gas developers or shipping vessels. There is a moderately used shipping lane across the Block however, this lane covers a wide area and as the survey only has the potential to exclude shipping from the mobile navigational safety zone around the vessel and equipment, the area of potential interaction in localised. In addition, the survey will be conducted parallel to the shipping lane so will not intersect it limiting the potential for interaction. Therefore the routine activity of the Project is not expected to significantly affect these receptors and potential impacts have been scoped out.
Impacts on local artisanal fishing activities	During consultations in June 2015 in Thandwe and Gwa, stakeholders were consulted on the area in which they fish. All stakeholders consulted suggested that local artisanal fishing is conducted out to a maximum water depth of 100 m and usually out to a maximum of around 20 miles (32 km) from the coast but can be out to 50 miles (92 km) from the coast. As such, there are unlikely to be any local fishing vessels in or nearby Block AD-10 and no impacts are anticipated. Potential impacts to deep water fishing activities which may present within the Block are further assessed in the IEE.

6.3 *DETERMINATION OF IMPACT SIGNIFICANCE, MITIGATION MEASURES AND RESIDUAL IMPACT SIGNIFICANCE*

6.3.1 *Impacts from Underwater Sound Generation on Marine Fauna*

Source of Impact

The seismic survey will use individual airguns; with a total gun array volume of approximately 4,000 cubic inches to generate underwater sound pulses. The airguns will be towed behind the seismic vessel at a fixed water depth of around 8 m and will be firing at intervals of 10 seconds with a shot point interval of 25 m. Sound exposure levels will be in the order of up to 263 dB re 1 μPa at 1 m for the array.

The underwater sound pulses generated by airguns will be of high amplitude and low frequency within the range of >0 to 300 Hz. Where these frequencies overlap with the auditory frequency range of marine fauna that are expected to occur in the vicinity of the Block AD-10, it can be anticipated airgun sound is likely to be audible to these species (*Table 6.14*). Actual audibility by marine species will primarily be influenced by the distance from the airguns (and level of transmission loss over this distance) and the specific hearing thresholds of marine fauna, but is also influenced by other factors such as background (ambient) sound levels (e.g. waves, rain, and shipping).

Table 6.14 Hearing Ranges of Marine Faunal Groups Potentially Present within or in the vicinity of Block AD-10

Group	Indicative Auditory Frequency Range
Toothed whales and dolphins (e.g. false killer whale)	15 Hz – 180 kHz(1)
Baleen whales (e.g. Bryde's whale)	7 Hz – 22 kHz(2)(3)
Dugongs	1 – 18 kHz(4)
Turtles	100 – 700 Hz(5)(6)
Whale shark	<1 kHz(7)
Fish	20 Hz – 1kHz(8)(9)

Underwater sound travels as a pressure wave and the pulsed sounds emitted from airguns are characterized by a rapid rise from ambient pressure to maximal pressure followed by a decay period. These are characteristics that mean underwater sound, at very high levels, can increase potential for injury to the sensitive auditory organs of marine fauna (10) or, at lower levels cause disturbance and a change in behaviour. Due to transmission loss as sound travels, the sound energy will decrease with distance from the sound source. Depending on received sound levels and the sensitivity of the specific marine fauna, exposure to underwater sound has the potential to affect receptors in four main ways:

(1) Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33:411-521

(2) Southall et al. 2007. Op. cit.

(3) NOAA 2013. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals: Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. Draft: 23 December 2013

(4) Anderson PK & Barclay RMR 1995. Acoustic signals of solitary dugongs: physical characteristics and behavioural correlates. Journal of Mammalogy 76(4):1226-1237.

(5) McCauley, RD, Fewtrell, J, Duncan, AJ, Jenner, C, Jenner, M-N, Penrose, JD, Prince, RIT, Adhitya, A, Murdoch, J & McCabe, K 2000, Marine Seismic Surveys – A Study of Environmental Implications, APPEA Journal, vol. 40, pp. 692-707.

(6) Bartol, SM & Musick, JA 2003, Sensory Biology of Sea Turtles in The biology of Sea Turtles, eds PL Lutz, JA Musick & J Wyneken, CRC Press, Boca Raton, Florida, USA, vol. 2, pp. 79-102.

(7) Myberg AA 2001. The acoustical biology of elasmobranchs, Environmental Biology of Fishes 30:31-45.

(8) Popper AN, Fay RR, Platt C and Sand O 2003. Sound detection mechanisms and capabilities of teleost fishes. In: Sensory Processing in Aquatic Environments eds. SP Colin and NJ Marshal, Springer-Verlag, New York, USA. pp. 3-38.

(9) Hastings MC, Popper AN, Finneran JJ and Lanford PJ 1996. Effects of low-frequency underwater sound in hair cells of the inner ear and lateral line of the teleost fish Asronotus ocellatus. Journal of the Acoustical Society of America 99:1759-1766.

(10) Southall et al. 2007. Op. cit.

- **Physical Injury**. Direct physical injury of the fauna due to rupture or damage of body tissue, which may lead to mortality in extreme cases.

- **Auditory Injury**. Permanent injury to hearing organs (known as a Permanent Threshold Shift (PTS)).

- **Physiological and Behavioural Changes**. Physiological changes include temporary auditory fatigue (known as Temporary Threshold Shift (TTS). Temporary behavioural changes include changes in swimming behaviour or direction of fauna.

- **Masking or interfering with other biologically important sounds** (including vocal communication), echolocation signals and sounds produced by predators or prey). The effects of the above in relation to different key receptors are discussed below.

Marine Mammals

Marine mammals can be adversely impacted by sound generated from seismic surveys if it affects their ability to echolocate, communicate or causes physical harm (through disorientation, and in extreme cases, trauma to the auditory apparatus). For marine mammals, there have been no confirmed cases where exposure to seismic airgun sound has directly caused mortality or serious physical injuries (1). There is inconclusive evidence whether injuries recorded in stranded marine mammal species are from direct exposure to underwater sound (1). There is evidence, however, that exposure to underwater sound may cause certain cetacean species to exhibit behavioural changes such as avoidance or displacement and in some cases causes a change in vocalisations, diving and foraging activities, and migratory pathways (2). Whether such behavioural changes results in an affect that could be considered as an adverse impact is, however, difficult to define unless, for example, such a change clearly results in a marine mammal not having access to an area of importance (i.e. critical habitat) during an important period.

Exposure to high levels of sound (whether from a seismic survey or other sources) may lead to temporary or permanent hearing impairment TTS or PTS. TTS occurs where the animals' hearing threshold rises temporarily and a sound must be louder to be heard. TTS can last for a few minutes to a few days before full recovery is achieved. This is generally referred to as auditory fatigue rather than auditory injury and is likely to cause a temporary change in the animals' behaviour as opposed to any physical change. PTS occurs when the animal suffers physical damage to its hearing leading to total or partial deafness or an impaired ability to hear sounds within specific

(1) Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33:411-521.

(2) Weilgart, L.,2013. "A review of the impacts of seismic airgun surveys on marine life." Submitted to the CBD Expert Workshop on Underwater Noise and its Impacts on Marine and Coastal Biodiversity, 25-27 February 2014, London, UK.

frequency ranges [1]. Southall et al. (2007) [1] published recommended cetacean physical injury threshold levels for Sound Exposure Levels (SELs) from multiple pulse sources such as noise generated from seismic operations. The cetacean physical injury threshold which may result in PTS was determined to be 198 dB re 1 $\mu Pa^2.s$ for cetaceans that hear at mid and low frequencies and 179 dB re 1 $\mu Pa^2.s$ for cetaceans that hear at high frequencies. The majority of cetaceans in the Area of Interest in Block AD-10 are mid or low hearing frequency cetaceans.

Increases in ambient underwater sound can also cause behavioural changes in marine mammals such as changes in their surfacing and diving behaviour in the presence of seismic sound [2]. For example, the movements of sperm whales in the Gulf of Mexico were recorded before, during and after seismic exposures where it was observed that individuals swimming speed and foraging behaviour appeared reduced. Other changes observed in marine mammals in response to increases in ambient underwater sound included a decrease in the frequency of dives as well as changes in diving depths [3], an increase in the amount of time spent at the surface [4] and increased swimming rate [1]. In terms of avoidance behaviour, toothed whales in offshore waters appear to demonstrate less avoidance of operating seismic survey vessels than baleen whales. They are occasionally seen within a few hundred metres of an operating airgun array and common dolphins seem to be tolerant of the sound from an array at distances greater than 1 km [5]. However, when dolphins are exposed to strong airgun sound from a nearby vessel they sometimes exhibit avoidance or behavioural changes.

Vocalisation changes have been recorded in cetacean species where it may represent attempts to overcome 'masking' effects and compensating for the additional sound in the environment [6]. These changes have been observed in response to sound generation from anthropogenic activities such as shipping, sonar use, and seismic activities.

Of the marine mammal species potentially present in the Area of interest, blue whales (*Balaenoptera musculus*) have been observed to call more frequently when seismic surveys were being conducted [3], humpback whales (*Megaptera*

(1) Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33:411-521.

(2) Weilgart, L.,2013. "A review of the impacts of seismic airgun surveys on marine life." Submitted to the CBD Expert Workshop on Underwater Noise and its Impacts on Marine and Coastal Biodiversity, 25-27 February 2014, London, UK.

(3) Richardson, W.J., Malme, C.I., Green, C.R., Jr., and Thomson, D.H. 1995. Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp.

(4) Stone, C.J., and Tasker, M.L. 2006. The effect of seismic airguns on cetaceans in UK waters. J. Cetacean Res. Manag. 8: 255–263.

(5) Goold (1996) Acoustic assessment of populations of common dolphin *Delphinus delphis* in conjunction with seismic surveying. Journal of the Marine Biological Association UK 76: 811-820

(6) Di Iorio, L. and Clark, C.W. 2010. Exposure to seismic survey alters blue whale acoustic communication. Biol. Lett. 6 (1): 51-54. doi:10.1098/rsbl.2009.0651

novaeangliae) changed their singing behaviour [1], and both pilot whales (*Globicephala melas*) and bottlenose dolphins (*Tursiops truncatus*) produced more whistles. Some species such as sperm whales (*Physeter macrocephalus*) and humpback whales have also shown to decrease or cease calls in response to sound exposure from seismic surveys, and fin whales (*Balaenopterid physalus*) in response to ship sounds [2]. Vocalisations are considered to be used by marine mammals for communication in feeding, mating, threat avoidance, and socialising and impacts to these vocalisations can therefore affect marine mammals.

Turtles

Marine turtles are considered less susceptible than marine mammals to increases in ambient underwater sound as turtles do not have an external hearing organ and can only direct sound through vibrations in their skull and the shell [3]. Marine turtle species that have been recorded in the vicinity of the Block, i.e. green turtles and hawksbill turtles, have been shown to respond to sound higher than 166 dB re 1 µPa (rms) and when levels were higher than 175 dB re 1 µPa (rms) demonstrated "erratic behaviour" or "agitation" [4]. However, turtles hear at lower frequencies, with peak hearing range of marine turtles from around 100 to 700 Hz [5] and as such could be more sensitive to the low frequency sounds generated by seismic surveys (typically from 10 to 300 Hz).

Limited information is available on the effects of increased underwater sound on turtles however it is possible that impacts are likely to be similar to other marine fauna including temporary or permanent hearing damage and behavioural changes [1]. Studies on turtles in relation to 3D seismic surveys have shown that turtles could exhibit responses (suggesting they are aware of the sound) out to 2 km from the sound source and avoidance behaviour (moving away from the sound) out to 1 km from the sound source [6]. As with marine mammals, turtles have also been observed to alter their diving behaviour in response to underwater sound. For example, some loggerhead turtles (*Caretta caretta*) in the Mediterranean Sea were observed to dive following an airgun shot [6]. Loggerhead turtles are thought to be present in the Area of Interest and could be found within Block AD-10.

(1) Miller, G.W., J.D. Moulton, R.A. Davis, M. Holst, P. Millman, A. MacGillvray, and D. Hannay. 2005. Monitoring seismic effects on marine mammals – southeastern Beaufort Sea, 2001-2002, pp. 511-542. In: S.L. Armsworthy, P.J. Cranford, and K. Lee (eds.), Offshore oil and gas environmental effects monitoring/Approaches and technologies. Battelle Press, Columbus, OH.

(2) International Whaling Commission (IWC). 2007. Report of the scientific committee. Annex K. Report of the Standing Working Group on environmental concerns. J. Cetacean Res. Manag. 9 (Suppl.): 227–296.

(3) Lenhardt, M.L., Bellmund, S., Byles, R.A., Harkins, S.W. and Musick, J.A. 1983. Marine Turtle reception of bone conducted sound. Journal of Auditory Research 23: 119–1125.

(4) McCauley R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch and K. McCabe, 2000. Marine seismic surveys – A study of environmental implications. APPEA J 40: 692–706.

(5) Bartol, SM & Musick, JA 2003, Sensory Biology of Sea Turtles in The biology of Sea Turtles, eds PL Lutz, JA Musick & J Wyneken, CRC Press, Boca Raton, Florida, USA, vol. 2, pp. 79-102.

(6) DeRuiter, SL and Doukara, KL., 2012. Loggerhead turtles dive in response to airgun sound exposure. Endang Species Res. Vol. 16: 55–63, 2012.

Fish

There is a lack of understanding about the effect of increases in underwater sound on fish species. Researches into underwater sound and the associated responses from fish species are currently based on a limited number of species (1). However, fish are generally considered to have good low frequency hearing. As stated in *Table 6.14*, fish hearing ranges are between 20 Hz – 1 kHz. The frequency of the sound produced by seismic surveys is within this range.

Behavioural changes in relation to exposure to sound have been observed in fish species with alarm responses (such as noticeable changes in fish swimming behaviour) recorded from 1 to 5 km from the seismic sound source, depending on the species threshold and the sound transmission loss. Although there are no conclusive studies on fish behavioural changes in relation to increases in ambient underwater sound, numerous studies have reported no significant effects. This is important as it indicates that in many situations fish are not significantly affected by increased levels of underwater sound. However, there are a number of studies which have shown that fish will move away from the area around the sound source following exposure to the sound. This avoidance area can in some instances be up to 2 km (2). It should be noted that any behavioural changes to fish have been observed to be short-lived (within a few minutes to hours) and fish tend to very quickly exhibit normal behaviour after an initial startle or avoidance response (3). Behavioural responses may not be an adverse impact but generally represent a minor change to the fish's behaviour such as changes swimming direction or speed.

The potential for physical injury of fish in relation to underwater sound is greater in species which have swim bladders - sacs inside fish filled with air which can be affected by sound pressure waves. However, this type of physical injury is only likely in very close proximity (i.e. a few metres) to the sound source and therefore, is highly unlikely to occur in adult fish as they can avoid the sound source (4) before it gets to high levels. Eggs and larvae in very close proximity to the sound source could be physically injured as they are present near the sea surface and unable to avoid the sound. However, the number of eggs and larvae likely to be impacted by close exposure to

(1) Popper, A. N., and M. C. Hastings, 2009. "The effects of anthropogenic sources of sound on fishes." Journal of Fish Biology 75.3: 455-489.

(2) Turnpenny, A. W. H. and Nedwell, J. R. 1994. The effects on marine fish, diving mammals and birds of underwater sound generated by seismic surveys. Consultancy Report FCR 089/94, Fawley Aquatic Research Laboratories Ltd., 40pp.

(3) Wardle, C. S., Carter, T. J., Urquhart, G. G., Johnstone, A. D. F., Ziolkowski, A. M., Hampson, G. & Mackie, D. (2001). Effects of seismic air guns on marine fish. Continental Shelf Research 21, 1005–1027.

(4) Gausland (2000). Impact of seismic surveys on marine life. The Leading Edge. August 2000, 903-905.

sound from a seismic survey will be negligible when compared to the vast number of fish eggs and larvae that occur throughout the water column (1).

Pelagic fish species are those which inhabit open water areas and generally live in the water column of the ocean (i.e., not associated with the seabed like demersal or benthic species). Some pelagic fish identified in the Area of Interest, such as Clupeids (e.g. herring and anchovy), are considered to be hearing specialists in that they have evolved specialised anatomical structures which enhance hearing sensitivity and range.

Existing/ In Place Controls

Measures to control and minimise any adverse impacts from underwater sound generation during the proposed survey activities will include:

- Implement Joint Nature Conservation Committee (JNCC) Guidelines (2) including alignment of Contractor operating procedures with JNCC Guidelines. The JNCC guidelines reflect best international practice for seismic operators to follow during the planning, operational and reporting stages.

- Optimum airgun configurations to ensure that the lowest possible sound level of airguns is selected for the required activity.

- In alignment with JNCC guidelines, a soft-start procedure will be utilised at the commencement of the seismic survey. The seismic sound will slowly build up to allow adequate time for marine fauna to leave the area.

- In alignment with JNCC guidelines, dedicated Marine Mammal Observers will be on-board the seismic vessel and will undertake pre-shooting search. Should any marine mammals/marine turtles be observed within 500 m of the seismic vessel during the pre-shoot search and soft-start procedures, the airguns will be powered down until the animals have moved beyond 500 m.

- In line with guideline, Passive Acoustic Monitoring (PAM) will be used to detect whether any marine mammals are in the vicinity of the seismic vessel during night time or low visibility operations.

Significance of Impact

It is important to consider that the source vessel will be constantly moving, therefore at any given location, marine fauna will only be exposed to elevated underwater noise levels associated with the survey for a short period of time. Furthermore, the use of soft start procedures will ensure that fish, marine mammals and marine turtles near the airgun array prior to firing will not be

(1) Popper, A. N., and M. C. Hastings, 2009. "The effects of anthropogenic sources of sound on fishes." Journal of Fish Biology 75.3: 455-489.

(2) The JNCC "Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys, 2010"

exposed to full power and instead will be given the chance to move away. Therefore, it is unlikely that any fauna will be exposed to the intense sounds long enough to cause injury. The risk of injury or significant behavioural changes to fauna as a result of the survey is considered to be low. Further information on the significance of the impact from underwater sound is presented below.

Marine Mammals

As stated in the literature above, toothed whales are seen within a few hundred metres of an operating airgun array and common dolphins seem to be tolerant of the sound from an array at distances greater than 1 km. As such, it is anticipated that injury distances would be only within a few hundred metres of the sound source at most and with the soft-start procedure and use of the marine mammal observers, there is unlikely to be any injury to mammals from the proposed activity.

The majority of published literature on this issue indicates that behavioural change in marine mammals is not experienced at very large (i.e. beyond 10km) distances from seismic surveys. It is important to recognise that behavioural change (for example a change to swimming patterns) is not an injury and any behavioural changes will be temporary i.e., until the species is far enough away from the sound source to not be impacted and until the seismic operation has moved away from an area. Marine mammals are highly mobile and are likely to avoid the area of increased sound around the vessel. The mitigation measures mentioned above will help reducing the potential impact on any marine mammals in the vicinity of the seismic vessel during start-up and will provide more time for marine mammals to vacate the area around the sound source in which potential impacts could occur. As the seismic vessel will also be moving, the temporal extent of the impact will be small on a particular area (a number of hours maximum) and the resultant magnitude of the impact is considered to be small.

Marine mammals are highly sensitive receptors as some of the species present in Rakhine waters are considered international and national species of conservation concern. It is anticipated that with all the existing control measures in place the impact will be of **Moderate** significance for marine mammals.

Turtles

Although marine turtles are considered less sensitive to increases in underwater sound than marine mammals, they are also typically less capable of quickly moving away. Marine turtles also show strong fidelity to specific nesting beaches and associated migratory corridors and it is therefore considered they can be susceptible to impacts which could alter these migrations. However, Block AD-10 is 150 km from the nearest nesting beaches on Manaung Island and is thus not likely to impact these nesting beaches directly. There is a potential for migratory routes of turtles to these

nesting beaches to be impacted by underwater sound generation by the Project. In addition, turtle nesting activity in Rakhine waters occurs from September to March with peak nesting in December and January therefore turtles could be present in Block AD-10 during the survey period, migrating to nesting beaches. However, during stakeholder consultations, it was stated that the numbers of turtles using the beaches of Rakhine is relatively small.

The likely impacts on behaviour of marine turtles are estimated by using the qualitative guidance in Popper *et al* (2014). Typically turtles are expected to experience behavioural effects of "high" level in the near zone. In this context "near" might be considered to be tens of metres from the source. Behavioural effects are predicted to be "moderate" at "intermediate" distances which might be hundreds of metres away. At "far" distances (which could be thousands of metres from the source) a "low" effect is predicted. However, soft start is likely to ensure that no turtles are within either near or intermediate distances from the sound source during the maximum sound exposure levels generated during the survey. As such, behavioural impacts due to sound are likely to be limited to "low". It is also important to note that any behavioural changes will be very temporary and once the survey has passed through an area (within a few hours) sound will have reduced to a level at which turtles are unaffected and return to normal behaviours. Marine turtles are considered to be highly sensitive receptors as all the species present in Rakhine waters are listed as species of conservational concern on the IUCN Red List. As such, given that the impact to behaviour is temporary (hours) and the vessel is mobile and will not impact one area for a large amount of time, the resultant impact will be of **Moderate** significance for marine turtles.

Fish

The potential for physical injury of fish in relation to underwater sound is greater in species which have swim bladders - sacs inside fish filled with air which can be affected by sound pressure waves. However, this type of physical injury is only likely in very close proximity (i.e. a few metres) to the sound source and is thus highly unlikely to occur in adult fish as they can avoid the sound source (1) before it gets to high levels. Eggs and larvae in very close proximity to the sound source could be physically injured as they are present near the sea surface and unable to avoid the sound. However, the number of eggs and larvae likely to be impacted by close exposure to sound from a seismic survey will be negligible when compared to the vast number of fish eggs and larvae that occur throughout the water column (2).

The threshold distance for changes to fish behaviour was not quantitatively assessed as adequate criteria for fish are not available. However, the behavioural reactions of fish are expected to be "Low" when the fish is in the

(1) Gausland (2000). Impact of seismic surveys on marine life. The Leading Edge. August 2000, 903-905.

(2) Popper, A. N., and M. C. Hastings, 2009. "The effects of anthropogenic sources of sound on fishes." Journal of Fish Biology 75.3: 455-489.

range of thousands of metres from the sound source. The qualitative use of "near", "immediate" and "far" field from Popper *et al.* (1) is consistent with other studies that observed behavioural effects out to 2 km (2). It should be noted that any behavioural changes to fish have been observed to be short-lived (within a few minutes to hours) and fish tend to very quickly exhibit normal behaviour after an initial startle or avoidance response (3). In addition, behavioural responses may not be an adverse impact but generally represent a minor change to the fish's behaviour such as changes in swimming direction or speed.

Fish are considered to be of medium sensitivity. Although one of the species identified as potentially present in the Area of Interest is listed as species of conservational concern on the IUCN Red List, this species is not considered to be highly sensitive to underwater sound. The majority of fish species in the Area of Interest are not species of conservational concern. As such, the resultant impact significance will be **Minor**.

Additional Mitigation, Management and Monitoring

The control measures adopted by the Project are considered international best practice for reducing the impact of underwater sound from seismic surveys on marine fauna (fish, marine mammals and turtles).

All information collected on marine fauna sightings will be reported to MOECAF as an additional enhancement measure, although this does not affect the overall impact significance rating.

Significance of Residual Impacts

Although the impact is of **Moderate** significance for marine turtles and marine mammals, it is highly unlikely that there will be any significant or permanent impact on them. The **Moderate** significance is due to the fact that many species of international conservation concern are present in the waters of the Rakhine State and as numbers of these species present is not known, turtles and mammals have been considered as highly sensitive receptors as a precaution. In reality, the actual impact from sound generation on marine turtles and marine mammals will be minor behavioural changes and the more permanent injury related impacts are, in practice, not considered to be likely / significant with the control and mitigation measures in place. It is therefore concluded that all residual impacts have been mitigated to as low as reasonably practicable and will not result in significant impacts to marine mammal or turtle species.

(1) Popper, A. N., and M. C. Hastings, 2009. "The effects of anthropogenic sources of sound on fishes." Journal of Fish Biology 75.3: 455-489.

(2) Turnpenny, A. W. H. and Nedwell, J. R. 1994. The effects on marine fish, diving mammals and birds of underwater sound generated by seismic surveys. Consultancy Report FCR 089/94, Fawley Aquatic Research Laboratories Ltd., 40pp.

(3) Wardle, C. S., Carter, T. J., Urquhart, G. G., Johnstone, A. D. F., Ziolkowski, A. M., Hampson, G. & Mackie, D. (2001). Effects of seismic air guns on marine fish. Continental Shelf Research 21, 1005–1027.

As such, the residual impact from increases in ambient underwater sound is considered to be mitigated to as low as reasonably practicable and will be of **Moderate** significance on all marine mammals and turtles (*Table 6.15*). The residual impact on fish will be of **Minor** significance (*Table 6.16*).

Table 6.15 Assessment of Impacts from Increases in Ambient Underwater Sound on Marine Mammals and Turtles

Impact	Increase in underwater sound leading to behavioural changes or physical impact on marine mammals				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Localised potential injury or behavioural changes to a small number of individuals.				
Frequency	Frequent.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		**Moderate**	Major

Table 6.16 Assessment of Impacts from Increases in Ambient Underwater Sound on Fish

Impact	Increase in underwater sound leading to behavioural changes or physical impact on fish				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Localised potential injury or behavioural changes to a small number of individuals.				
Frequency	Frequent.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	**Minor**		Moderate	Major

6.3.2 Impacts from Unplanned Entanglement of Marine Turtles with Towed Equipment

Source of Impact

The seismic survey will use towed streamers which have tail buoys attached to the end. The potential for marine mammals to become entangled or trapped in seismic equipment is remote. There is the potential risk of collision with or entrapment of marine turtles. Turtles are smaller than marine mammals and less mobile and could potentially become entangled in the towed seismic equipment, specifically the tail buoys. The standard tail buoys used by seismic surveys are shown in *Figure 4.4*. The tail buoy is connected to the far end of each streamer and warns other marine users of the presence of the streamer.

Turtles also need to approach the water surface in order to breathe which increases the potential for entrapment. Turtles becoming fatally trapped in seismic equipment has been reported off of West Africa in 2007 (1).

Existing/ In Place Controls

Measures to control/ minimise adverse impacts from towed equipment will include:

- The Project will install turtle guards on tail buoys in order to reduce the risk of trapping turtles in the seismic equipment. Turtle guards are simply additional structures on the underside of the tail buoy which are designed to prevent turtles from entering gaps in the tail buoy which can potentially lead to drowning.

- Implement JNCC Guidelines (2) including the preparation of specific protocols for the management of marine mammal and turtle interactions in contractors' management plans.

- In alignment with JNCC guidelines, a soft-start procedure will be utilised at the commencement of the seismic survey. The seismic sound will slowly build up to allow time for marine turtles to leave the area.

Significance of Impact

The above measures will help reduce the potential that any marine turtles are present in the vicinity of the seismic vessel which in turn reduces the potential for turtles to collide with seismic survey equipment. The presence of turtle species in offshore waters is not known, however, 25 turtles were observed during a survey conducted in Block AD-03 (located to the east of Block AD-10) from March to June, 2015 which suggests that there may be turtles present in Block AD-10. Turtles are also likely to avoid the area of increased sound around the vessel which could limit the potential for interactions between equipment and turtles. Turtles will be migrating to and from nesting beaches on Manaung Island and the mainland coast of Rakhine between September and March, earlier than the survey is likely to be in progress. It is recorded that hawksbill, green and olive ridley turtles are thought to nest in Rakhine beaches. Although no information is known on the numbers of turtles that nest annually in this area, anecdotal evidence from local fishermen and villagers suggests that they do not see them in large numbers. This may suggest that the Rakhine coast is not an area which contains significant numbers of nesting turtles and any potential entanglement is unlikely to have a significant impact on these species at the population level. In addition, the likelihood of the impact occurring is rare as any potential interaction is likely to be infrequent, will only potentially affect a very small number of

(1) Weir, C.R. (2007). Observations of marine turtles in relation to seismic airgun sound off Angola. Marine Turtle Newsletter, 116: 17-20.

(2) The JNCC "Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys, 2010"

individuals and will not therefore have an impact on the population level as a whole. As such the impact magnitude is considered to be small. Turtles are a highly sensitive receptor and the impact will thus be of **Moderate** significance.

Additional Mitigation, Management and Monitoring

The assessment has indicated that the impacts associated with entrapment of marine turtles are considered to be of **Moderate** significance**.** However, with the control measures already in place and the fact that turtle entanglement is not likely, the impact to turtles from entanglement with towed equipment is considered to be acceptable and no additional mitigation or monitoring activities are considered necessary.

All information collected on marine turtle sightings will be reported to MOECAF as an additional enhancement measure, although this does not affect the overall impact significance rating.

Significance of Residual Impacts

The residual impact on turtles from towed equipment is deemed to be of **Moderate** significance (*Table 6.17*).

Table 6.17 Assessment of Impact of Entrapment of Marine Turtles by Hydrophone streamers

Impact	Marine Turtle entrapment in towed equipment				
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Localised potential injury or mortality to a small number of individuals.				
Frequency	Infrequent.				
Likelihood	Unlikely.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	**Moderate**	Major	

6.3.3 Impacts from Unplanned Hydrocarbon Spills to Marine Fauna and Habitats

Source of Impact

There is the potential for an unplanned spill of fuel from the vessels (e.g. during refuelling) which could lead to water contamination and secondary impacts to biodiversity. Scenarios in which spills could arise vary from small scale spills (around 10m^3), such as a spill during refuelling due to a hose break, to larger scale spills such as those from vessel collisions and rupture of the vessels fuel tank (2,000 m^3 or around half of the fuel carried by the seismic vessel). Smaller spills are more common but have a smaller magnitude of impact than larger spills. Larger spills are extremely rare. The seismic and

other vessels are likely to use fuel which is non-persistent or "light" fuel (such as Marine Gas Oil (MGO) and Marine Diesel Oil (MDO)). These fuel spills, in the unlikely event of occurrence, would evaporate quickly in the open waters environment (such as that found in Block AD-10) and would be rapidly diluted and dispersed by ocean currents.

Potential impacts from unplanned spills to marine mammals, marine turtles, fishes and seabirds which may be found within the offshore spill area are discussed below.

Marine Mammals

Marine mammals are highly mobile and a number of field and experimental observations indicate whales and dolphins may be able to detect and avoid surface slicks. However, in this instance, the only likely spill would be from the vessel diesel fuel which is unlikely to cause a surface slick as it is not oil. Marine mammals that have direct physical contact with surface slicks may suffer surface fouling or ingestion of hydrocarbons and inhalation of toxic vapours. This may result in the irritation of sensitive membranes such as the eyes, mouth, digestive and respiratory tracts and organs, impairment of the immune system or neurological damage (1) (2). If prey (fish and plankton) is also contaminated, this can result in the absorption of toxic components of the hydrocarbons, though 'gulp-feeders' such as dolphins targeting prey at depth in the water column are likely to be less susceptible.

Seabirds

Offshore Myanmar waters are potential foraging grounds for seabirds which are vulnerable when coming into contact with surface slicks during feeding or resting on the sea surface. Physical contact of seabirds with surface slicks may result in fouling of feathers and hypothermia (loss of thermoregulation), decreased buoyancy and potential to drown, inability to fly or feed, anaemia, pneumonia and irritation of eyes, skin, nasal cavities and mouths (3) (4). This may also lead to mortality due to oiling of feathers or the ingestion of hydrocarbons.

Marine Turtles

Adult marine turtles exhibit no avoidance behaviour when they encounter an oil slick (5). Contact with surface slicks can therefore result in hydrocarbon

(1) Etkins, D.S. (1997) The impacts of oil spills on marine mammals. OSIR Report – Special Report. OSIR.

(2) IPIECA (International Petroleum Industry Conservation Association) (1995). Biological Impacts of Oil Pollution: Rocky Shores, International Petroleum Industry Environmental Conservation Association, No. 7.

(3) AMSA (Australian Maritime Safety Authority) (2012) The effects of maritime oil spills on wildlife including non-avian marine life. http://www.amsa.gov.au/marine_environment_protection/national_plan/general_information/oiled_wildlife/oil_spill_effects_on_wil

(4) IPIECA (International Petroleum Industry Conservation Association) (1995) *Op. cit.*

(5) Odell, DK. and MacMurray, C. (1986) Behavioural Response to Oil. Final Report: Study on the Effect of Oil on Marine Turtles. S. Vargo, Lutz, PL., Odell, DK., VanFleet, T. and Bossart, G., Mineral Management Services Contract.

adherence to body surfaces (1) causing irritation of mucous membranes in the nose, throat and eyes leading to inflammation and infection (2). Oiling can also irritate and injure skin which is most evident on pliable areas such as the neck and flippers (3).

Fish

Fish mortalities are rarely observed to occur as a result of oil spills, especially in open water environments (4). This is often attributed to pelagic fish being able to detect and avoid surface waters underneath oil spills by swimming into deeper water or away from the affected areas.

Existing/ In Place Controls

Measures to control/ minimise adverse impacts from unplanned spills will include:

- Vessel standard operating procedures will be prepared and a refuelling plan will be prepared and implemented; and
- Contingency plans will be prepared and implemented, e.g. vessel Shipboard Oil Pollution Emergency Plans (SOPEPs).

Significance of Impact

The above measures will help reducing the likelihood that a spill would occur. Even if spill of fuel does occur, the extent of the impact is expected to be localised given that the spilled diesel fuel will be evaporated and diluted quickly in the offshore environment of Block AD-10.

Small spills in the offshore and nearshore are unlikely to have any significant effects on the marine environment and will be readily diluted and dispersed. Large spills in the offshore environment are also unlikely to have any significant effects. Given the distance offshore of the Block (over 150km from the mainland) as well as the small volume and high dispersible nature of the fuel, the sensitive habitats along the mainland Rakhine coast are unlikely to be affected by the spills. These spills would generally only affect water quality and animals in close proximity which may occur at the offshore open water habitats of Block AD-10. In addition, large marine fauna (fish, turtles and mammals) may also exhibit avoidance behaviour and move away from the spill-affected area.

(1) Gagnon, MM. and Rawson CA. (2010) Montara Well Release: Report on necropsies from a Timor Sea green sea turtle. Perth, Western Australia, Curtin University: 15.

(2) Etkins, D.S. (1997) *Op. cit.*

(3) Lutcavage, ME., Lutz, PL., Bossart, GD., and Hudson, DM. (1995) Physiologic and clinicopathological effects of crude oil on loggerhead sea turtles. Archives of Environmental Contamination and Toxicology 28: 417-422.

(4) ITOPF (International Tank Owners Pollution Federation) (2011) Effects of Oil Pollution on the Marine Environment. Technical Information Paper. Technical paper No. 13. The International Tank Owners Pollution Federation Limited.

Given the above, as a spill of any kind is highly unlikely to occur (given the mitigation measures in place) and would dilute and disperse quickly as it is diesel, there is unlikely to be a significant effect on marine fauna and habitats and would thus be negligible magnitude impact. Marine fauna and coastal habitats that may be impacted by an oil spill have varying degrees of sensitivity. However, the impact would be of **Negligible** significance overall.

Additional Mitigation, Management and Monitoring

Provided that the control measures are in place, the likelihood of a spill occurring is extremely low and no additional mitigation is required.

Significance of Residual Impacts

The residual impact from an unplanned spill would be of **Negligible** significance for all marine fauna and habitats (*Table 6.18*).

Table 6.18 Assessment of Impacts from Accidental Spills on Marine Fauna and Habitats

Impact	Water contamination and secondary impacts to biodiversity from accidental spills				
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Localised potential to a small number of individuals.				
Frequency	Infrequent.				
Likelihood	Rare				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	**Negligible**	Minor	Moderate	Major	

6.3.4 Impacts on Fishing Activity from Physical Presence of Seismic Vessel and Equipment

Source of Impact

The following section assesses the impacts to fishers from potential physical disturbance due to the presence of the seismic vessel and equipment based on the areas / locations in which they fish as defined in *Section 5*. The assessment excludes the local Rakhine fishermen which will be fishing over 100 km from the Block and focuses on potential impacts on fishing activity in deep water (water depth >200 m and distance from the mainland coast > 200 km).

Temporary disturbance of fishing activities could occur due to the presence of the seismic vessel and equipment and implementation of the mobile safety zone. This means that some fishermen may have to move outside of the

safety zone in order to catch fish. Temporary disturbance could have knock on effects on livelihoods of fishers.

The winter season (October to April) is the key fishing season, however, large commercial trawlers from outside Rakhine state fish throughout the year. Fishermen in the deep water area use trawls as well as longlines, hook and lines and drift nets, some of which are thousands of feet in length and can take considerable time to collect back to the fishing vessel. Fishing gear could potentially be damaged if it got entangled with the survey equipment.

Existing Controls

In order to ensure potential impacts from the seismic survey on the fisheries and the fishing community are avoided or reduced as far as possible, the following control measures are planned:

- A mobile navigational safety zone around the seismic survey array will be implemented to limit the duration and extent of disruption to the fishing activity in any area.

- An appropriate number of chase vessels will move with the survey vessel in order to liaise with fishermen in the vicinity of the seismic vessel in the day time and at night. The number of chase vessels will vary to help ensure the Project can adequately manage potential interactions with fishers, take appropriate action to protect the safety of fishers, and disclose information about the seismic survey as necessary.

- Survey vessels will comply with international standards of navigational safety.

- Chase vessels will have Myanmar speaking Fishing Liaison Officers (FLOs) on-board to facilitate potential interaction with fishermen at sea.

- Develop a Stakeholder Engagement Plan that will support timely sharing of information on the details of the seismic survey in order to inform stakeholders, especially fishers.

A grievance mechanism will be developed and implemented to provide an avenue for stakeholders, including those in fishing communities, to raise concerns with the Project and provide a process for timely resolution of grievances. Although this measure does not affect the impact significance, it has been included as an important component of Statoil's responsibilities to ensure impacts are avoided or reduced as far as possible.

Communication and information sharing will be implemented to minimise misunderstanding regarding the extent of the mobile safety zone and the duration of the activities. Clear information will be provided to ensure that fishers are aware that the Project will not exclude people from their fishing grounds but rather will cause only a temporary disturbance to fishing activities, if any.

The Project will use diverse channels to communicate with fishing communities before and during the seismic activity.

Significance of Impacts

The communication of timely information will help to raise awareness of seismic activity and potential disturbance to fishing activity to help fishers to avoid the vessel, seismic equipment and the mobile safety zone. In addition, the Project will have chase vessels which will communicate with fishing vessels they encounter whilst at sea. The chase vessels will also be able to ensure that fishing vessels and gear are not in the path of the seismic vessel therefore reducing the potential for damage to fishing vessels or gear. Once the seismic vessel leaves an area, fishing vessels will be able to go back into that area minimising the overall time that fishing is restricted in a particular area.

Larger commercial fishing vessels from other regions in Myanmar and other countries could be fishing within and in the vicinity of the Block. These vessels, however, tend to have larger fishing grounds with highly developed navigational and communication systems which will be able to easily avoid the mobile safety zone around the vessels and equipment. Therefore, displacement from one area will be of negligible magnitude.

With the existing control measures in place, it is expected that the impacts on fishing activities are likely to be **Negligible** and impacts on livelihoods should be **Negligible**.

Additional Mitigation, Management and Monitoring

No additional mitigation is required. A number of factors will be tracked to monitor the effectiveness of mitigation measures:

- Number of interactions between chase vessels and fishing boats;
- Feedback from ongoing stakeholder engagement; and
- Tracking of grievances raised.

Significance of Residual Impacts

It is anticipated that there may be **Negligible** residual impact caused by disturbance to fishers (*Table 6.19*).

Table 6.19 Assessment of Impacts on Fishermen

Impact	Fisheries and Fishing Community			
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International

Impact Scale	Impact scale will be limited to a relatively small number of vessels (compared to the overall number of vessels engaged in fishing) in the deep water.				
Frequency	Duration of the survey activities – not more than 3 months.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	**Negligible**	Minor	Moderate	Major	

6.3.5 *Impacts from Unplanned Collisions on Fishing Vessel and Other Marine Users*

Source of Impact

Any potential physical interactions between fishing vessels / other shipping and exploration survey activities may result in damage to fishing gear (e.g. nets/lines damaged or entangled), damage to vessels or sinking of vessels with the potential for loss of life.

Additional concerns associated with interactions with other vessels include potential for concomitant pollution effects (fuel oil spillage). The potential impacts from an accidental release of fuel are provided in *Section 6.3.3*. Any damages would adversely impact the fishermen who would have to pay for replacement gear and would not be able to fish until the damages were fixed. This could lead to secondary effects on fishing communities through a reduction in fishing revenue.

There is also a shipping lane between ports in the north (in Bangladesh) connecting to Malaysia. This shipping lane is moderately used by marine traffic. The issues associated with other marine users are the same as those mentioned above for fishing except for damage to fishing gear.

Existing/In Place Controls

The existing controls for fisheries and other marine users from unplanned collisions will be the same as those mentioned for impacts on fishing activity from physical presence of seismic vessel and equipment in *Section 6.3.4*.

Significance of Impacts

The seismic survey vessel will be accompanied at all times by an appropriate number of chase vessels that would act as fishing liaison as well as look out for the presence of other marine users. In addition, there is unlikely to be any fishing vessels from Rakhine State in Block AD-10 and the vessels from outside of Rakhine State have fishing grounds that cover a wide area and advance navigational and communication systems to warn them of the presence of the seismic vessel. The potential for encountering fishing vessels is fairly low.

The shipping lane between ports in the north (in Bangladesh) connecting to Malaysia is not heavily used and covers an area larger than the Block (refer to

Figure 5.18). Shipping vessels in transit with a good standard of navigational equipment can easily avoid the Project activities without any disruption. Block AD-10 is outside of the main shipping lane and therefore the potential for encountering shipping is low.

Given the measures in place, the risk of collision or entanglement between the seismic vessel and equipment and fishing vessels or other marine users is considered of **Negligible** significance.

Additional Mitigation, Management and Monitoring

Mitigation measures to help ensure that a collision is unlikely will be the same as those for impacts on fishing activity from physical presence of seismic vessel and equipment in *Section 6.3.4.*

Significance of Residual Impacts

Based on the assumption that the Project will be able to respond to claims for compensation associated with unplanned events in a timely manner, the impacts on fishing vessels and other marine users are likely to be **Negligible** (*Table 6.20*).

Table 6.20 Assessment of Impacts from Unplanned Collisions on Fishing Vessels and Other Marine Users

Impact	Fishing Vessel and Other Marine Users (including impact to livelihoods)				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Affect the vessels using the block area.				
Frequency	Duration of the survey activities.				
Likelihood	Unlikely.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium (Fishing vessels)		High (livelihoods)
Impact Significance	**Negligible**	Minor		Moderate	Major

6.3.6 Cumulative Impact Assessment

Cumulative impacts encompasses impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. The IFC (2012) defines cumulative impacts as those generally recognised as important on the basis of scientific concerns and or concerns from affected communities(1).

(1) IFC Performance Standards on Environmental and Social Sustainability, January 2012, International Finance Corporation, World Bank Group

Cumulative impacts summarised in this section refer to the additional impacts that may be generated by other developments or activities in the vicinity of the Block that when added to the impacts of the proposed seismic survey combine to cause a greater impact. Such impacts may arise due to spatial overlap (e.g. overlap in spatial extent of water quality changes) or temporal overlap (e.g. underwater sound impacts caused by seismic activities at the same time from different sources).

Block AD-10 is surrounded by other offshore blocks AD-02 and AD-09 in the north, AD-11 and AD-12 in the west, AD-13 and AD-04 in the south and AD-03 in the east (shown in *Figure 5.17*). There are no planned activities within Block AD-11, AD-12, AD-13, and AD-04 during the time of the survey. Block AD-03 is licensed to Ophir who have already completed their seismic activities.

There are likely to be concurrent activities with those in Block AD-10 in AD-02 (operated by BG Group) and in either Block AD-09 or AD-11 (both operated by Shell). As such, this may lead to cumulative impacts.

Activities in Block AD-09, AD-11 and AD-02 are likely to be similar to the activities proposed in Block AD-10. The main environmental impacts would therefore arise from the generation of underwater sound that could lead to disturbance of marine fauna and the physical presence of seismic equipment which could pose an entanglement risk. The main social impacts arise from the temporary displacement of fishing activity; however, as mentioned in *Section 0*, this will not include local Rakhine State fishermen. As the mitigation measures listed in the above sections are standard international best practise for seismic surveys it is likely that the block holders of Block AD-09, AD-11 and AD-02 will adopt the same practises, therefore, reducing the potential for a cumulative impact. In addition, typically to avoid any risk of operational interference, offshore seismic surveys maintain minimum separation distances of at least 20 to 30 km and often far greater.

In terms of environmental impacts, the impact that has the greatest spatial extent is the generation of underwater sound. As stated above, the distance between operations will be at least 20 km. Therefore cumulative impacts are unlikely to occur in relation to underwater sound. The predicted injury thresholds for turtles, mammals and fish based on a literature review (*Section 6.3.1*) will not be as large as this separation distance and therefore no cumulative injury impacts are anticipated. Some temporary behavioural impacts are possible further out and may extend beyond this separation distance. However, these behavioural changes would be very limited in scale (i.e. a minor change in swimming patterns) and not affect the species in any significant way. Behavioural changes for fish and marine turtles are anticipated to be low when animals are over a kilometre away from the sound source. It is important to note that these distances are just for behavioural changes and not injury.

The operation of the two seismic surveys at the same time could also create a barrier across marine turtle migratory pathways to their nesting beaches. It is however, unclear where the marine turtles will be migrating from and if they will be in these deep water blocks. However, there is unlikely to be a large number of turtle species using these nesting beaches in Rakhine State and turtles will be able to avoid the mobile sound source and continue to migrate to the nesting beaches. As assessed in *Section 6.3.1*, it is expected that potential behavioural changes for turtles are "low" when a kilometre or more from the seismic vessel. With the standard mitigation measures in place, any impacts are unlikely to cause any lasting impacts on the overall behaviour of the species present (i.e., feeding or nesting behaviour) and the resultant impact will be of **Negligible** significance.

Overall, the impact from underwater sound on all receptors will be the same magnitude as those experienced during the Block AD-10 survey but will only have a limited area of overlap and will be therefore of **Moderate** significance to marine mammals and turtles and of **Minor** significance for fish.

In addition, the potential for cumulative spills of fuel from the vessels is extremely unlikely to occur, and as both vessels use light fuels which are readily diluted and dispersed and implement standard mitigation measures, impacts would be expected to be **Minor**.

In terms of social impacts, although the Blocks are large in size and cover thousands of square kilometres, the exclusion zone for each survey will be limited to a mobile navigational safety zone around each of the vessels. As such, the area from which fishermen will be temporarily displaced is relatively small. In addition, no Rakhine State fishers are expected to fish in or in the vicinity of Block AD-10 therefore the impact will be limited to large commercial fishing vessels which will be less impacted by the exclusion zone. It is expected that the potential social impacts from the seismic surveys, if properly mitigated, will be localised and the impact will be of **Negligible** significance overall.

6.3.7 Summary of Impacts

The main potential impacts associated with the project and required mitigation measures are summarised below and in *Table 6.21*:

- Potential increases in ambient underwater sound and generation of sound pressure levels from the operation of air guns. These activities have the potential to impact ecologically sensitive receivers, e.g. marine mammals, marine turtles and fish.

- Potential water contamination and related secondary impacts to biodiversity and fishing from accidental spills of chemicals or fuel (e.g. during offshore re-fuelling).

- Potential risk of entanglement of marine turtles by the operating seismic survey hydrophone streamer.

- Potential short-term disturbance to fishing activities.
- Potential risk of collisions with fishing vessels and other marine users and entanglement of fishing gear by the operating seismic hydrophone streamer.

Table 6.21 Summary of Potential Impacts and Residual Impact Significance

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impact
Impacts from towed equipment by collision with or entrapment of marine turtles	• Install turtle guards on seismic survey tail buoys in order to reduce the risk of trapping turtles in the seismic equipment. • Implement JNCC Guidelines (1) including the alignment of Contractor operations with JNCC Guidelines. • In line with JNCC guidelines, implement a soft-start procedure to allow adequate time for marine fauna to leave the area). • As an enhancement measure, all sightings of marine mammals / turtles should be recorded and reported to MOECAF following survey completion.	**Moderate**

Impacts from underwater sound on marine fauna	• Optimum airgun configurations to ensure that the lowest possible sound level of airguns is selected.
	• Implement JNCC Guidelines (1) including alignment of Contractor operations with JNCC Guidelines.
	• In line with JNCC guidelines:
	  • Implement a soft-start procedure to allow adequate time for marine fauna to leave the area,
	  • Dedicated Marine Mammal Observers will be on-board to undertake pre-shooting search
	  • the vessel to postpone start-up if mammals observed within 500 m and
	  • Passive Acoustic Monitoring (PAM) will be used to detect marine mammals in the vicinity of the seismic vessel during night time or low visibility operations.
	• To ensure protection of certain marine mammal species, the soft-start procedure will be extended to between 20-30 minutes duration.
	• As an enhancement measures, all sightings of marine mammals / turtles should be recorded and reported to MOECAF following survey completion.
		Minor (for fishes)
		Moderate (for marine mammals and turtle)

Impacts from unplanned spills on marine fauna	• Accepted industry good practice operating procedures will be implemented, including an offshore re-fuelling plan. • Contingency plans will be prepared and implemented, e.g. vessel Shipboard Oil Pollution Emergency Plans (SOPEPs).	**Negligible**

(1) The JNCC "Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys, 2010"

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impact
Impacts on marine users, fisheries and fishing communities from physical presence of seismic vessel, and equipment, unplanned collisions and underwater sound	• A mobile navigational safety zone will be implemented around the seismic vessel and equipment. • An appropriate number of chase vessels that will liaise with fishermen and other mariner users. • The chase vessel(s) will have Myanmar speaking Fishing Liaison Officers on-board. • Survey vessels will comply with international standards of navigational safety. • A Stakeholder engagement plan will be developed to ensure timely sharing of information on the movement of survey vessels. Although this measure does not affect the impact significance, a grievance mechanism for the Project will be disclosed and implemented and timely investigation of any grievances will be conducted.	**Negligible** (shipping, fishing activities) and livelihoods)

7 PUBLIC CONSULTATION AND DISCLOSURE

This section presents a summary of the consultation undertaken in the development of the IEE, including description of:

- Regulatory and corporate requirements;
- Objectives of consultation;
- Approach and scope of engagement for the impact assessment;
- Format and content of consultation meetings;
- Key issues raised during consultation;
- Further disclosure and consultation; and
- Approach for developing a grievance mechanism.

7.1 PURPOSE OF THE CONSULTATION

The specific objectives for stakeholder engagement were to:

- Inform relevant stakeholders about Statoil and its planned Project activities;
- Identify stakeholders and communities potentially affected by Project activities;
- Gather baseline information on the social and biological environment; and
- Engage with potentially affected groups and individuals to understand the scope of fishing activities, potential Project impacts and discuss appropriate mitigation measures.

7.2 METHODOLOGY AND APPROACH

7.2.1 *Identification of Relevant Stakeholders and Potential Issues*

The process of identifying potentially affected stakeholders started with scoping which was conducted for the Project Proposal Report submitted to MOGE and MOECAF on the 3rd October 2014. The purpose of scoping was to identify relevant issues and the townships and villages potentially impacted. The scoping exercise involved both desk-based and preliminary consultation with a number of stakeholders including government authorities, non-governmental organisations (NGOs), community based organisations (CBOs), members of fishing communities and fishing organisations, those with knowledge of fishing practices in Myanmar and individual experts (e.g. marine specialists from local universities).

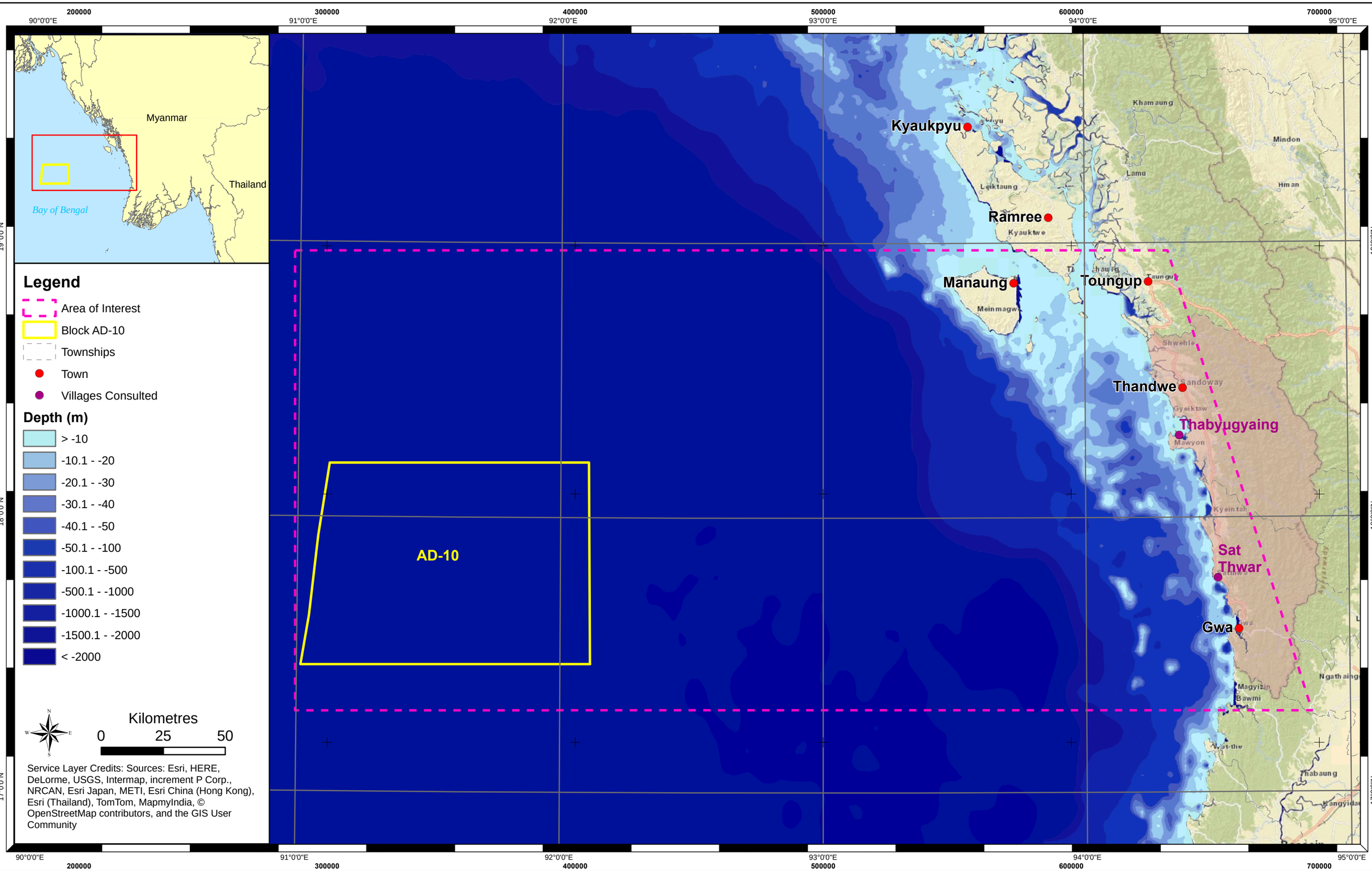


Figure 7.1

Consultation in Rakhine State

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Date: 30/7/2015

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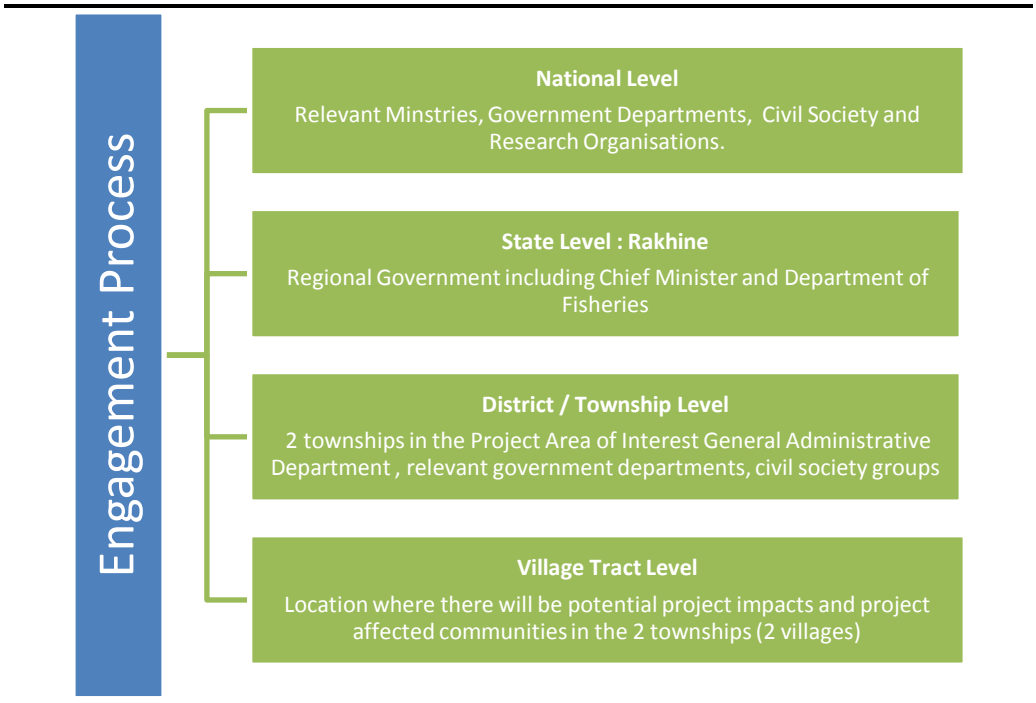
The scoping process concluded that those fishers active in and around Block AD-10 would likely be from Thandwe and Gwa townships (as these are the closest townships to the Block), as well as Yangon, which informed planning of the stakeholder engagement process for the assessment and fed into the Stakeholder Engagement Plan submitted to MOGE on the 22nd May 2015. *Figure 7.1* illustrates the Area of Interest and the location of where consultation has been undertaken.

Stakeholder engagement is an ongoing process and as such new stakeholders may emerge as the Project progresses. This will be captured and inform ongoing stakeholder engagement activity that will be undertaken for the Project.

7.2.2 *Overall Approach and Scope of Engagement for the Impact Assessment*

Stakeholder engagement was conducted at the four administrative levels, in line with MOECAF regulations and subject to permissions of responsible authorities (1). *Figure 7.2* provides an overview of the levels engaged including: National Government, Rakhine State, district and township levels, and selected village (tract) levels focused on those where significant fishing communities are located.

Figure 7.2 Engagement at Four levels with Key Stakeholders



Engagement was undertaken in June 2015. A consultation team consisting of ERM, REM, accompanied by Statoil representatives conducted meetings and

(1) Prior to any public consultation in Rakhine, a meeting was held between Statoil, the environmental consultants and the Chief Minister of Rakhine to discuss the proposed Stakeholder Engagement Plan and receive permission on visiting the townships. This meeting was held on the 11th June 2015 in Sittwe.

consultations at the four administrative levels. The team was also accompanied by a MOGE representative.

National Level

Stakeholder engagement at the national level was focused on government agencies with regulatory and policy making responsibility. The purpose of early engagement was to introduce the Project and Statoil, seek clarity on the EIA process and expectations on stakeholder engagement and disclosure. The opportunity was also used to obtain required permissions for engagement with agencies at state and township level and get access to data and information for the IEE Study.

In subsequent stages, engagement covered identification of relevant stakeholders at the state, township and village tract level. The list of stakeholders consulted at the national level included:

- MOGE;
- MOECAF;
- Myanmar Port Authority; and
- DoF.

State Level

Stakeholder engagement at the state level focused on obtaining required permission for engagement activities at the township, village tract and village level and get access to information on offshore and inshore fishing activities in the state. At the state level the Project had meetings with:

- The Chief Minister of Rakhine State;
- The Divisional Administrator;
- MOECAF's regional office;
- DoF; and
- Fishermen and boat owners

District / Township Level

Engagement was focused on two coastal townships in Rakhine State relevant to the Project: Thandwe and Gwa, as suggested during meetings with the Chief Minister of Rakhine State in Sittwe.

These townships feature varying levels of industrial and artisanal fishing activities, including offshore and inshore fishing fleets, processing and supply locations, as well as transportation hubs to domestic and international markets. It was agreed that these townships included communities with

some of the greatest reliance on fishing as well as potential presence in or nearby Block AD-10. Therefore, a sample of villages from these townships was agreed to provide the most relevant picture of potentially affected fishing communities. It should be noted that the sample communities consulted provide an indication of the fishing activity undertaken in Rakhine State but does not fully represent those communities that fish only in the shallow water areas as potentially fisheries in deeper waters (>200 m) were targeted for consultation. The majority of local artisanal fishing in Rakhine waters is thought to occur in this shallow water area within 20 miles from the mainland coast.

The purpose of engagement was to make the community aware of the Project, to obtain necessary local permissions for meetings, seek an understanding of specific issues and stakeholder concerns in the individual townships, discuss potential impacts and mitigation measures and obtain district and township level social and environmental data.

The key stakeholders engaged with included;

- General Administration Department;
- Township Fishery Department;
- Fishing associations; and
- Boat owners and traders.

Village Level

Consultations were undertaken in villages with significant fishing activities. Consultations at the village level included consultations with:

- Village Tract Leader (government appointed position);
- Village Leaders (non-governmental position);
- Fishing communities including boat owners and workers;
- Fishing association; and
- Other interested members of the village (e.g. teachers).

7.2.3 Format and Content of Consultation Meetings

Key Principles

The consultation process was guided by the following key principles:

- *Inclusive*: The consultations were organised to ensure representation of potentially affected and interested stakeholders. Separate focus group discussions (FGDs) were undertaken with fishermen and boat owners.

- *Sharing of information:* At the township and village level consultations, special emphasis was given to build community level understanding of the Project and all the information was provided in Myanmar language.

- *Participatory:* Stakeholders were encouraged to actively participate in the consultations and were always given the opportunity to ask questions. *Gender inclusive:* The team consisted of female representatives for undertaking focus group discussions with women.

The approach to consultation, informed by these principles, is described below.

Consultation Approach

The stakeholder consultation meetings were structured as followed:

- *Introductions and information disclosure:* Introduce Statoil, the Project, the IEE, the proposed stakeholder engagement process, the potential environmental and social impacts and mitigation to help the stakeholders understand the Project and Statoil's intentions for engagement;

- *Question and answer session* for all stakeholders to raise concerns, comments or ask questions to which Statoil can directly respond; and

- *Data collection:* Collection of more in-depth information through FGDs and one-on-one interviews with key stakeholder groups. It should be noted that the FGDs were only conducted at the township / district and village / village tract level.

In order to inform stakeholders about the Project and share information on the activities, a two page flyer was produced which contained Project information and details on how to feedback into the Project (presented in *Annex 7.1*). All information was communicated through use of visual media (including posters and power point presentations) and was provided in local Myanmar language (see *Annex 7.1*). The material also provided details for an information hotline telephone number and email address.

To gather more environmental and social baseline data and to identify potentially affected communities, FGDs were undertaken with fishermen, women and village leaders, and were guided by questionnaires covering information relating to:

- V*illage profile:* Collected information on demographic patterns, communities, occupations, vulnerable groups, access to infrastructure and services and communication and grievance systems.

- *Fishing Methods:* Collected information on number / type of boats, fishing season, fishing locations, fishing camps, trip duration and fishing gear used.

- *Environment:* Collected information on type of fish caught, sighting of marine mammals and turtles, locations of sensitive habitats (coral reefs, seagrass beds, and mangroves), locations of turtle nesting beaches, timing of turtle nesting, fish / invertebrate spawning areas, and protected areas.

Visual tools, such as pictures of fishing gear, maps and pictures of marine species, and hands-on activities, such as drawing fishing areas on hard copies of maps, were utilised in order to increase the involvement of the communities in the stakeholder consultation process. All information collected was summarised and confirmed with stakeholders at the end of each discussion. Stakeholders were also given time to share their concerns and views and any further clarifications they required at the end of the meetings.

Any queries raised by the stakeholders was responded to, and also noted to feed into the impact assessment process for the IEE.

7.3 SUMMARY OF CONSULTATION ACTIVITIES UNDERTAKEN

Figure 7.1 provides an overview of where consultation was undertaken and the key consultations at a regional level and below are highlighted in *Table 7.1.* Photos taken during public consultations in Rakhine are shown in *Figure 7.3* (1).

Table 7.1 Summary of Public Meetings undertaken as part of the IEE process

Date	Location
11th June 2015	Chief Minister Meeting
15th June 2015	Thandwe Township Meeting
16th June 2015	Thabyugyaing Village Meeting
17th June 2015	Gwa Township Meeting
18th June 2015	Sat Thwar Village Meeting

7.4 SUMMARY OF MAIN COMMENTS RECEIVED DURING CONSULTATION MEETINGS

Some of the key concerns and expectations of the stakeholder groups identified during the public meetings are detailed in the following sections. It should be noted that in general very few questions were asked regarding the proposed Project as it was generally felt that the coastal fishing activities would not overlap and therefore would not be impacted by Project activities. The minutes of meetings at the township and village level for question and answer sessions are provided in *Annex 7.2.*

7.4.1 *Social Investment*

A common question raised during consultation meetings regarded the likely benefits to local people and/or Rakhine State from the Project. The focus of discussions on social investment concerned what community projects Statoil would undertake during the drilling and production phases or oil and gas

(1) Permission to take photos was requested and granted at each meeting included in the Figure.

Photo 1: Consultations in Sat Thwar

Photo 2: Consultations in Thabyugyaing

Photo 3: Q&A session at Sat Thwar

Photo 4: Secondary School in Sat Thwar

Photo 5: Meeting Hall in Sat Thwar Village

Photo 6: Meeting Hall in Thabyugyaing

Figure 7.3a

Photo Records of Stakeholder Consultation

DATE: July 2015

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Photo 7: Focus Group Discussion in Thabyugyaing

Photo 8: Village Questionnaire in Sat Thwar

Photo 9: Township Meeting in Thandwe

Photo 10: Township Meeting in Gwa

Photo 11: Project Presentation in Gwa

Photo 12: Meeting Hall in Thandwe

Figure 7.3b

Photo Records of Stakeholder Consultation

DATE: July 2015

Environmental Resources Management

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exploration. There were also a number of questions regarding the agreement Statoil have in place with the Myanmar government and also related to revenue sharing between Rakhine State and the Union Government.

Statoil explained that social investments were not dealt with within the scope of the IEE, as the Study focuses on the impacts derived from the Project. However, social investments will be addressed as part of Statoil's ongoing engagement at a later stage.

7.4.2 Impact on Fishing

As the majority of people consulted were directly involved in the fishing industry, a key concern raised related to the potential impacts of the Project on the fishing activities in offshore areas. Stakeholders were concerned about the impact of the sound generated from the survey on fish and invertebrate species. Stakeholders were concerned that sound could scare fish away or impact species that could not swim away such as sea cucumbers, in turn, impacting their livelihoods. The concern of potential impact on fishing is addressed in the impact assessment (*Section 6*). *Annex 7.2* contains the minutes of the Q&A session in each township and village visited in June 2015, including a list of all attendees.

7.4.3 Impacts from Future Operations

A common concern raised related to the impacts of future drilling. Stakeholders wanted to know when drilling might occur and what would be the impact to fisheries and fish resources. Responses were provided in the meetings stating that this IEE Report would only cover the currently planned seismic survey and additional consultation and another IEE / EIA Report will be produced in the event of future developments. Drilling is outside the scope of this IEE Report.

7.5 INFORMATION DISCLOSURE AND RECOMMENDATIONS FOR FUTURE CONSULTATIONS

7.5.1 Further Disclosure

The disclosure process will include disclosure of the summarized findings of the IEE Study in local language in the townships visited. The IEE Report will also be disclosed on Statoil's website and will be advertised in two papers; one national and one local Rakhine journal. The Project will also disclose the grievance mechanism for the Project and information regarding movement of the seismic survey vessel to stakeholders. Detailed plans for disclosure will be developed prior to the commencement of the Project.

7.5.2 Further Consultations

The engagement activities so far were undertaken as part of the IEE process. However, stakeholder engagement is understood to be a continuous process to be undertaken throughout the life of the Project, in this case during the

duration of the seismic survey. Statoil will develop a Stakeholder Engagement Plan (as indicated in the ESMP) to manage this ongoing consultation, address concerns if new stakeholders emerge and monitor stakeholder feedback.

7.5.3 Grievance Mechanism

Statoil requirements include development of grievance mechanism to facilitate resolution of concerns for all stakeholders directly or indirectly impacted by the Project. The scale and type of the mechanism will reflect the level of risks and impact and should be readily accessible, comprehensible, transparent and culturally appropriate.

The grievance mechanism will complement routine stakeholder engagement. The key purpose of the grievance mechanism will be to allow stakeholders, especially the fishing community to approach the Project should there be any grievances in relation to the seismic survey and / or concerns about potential impact associated with the seismic activity. Statoil will develop a grievance mechanism tailored to the operating context and aligned with existing process as requested by stakeholders.

8 CONCLUSION AND RECOMMENDATIONS

8.1 RECOMMENDATIONS FOR FUTURE ACTIONS

The Project will have an ESMP which will detail the required mitigation measures and all reporting and monitoring. Statoil will have an HSSE representative on board the vessel to inspect the contractors activities and ensure compliance with the stated mitigation.

The IEE Report disclosure process will include disclosure of the executive summary of the IEE study in Myanmar language in the townships visited; Thandwe and Gwa. The IEE Report disclosure will also be advertised in two newspapers; one national and one local Rakhine. The Project will also disclose information about the grievance mechanism for the project and information regarding movement of the seismic survey vessel to stakeholders. Detailed plans for disclosure will be developed prior to the commencement of the Project.

The engagement activities thus far, were undertaken as part of the IEE process. However, stakeholder engagement is understood to be a continuous process to be undertaken throughout the life of the Project, in this case during the duration of the seismic survey. Statoil will develop a Stakeholder Engagement Plan (as indicated in the ESMP and *Section 6* of this IEE Report) to manage this ongoing consultation, address concerns if new stakeholders emerge and monitor stakeholder feedback.

8.2 CONCLUSION

The IEE Study for the 2D seismic survey in Block D-10 was conducted to comply with the requirements of the MOECAF draft *EIA Procedures*. The IEE demonstrates that the proponent understands the environment and social setting in which they are operating and has properly assessed the key potential environmental and social impacts associated with the proposed Project. A project-specific, dedicated Environmental Social Management Plan (ESMP) has been developed and presented as a tool to manage impacts associated with the Project and ensure legislative compliance and standards of good practice during the execution of the seismic survey in Block AD-10. Provided that the recommended mitigation measures are properly implemented, it is expected that the environmental and social impacts of the proposed seismic survey at Block AD-10 would be managed by Statoil in a professional and acceptable manner. As such, the IEE concludes that **no Major** impacts on the environment and people are anticipated from this Project and all impacts have been properly mitigated to be as low as reasonably practical.

Annex 2.1: CVs of the Environmental and Social Experts

Craig A Reid

Partner

Craig A. Reid is a Partner with Environmental Resources Management (ERM) and Manager of the Hong Kong based Marine Sciences Group.

With over 16 years' experience Mr Reid is responsible for providing technical services to ERM's clients worldwide to help manage environmental risks and challenges. Mr Reid has specific experience in servicing ERM's key industry sectors, namely Oil and Gas, Power and Mining as well as a strong background in Government regulatory and management services.

Mr Reid has worked extensively in Myanmar for almost 10 years, most significantly through his role as Project Manager for the Shwe Gas Development Impact Assessments for Blocks A1 and A3, for Daewoo International Corporation. Mr Reid has also worked on assessments related to the Yadana Development for Total, as well as those for China National Petroleum Corporation (CNPC) and Hyundai Heavy Industries. Most recently Mr Reid has been helping international operators such as RocOil and BG understand potential environmental and social risks as well as the regulatory regime as part of their consideration into exploring this market. Through these studies Mr Reid has gained an excellent understanding of the Myanmar environment, as well as strong relationships with local consultancies, academics and Governmental Departments such as the Ministry of Environment, Conservation and Forestry (MOECAF) and the Myanma Oil and Gas Enterprise (MOGE).

In addition to the above, Mr Reid has worked on projects related oil and gas infrastructure, seismic survey, exploratory and production drilling, decommissiong, dredging, disposal and reclamation, mud disposal facilities, port management, onshore and offshore power generation, offshore wind farms, sewage infrastructure, sewage treatment plants, sewerage schemes, incinerators, fuel storage facilities, theme parks, highways, railways, submarine cables and overhead power lines. The results of these studies have been used to present information on baseline conditions of sensitive habitats and biodiversity, to assess acceptability of installations, developments or facilities, or to develop and implement mitigation, management and marine conservation programmes.

Through these projects Mr Reid has gained a balance of experiences from the perspective of the proponent as well as that of the contractor and consultant. Mr Reid has been able to bring those skills to ensure projects gain regulatory approval or achieve the desired outcome be it from an environmental, engineering or cost perspective.

Based in Hong Kong, Mr Reid has worked extensively internationally, having undertaken studies in Africa (Angola, Benin, Egypt, Gabon, Ghana, Liberia, Nigeria, Sierra Leone and Togo), Middle East (Abu Dhabi, Iran, Bahrain, Qatar and Saudi Arabia) South East Asia (Singapore, Thailand, Philippines, Malaysia, Vietnam, Brunei and Myanmar) East Asia (China, Hong Kong, Japan and South Korea) and the Pacific Rim (Australia, New Zealand and Fiji).

EDUCATION

- BSc (Hons), Marine Biology, University of Stirling, Scotland, United Kingdom, 1997

Professional Affiliations & Registrations

- Member of the International Association for Impact Assessment
- Member of the Society of Petroleum Engineers
- Member of the Marine Biological Association of Hong Kong
- Member of the Hong Kong Institute for Environmental Impact Assessment

FIELDS OF COMPETENCE

- Marine Biology, Ecology and Water Quality
- Environmental Impact Assessment (EIA)
- Environmental Monitoring
- Site selection and route assessment
- Natural Resource Management

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PROJECTS IN MYANMAR

- ESIA for Exploration of Blocks AD6 and AD8, Chinnery Assets Limited (CNPC), 2013. *Project Director.*
- Environmental Risk Assessment for Offshore Exploration, for BG, 2013. *Technical Advisor.*
- Myanmar HSE Regulatory Framework Study, for RocOil, 2013. *Project Director.*
- Air Dispersion Modelling for Shwe Gas Development, for Daewoo International Corporation (Myanmar E&P), 2013. *Project Director.*
- EIA for the Shwe Gas Field Shore Base for Shwe Gas Field Development, for Daewoo International Corporation (Myanmar E&P), 2010. *Project Manager.*
- EIA for the Midstream Pipeline and Gas Metering Station for Shwe Gas Field Development, for Daewoo International Corporation (Myanmar E&P), 2009. *Project Manager.*
- Terrestrial Environmental Baseline Study for Onshore Midstream Facilities and Pipeline Landing Site, for Daewoo International Corporation (Myanmar E&P), 2008. *Project Manager.*
- Marine Environmental Baseline Survey for Midstream Pipeline, for Daewoo International Corporation (Myanmar E&P), 2008. *Project Manager.*
- Impact Identification Study for the Alternative Midstream Pipelines and Associated Onshore Facilities, for Daewoo International Corporation (Myanmar E&P), 2008. *Project Manager.*
- Drill Cuttings Modelling Study for Offshore Production Platform, for Daewoo International Corporation (Myanmar E&P), 2007. *Project Manager.*
- Environmental Impact Assessment for Upstream Facilities in Offshore Myanmar, for Daewoo International Corporation (Myanmar E&P), 2007. *Project Manager.*
- Marine Environmental Baseline Survey for the Development of Upstream Facilities in Offshore Myanmar, for Daewoo International Corporation (Myanmar E&P), 2006. *Project Manager.*
- Impact Identification Study for the Development of Upstream Facilities in Offshore Myanmar, for Daewoo International Corporation (Myanmar E&P), 2005. *Project Manager.*
- EIA for a Medium Compression Platform, Myanmar (Hyundai Heavy Industries & Total E&P Myanmar), 2007. *Project Manager.*
- Preliminary Environmental and Social Scoping Study for the Development of an Offshore Gas Field, for Daewoo International Corporation (Myanmar E&P), 2004. *Project Manager..*

OIL AND GAS PROJECTS

MARINE SEISMIC SURVEY (2-D, 3-D AND 4-D)

- Screening and Scoping Study for 3D Seismic Survey of three Blocks in the South China Sea, Shell, 2012. *Partner in Charge.*
- Environmental Scoping and Management Plan for 3D Seismic Survey of Blocks 64/18 and 53/30 in the South China Sea, China, Chevron, 2010. *Project Manager.*
- Environmental Risk Assessment of a 3D Marine Seismic Survey in Southern Chinese Waters, BG, 2008. *Marine Ecology Specialist.*
- Survey on Environmental Impact of Marine Seismic Operations, Japanese Oil, Gas and Metals Corp, 2008 - 2009. *Project Manager.*
- ESHIA for Block G4/50 Seismic Survey, Gulf of Thailand, Chevron, 2008 - 2009. *Marine Ecology Specialist.*
- Monitoring Impacts of 3D Marine Seismic Surveys for Browse Field Development, Woodside Energy Limited, Australia, 2007 – 2009. *Lead Scientist.*
- Environmental Review for 2D Marine Seismic Survey in Southern Chinese Waters, BG, 2007. *Project Manager.*
- Environmental Protection Statement for Maxima 3D Marine Seismic Survey at Scott Reef, Woodside Energy Limited, 2007. *Lead Scientist.*
- Marine Seismic Survey Integrated Impact Assessments, Offshore Brunei Darussalam, Brunei Shell Petroleum Sdn Bhd, 2004 – 2006. *Lead Scientist.*

EXPLORATORY/PRODUCTION OPERATIONS

- ESHIA for Seismic Exploration of Blocks 15/10 & 15/27 in South China Sea, Chevron, 2013. *Project Director.*
- ESHIA for Exploration Drilling of Block 42/05 in South China Sea, Chevron, 2013. *Project Director.*
- ESIA for Exploration Drilling of a Deepwater Well in the Sea of Japan, JX Nippon Oil, Japan, 2012. *ESIA Advisor.*
- ESHIA for Exploration Drilling of Block 64/11, 53/30 and 42/05 in South China Sea, Chevron, 2011. *Project Director.*
- ESHIA for Block B Gas Development, Vietnam, for Chevron Vietnam, 2010. *Lead Marine Scientist.*
- ESHIA for Pandora Offshore Gas Development, Talisman, Papua New Guinea, 2010 ongoing. *Lead Marine Scientist.*
- ESHIA for Shore Base for Offshore Operations, Thailand, for Chevron Pattani Thailand, 2008 – 2009. *Project Manager.*
- ESHIA for Block G4/48(c) Production Facility, Gulf of Thailand, Chevron, 2007 – 2008. *Lead Marine Scientist.*

- Status and Trends of HSE Issues in the Oil and Gas Industry, Japanese Oil, Gas and Metals Corp, 2007, 2008 and 2010. *Key Presenter.*
- Impact Assessment of Mampak Block 4 Field Development, Brunei Shell Petroleum Sdn Bhd, 2006 – 2009. *Lead Marine Scientist.*
- Main Oil Line Replacement Study, Brunei Shell Petroleum Sdn Bhd, 2007 – 2008. *Lead Marine Scientist.*
- Impact Assessment of Bugan Field Development, Brunei Shell Petroleum Sdn Bhd, 2006 – 2009. *Lead Marine Scientist.*
- Pipeline Replacement Project, Brunei Shell Petroleum Sdn Bhd, 2007. *Lead Marine Scientist.*
- Impact Assessment of Seria North Flank Development, Brunei Shell Petroleum Sdn Bhd, 2006 – 2007. *Lead Marine Scientist.*
- Bugan Phase II ROV Field Survey, Brunei Shell Petroleum Sdn Bhd, 2006. *Lead Marine Scientist.*
- Integrated Impact Assessment of the Jetty Relocation Project, Brunei Shell Petroleum Sdn Bhd, 2004. *Lead Marine Scientist.*

DRILL CUTTINGS AND PRODUCED WATER DISPOSAL

- Drill Cuttings Study for Block D12 in Offshore Sarawak, for Shell Sarawak Berhard, Malaysia, 2012. *Project Director.*
- Drill Cuttings Modelling for Well SH-05 in Abu Dhabi, for Wintershall, Abu Dhabi, UAE, 2011. *Technical Lead.*
- Drill Cuttings and Oil Spill Modelling for Hair Dalma HD-09 Well in Abu Dhabi, for ADMA-OPCO, Abu Dhabi, UAE, 2011. *Project Manager.*
- Drill Cuttings and Oil Spill Modelling for Block 64/11, 53/30 and 42/05 in South China Sea, Chevron, 2011. *Project Director.*
- Drill Cuttings Modelling Study Bugan Field Development (Brunei Shell Petroleum Sdn Bhd), Brunei, 2008. *Project Manager.*
- Drill Cuttings Modelling Study Bubut Field Development (Brunei Shell Petroleum Sdn Bhd), Brunei, 2007. *Project Manager.*
- Peragam Exploration Well Drill Cuttings Modelling, Brunei Shell Petroleum Sdn Bhd, 2006 – 2007. *Project Manager.*
- BSP CP127ST1 Well CPDP-12, Champion South-East Development Project, for Brunei Shell Petroleum Sdn Bhd, Brunei, 2007. *Project Manager.*
- Oil Spill Modelling Study for Offshore Production Platform, TOTAL, 2007 – 2008. *Project Manager.*
- Oil Spill Modelling Study for Offshore Production Platform, Shell Australia, 2007 – 2008. *Project Manager.*

FLOATING PRODUCTION STORAGE AND OFFLOADING (FPSO) VESSELS

- Fishing/Fisheries Scoping/Baseline Study for Offshore Developments, Ghana, for Tullow Ghana Ltd, 2010 - ongoing. *Technical Specialist.*
- Integrated Impact Assessment of the Development of Cendor Field, Petrofac, 2005 – 2006. *Lead Marine Scientist.*

LNG TERMINALS (EXPORT AND RECEIVING)

- Environmental Social Health Impact Assessment for a Floating Liquefied Natural Gas Facility in Offshore Waters, Northwest Australia, Confidential, 2008 – 2009. *Marine Ecology Specialist.*
- Manzanillo LNG Terminal, Korea, Samsung Engineering Company Ltd (SECL), 2008. *Lead Marine Scientist.*
- Environmental Impact Assessment (EIA) of Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities, CAPCO, 2005 – 2007. *Project Coordinator.*
- Adequacy Review of Environmental Assessment for Proposed Taranaki LNG (New Plymouth Council), 2008. *Lead Marine Scientist.*
- Environmental and Risk Assessments for two Natural Gas Facilities in Southeast Asia, CAPCO, 2004 – 2005. *Project Coordinator.*
- Detailed EIA and FEED Study for Submarine Gas Pipelines from Shenzhen LNG Terminal to Tai Po Gas Production Plant, Hong Kong & China Gas Company, 2002 – 2003. *Lead Marine Scientist.*
- Study of Potential Land-based Sites for Natural Gas Facilities in Southeast Asia, CAPCO, 2002 – 2003. *Project Coordinator.*
- Site Selection and Scoping Study for an LNG Terminal in Thailand, Confidential Client, 2005 – 2006. *Lead Marine Scientist.*

DECOMMISSIONING

- Options Assessment Update for Lufeng 22-1 Oil Field Decommissioning Project, Statoil, 2008–2009. *Project Manager.*
- Options Assessment for Lufeng 22-1 Oil Field Decommissioning Project, Statoil, 2004. *Lead Marine Scientist.*
- Platforms Decommissioning Campaign, Offshore Brunei Darussalam, Brunei Shell Petroleum Sdn Bhd, 2004. *Lead Marine Scientist.*
- Environmental Impact Study of Temsah NW Platform Disposal, Eni E&P, 2005. *Lead Marine Scientist.*
- Consultation on Decommissioning of Overseas Offshore Platforms, CNOOC, 2005 – 2006. *Project*

Manager.

DOWNSTREAM PROJECTS

- ESHIA for a Greenfield Refinery in Mandji Free Trade Zone, Samsung C&T, Gabon, 2012. *Project Director.*

POWER SECTOR PROJECTS

- Seawater Recirculation Study for Jeddah South Power Plant Stage I, HHI, Saudi Arabia, 2012. *Partner in Charge.*
- Marine Biodiversity Study for Shoaiba Power Plant Stage III, HSBC, Saudi Arabia, 2012. *Marine Expert.*
- EM&A Team for Installation of Offshore Wind Farm in Southwest Lamma Waters, Hong Kong, for The Hongkong Electric Co., Ltd., 2011 – ongoing. *Project Director.*
- Investigation into Fish Ingress at Hong Kong Electric Power Station, Lamma Island, Hong Kong, 2010 – 2011. *Project Manager.*
- ESHIA Update for Mong Duong 2 Power Plant, Vietnam, AES, 2010 – 2011. *Marine Ecology Specialist.*
- Cooling Mist Dispersion Study at Sabyia Combined Cycle Gas Turbine Power Station, Kuwait, HHI, 2009 – 2010. *Project Manager.*
- EIA for an Offshore Wind Farm Development in Hong Kong, for The Hongkong Electric Co Ltd, 2007 - 2009. *Project Manager.*
- Environmental, Health and Safety Impact Assessment (ESHIA) for Vung Ang II Thermal Power, for One Energy, Vietnam. 2008 - 2010. *Marine Ecology Specialist.*
- Environmental Impact Assessment of the Development of a 2,750MW Power Station and Desalination Plant in Jubail Industrial City, Marafiq IWPP, Kingdom of Saudi Arabia, for WSP Environmental Middle East, 2007. *Marine Ecology Specialist.*
- Seawater Recirculation Study, Al Dur IWPP, for Hyundai Heavy Industries Co. Ltd, Bahrain, 2008. *Project Manager.*
- Seawater Recirculation Study, Marafiq IWPP, Hyundai Heavy Industries Co. Ltd., Kingdom of Saudi Arabia, 2006 – 2007. *Project Manager.*
- Baseline Water Quality Survey, Marafiq IWPP, Hyundai Heavy Industries Co. Ltd., 2006, Kingdom of Saudi Arabia. *Project Manager.*
- Thermal Plume Dispersion Study, Ma'aden Phosphate Company, Kingdom of Saudi Arabia, 2009. *Project Manager.*
- Kwang Yang Combined Cycle Power Plant Cooling Water Review, BP, South Korea, 2005.
- Emissions Control Project at the Castle Peak Power Station "B" Units, CAPCO, Hong Kong, 2006. *Marine Ecology Specialist.*
- Cooling Water Culvert Improvement Works, CLP Power, Hong Kong, 2002. *Marine Ecology Specialist.*
- EIA for an 1800 MW Gas-Fired Power Station at Lamma Extension, The Hongkong Electric Co., Ltd., Hong Kong, 1998 – 1999. *Marine Ecology Specialist.*
- Identification of Constraints to the Routing of HEC New Gas Pipeline - Desktop Study, The Hongkong Electric Co., Ltd., 1998. *Project Manager.*

PORT RELATED PROJECTS

- ESIA of a Greenfield Port, APM Terminals, Nigeria, 2012. *Project Director.*
- Contaminated Sediment Disposal Facility at South of Brothers – EIA Update, Civil Engineering and Development Department, Hong Kong Government, Hong Kong, 2009 - 2010. *Project Manager.*
- EM&A for Contaminated Mud Pit IV at East of Sha Chau, CEDD, Hong Kong Government, 2009 – 2013. *Deputy Environmental Team Leader.*
- EM&A for Contaminated Mud Pit IV at East of Sha Chau, CEDD, Hong Kong Government, 2005 – 2009. *Deputy Project Manager.*
- EM&A for Contaminated Mud Pit IV at East of Sha Chau, CEDD, Hong Kong Government, 1997 – 2002. *Project Coordinator.*
- Ecological Monitoring for Uncontaminated Mud Disposal, CEDD, Hong Kong Government, 1999 – 2002. *Project Manager.*
- Review of the Contaminated Mud Disposal Strategy and the need for an Intermediate Contaminated Mud Disposal Facility, CEDD, Hong Kong Government, 2002 – 2003. *Project Manager*
- Ecological, Fisheries and Water Quality Impact Assessment Study for the Proposed Port Development at Northwest Lantau, EDLB, Hong Kong Government, 2005 – 2007. *Water Quality Specialist.*
- Environmental Impact Assessment of Savusavu Port, Rural and Outer Islands Project, Asian Development Bank, Fiji, 2006 – 2007. *Environmental Team Lead.*
- EIA of the Development of a Container Terminal, Vietnam, SPCT/P&O Ports, Vietnam, 2006 – 2008. *Lead Marine Scientist.*
- Permanent Aviation Fuel Facility, Leighton Contractors Asia Limited, Hong Kong, 2003 – 2009. *Environmental Team Leader.*
- Strategic Assessment and Site Selection Study for Contaminated Mud Disposal, CEDD, Hong Kong Government, 1999. *Marine Ecology Specialist.*
- Site Specific Feasibility of Sludge Management Strategy and Sludge Disposal Plan, EPD, Hong Kong Government, 1998 – 2000. *Marine Ecology Specialist.*
- Focussed Cumulative Water Quality Impact Assessment for the West Po Toi Sand Borrow Area,

HAM Dredging & Marine Contractors, 2001. *Marine Ecology Specialist.*

- Baseline Survey at East Tung Lung Chau, CEDD, Hong Kong Government, 1999. Non-Statutory Marine Environmental Monitoring Update, Airport Authority Hong Kong, 2002 – 2003. *Marine Ecology Specialist.*
- Performance Verification of Stanley and Shek O Outfalls, EPD, Hong Kong Government, 1999 – 2001. *Marine Ecology Specialist.*
- Sustainable Development for the 21st Century, Supplementary Agreement for Undertaking Baseline Surveys - Monitoring of Toxics in Marine Sediment and Biota, PlanD, Hong Kong, 2000. *Marine Ecology Specialist.*

MINING PROJECTS

- Marampa Mine ESHIA, London Mining PLC, Sierra Leone, 2012. *Aquatic Specialist*
- ESHIA of Weda Bay Nickel Mine, ERAMET, Indonesia, 2011. *Marine Specialist.*

TRANSPORT

- EIA Review Consultancy for Hong Kong Airport Third Runway Project, Airport Authority Hong Kong, Hong Kong, 2012-2013. *Project Manager*
- EIA Review for Area 54 Road Network, Transport Department, Hong Kong, 2012-2013. *Project Director.*

SEWAGE INFRASTRUCTURE AND DRAINAGE

- Agreement No. CE 55/2009 (DS) - Outlying Islands Sewerage Stage 2 – South Lantau Sewerage Works – Investigation EIA, Hong Kong, for DSD, 2010 – 2014. *EIA Manager.*
- Agreement No. CE 6/2002 (DS) - Drainage Improvement in Northern New Territories – Package C - Investigation, Design and Construction – EIA for TKL05, Hong Kong, for DSD, 2010 – 2012. *EIA Manager.*
- Agreement No. CE 6/2010 (DS) - Improvement of Yuen Long Town Nullah (Town Centre Section) – Investigation EIA, Hong Kong, for DSD, 2010 – 2012. *EIA Manager.*
- Environmental Impact Assessment of Regulation of Shenzhen River Stage IV EIA Study, Hong Kong, for DSD, 2009 – 2011. *Water Quality Specialist.*
- Hong Kong Sewage Harbour Area Treatment Scheme (HATS) Stage 2 – Supplementary Water Quality Monitoring, EPD, Hong Kong Government, Hong Kong, 2007 – 2011. *Project Manager.*

NATURAL RESOURCE MANAGEMENT

- Total Water Management for Hong Kong – Feasibility Study, DSD, Hong Kong Government, 2005 – 2008. *Project Manager (Environmental).*
- Study in Terrestrial Habitat Mapping Based on Conservation Value, SDU, Hong Kong Government, 2002 – 2003. *Project Manager.*
- Artificial Reef Deployment Study, AFCD, Hong Kong Government, 1998 – 1999. *Marine Ecology Specialist.*
- Fisheries Resources and Fishing Operations in Hong Kong Waters, AFCD, Hong Kong Government, 1998. *Marine Ecology Specialist.*
- Seabed Ecology Studies, AFCD, Hong Kong Government, 1998 – 1999. *Marine Ecology Specialist.*

ROUTE SELECTION AND ENVIRONMENTAL PERMITTING

- FLAG North Asian Loop, International Submarine Cable System, Hong Kong to Taiwan, (FLAG Telecom), Hong Kong, 2001 - 2002. *Marine Ecology Specialist*
- New T&T Hong Kong Limited, Domestic Cable System (New T&T), Hong Kong, 2000 - 2001. *Marine Ecology Specialist*
- C2C International Submarine Cable System – Hong Kong Section (SingTel and GB21), Hong Kong, 2000 – 2001. *Marine Ecology Specialist*
- East Asian Crossing (EAC1) International Submarine Cable System (Asia Global Crossing and KDD SCS), Hong Kong, 2001. *Marine Ecology Specialist*
- East Asian Crossing (EAC2) International Submarine Cable System (Global Crossing Development Co. and NEC Networks), Hong Kong, 2001. *Marine Ecology Specialist*
- Telecommunications Installation at Lot 591SA in DD 328, Tong Fuk, South Lantau Coast and Associated Cable Landing Work in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System (Level(3)), Hong Kong, 2000. *Marine Ecology Specialist*
- 132kV Submarine Cable Installation for Wong Chuk Hang – Chung Hom Kok 132kV Circuits (The Hongkong Electric Co. Ltd), Hong Kong, 2001 - 2002. *Marine Ecology Specialist*
- 132kV Submarine Cable Circuits from A Kung Wan to Sai Kung Pier (CLP Power), Hong Kong, 1999. *Marine Ecology Specialist*
- Seabed Survey Work for the Proposed 11kV Cable Circuits from Tai Mong Tsai to Kiu Tsui (CLP Power), Hong Kong, 1999. *Marine Ecology Specialist*
- Seabed Survey Work for the Proposed 11kV Cable

Circuit between Pak Lap and Fu Tau Fan Chau (CLP Power), Hong Kong, 1999. *Marine Ecology Specialist*

SELECTED PUBLICATIONS

- Grebe, C.C, Smith, L. & **Reid, C.A** (2009) The Effects of Marine Seismic Acquisition in a Coral Reef Environment: Results from a Multi-Disciplinary Monitoring Program at Scott Reef, Western Australia. APPEA Conference 2009.
- Grebe CC, Smith L, **Reid CA**, Hearn RL and Colman JG (2008) *The Effects of Marine Seismic Acquisition in a Coral Reef Environment: A Synthesis of Results from a Multi-Disciplinary Monitoring Program at Scott Reef, Western Australia.* APPEA 08.
- Hastings M, **Reid CA,** Hearn R, Grebe C and Coleman J (2008) *The Effects of Seismic Airgun Noise on the Hearing Sensitivity of Tropical Reef Fishes at Scott Reef, Western Australia.* Proceedings of the Institute of Acoustics, 2008.
- C.C. Grebe, J.G. Colman & **C.A. Reid** (2008) *Practical application of an adaptive management approach for a marine seismic survey*. IAIA08 Paper.
- Qui JW, **Reid CA**, Kennish R and Qian PY (2003) *Recolonisation of Benthic Infauna Subsequent to Capping of Contaminated Mud Pits with Uncontaminated Sediments in East Sha Chau, Hong Kong.* Estuarine and Coastal Shelf Science 56 (2003) 819-831.
- Germano JG, **Reid CA**, Whiteside P and Kennish R *(2002) Field Verification of Computer Models Predicting Plume Dispersion in Hong Kong*. Dredging 02 - Proceedings of American Society of Engineers.
- Kennish R, Lui PH, Chan A, Allery SC, Leung KF and **Reid CA** (2002) *Sewage Outfall Performance Verification in Hong Kong: The results of an integrated modeling and monitoring approach.* Proceedings of the International Conference Wastewater Management & Technologies for Highly Urbanized Coastal Cities 2002, pp 295-301.
- Nicholson S, Clarke SC, Word JQ, Kennish R, Barlow KL & **Reid CA** (2000) *Quality Assurance in the Toxicological Assessment of Hong Kong Dredged Sediments: The Potential Influence of Confounding Factors on Bioassay Results.* ISWA Conference Proceedings, October 2000, Hong Kong

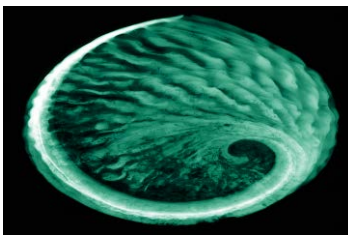
CONTACT DETAILS

ERM-Hong Kong Ltd.,
16th Floor, DCH Commercial Centre,
25 Westlands Road,
Quarry Bay,
Hong Kong

Tel: +852-2271 3179
Mob: +852-6206-5065
Fax: +852-2723-5660
Email: craig.reid@erm.com
Web: www.erm.com

Dr Robin Kennish

ESHIA Project Director



Dr Robin Kennish is ERMs Asia Pacific Managing Partner for Impact Assessment and Planning. As a Partner of ERM he has responsibility for managing and directing large scale capital project ESHIAs particularly for the Oil & Gas Sector. Dr Kennish is a Chevron Qualified ESHIA Facilitator (QEF).

Dr Kennish has over nineteen years' experience in environmental management with extensive experience in managing large-scale projects. His particular focus has been on the impacts of oil and gas projects on the environment including the following:

- **Oil & Gas Exploration & Production Vietnam:** Directed ESHIAs of marine seismic, exploratory drilling. This includes ESHIA of full scale gas production in Block B for Chevron.

- **Oil & Gas Exploration & Production Thailand:** Managed ESHIA assessments of infrastructure projects and exploration and production activities for Chevron including work on Blocks 64/50 and 64/48c.

- **Oil & Gas Exploration & Production Mainland China:** Managed and contributed to ESHIAs for industrial projects including gas pipelines, mining, offshore platforms and marine seismic surveys. This includes work for Chevron in the South China Sea on Blocks 42/05 and 53/30.

- **Oil & Gas Exploration & Production Philippines:** Provided marine biological input to assessments of exploration and production activities. Directed the preparation of EMS procedures and manuals in readiness for an Oil & Gas major's exploratory drilling activities.

- **Oil & Gas Exploration & Production Myanmar:** Directed the ESHIA studies for exploration and production activities in the Shwe Gas field as well as the Yadana block.

In addition to the above, Dr Kennish has also significant experience in the Mining sector throughout the Asia Pacific region. This has included work in the Philippines, Myanmar, Indonesia, China & Vietnam.

Fields of Competence

- Environmental, Social, Health Impact Assessments (ESHIAs)
- Equator Principle and IFC Performance Standards
- Ecology, Marine Biology and Fisheries
- Water Quality Assessments
- Environmental Permitting
- Stakeholder Negotiations

Education

- BSc (Hons) Marine Biology, University of Liverpool UK, 1991
- PhD Marine Biology, University of Hong Kong, 1995

Professional Affiliations

- Member of the Society of Environmental Toxicology & Chemistry
- Member of the Society of Petroleum Engineers

Key Relevant Projects

Chevron Projects

Environmental Screening / Scoping for 3D Seismic Survey of Blocks 15/10 and 15/28 in the Pearl River Estuary of the South China Sea, China, Chevron, 2013-ongoing. ERM was commissioned by Chevron to undertaken a Screening / Scoping study for a marine seismic survey in the South China Sea. The survey was to cover two blocks where key issues related to sensitive marine mammal habitat and fishing operations. Dr Kennish is the QEF for the study

Environmental Scoping, ESHIA and Management Plan for Exploratory Drilling of Blocks 42/05, 64/18 and 53/30 in the South China Sea, China, Chevron, 2011-ongoing. ERM was commissioned by Chevron to undertaken Screening / Scoping study for exploratory drilling in the South China Sea. An ESHIA is now underway focusing on key issue identified in the screening/scoping such as drill cuttings disposal and spill modelling. Dr Kennish was the ESHIA Subject Matter Expert for the original study and QEF for the ESHIA Update for Block 42/05.

Environmental Scoping and Management Plan for 3D Seismic Survey of Blocks 64/18 and 53/30 in the South China Sea, China, Chevron, 2010. ERM was commissioned by Chevron to undertaken a Screening / Scoping study for a marine seismic survey in the South China Sea. The survey was to cover two blocks where key issues related to sensitive marine mammal habitat and fishing operations. Dr Kennish was the ESHIA Subject Matter Expert for the study.

ESHIA for Block B Gas Production Project Western Vietnam (Chevron Vietnam), 2011-2012. ERM is conducting the ESHIA for an Oil and Gas major to support their project development to extract gas from fields located in western Vietnam waters of the Guld of Thailand. ERM has supported the local regulatory EIA process and also prepared a supplementary ESHIA to meet corporate requirements. Key issues included drill cuttings modelling. Dr Kennish was the project Director.

Block G4/50 3D Seismic Survey ESHIA, Gulf of Thailand (Chevron Thailand) 2008. ERM was commissioned to undertake an ESHIA examining the potential impacts associated with 3D Seismic Surveys of an exploration block in the Gulf of Thailand. Dr Kennish was the Technical Specialist for the project and also lead the Chevron Screening-Scoping assessment.

Block G4/48(c) Production ESHIA, Gulf of Thailand (Chevron Thailand) 2007. ERM was commissioned to undertake an ESHIA examining the potential impacts associated with the development of an offshore oil production block in the Gulf of Thailand. Dr Kennish was the Technical Specialist for the project and also lead the Chevron Screening-Scoping assessment.

Oil & Gas Projects

Exploratory Drilling Offshore Danang, Vietnam (Confidential Client), 2010 – 2012. ERM is providing EHS services to an Oil and Gas major to support their efforts in exploratory drilling in waters offshore of Danang in Eastern Vietnam. ERM has supported the local regulatory EIA process and also prepared a supplementary EIA to meet corporate requirements. Dr Kennish was the project Director.

Seismic Exploration, Deepwater Southwestern Vietnam (Confidential Client), 2010 – ongoing. ERM is providing EHS services to an Oil and Gas major to support their efforts in marine seismic surveying in deepwater offshore of Southwestern Vietnam. ERM has supported the local regulatory EIA process and also prepared a supplementary EIA to meet corporate requirements. Key issues included the preparation of a marine mammal risk assessment. Dr Kennish was the project Director.

Black Point Power Station Gas Supply Project, Hong Kong (CLP/ExxonMobil), 2009-2010. ERM is undertaking the EIA of the installation and operation of submarine gas pipelines between China and Hong Kong. As part of the EIA ERM also completed Quantitative Risk Assessments of the gas Receiving Stations and conducted 3D water quality and hydrodynamic modeling. Dr Kennish was the Project Director.

Exploratory Drilling Environmental Monitoring Program, Scott Reef, Western Australia, (Woodside Energy Ltd.), 2008 – 2011. Dr Kennish was involved in the design and planning for the execution of a targeted suite of monitoring programs to assess potential impacts of drilling in a sensitive coral reef environment. Dedicated programs to assess the disposal of drill cuttings, wastewater, rig footprint, underwater noise and artificial light have been implemented through a series of offshore surveys resulting in a series of specialised reporting deliverables that fully document the impacts of exploratory drilling on a remote coral reef system.

Environmental Social Impact Assessment for the West East Pipeline (Shell) 2002. Dr Kennish provided input to the ESIA report for this 1,400 km pipeline that traverses China from Xinjiang to Shanghai. His key responsibilities included an assessment of operation and construction phase impacts to water quality and biodiversity, and the preparation of management and mitigation measures.

EIA of LPG - LNG Plant, Peru (Pluspetrol Peru Corporation) 2003. ERM performed an environmental and social Impact assessment including environmental management and monitoring plan for Camisea Gas Export project facility. The facility includes the gas fractioning plant and a marine loading terminal. Dr Kennish advised the in-country team on installation methods to minimize water quality and ecological impacts to a sensitive nature reserve.

Huizhou 21-1 Natural Gas Submarine Pipeline, CACT Operators Group, 2002 - 2003. ERM has been commissioned to provide consulting services and specialist advice to the project. ERM provides technical assistance and negotiations with various parties and engineering support to the preliminary design of the system. Dr Kennish worked as a technical advisor on the project responsible for government liaisons and pipeline crossing parties.

Environmental Impact Assessment of Exploratory drilling of 4 blocks in the South China and Yellow Seas. – Scoping, EIA and EMMP reporting (Devon Energy Ltd), October 2007-2010. Dr Kennish was the Project Director of the environmental assessment and management plans for four exploratory drilling projects being undertaken in the South China Sea.

Environmental Impact Assessment for Gas Export Facility Development in Offshore Myanmar (Daewoo IC E&P), 2007. ERM was commissioned to conduct the EIA of natural gas exploration and production facilities in offshore Myanmar. Dr Kennish was the Project Director.

Oil Spill Modelling Study for Offshore Production Platform Australia (Total), 2007-2008. ERM was commissioned to undertake an assessment of the potential dispersion characteristics of a potential oil spill associated with an offshore drilling platform operating in the Northwest Australian Basin. ERM used the in-house modelling tool, GEMSS® (Generalized Environmental Modelling System for Surface waters) to investigate various oil spill scenarios and recommended mitigation measures to prevent adverse impacts to water quality. Dr Kennish was the Technical reviewer.

EIA for a Medium Compression Platform S Myanmar, (Hyundai Heavy Industries & TOTAL E&P), 2007- onwards. ERM undertook Supplementary EIA for additional development works at an operating production field in offshore waters of S Myanmar. Dr Kennish was the Project Director.

Impact Assessment of Bugan Field Development (Brunei Shell Petroleum Sdn Bhd), Brunei, 2006-7. ERM was commissioned to undertake an Impact Assessment (IA) of the Bugan Field Development. As a precursor to the IA, a scoping review is being conducted to identify constraints associated field development. Key environmental constraints include the presence of coral communities within the vicinity of works. Dr Kennish had oversight of the drill cuttings modelling works.

Survey on Environmental Impact of Marine Seismic Operations, Japanese Oil, Gas and Metals Corp, 2008 - 2009. ERM have been commissioned by JOGMEC to undertake a desktop assessment of the potential effects of marine seismic surveys, primarily through the use of airguns and the generation of underwater sound, to marine life. As part of the assessment ERM undertook a generic EIA as well as review current legislative and industry guidelines / corporate practices to recommend mitigation measures that could be applied by Japanese Oil and Gas companies as part of seismic exploration. Dr Kennish was the Project Director for the study leading the technical review of all deliverables and delivering the final presentation to stakeholders from the industry.

Status and Trends of HSE Issues in the Oil and Gas Industry, (Japanese Oil, Gas and Metals Corp) 2008, 2007 and 2009. ERM delivered a 3 day training workshop on ESHIA and HSE Issues that face Oil and Gas companies in 2007 and again in 2008. Dr Kennish organised the Workshop and led four of the presentations (How to do ESIA, Oil and Gas Operations in Sensitive Environments, EIA Related Treaties and Implications for Japanese Oil and Gas companies).

Environmental Review for 2D Marine Seismic Survey in Southern Chinese Waters (British Gas), China, 2007. ERM was commissioned to develop an environmental baseline profile of three exploration blocks in South China Sea intended for seismic exploration. In addition, a preliminary risk

assessment of the seismic exploration programme was prepared with respect to environmental and stakeholder sensitivities. Dr Kennish was the Lead Marine Scientist for the study.

Monitoring of 3D Seismic Survey for Browse Development Offshore Australia (Woodside), 2007-onwards. ERM lead the design and management of a comprehensive monitoring survey to be conducted as part of 3D seismic work on the Browse development. Surveys were undertaken of coral, reef fish, cetaceans, and marine reptiles before and after the 3D Seismic works. Dr Kennish was the Marine Team Leader also with responsibility of stakeholder workshops.

Oil Spill Modelling Study for Offshore Production Platform Australia (Shell Australia), 2007-2008. ERM undertook an oil spill modelling exercise as part of an EIA assessing the installation of an offshore oil production platform in Northwest Australia. ERM used the in-house model GEMSS® (Generalized Environmental Modelling System for Surface waters) to characterize various potential oil spill scenarios to assist in the development of an Oil Spill Response Plan. Dr Kennish was the Technical reviewer.

Marine Seismic Survey Integrated Impact Assessments, Offshore Brunei Darussalam (BSP) Brunei, 2004-2005. ERM has been commissioned to undertake Integrated Impact Assessments (IIA) to identify the likely health, social and environmental impacts of two marine seismic surveys in Brunei. The work also involves an investigation into the potential environmental effects of airguns on ecologically valuable coral reefs in the exploration area, associated reef fish and commercial fishing grounds. As part of the assessment, ERM will be conducting field trials to evaluate the behavioural response of both free swimming and captive reef fauna to seismic activity as well as a determination of the potential sublethal physiological effects to reef fish exposed to seismic airguns. Coral reef condition before and after the marine seismic surveys will also be monitored to correlate any observed impacts with the pressure levels measured during airgun tests. The results of the investigation will be used to determine the potential significance of impacts and where necessary provide preventive, mitigative and curative measures for future marine seismic surveys applicable to oil exploration and development. Dr Kennish was the Project Director.

Terrestrial Environmental Baseline Study for Onshore Midstream Facilities and Pipeline Landing Site, Myanmar (Confidential Client), 2008. ERM has been commissioned to undertake an onshore terrestrial ecology survey of the proposed landing site and onshore pipeline for the development of a natural gas export facility in Myanmar. The study will include multi-disciplinary ecological surveys following standard international scientific procedures with the results being used to assist a future environmental impact assessment for the construction and operation of the proposed facilities. Dr Kennish was the Project Director.

Marine Environmental Baseline Survey for Midstream Pipeline, Myanmar (Confidential Client), 2008. As part of a series of studies providing environmental services associated with the assessment of a natural gas export facility in Myanmar, ERM have been commissioned to undertake a second marine baseline study of offshore facilities, this time of the midstream pipeline. The study will involve targeted sediment, water and biological sampling along the pipeline route to suitably characterise the habitats for future impact assessment.

Impact Assessment of Seria North Flank Development (Brunei Shell Petroleum Sdn Bhd), Brunei, 2006-7. ERM has been commissioned to undertake an Impact Assessment (IA) of the Seria North Flank Development. As a precursor to the IA, a scoping review is being conducted to identify constraints to the development options. Key environmental constraints include environmentally sensitive coastal habitats within the vicinity of works. Following the scoping study, an IA will be conducted in order to assess the significance of, and propose mitigation, management and monitoring for key potential environmental, social and health impacts associated with the project. Dr Kennish was the Lead Environmental Scientist for IA.

Drill Cuttings Modelling Study Bubut Field Development (Brunei Shell Petroleum Sdn Bhd), Brunei, 2007. ERM was commissioned to undertake a hydrodynamic and mathematical modelling study of the disposal of drill cuttings as a result of drilling for hydrocarbons in offshore Brunei waters. Key concerns were the potential dispersion of synthetic based drilling fluid muds adhered to drill cuttings and their subsequent potential to deposit on sensitive coral habitats located within close proximity to the works. Dr Kennish had oversight of the drill cuttings modelling works.

Peragam Exploration Well Drill Cuttings Modelling (Brunei Shell Petroleum Sdn Bhd), Brunei, 2006. ERM were commissioned to undertake a

hydrodynamic and mathematical modelling study of the disposal of drill cuttings as a result of exploratory drilling for hydrocarbons in offshore Brunei waters. Key concerns were the potential dispersion of synthetic based drilling fluid muds adhered to drill cuttings and their subsequent potential to deposit on sensitive coral habitats located within close proximity to the works. Dr Kennish had oversight of the drill cuttings modelling works.

Preliminary Environmental & Social Scoping Study for Gas Export Facility Development in Offshore Myanmar (Confidential Client), 2006. ERM has been commissioned to conduct a scoping study of the scope for Environmental and Social Impact Assessments of natural has exploration and production facilities in offshore Myanmar. Dr Kennish was the Project Director.

Construction of Twin Submarine Gas Pipelines from Shenzhen LNG Terminal to Tai Po Gas Production Plant (Aker Kvaerner) 2004-2006. ERM has been retained to act as Independent Environmental Checker for the construction and installation of a 32 km twin submarine NG pipeline connecting Hong Kong and China. Dr Kennish was the Project Director and prepared the environmental input to the construction tenders.

Detailed EIA and FEED Study for Submarine Gas Pipelines from Shenzhen LNG Terminal to Tai Po Gas Production Plant (Hong Kong & China Gas Company) 2002-2003. ERM was retained to lead the EIA and FEED studies for a 32 km submarine NG pipeline connecting Hong Kong and China. Key issues include impacts to water quality and corals from pipelines jetting works. Dr Kennish was the Project Manager and secured award of Environmental Permits for construction of the project.

Consultation on the Decommissioning of Overseas Offshore Platforms (Confidential Client) 2005 – 2006, China. ERM were commissioned to undertake a desktop review of the relevant laws and regulations, standards, techniques and practices of international oil companies concerning offshore decommissioning operations. As part of the study, potential decommissioning scenarios were evaluated to identify environmental risks and potential mitigation measure. Dr Kennish was the Project Director for the study.

*I*mpact Identification Study for the Development of Upstream Facilities in Offshore Myanmar (Confidential Client), Myanmar, 2006. Following on from a recent high level scoping study, ERM were commissioned to undertake an impact identification study, or detailed scoping study, of the development of upstream infrastructure for a Gas Export Facility in offshore Myanmar. The project identified key data gaps in available environmental and social information and recommended the way forward for future assessments. Dr Kennish was the Project Director for the study.

Platforms Decommissioning Campaign, Offshore Brunei Darussalam (BSP) Brunei, 2004. Dr Kennish led the marine ecological impact assessment as part of the proposed deployment of artificial reefs through decommissioning of six redundant platforms in waters offshore Brunei. In addition, Dr Kennish was responsible for reviewing the design and deployment site for the proposed artificial reefs as well as recommending mitigation measures and long-term management plans.

Permanent Aviation Fuel Facility (Leighton Contractors Asia), 2003 – 2012. ERM has been retained as the Environmental Team to monitor the construction of an aviation fuel facility that includes a submarine pipeline, receiving jetty and tank farm. Key issues include construction impacts to water quality and monitoring potential impacts to the endangered Indo-pacific Humpbacked Dolphin through underwater acoustics. To address these concerns ERM has been responsible for developing innovative underwater noise mitigation through the installation of bubble jackets around the jetty piling works. Dr Kennish was the Project Director.

Options Assessment Lufeng 22-1 Decommissioning, (Statoil Orient Inc) 2002. Marine specialist to assist in identifying the preferred option for decommissioning the Lufeng 22-1 oil field, a sub-sea facility located 250km southeast of Hong Kong in 330m of water. This was the first decommissioning in the PRC South China Sea and the project demonstrated to regulators that different options had been assessed against cost, safety, stakeholder acceptability and environmental criteria. Dr Kennish role was to evaluate the enhancement potential of the structures if they were to be used as Artificial Reefs.

Dr Jasmine Ng

Principal Consultant

Dr Jasmine Ng is a Principal Consultant at ERM-Hong Kong's Marine Sciences Team. She has over ten (10) years of experience in regional and international marine environmental management.

Dr Ng has a strong technical background in marine science and specialises in leading impact assessments and environmental monitoring for Oil and Gas and large-scale development projects in the Asia-Pacific region. Based in Hong Kong, Dr Ng has worked on impact assessment for Oil and Gas projects in South East Asia (Myanmar, Vietnam, Thailand, Malaysia, Singapore, Brunei and Indonesia), North East Asia (China, Hong Kong, Japan and South Korea), Australia, Pakistan, Kazakhstan, Qatar, Romania and Gabon. She has led the environmental, social and health impact assessment (ESHIA) of upstream marine developments including seismic surveys, exploratory drilling operations and full production complexes, and for midstream/ downstream facilities such as pipelines, export facilities, LNG terminals and refineries.

Dr Ng is also experienced in managing and preparing impact assessments for reclamations, ports, airport, submarine pipelines, cables and utilities, offshore windfarms and coastal infrastructure/ development projects undertaken to comply with requirements from regulators, international lending organizations and/ or the project owners'/ proponents' corporate standards. She is therefore familiar with requirements of lenders such as the International Finance Corporation's Performance Standards and general and industry-specific Environmental, Health, and Safety Guidelines.

Dr Ng previously worked as a Marine Environmental Adviser for INPEX Browse Ltd (on secondment) on the proposed Ichthys Gas Field Development (original Maret Islands option, Western Australia). For this gas field and onshore processing facilities development project, Dr Ng was one of the technical authors of the Marine EIA and EMMP prepared as part of the Environmental Impact Statement/ Environmental Review and Management Program (EIS/ ERMP) originally planned for submission to the Western Australian/ Australian Commonwealth Governments.

Fields of Competence

- Environmental Impact Assessment (EIA)
- Environmental, Social and Health Impact Assessment (ESHIA)
- Marine Ecology and Fisheries

Professional Affiliations & Registrations

- Member, Hong Kong Institute of Environmental Impact Assessment (HKIEIA)
- Member, Marine Biological Association of Hong Kong

Education

- PhD in Marine Ecology, The University of Hong Kong, 2007.
- BSc(Hons) in Environmental Life Science, The University of Hong Kong, 2003.

Languages

- English
- Chinese (Cantonese and Mandarin)

Key Projects

EIA/ ESHIA Projects – Oil & Gas

EIA for Onshore Gas Terminal and Supply Base (Confidential Client), Block A-1 and Block A-3 Gas Development, Myanmar, 2009-2010. ERM were commissioned to undertake an EIA for a proposed onshore supply base facilities, which included a supply base, an access road and a jetty, on Ramree Island, Myanmar, to support the construction, operation and maintenance of offshore and onshore facilities as part of the upstream and midstream development of Block A-1 and Block A-3. Dr Ng was the Marine Scientist and led the preparation of the EIA Report and Environmental Management and Monitoring Plan (EMMP).

EIA for Block A-1 and Block A-3 Gas Development and associated Midstream Pipeline (Confidential Client), Myanmar, 2007-2008. ERM undertook the EIA for a proposed offshore gas field development in Myanmar. The scope of works included screening, scoping and assessment of impacts, and seasonal baseline field surveys to support the EIA. Dr Ng was the Marine Scientist and led the preparation of the EIA Report and Environmental Management and Monitoring Plan (EMMP).

Environmental Impact Assessment (EIA) for a Medium Compression Platform, Myanmar (Hyundai Heavy Industries & Total E&P Myanmar), 2007. ERM undertook a supplementary EIA for additional development works at an operating production field in offshore waters of S Myanmar. Due to a lack of local legislation, the assessment was undertaken to Company HSE Standards supplemented by World Bank and IFC Guidelines. Dr Ng was the Marine Scientist and Project Coordinator and authored the EIA Report.

ESHIA Screening & Scoping for Marine 3D Seismic Survey of Blocks 62/17 and 35/10, YingGeHai Basin, South China Sea (Shell China Exploration and Production Co Ltd), 2012-2013. ERM were commissioned to undertake the Screening and Scoping stages of the ESHIA for the proposed marine 3D seismic campaign in Blocks 35/10 and 62/17 of the South China Sea. Dr Ng was the Marine Scientist and completed the desktop screening and scoping studies as per Shell's internal requirements.

ESHIA for YingGeHai Offshore Exploratory Drilling, Hainan, China (Shell China Exploration and Production Co Ltd), 2013. ERM have been tasked to conduct the ESHIA of the proposed exploratory drilling campaign in Blocks 35/10 and 62/17 of the South China Sea. Dr Ng is the ESHIA Technical Specialist and will provide expert input to the ESHIA related to potential impacts of the campaign on the marine environment.

Environmental Risk Assessment for Two 3D Seismic Surveys, South China Sea (BG Group), 2008 and 2010. ERM were contracted to conduct two preliminary environmental risk assessments to examine the potential risks associated with 3D seismic surveys in three exploratory blocks in the South China Sea. Dr Ng was the Marine Scientist and was responsible for the preparation of the risk assessment document.

Environmental Risk Assessment for Exploratory Drilling Campaign, South China Sea (BG Group), 2008. ERM were contracted to conduct the preliminary environmental risk assessment to examine the potential risks associated with a exploratory drilling campaign in three exploratory blocks in the South China Sea. Dr Ng was the Marine Scientist and was responsible for the preparation of the risk assessment document.

Environmental, Social and Health Impact Assessment (ESHIA) Study for Block B Development, Southwest Vietnam Sea (Chevron Vietnam), 2010-2012. ERM were commissioned to conduct a detailed ESHIA to examine the potential environmental, social and health risks associated with the development of the Vietnam Block B Gas Project (production of Blocks Blocks B & 48/95 and 52/97). Dr Ng is the Senior Marine Scientist of this Project and works directly with the local ESHIA Team and Project Team to establish the environmental baseline profile of the Blocks, assess potential impacts, and identify and develop feasible and practical mitigation, enhancement and monitoring measures. She has been seconded to the project offices in Vietnam for five weeks for the preparation of the ESHIA documents.

Supplementary EIAs for Offshore Da Nang Exploratory Drillin Campaigns, East Vietnam Sea (ExxonMobil Exploratory & Production Vietnam Ltd), 2010-2011. The internal SEIA provides an assessment of the potential environmental impacts associated with the exploratory drilling activities in Block 119 in offshore Danang, Vietnam. Dr Ng was the Senior Marine Scientist and authored the SEIA and Environmental Management and Monitoring Plan which outlines the monitoring and mitigation requirements for the project.

SEIAs for Offshore Vung May Marine Drop-core and 3D Seismic Surveys, South Vietnam Sea (ExxonMobil Exploratory & Production Vietnam Ltd), 2011. Dr Ng was the lead author for these two SEIAs which assessed the potential environmental impacts associated with 3D seismic survey and marine drop-coring activities within the deep water blocks (Blocks 156-159; up to 2,000 m) in Vietnam. She also provided a desktop technical review of baseline conditions of marine mammals within the blocks.

ESHIA for 3D Marine Seismic Survey in Block G4/50, Gulf of Thailand (Chevron Petroleum (Thailand) Ltd), 2008. ERM were commissioned to conduct a detailed ESHIA to examine the potential environmental, social and health risks associated with 3D seismic surveys in the Concession Block G4/50 in the Gulf of Thailand. Key issues for the study relate to assessing disturbance to marine fauna and habitats, potential for marine pollution, interactions with local and commercial fisheries, and potential impacts on dive sites associated with the tourist destinations of Koh Samui, Koh Tao and Koh Pha Ngan. Dr Ng was the Marine Scientist of this Project and was responsible for the preparation of ESHIA documents.

EIA for Block G4/48(c) Offshore Production, Gulf of Thailand (Chevron Pattani Ltd), 2007-2008. ERM were commissioned to undertake an ESHIA examining the potential impacts associated with the development of an offshore oil production block in the Gulf of

Thailand. The proposed development involved the installation of three new wellhead platforms and interconnecting facilities, and key issues relate to potential impacts on the marine environment during different project phases. Dr Ng was the Marine Scientist and Project Coordinator and led the preparation of the ESHIA document.

Environmental Impact Statement/ Environmental Review Management Programme (EIS/ERMP) for the Ichthys Gas Field Development (INPEX Browse Ltd), 2007-2008. INPEX proposed to develop the Ichthys Gas Field of Western Australia (WA) and as part of the environmental assessment process, an Environmental Impact Statement/ Environmental Review Management Programme (EIS/ERMP) document would be produced for submission to the authorities. For this gas field and onshore processing facilities development project, Dr Ng was the Marine Environmental Adviser and was one of the technical authors of the Marine Impact Assessment of the EIS/ ERMP originally planned for submission to the Western Australian/ Australian Commonwealth Governments. She was seconded to INPEX Browse in Perth, Australia for six weeks for the preparation of the EIS/ERMP.

Environmental Review of Maxima 3D Marine Seismic Survey at Scott Reef, Northwest Shelf of Australia (Woodside Energy Ltd), 2007-2008. ERM were commissioned to provide environmental services to Woodside for the proposed Maxima 3D marine seismic survey at Scott Reef in offshore northwestern Australian waters, as part of the Browse Field Development Study. Dr Ng was the Marine Scientist and reviewed the results of scientific investigations conducted as part of the environmental Adaptive Management Program of the project. She prepared a Synthesis Report which outlined to the industry the ecological implications of 3D marine seismic survey. This work represents one of the largest multi-disciplinary field studies into the environmental effects of seismic surveys on marine life.

Environmental Hazard Review (ENVID) for the LR2 Refinery (CHIYODA CTCI Joint Venture), 2013. A ENVID workshop for the construction and operation of the LR2 Refinery was held with the project owner and engineering and construction contractor with a view to identifying potential environmental risks associated with the new refinery tank farms, process infrastructure, utilities and jetty and formulating safeguards and mitigation measures. Dr Ng was the chairperson facilitating the ENVID.

ESHIA IFC Gap Analysis for an LNG Import Terminal Project, Pakistan (Confidential Client), 2011. The purpose of the assignment was to perform a desktop gap analysis for the project EIA against relevant IFC Performance Standards (IFC PS) and provide recommendations for actions needed to address the identified gaps. Dr Ng provided technical review of the project EIA against the requirements of IFC PS1 (Social and Environmental Assessment and Management Systems), PS6 (Biodiversity Conservation and Sustainable Natural Resources Management), and IFC EHS Guidelines for Ports, Harbors, and Terminals.

Cumulative Impact Assessment for an LNG Import Terminal, Pakistan (Confidential Client), 2011. Based on the recommendations of the ESHIA IFC Gap Analysis to help achieve compliance with the IFC PS, a cumulative impact assessment was undertaken to assess the potential cumulative environmental and social impacts associated with the concurrent construction and operation of this terminal and other LNG projects being planned in the same area. Dr Ng was the ESHIA Technical Specialist who led the assessment.

Domino-1 Exploratory Drilling Evnrionmental Impact Assessment, Offshore Black Sea (ExxonMobil Exploratory & Production Romania Limited), 2011. Dr Ng is the lead author for this internal EIA which assessed the potential environmental impacts associated with exploratory drilling of one well (~ 920 m) in offshore Romanian Black Sea. Key issues include the assessment of potential impacts of unplanned spill event on the western Black Sea coast which comprises RAMSAR and UNESCO wetlands and Important Bird Areas.

Marine Monitoring of Oil and Gas Activities in the North Caspian, Republic of Kazakhstan (Agip KCO), 2009. ERM was appointed by Agip KCO to review the marine monitoring data collected in the vicinity of Agip KCO's facilities in the North Caspian as part of an ongoing programme. Dr Ng applied statistical techniques to aid in the interpretation of three years of monitoring results in respect of the North Caspian environment. The interpretation would help detect if Agip KCO's activities in the Kashagan field resulted in any environmental impacts in the marine environment in the vicinity. Monitoring results were also checked against relevant local and international standards.

Survey on Environmental Impact of Marine Seismic Operations (Japan Oil, Gas and Metals National Corporation [JOGMEC]), 2008-2009. JOGMEC has contracted ERM to undertake a comprehensive desktop review on the potential environmental implications and existing management of marine

geophysical seismic surveys (towed streamer and ocean bottom cable surveys). Dr Ng was the Marine Scientist and authored the Review Report which presented the fundamentals of marine seismic operations and the potential environmental impacts arising from these operations, summarised the regulatory requirements and management of marine seismic surveys by international and industry associations, oil and gas majors, geophysical contractors and oil/ gas-producing countries, and discussed high-profie case studies and potential alternative techniques to seismic surveys.

EIA for Black Point Gas Supply Project, Hong Kong – China (ExxonMobil/ CLP Power JV), 2008-2010. CAPCO (JV of ExxonMobil and CLP Power) examined the options to obtain natural gas from gas suppliers in Mainland China via submarine gas pipelines to fuel their Black Point Power Station and has commissioned ERM to undertake a series of strategy and permitting studies for achieving timely statutory approval of this Project. Dr Ng is the Project Manager and is responsible for the day-to-day coordination of the Project. She also leads the preparation of various non-statutory and statutory submissions (eg internal strategy papers and EIA reports and supporting submissions for government), and acts as the Field Team Leader for intertidal and benthic surveys undertaken to support the EIA preparation.

Environmental Monitoring and Audit (EM&A) for The First Phase of the Black Point Gas Supply Project, Hong Kong (ExxonMobil/ CLP Power JV), 2010-2013. ERM has been commissioned to act as the Environmental Team (ET) consultant to support the implementation of the EM&A programme which includes marine mammal monitoring and water quality monitoring. Dr Ng is the Project Manager and is responsible for the day-to-day coordination of the Project.

Liquefied Natural Gas Terminal in Hong Kong (ExxonMobil/ CLP Power JV), 2007-2008. ERM assisted with the pre-construction services for the Hong Kong LNG Project. This work has included baseline environmental surveys, stakeholder liaison activities, Archaeological Rescue Excavation and Landscape masterplanning, etc. Dr Ng was one of the key authors of the marine Environmental Enhancement Plan for the project.

EIA/ ESHIA Projects – Power

ESHIA for a 2 x 620 MW Coal-fired Thermal Plant in Mong Duong, Vietnam (Confidential Client), 2010-2011. ERM were commissioned to conduct an ESHIA for a 2 x 620 MW coal-fired thermal plant at the coast of Mong Duong, Vietnam. Dr Ng was the Technical Reviewer and was responsible for providing specialist input and reviewing the Ecological Impact Assessment presented as part of the ESHIA.

Marine Biodiversity & Sagea Lagoon Ecology Impact Assessment for a Nickel & Cobalt Mine in Weda Bay, Indonesia (Confidential Client), 2009-2011. ERM were commissioned to conduct a series of marine baseline sur veys and the marine impact assessment for a mining development in Indonesia. Dr Ng was one of the key authors of the marine impact assessment.

ESHIA for a 2 x 660 MW Coal-fired Thermal Plant in Vung Ang, Vietnam (Confidential Client), 2008-2009. ERM were commissioned to conduct an ESHIA for a 2 x 660 MW coal-fired thermal plant at the coast of Vung Ang Bay, Vietnam. Dr Ng was the Marine Scientist and led the intertidal rocky shore and sandy shore baseline ecological surveys, and was responsible for the preparation of the Ecological Impact Assessment presented as part of the ESHIA.

EIA Study of an Offshore Wind Farm in Hong Kong (Hong Kong Electric Ltd.), 2008 – 2010. ERM undertook an EIA of two potential locations for an offshore wind farms in Hong Kong. Key issues for the EIAs include impacts of sensitive marine habitats for finless porpoise and seabirds. Dr Ng led the intertidal field surveys was the lead author for the Marine Environmental Baseline reports.

EIA/ ESHIA Projects – Port & Transport

Pre-Environmental Impact Assessment Advisory Services for the proposed Grand Nicaraguan Canal, Nicaragua (Confidential Client), 2013 onwards. The Grand Nicaraguan Canal is a proposed "wet canal" which would connect deepwater ports on the Pacific and Caribbean coasts of Nicaragua to enable ship passage, possibly for post-Panamax ships of up to 250,000 tons. ERM were engaged to provide Pre-EIA services for the proposed canal and the associated supporting infrastructures (which may include railway, roads, ports and airport, etc.). One of the key scope of services is to undertake, in liaison with the Engineering Contractor, route selection and alternatives analysis to determine the preferred route for the canal and the probable location for other supporting infrastructures. Dr Ng is the Hong Kong Liaison and ESIA specialist for this Project who is responsible for collaborating with the Engineering Contractor regularly to discuss potential

environmental and social risks associated with the potential routes and construction technologies, and review design alternatives and provide feedback.

Independent Review for the EIA of the Expansion of Hong Kong International Airport into a Three Runway System (The Airport Authority Hong Kong), 2012-2014. ERM is working as the independent reviewer of the EIA of Hong Kong's Airport Expansion project. The runway expansion works will include a 650 ha reclamation and ERM's EIA review team is working with four EIA consultants and three engineering scheme design consultants to complete the regulatory permitting work. Dr Ng is the Project Manager and her duties in this mega-project include managing the day-to-day activities of the EIA review work, client/ consultant/ government liaison, advising permitting strategies and technical review of EIA report and associated submissions.

EIA Further Study for Contaminated Sediment Disposal Facility to the south of The Brothers, Hong Kong (Civil Engineering and Development Department, HKSAR Government), 2011-2012. ERM carried out an EIA further assessment to provide a standalone assessment of projected future baseline conditions with and without the South Brothers Facility and the 'net' impacts of the Facility for recommending appropriate measures to mitigate and minimise the "net" impact. Dr Ng was the EIA Further Study Lead Liaison Team Lead responsible for reviewing the potential cumulative impacts from concurrent development projects and conducting local public consultations.

EIA Review for Contaminated Sediment Disposal Facility at South of Brothers, Hong Kong (Civil Engineering and Development Department, HKSAR Government), 2009-2011. ERM were commissioned to update the approved EIA with particular focus on assessing cumulative impacts from concurrent projects in the vicinity of the facility. The review involved assessment of cumulative impacts from numerous projects in northwest Lantau waters on water quality, fisheries and marine ecology, including seagrass / mangrove habitat and the nearby marine park for the Chinese White Dolphin. Dr Ng is the Project Coordinator and Local Consultation Specilalist for the study and is the key author for the EIA Review Report and led the human/ ecological risk assessments and bioaccumulation assessment.

EIA Study for a Marina Development on Lamma Island, Hong Kong, (The Baroque on Lamma Ltd), 2010-2014. ERM is undertaking the EIA and planning applications for a marina development off southeast Lamma Island. Key issues for the EIAs include impacts of sensitive marine habitats for finless porpoise, marine turtle, and fisheries. Dr Ng is leading the aquatic field surveys (freshwater macro-invertebrates) and baseline fisheries survey and is the lead author for the Fisheries Impact Assessment.

Publications

- Ho GWC, Leung KMY, Lajus D, **Ng JSS**, Chan BKK (2009) Fluctuating asymmetry of *Amphibalanus (Balanus) amphitrite* (Cirripedia: Thoracica) in association with shore height and metal pollution. *Hydrobiologia* 621: 21-32
- Wai TC, **Ng JSS**, Leung KMY, Williams GA, Dudgeon D (2008) The source and fate of organic matter and the significance of detrital pathways in a tropical coastal ecosystem. *Limnology and Oceanography* 53(4): 1479-1492
- Hutchinson N, Davies MS, **Ng JSS**, Williams GA (2007) Trail following behaviour in relation to pedal mucus production in the intertidal gastropod *Monodonta labio* (Linnaeus). *Journal of Experimental Marine Biology and Ecology* 349: 313-322
- **Ng JSS**, Lui KKY, Lai CH, Leung KMY (2007) *Harpiosquilla harpax* (Crustacea, Stomatopoda) as a biomonitor for trace metal contamination in benthic sediments in Hong Kong waters. *Marine Pollution Bulletin* 45: 1523-1529
- Lui KKY, **Ng JSS**, Leung KMY (2007) Spatio-temporal variations in the diversity and abundance of commercially important Decapoda and Stomatopoda in subtropical Hong Kong waters. *Estuarine, Coastal and Shelf Science* 72: 635-647
- **Ng JSS**, Wai TC, Williams GA (2007) The effects of acidification on the stable isotope signatures of marine algae and molluscs. *Marine Chemistry* 103: 97-102
- **Ng JSS**, Williams GA (2006) Intraspecific variation in foraging behaviour, the influence of shore height on temporal organization of activity in the chiton *Acanthopleura japonica*. *Marine Ecology Progress Series* 321: 183-192

Becky Summons

Consultant

Becky Summons is a Consultant with ERM based in the Hong Kong Office. Miss Summons has over 6 years' experience in Environmental and Social Impact Assessments and has worked on a number of projects in the oil and gas, renewables and marine cable industries. Specializing in the marine environment, Becky has extensive knowledge of international regulatory and UK permitting requirements for upstream oil and gas activity. She has particular experience in undertaking environmental and social impact assessment to lender requirements (such as IFC, EBRD, Equator Principles and JBIC). Becky has also prepared and reviewed a number of scopes for feasibility and baseline environmental and / or social studies in support of large scale oil and gas exploration campaigns.

Becky has significant experience in the preparation and management of a variety of offshore Environmental, Health and Social Impact Assessments (ESIAs/ EIAs / ESHIAs), Environmental Statements (ESs), Habitat Regulations Assessments (HRAs), Appropriate Assessment (AAs) and Strategic Environmental Assessments (SEAs). As part of these works, Becky has managed a range of projects for clients in the oil and gas industry including BP, BG Gorpu, Statoil, EnQuest, Petrofac, PA Resources, GDF Suez, RWE, South Stream Transport B.V. and Wintershall.

Becky has also lead or supported stakeholder engagement for oil and gas projects, ensuring all consultation was conducted to IFC requirements. Becky's engagement experience includes: setting up and running workshops; preparing engagement plans, consultation databases, meeting minutes and presentation materials and participating in stakeholder consultation. This engagement has included liaison and meetings with local and fishing communities, fishing organizations, governing bodies and local academic institutions.

She was seconded to the BP offices in Aberdeen in 2010-2011 where she worked within the subsea and wells environmental team on all environmental permits required for BPs oil and gas activity within the UKCS. This role required liaison with the Environmental Advisor at BP, the DECC and other statutory bodies.

Becky has been involved in a number of upstream offshore oil and gas environmental permits including PONs, OPEPs (Oil Pollution Emergency Plans) and Marine Licenses Through this, Becky has gained extensive knowledge of chemical and environmental impact assessments including air, waste and chemical emissions, oil spills, seabed disturbance and underwater noise.

Since joining ERM, Becky has been working on projects for BG Group, Statoil and Chevron related to offshore seismic exploration in Myanmar.

EDUCATION

- MSc, Marine Environmental Protection, Bangor University, Wales, United Kingdom, 2009
- BSc (Hons), Marine Biology, University of Swansea, Wales, United Kingdom, 2003

PROFESSIONAL AFFILIATIONS & REGISTRATIONS

- Member of the Institute of Environmental Management & Assessment (IEMA)
- DECC Level 2 Corporate Manager (Oil Spill Response): Oil Spill Response (September 2011)

FIELDS OF COMPETENCE

- Marine Biology and Ecology
- Environmental Impact Assessment (EIA)
- Environmental Monitoring
- Oil and Gas Specialist
- Environmental Planning and Regulations
- Stakeholder Engagement

CONTACT DETAILS

ERM-Hong Kong, Limited
16th Floor, Berkshire House, 25 Westlands Road, Quarry Bay, Hong Kong
Direct Office Line: (852) 2271 3179
Tel: +852-2271-3191
Fax: +852-2723-5660
Email: rebecca.summons@erm.com
Web: www.erm.com

ERM

SELECTED PROJECT EXPERIENCE

SEISMIC SURVEY

- **2D and 3D Seismic Survey, Offshore Myanmar, BG Group, 2015-Ongoing.** Becky is the Project Manager for a 2D and 3D exploration campaign (including seismic surveys, gravity & magnetic surveys and seabed sampling) in Blocks A-4 and Ad-02 in the waters offshore Rakhine State in Myanmar. The role includes client liaison, marine environmental baseline and impact assessment and preparation of the IEE Report to local Myanmar requirements. The work also involved stakeholder engagement in the Rakhine State in 4 townships to participate in focus group discussions on fishing and the environment. The engagement has also involved discussion with key stakeholders such as universities, NGOs, government authorities and Myanmar fishing associations.
- **2D Seismic Survey, Offshore Myanmar, Statoil, 2015-ongoing.** Becky is the Project Manager for a 2D seismic survey in Block AD-10 in the waters offshore Rakhine State in Myanmar. The role includes client liaison, marine environmental baseline and impact assessment and preparation of the IEE Report to local Myanmar requirements. The work also involved stakeholder engagement in the Rakhine State in 2 townships to participate in focus group discussions on fishing and the environment.
- **Seismic Survey ESIA, Honduras, BG Group, 2014-2015**. Becky was the marine ecological project manager for an ESIA required for a seismic survey in Honduran Caribbean waters. Work involved the development of the marine ecological impact methodology and criteria, the preparation of the baseline and impacts assessment and development of mitigation measures and monitoring requirements.
- **Seismic Survey Application and ES, PA Resources, Greenland, 2010**. Becky was involved in the preparation of applications with an associated ES for proposed 3D seismic activity in Disko Bay (West Coast of Greenland). Work involved liaison with local authorities, review and assessment of baseline environmental data and environmental impact assessment.
- **Offshore oil and gas permitting, BP, RWE, GDF Suez, EnQuest, Wintershall, UK 2009-11**. Becky has undertaken over 15 applications for seismic surveys within the North Sea. These have included underwater noise modelling analysis, baseline creation and impact assessment to meet permitting requirements.

MIDSTREAM (PIPELINES)

- **South Stream Offshore Pipeline Project, South Stream Transport B.V., 2012-2014**. The SSOPP was a major development scheme to bring gas from the Russian gas fields to Europe via a pipeline under the Black Sea. Becky was the country manager for the Turkish EIA and ESIA process and was responsible for the delivery of all reports from scoping to final ESIA related to Turkish permitting requirements. She was also responsible for delivering the marine ecology Chapters for all three countries (Russia, Bulgaria and Turkey). Becky also managed the stakeholder engagement aspects of the project within Turkey which included liaison with ministries, NGOs and academic organisations to support the national approval process. She also assisted with the stakeholder consultation primarily focused on fishing communities and organisations as the Project was located >100km from the coastline. Becky's responsibilities in the marine ecology aspects include: sole author of the scope of work for Turkish, Russian and Bulgarian marine survey. The survey included benthic, mammal and seabird surveys in the Black Sea and was undertaken to meet international standards, development of impact assessment criteria for marine receptors, preparation of the marine ecology chapters for the ESIA and assistance with the planning of HRA/Appropriate Assessment for Bulgaria and other required documents for permitting requirements.

EXPLORATION AND DRILLING

- **Conrie Field Development Environmental Statement (ES), EnQuest, UKCS 2011-2012**. Becky was project manager, lead author and focal point to deliver the ES for the Conrie Field Development in the Northern North Sea including 8 new wells and a tie-back to the existing Don Platform. This work included the preparation of an ES detailing impacts from construction of and production from the Conrie Field in the Northern North Sea. Work included liaison with statutory bodies, chemical, noise, air and other environmental impacts associated with oil and gas developments based on baseline surveys.
- **Don SW and West Don and Exploration offshore oil and gas permitting, EnQuest, 2010-2011**. Becky was project manager and focal point for environmental permitting work for EnQuest in their Don Field. Work involved the preparation of a variety of environmental permits (PONs/ OPPCs/ OPEPs) for drilling and intervening wells, seismic surveys and installing pipelines and platforms and liaison with regulatory bodies. Impact assessments were carried out for the following; Don SW and West Don, Heather and Ivy, Crathes and Knightsbridge.

- **BP Secondment, Aberdeen, BP, 2010 – 2011 (6 months).** Becky was seconded into the BP offices in Aberdeen to assist the wells and subsea environmental advisor with permitting regulations of all BP upstream activities in the UKCS. Work involved liaison with statutory bodies and preparation, tracking and submission of E&P permits for the UKCS.
- **Offshore oil and gas permitting, BP, RWE, GDF Suez, EnQuest, Wintershall, UK 2009-11.** Becky was project manager and focal point for environmental permitting work for EnQuest exploration drilling within the UKCS. Becky was also involved in the preparation and management of environmental assessments and permits of a number of well drilling and intervention programs for a variety of companies operating within the UKCS. Work included; preparation of ESs, seismic surveys applications, drilling and intervention permits for wells, permits for installation of pipelines, platforms and subsea templates.
- **Exploration drilling Oil Pollution Emergency Plans (OPEPs), EnQuest, Wintershall, BP, 2010-2011**. Becky was the lead author for a number of Oil Pollution Emergency Plans (OPEPs) for BP, Wintershall and EnQuest and undertook frequent liaison with governmental departments on the requirements of new legislation into oil spill response. This work involved assessment of oil spill models and key sensitivities in the area. The OPEP was prepared in accordance with new government guidelines.
- **Seaward License Round (R26) Applications, RWE and GDF Suez, 2010**. Becky authored the environmental appendix for RWE and GDF Suez to support their 26th round license applications. This involved identification of key sensitivities and assessment of any potential impacts.

DUE DILIGENCE/RISK

- **TAP / TANAP ESIA Commitments Risk Assessment, BP, 2014**. Becky was the Project Manager for a risk assessment of ESIA commitments contained within the commitment registers for two gas pipelines (TAP and TANAP). This work involved a review, categorisation and pre-screening of the ESIA commitments in order to undertake a risk assessment. The risk assessment focused on business, HSE and financial risks (associated with the inaction of commitments) and highlights those with the greatest risk to the Project.

POWER

- **Power Cable Constraints Mapping, Transelec, Chile, 2011**. Becky was involved in constraints mapping for a proposed marine cable in Chile. The project aimed to link a new hydroelectric energy dam with the existing infrastructure. The work was mainly GIS based and involved analysis of baseline data and data from the local authorities on key sensitivities in the region.
- **Habitats Regulations Assessments (HRA) for siting of a nuclear power station, DECC, 2010**. Becky assisted in the preparation of HRAs for two locations within the UK identified as potential sites for nuclear power stations. This work involved assessing potential impacts from the power plants in terms of the impact on neighbouring protected areas.
- **GTI and BWII Windfarms due diligence, Germany, 2009-10**. Becky was involved in the due diligence work for two large German windfarm developments in the North Sea. Work involved managing the translation of documents from German and overall document management for all key reports. Becky also prepared the environmental and permitting sections of a due diligence report to focus on any key issues that could arise from the proposed wind farms.
- **EriGrid cable (England –Ireland Interconnector) ES, Ireland, 2009-2010**. Becky assisted in the preparation an ES for a power cable between Ireland and Wales. This involved analysis of baseline data in terms of key sensitivities observed along the cable route. The work also involved constraint mapping using GIS.

FIELD WORK EXPERIENCE (VOLUNTARY AND ACADEMIC)

- **Menai Strait, Bangor, Wales**. Laboratory and shoreline work. Pier based sampling of plankton, measuring diel vertical migrations exhibited by Elminius modestus (barnacle larvae) and rocky shore sampling of barnacle settlement preferences.
- **Gower Peninsula, Wales**. Laboratory and shore based work. Seaweed sampling for small epifaunal gastropods on red algal strands in the intertidal, microscope based species identification.
- **Millport Biological station, Isle of Cumbrae, Scotland**. Laboratory, shoreline and boat work. Sandy shore transects and corers for sediment analysis, measuring beach profiles. Offshore and nearshore grab sampling and bean trawling for benthic species analysis. Lab work (microscope) for taxonomic identification.
- **National Oceanography Centre, Southampton and English Channel**. Laboratory and boat work. On board research (ROV) into tube worm reefs and Maerl growth open water experiments. Beam trawls for benthic species analysis. Fish stomach analysis.

Neena Singh

Partner

Ms Neena Singh has more than 20 years of experience in the field of social development and is presently a Partner with ERM India, and heads the Impact Assessment and Planning team. As the Head of the team she is responsible for business development as well as co-ordination of all the projects that are undertaken by the Group. She is also a key member of ERM Group's Social network and responsible for business development in the region.

She has extensive experience in carrying out reviews, assurance audits, social assessments, Social Impact Assessment and Resettlement and Rehabilitation studies and preparation of Rehabilitation Action Plans (RAP), in diverse sectors such as mining, oil and gas, infrastructure such as roads and power, agriculture, forestry and water and sanitation. She has also worked with local governments, both urban and rural, in the areas of utility and sector reforms, governance and capacity building/training in environmental and social management. Prior to joining ERM she was associated with Centre for Science & Environment, an international environmental NGO, as a Policy Analyst and Programme Associate for Forestry and Conservation and Livelihood programmes. In that capacity she extensively researched and wrote on policy issues as well as on grass-root issues in CSE publications like Down to Earth.

Neena is currently leading a study for the Government of India, Ministry of Mines, to develop a Sustainable Development Framework for the mining sector in India.

She has worked in India, Bangladesh, Laos, Vietnam, Indonesia, Mongolia, Russia, Kazakhstan, Angola, Sri Lanka and Jordan in different capacities as a social and R & R expert. Ms. Singh has worked with local, state and central government, and a large number of donor agencies like the World Bank, IFC, ADB, EBRD, DfID, ICEF, WSP-SA and UNICEF. Her key private sector clients include Rio Tinto, BHP Billiton, Holcim, Lafarge, Chevron, BP, Shell, Vedanta Resources and Cairn Energy amongst others. Some of her private banks/financial institutions clients include Citigroup, HSBC, Wachovia, Barclay, Standard Chartered, DEG, FMO etc. In doing this she has been regularly using, and is very familiar with institutional policies corporate policies, guidance manuals and global commitments to social and environmental goals of such companies.

Fields of Competence

- Social audits, Independent reviews and Assurance
- Social Impact Assessments
- Resettlement & Rehabilitation
- Monitoring and Evaluation
- Community relations and stakeholder engagement
- Poverty analysis, social analysis and livelihoods studies
- Training and Capacity Building
- Sector reforms and policy studies

Education

- M Phil in Geography (Thesis on Rural Development) from Delhi School of Economics, University of Delhi.
- M A (Geography) from Delhi School of Economics.
  (Specialised in Regional Planning) 1991.
- Bachelor of Arts (Honors) in Geography, from Kirori Mal College in Delhi University, 1989.

Languages

- English
- Hindi

Key Sectors

- Power (Conventional and Renewable)
- Oil and Gas and energy
- Mining
- Infrastructure (Roads, Industry, Water and Sanitation etc.)
- Local Government and sector reforms
- Natural Resource Management
- Agriculture

CERTIFICATION

Neena is trained as a Lead Auditor for SA 8000.

OTHER EXPERIENCE

- South Asian Focal Point for the GEF-NGO Network between 1996 and 1998.
- NGO Coordinator at the first Global Environment Facility (GEF) Assembly, held in New Delhi in 1998, where representatives of nearly 150 governments participated.

EMPLOYMENT RECORD

- July 06 to present: **Partner** at ERM
- March 03 to July 06: **Technical Director** with the Social Development and Natural Resources Group at ERM India
- Nov ' 2002 to March 2003: **Principal Consultant** at ERM India
- May 2001 to November 2002: **Senior Consultant** with at ERM India
- Sept '98 to May 2001: **Consultant** at ERM India
- July '95 to Aug '98: **Policy Analyst and Programme Associate**, Centre for Science and Environment, New Delhi.
- Aug '94 to June '95: **Research Associate**, Indian Institute of Public Administration, New Delhi
- Sept '93 to July ' 94: **Research Associate** in the Centre for Micro Planning and Regional Studies in the Lal Bahadur Shastri National Academy of Administration, Mussoorie.
- Mar '93 to Sept '93: **Research Associate** in the Centre for Education Management and Development, a Delhi based NGO

Socio-economic Impact Assessment, Social Analysis and Resettlement Action Plans

Neena has led the Social Consulting team to undertake detailed baseline surveys, social impact assessment and develop Social Management Plans, Resettlement Action Plans as well as specific plans to address livelihood and community development issues.

Independent Third Party Resettlement Audit for the West Africa Gas Pipeline Project Resettlement Action Plans
Client: West Africa Gas Pipeline Company Limited
The West Africa Gas Pipeline (WAGP) Project involved the development of a pipeline to transport gas produced in the Western Niger Delta of Nigeria to three neighboring countries – Benin, Togo and Ghana. A separate RAP has been prepared for each country. ERM has been invited to conduct a third party independent audit for the 4 RAP as well as the Community Development Plans in each country, and assess whether the RAP objectives have been met, the adequacy of the compensation measures and transparency and effectiveness of the grievance redressal mechanisms.

Neena was the overall Project Director for the Audit, which involved an international team.

Social Assessment and development of Resettlement Action Plan for the Guangdong LNG Project in Guangzhou, Guangdong province in China: *Client: Guangdong LNG Project*
The GD LNG Project is an equity joint venture (JV) partnership of CNOOC, BP and a number of Sponsor Companies. GDLNG sponsors are committed to socially responsible development of the project and have therefore requested that a Social Impact Assessment be conducted and a Resettlement Plan be developed for the project.

The purpose of the SIA was to identify, at an early stage, potential health and social impacts resulting from the construction and operation of this project and provide management measures to reduce potential impacts and maximise the positive effects as far as practicable. Engagement with project affected people and the wider community was recognized as being crucial to the timely and successful implementation of such projects in China. Neena was the Resettlement Specialist in the project and was involved in preparation of the Public Consultation and Disclosure Plan and RAP.

Impact Assessment and Developing an RAP for Impacts on fishing for an LNG Terminal Project in Angola, Africa: *Client: Cabindia Gulf Oil Company Limited*
ERM was involved in conducting an Environmental and Social Impact Assessment for a proposed LNG project around the Kwanda Base. Fishing was an important livelihood activity in the project area, and ERM assessed the impacts of the project on fisheries and fishing livelihoods, and eventually preparing an RAP outlining the entitlement framework to compensate and mitigate the impacts on the local community. Neena was a part of a two-member RAP team who prepared the RAP and disclosed it to the local community

Social Impact Assessment & formulation of Social Management Plan (SMP) in Bangladesh

Client: Unocal's (Chevron) Oil & Gas operations
ERM assessed the range of impacts that the 30 year project will have in the host area, tracing the project social footprints and formulating a management plan to mitigate the negative impacts and maximize the positive benefits. The assignment involves close coordination with the corporate group and in depth capacity building and handholding for the Unocal/ Chevron business unit in Bangladesh to actually implement a Social Management Plan. A series of workshops and trainings have been organized to enable the organization for such activities. Neena was the Senior Reviewer and Quality Assurance Partner for the project.

Social Assessment and Mitigation strategy for a midstream pipeline project
Client: Cairn India
Cairn Energy India Limited, in joint venture with ONGC, is developing oil fields in the Rajasthan state. There is a proposal to lay an on-shore crude oil evacuation pipeline and related facilities located about 35 Km North-East of Barmer in State of Rajasthan, up to a new terminal at Jamnagar-Salaya in State of Gujarat via Sanchore and Viramgam.

It has been tentatively estimated that the overall pipeline route length for transportation of crude oil would be 600 km. The pipeline will traverse through the state of Rajasthan for approx 150 km and the rest in the state of Gujarat. The pipeline will cross the districts of Barmer, Jalore and Sanchore in Rajasthan and Banaskantha, Ahmedabad, Patan, Rajkot, Surendranagar and Jamnagar in Gujarat
To meet its internal corporate requirements as well as IFC Performance Standard requirements, Cairn asked ERM to undertake a socio-economic baseline and impact assessment and develop a management plan to address key impacts. Neena was the Project Director for the assignment and responsible for all reporting and deliverables as well as client interaction.

ESIA Studies and Resettlement Plan Framework (RPF) for the Western Cluster Iron Ore Project: Liberia
Client: Western Cluster Limited

ERM has been commissioned to undertake Environmental and Social Impact Assessment (ESIA) and associated studies including preparation of RPF for the development, operation and closure/handover of the Western Cluster iron ore assets in Liberia including the railroad corridor(s) connecting the port and mining developments, road for transportation in initial years

ERM through the ESIA has been asked to inform the Project's management of environmental and social risks and impacts; meet expectations of good international industry practice (GIIP) and Vedanta's internal corporate standards; and fulfil Liberian regulatory EIA requirements before commencing with the project.

ERM India is playing an important role in the Project design too through environmental and social consideration identified in course of the baseline studies. ERM is also preparing the Resettlement Plan Framework (RPF) for the client which is quite crucial in wake of the complex land issues in Liberia and the regulations which apart from being complex are still in the nascent stages, primarily due to civil war which spanned almost 20 years.

Social Impact Assessment and Resettlement Framework for the Luhri Hydel Power project in Himachal Pradesh.
Client: Sutluj Viduy Nigam Limited (SJVN)
ERM is undertaking a detailed social impact assessment and preparing a resettlement framework for the 775 MW Luhri Run of the River (RoR) project. The SIA covers 68 potentially impacted villages and includes extensive consultations, household and village impact assessment and drafting a resettlement framework for the project. The project is being funded by the World Bank.

Neena is the Partner- in- Charge and lead Social Specialist for the assignment.

Social Assessment and preparation of RAP for the Allain Duhangan Hydel Power Project in Himachal Pradesh
Client: Rajasthan Spinning and Weaving Mills Pvt Ltd/IFC

RSWML is seeking partial financing from the International Finance Corporation (IFC**)** for the project. To fulfill the requirements of IFC's Environmental and Social Review of the project, ERM India was invited to prepare a detailed information on environmental and social impact assessment of the project, along with seven specialized studies and a reconnaissance survey for the proposed transmission line corridor, prior to IFC's approval on financing the project. ERM prepared a detailed RAP for the project, recommended institutional and monitoring mechanisms and developed a detailed Public Consultation and Disclosure Plan for the entire project

period.

Neena was the lead social specialist for the project and in addition to undertaking the tasks listed above, was also responsible for the public consultations, public hearings and dialogue with villagers, IFC and the NGOs as a part of the public disclosure programme.

Social Impact Assessment and preparation of impact mitigation plans for China Light and Power in Jhajjhar, Haryana,

Client: China Light and Power/ ADB/IFC

The assignment involved preparation of a SIA and undertaking census survey of more than 1800 project affected households and developing impact mitigation strategies (like the Livelihood Restoration and Community Development plan) for these families. Neena is the project director and overall in charge of this assignment

ESIA and Resettlement Framework for of the Nam Xane 3 Hydropower Project in Lao PDR

Client: Rohas Euco Industries Berhad, 2007.

Nam Sane 3 Hydroelectric Power (HP) Project, located in Ngan subdistrict of Khoune District, Xieng Khouang Province has been identified as one of the potential sites for hydropower generation in Lao PDR. The proposed Nam Sane 3 hydro power project is being funded and developed by Rohas- Euco Industries (REI) Berhad. As about 500 families are expected to get displaced because of the project, a resettlement framework is also being developed to inform decision for the feasibility stage.

Neena was the lead social specialist for the project which includes a social impact assessment and resettlement planning for the proposed hydro power project in a remote and impoverished mountainous region of Laos.

RAP External Monitoring & Assurance

Client: Sakhalin Energy Investment Company (SEIC)

As a part of its Resettlement Action Plan commitments, SEIC is committed, in addition to internal monitoring, a regular *Third Party Monitoring* and assurance that is to be conducted by independent experts. Neena has been appointed as the external RAP Monitor and is conducting monitoring twice a year till such time that the expert believes that the RAP commitments have been met. The objective of the monitoring is to highlights progress in RAP implementation, identify gaps or deviations from the RAP and recommend measures to close those gaps and improve overall social performance of the company.

Post Resettlement Audit in Uralsk and Aksai (Kazakhstan)

Client: KPO

ERM undertook a mid term and end term assessment of the resettlement and rehabilitation of 179 families that were resettled by KPO, a consortium of oil companies. The assignment assessed whether the objectives of the RAP are being met, and processes in place sustainable. The assessment also identified issues that need to be taken up for action and remediation if required. Neena is a part of a 3 member international team as a resettlement specialist.

Review of Land Acquisition and Resettlement and advisory services to the proposed Petrochemical and Port Development Project in Vietnam.

Client: Confidential

ERM is advising a Thailand based company interested in setting up a petrochemical plant in Vietnam on a range of issues including Environment and Social Impact Assessment and resettlement. The assignment included a rapid assessment of land acquisition and resettlement, providing a gap assessment against international standards, and determining the actions to be taken to close the gaps. ERM also conducted a workshop with government and other stakeholders on international standards as a part of the advisory service.

Neena was the lead Resettlement Specialist for the assignment.

Resettlement Completion Audit

Client: Lafarge Surma Cement Limited, Bangladesh

Lafarge has undertaken construction of a cement plant about 250 km from Dhaka wit funds from the International Finance Corporation (IFC). The company has acquired 178 acres of land for different project components like the cement plant, long belt conveyor (LBC), colony, road and community area. A Resettlement Action Plan (RAP) was prepared for the above mentioned project and has been implemented since 1999. ERM was commissioned to undertake a resettlement completion audit with the objective of assessing resettlement in the context of the objectives of OD 4.30 (Involuntary Resettlement), and determine whether the Resettlement Action Plan (RAP) was implemented in such a way that affected people were not made worse off and, preferably, benefited by the resettlement. Neena was the Project Director and responsible for interaction with the Client and overall project execution.

Independent Review and finalizing of Resettlement Action Plan for Public Disclosure (Sakhalin, Russian Federation)
Client: Sakhalin Energy Investment Company (SEIC.)
SEIC has been asked by prospective Lenders (EBRD) to prepare and RAP and disclose it for public review. ERM has been asked to independently review the RAP prepared by SEIC as well as the comments provided by the Lenders, identify and close gaps, and highlight potential risks to SEIC. As the Team Leader, Neena worked closely with the SEIC Social Performance Team, the Legal team and the Land Approvals team in Sakhalin to review and finalise the RAP.

Land Acquisition and Resettlement Advisory Support for integrated cement plant in Darlaghat, Himachal Pradesh, India.
Client: Ambuja Cements Limited, Holcim group of companies
The assignment involves dealing with and supporting ACL on issues of resettlement, land acquisition strategies and community engagement practices. Preparation of RAP/SIA and implementation of these are some of the crucial aspects of this complex project involving large scale land acquisition and resultant displacement. Neena is the project director and overall in charge of this year long assignment

Development of RAP and associated risk management for a voluntary resettlement project in Kazakhstan. Client*:* *Tengizchevroil (TCO)*
ERM was asked by a consortium of oil companies to assess the impacts of voluntary resettlement of 179 families to an urban settlement in Kazakhstan. ERM analysed the household survey to assess impacts, developed an entitlement framework and a detailed RAP for the project affected families, following the international best practices. The RAP included an implementation plan, institutional arrangements, and a public consultation and disclosure plan. Neena was a part of an international team working on the project.

SIA updation and Resettlement Planning for mining operations of Lafarge cement in Meghalaya
Client: Lafarge Umiam Mining Private Limited (LUMPL)/IFC
ERM India had conducted the social impact assessment and done R&R planning for the limestone mining project proposed by LUMPL in Shella and Nongtrai Durbar in Meghalaya ERM is currently updating the SIA and also developing an R&R plan for the individuals/groups affected by the project. The assignment involves census survey of all the project affected households in the mine and the 10 kms long over land belt conveyor area. Neena is the project director for the assignment.

Developing a Sustainable Development Framework for the Mining Sector in India
Client: Government of India, Ministry of Mines

ERM has been asked by the Ministry of Mines to develop an SDF for the mining sector in India that integrates the environmental integrity, social concerns and good governance systems. The draft SDF will cover all non-coal, non-fuel minerals (both major and minor minerals and will define the factors and parameters influencing sustainable and scientific mining (and indicators thereof), broad criteria beyond which mining may not be deemed sufficiently sustainable and for scientifically manageable and systemic measures needed to be taken or built in to increase sustainability of mining operations considering its entire life cycle

Monitoring and Evaluation of the R&R of Vadodara Halol Road project.
Client: Gujarat Toll Road Company Limited.
The Government of Gujarat and IL&FS are promoting the widening of the existing state highway (SH-87) between Vadodara and Halol to increase traffic flow capacity in this vital economic zone of Gujarat. The acquisition of land for constructing the bridge has resulted in the loss of agricultural land and livelihood for some people who would be resettled and rehabilitated
The monitoring work assigned to ERM involved the assessment of the progress of the resettlement programme to provide the project proponents with an independent evaluation of the situation, identification of difficulties, ascertaining problem areas, providing signals of caution and thereby drawing attention to the mitigation measures required. Neena was the project director and overall in chare of the assignment.

Monitoring and Evaluation of the R&R Programme of the Delhi- Noida Project
Client: Noida Toll Bridge Company Limited
NTBCL has financed the construction of the Noida Toll Bridge over the River Yamuna connecting Delhi and Noida in UP. The acquisition of land for constructing the bridge has resulted in the loss of agricultural land and livelihood for 300 people who had to be resettled and rehabilitated. ERM was appointed to facilitate negotiations, ensure appropriate compensatory arrangements, and to

undertake an independent monitoring and evaluation of the implementation of the rehabilitation program.

Independent Review of community engagement and CSR programme for an integrated cement plant in Himachal Pradesh
Client: Ambuja Cements/ Holcim
ERM India was engaged to review the community engagement and CSR programme of Ambuja's integrated cement plant in Himachal Pradesh. The objective of the review is to provide a third party and unbiased assessment of the approach to community relations and engagement till date, identify the issues of concern and key challenges and provide a broad strategy for the project expansion planned in the near future based on lesson learnt till date. Findings of the review were discussed in a workshop. Neena was the project director and overall in charge of the assignment.

Monitoring & Evaluation of the Resettlement and Rehabilitation Action Plan for the proposed Steel Plant in Gopalpur, Orissa
Client: Tata Iron & Steel Company (TISCO).
TISCO had acquired large tracts of land in Gopalpur, Orissa, for setting up a 10MW integrated steel plant. The land acquisition resulted in the displacement of over 10,000 people in the area. TISCO has undertaken a Resettlement and Rehabilitation (R&R) Action Plan (RAP) for the displaced people.

ERM was commissioned by TISCO to monitor and evaluate the implementation of the RAP. Apart from the monitoring and evaluation of the RAP, TISCO had also requested ERM to work in close association with the implementing agency and suggest various income generating activities which could be introduced in the rehabilitation site to ensure a regular and sustainable source of income for the resettled people to restore or improve their standard of living compared to the pre-resettlement period.

Monitoring and Evaluation of R & R activities in the Grand Trunk Road Improvement Project.
Client: National Highways Authority of India
The National Highways Authority of India (NHAI) has been given the mandate for implementation of the National Highways Development programme (NHDP) that includes nearly 421 km of the 900 km long Agra-Dhanbad section of the National Highway-2 (NH-2, which is being strengthened under the Grand Trunk Road Improvement project (GTRIP) funded by a credit from the **International Bank for Reconstruction and Development** (IBRD).

The project proponents intended to have an independent assessment of the implementation of the R&R Action Plan and its compliance to the World Bank guidelines to enhance its effectiveness and hence reduce the adverse impact on the resettled community. ERM India has been asked by NHAI to conduct monthly and quarterly monitoring of R and R activities as also annual, mid term and end term evaluation.

Social Assessment and preparation of the RAP for Ashram Chowk Flyover Project
Client: Noida Toll Bridge Company Limited
NTBCL proposed to construct a flyover with two clover leaves at the intersection of the Mathura Road and the Ring Road at Ashram Chowk in Delhi. The project is supported by the World Bank. The implementation of the project was likely to result in displacement of about 50 hutments (families) and a partial/total elimination of commercial enterprises in the project affected area. ERM was commissioned to undertake the socio-economic baseline survey of the affected people, identify the project affected persons, evaluate the extent of their loss, develop a compensation package, locate a resettlement site and develop a R&R Action Plan. Neena as a project manager in this assignment was involved in household survey, RAP and specifically overlooked livelihood restoration strategies for all PAFs.

Social Impact Assessment and Resettlement Action Plan for proposed cement plant and limestone mine in Rajasthan
Client: Gujarat Ambuja Cements Limited/ Holcim
ERM was commissioned by Gujarat Ambuja Cement Limited (GACL) to carry out a Social Impact Assessment to understand the extent and degree of impact among the affected stakeholders arising from the project and use the assessment to develop a Resettlement Action Plan and restore the livelihoods of those impacted. Neena was the Project Director and lead resettlement expert for the project.

Social Assessment, Preparation of the Public Consultation and Disclosure Plan, Resettlement and Rehabilitation Action Plan and the Indigenous Peoples' Development Plan for the proposed limestone mining project in Nongtrai village, Meghalaya
Client: Lafarge Surma Cement/IFC.

ERM India conducted the social impact assessment for the limestone mining project proposed by Lafarge Surma Cement (LSC), Dhaka, in Nongtrai village in Meghalaya. LSC had applied to the Internal Finance Corporation (IFC) to fund part of the project, which

will extract limestone from Meghalaya to be transported across an elevated conveyor belt to the cement plant in Bangladesh across the international border between the two countries. The Social Assessment, RAP and IPDP reflected the special socio-economic and political profile of the tribal communities in this North-Eastern State of India, while adhering to the requirements of IFC. Neena was the Project Director and lead resettlement expert for the project

Preparation of Resettlement Action Plan Framework and a Public Consultation and Disclosure Plan
Client: Cairn Energy India Limited (CEIL).

Cairn was seeking IFC funding for the development and operations of their Mangala site in Barmer in Rajasthan state in India, and required to have in place an RAP and a PCDP to address and mitigate all permanent land acquisition and resettlement related impacts. IFC required this RAP to meet its standards on resettlement as well as public disclosure. At this stage ERM prepared the RAP Framework in consultation with IFC and CEIL with the objective that the Framework will inform and guide specific RAPs that get prepared closer to the implementation time.
Neena was the Project Manager for the assignment and responsible for all reporting and deliverables as well as client interaction.

Updating an Environment and Social Impact Assessment Report to meet EP requirements for a petroleum refinery project in Gujarat, India
Client: Essar Oil Limited
ERM is in the process of updating an ESIA report for a petroleum refinery expansion project in Jamnagar, Gujarat. EOL is seeking funds from financial institutions for the purpose. The report needed to meet the requirements of Equator Principles Financial Institutions (EPFIs). Neena was the social specialist in the team.

Socio-Economic Baseline Study and impact assessment of a mine exploration site in Madhya Pradesh
Client: Rio Tinto
Rio Tinto commissioned ERM for a project, which entailed the development of a detailed social baseline for the project, which was at the prospecting stage. The project involved an assessment of local community dependence on forest resources, which may be impacted by the project and issues to enhance the ongoing community relations interventions by the client.

ERM was asked to conduct village appraisals, detailed stakeholder analysis and local institutional assessment to enable the project proponent to make informed decisions for the subsequent stages, including scoping for the impact assessment. Village appraisals were conducted through participatory methods and involved the villagers in the process of developing community maps, resource maps as well as interaction patterns with different receptors. Stakeholder mapping and analysis was done for individual villages as well as for the project as a whole. Neena was the project director and overall in charge of the study.

Community Mobilization for Pastureland Management in Mongolia: *Client: World Bank*
ERM executed one component of the project called Community Mobilisation for Pasture Land Management (PLM) which involved mobilizing the local herders to understand the risks and impacts of current grazing and migration activities and building their capacities for improved pasture land management. ERM partnered a local NGO, Centre for Policy Research for the assignment.

Neena's role as a community mobilization specialist is involved documenting best practices in pasture management across the world, preparation of training manuals, developing M & E criteria and indicators and building the capacities of the local NGOs participating in the programme

Comprehensive Environment, Social and Health Impact Assessment: *Client: Hazira Port Private Limited (Shell Hazira Group)*
ERM was commissioned by HPPL, a part of Shell India, to undertake a CESHIA for all their project components (multi-cargo port, terminal, pipeline and infrastructure corridor) in Hazira and prepare an implementable impact management action plan. The CESHIA was developed not only under the requirement of MoEF but also as a corporate requirement of the Royal Dutch/Shell Group. The assignment involved extensive field analysis covering 6 villages in and around Hazira and a series of workshops with Shell personnel to develop a practical and mutually acceptable management action plan. Neena is the project director and overall in charge of this year long assignment

Socio- Economic baseline study for proposed facility in Vadodara and Halol (India):
Client: Aloca Asia Limited
ERM India was commissioned by Alcoa Asia Limited

to conduct a social screening and social risk profiling for its proposed Foil manufacturing facilities in western India. The outcome of the assessment was to compare the risks and opportunities in two possible site options for the client. Neena was the Project Director for the assignment and responsible for all reporting and deliverables as well as client interaction

Social Baseline studies and stakeholder analysis
Client: Cairn Energy India Pvt. Ltd.
The assignment included preparation of social baseline, strategic impact assessment of Cairn's operations in the block as well as formulation of stakeholder management strategy based on consultations with various categories of stakeholders. Neena was responsible for regular interaction with the client, developing the methodology and reviewing the reports. Neena was the Project Director for the assignment, with overall responsibility of the project, client interface and quality assurance of the deliverables.

Socio-economic Baseline Study for a proposed iron ore mine in Orissa
Client: Rio Tinto
The study involved preparation of the socio-economic and political profile of the area and provide strategic inputs into their project planning. The study took a broad brush approach drawing on existing data and literature with the multiple purpose of providing the company with background socio-economic, demographic and political information coupled with interpretative assessment. The study brought out a preliminary risk assessment as well as a stakeholder mapping and indicate broad level mitigation strategies.

Environment and Social Impact Assessment, Nepal
Client: Cairn Energy Plc.
Cairn Energy has signed an agreement with the Government of Nepal to explore oil and gas in 5 block in primarily the Terai regions of Nepal. The initial work would include geological field work, airborne geophysics and seismic surveys in each block. ERM was asked to conduct a desk-based environmental and social screening together with a stakeholder assessment, identification of impacts and development of generic mitigation measures. The aim of the early ESIA was to aid planning and design of the seismic operations, and to provide relevant information for Cairn's Nepalese permitting requirements.

The work was jointly undertaken by ERM India and ERM UK team. Neena was the Social Development Specialist in the project.

Social, Environmental and Political Risk Assessment for a Coal Bed Methane Project
Client: British Petroleum
The client has been awarded a Coal Bed Methane exploration concession in West Bengal. The client is looking for an initial project screening based on desk-op research as well as a reconnaissance visit to understand the major risks to the viability of the project from an environmental and social perspective, and scope out the requirement of a detailed ESIA. Neena is the Project Director for the assignment.

Environmental and Social Impact Assessment for Coal Bed Methane Project.
Client: British Petroleum
The operator of Coal Bed Methane (CBM) exploration and production license issued by Government of India for the Birbhum Block located in the State of West Bengal, India.

ERM was commissioned to undertake the Environment and Social Impact Assessment study for the project. The ESIA was done to not only meet the requirements of the regulatory framework but also to the standards of BP. Neena was the Partner in Charge and Project Director for the assignment.

Social and Environmental Analysis for the Second Maharashtra Rural Water Supply and Sanitation project.
Client: Department of Water Supply and Sanitation, Government of Maharashtra
ERM conducted a social and environmental analysis, which a part of the project preparation study of the World Bank supported water and sanitation project. The objective of the study is to assist the GOM in designing the project taking into account the socio-economic characteristics of the target population and the environmental issues, so that the project / program delivers sustainable water and sanitation services to rural communities at large and poor and vulnerable groups (such as women, scheduled castes and scheduled tribes), in particular. The analysis was conducted in 20 villages spread over 5 districts covering different geographical locations in the state and more than 600 households. A separate Indigenous Peoples Development Plan (IPDP) was also prepared with extensive consultations and participatory PRA and planning activities with tribal communities in Gram Panchayats (local village representative bodies)

in seven districts with high tribal concentration. Neena was the project manager and lead social expert for the assignment.

Review and Assurance

Neena has been involved in a number of independent reviews, due diligence assessments as well as provided external assurance to firms and large projects against international standards like the IFC Performance Standards, the various Operational Policies of the World Bank and sister organizations as well as several Equator Banks. These reviews have been instrumental in identifying gaps and providing guidance to the organizations on measures for gap closure and strengthening their Environment and Social Management Systems.

Independent Equator Principle Review of a Coal reject based Thermal Power Plant in Chhattisgarh.
Client: Confidential
The client, an American bank, financed a 2*135 MW coal reject-based thermal power plant in Korba in Chattisgarh India. Being an Equator Principle signatory bank, the client required an independent environment and social review of the Environmental Impact Assessment and Environment Management Plan of the project to assess any significant gaps with respect to Equator Principles and the relevant IFC Performance Standards. Neena was the project director, senior reviewer and Partner-in-Charge of the project

IFC Performance Standard Review of the Sasan Ultra Mega Power Plant
Client: US Exim Bank
R-Power is undertaking the development of an ultra mega power plant in the Singrauli district of Madhya Pradesh. ERM undertook an environmental and social diligence for the same to develop an action plan for key environmental and social commitments for US Exim Bank. Neena was the lead social specialist for the assignment.

Independent review of Environmental and Social Impact Assessment Report/Statement of the 1000MW Hydroelectric Project in Himachal Pradesh
Client: An International Financial Bank (Confidential)
The proposed HEP envisages construction of a dam on Satluj river. ERM was asked to carry out a review of the ESIA report of the above project to identify environmental and social issues, which would directly or indirectly have financial or legal implications for the project proponent during commissioning, operation and decommissioning. An assessment of the potential for an adverse reaction on environmental and social grounds on a local, national and international sale was also required. Neena was one of the social and resettlement specialists involved in the review, along with team members from India and UK.

Independent review of the ESIA of a proposed Thermal Power Project in Madhya Pradesh, India
Client: Citigroup
A large Indian EPC contractor was proposing to bid for the Thermal Power Project with Citigroup as its possible financier. Citigroup as an Equator Principle signatory bank, requested ERM India to assess if the Environmental and Social Impact Assessment for the project meets the requirements of the Equator principles and IFC performance Standards, and in case of gaps, the likely costs involved in closing those gaps. The estimated costs were then taken on board in the bid preparation. Neena was the project director and overall in charge of assignment

Independent Monitoring of Aryan Coal implementation of ESAP.
Client: Wachovia Bank/Wells Fargo
ERM has been asked by Wachovia (now Wells Fargo) to undertake a third party/independent monitoring of the implementation of the ESAP. The ESAP has been prepared to meet the Equator Principles requirements as well as the IFC Performance Standards. ERM will conduct semi-annual monitoring.

Social and Environmental Screening for a Proposed Wind Power Project
Client: BP Alternative Energy
ERM undertook an Environmental and Social screening and Risk Profiling of a proposed 40 MW Wind Power project in Maharashtra, India. The objective of the assignment is to identify and highlight the key risks facing the project, if any, to be able to effectively inform decisions being made at an early stage. Neena is the Project Director for the assignment.

External Assurance Services
Client: Rio Tinto
The aim of the external assurance was to independently assess Rio Tinto's corporate social and environment reporting in terms of its relevance, completeness, accuracy and responsiveness. Rio Tinto's updated version of The Way We Work (TWWW) was the standard against which ERM assessed corporate reporting.

Neena was a part of a two member team, as a community specialist, that reviewed Rio Tinto's

Indian Exploration Operations. The review was conducted through a series of interviews with the Rio Tinto staff, data verification of environment, community, health and safety aspects, site visits and interactions with the local community in their operations in Bangalore, India.

Independent environmental and social review of the Colombo-Kutanayake Expressway Project, Sri Lanka
Client: Confidential
The Expressway is being proposed to link Colombo with the international airport. The client, an international financial institution, required an impendent review of the EIAs and EMPs of the project to assess any significant gaps with respect to WB/IFC/Equator Principles (the 'Applicable Standards'), before deciding to fund the project. Neena was the lead social expert for the assignment and partner-in-Charge for the project

Independent Review and Comparison of World Bank Group Guidelines on Environmental and Social Issues with Indian Regulations
Client: International Finance Corporation.
As a part of this exercise Neena comprehensively compared the social and environmental policies of these two institutions to highlight the coherence and divergence both at the policy levels as well as operational levels**.** The study was a part of an initiative by the two institutions to streamline their safeguard policies

Independent Desk top assessment of a proposed acquisition of coal mines in Indonesia
Client: An International Bank
ERM was asked to undertake a desk top review of the ESIA and related information for a proposed acquisition of coal mines in Indonesia by an Indian multinational company to identify key gaps with respect to Equator Principles and IFC/World Bank requirements. ERM was asked to provide broad recommendations to be included in the covenants between the bank and the client company. Neena was the project director and overall in charge of assignment

Environmental and social due diligence for the Lenders Group to the Tangguh project
Client: Lenders Group
ERM was appointed by the Lenders Group to BP Berau to undertake an environmental and social due-diligence of the Tangguh LNG project in West Papua, Indonesia. ERM was required to review relevant national and international policies and guidelines and appraise the compliance of the ESIA (locally called AMDAL) document that was approved by the Indonesian Government. In doing so ERM advised the Lenders groups on risks and way forward. Neena was a part of the due diligence process as a resettlement and indigenous community specialist.

Independent Performance Standards Review of a Sugar Plantation Project in Kenya
Client:Confidential
The client is planning to revive a major sugarcane plantation and factory in the East coast of Kenya and is proposing to seek international funding. ERM was asked to conduct a detailed independent review of the environmental and social/resettlement performance of the project and suggest measures to close the gaps and develop compliance to the standards. ERM prepared a detailed Action Plan as a recommendation for the client.

Neena was the Social and Resettlement expert in the three- member team.

Independent Environmental and Social Review of the India Tollroad Expansion Project
Client: Citigroup
Citigroup was proposing to finance a toll road project in Gujarat and Rajasthan in India, which it had categorized as Category A project, according to the Equator Principles and Citigroup's internal Environmental and Social Risk Management Policy (ESRMP). Citigroup requested ERM (the Independent Environmental and Social Consultant-IEC) to perform an Environmental and Social Due Diligence (ESSD) of the project to confirm compliance with the Equator Principles, ESRMP, IFC Performance Standards, IFC EHS and World Bank PPAH Guidelines. Neena was the Project Director and Social and Resettlement Specialist in the team.

Independent Review of a Cement Plant expansion project in Assam, India
Client: DEG
ERM was contracted by Calcom Cement Private Limited to independently review and prepare and action plan for its expansion and development project in the state of Assam, against national environmental, health and safety and labour requirements, ILO convention commitments as well as IFC Performance Standards. Neena was the senior social reviewer for the project.

Independent Social Review of the SIA, RAP and IPDP of the Rural Transport Improvement Project in Bangladesh,
Client: Local Government Engineering Department,

Bangladesh.
LGED invited ERM India to conduct an independent social and environmental review of the social and environment impact assessment reports and Resettlement Framework of the RTIP to ensure that the reports met the guidelines and basic requirements of the World Bank, which is funding the project. The assignment included assessing the adequacy of data and baseline information, methodology, Project impacts and remedial measures, policy framework assessment, appropriateness of institutional arrangements, implementation mechanisms and monitoring and evaluation. The scope of the social review also included rewriting and finalizing the Social Assessment and Resettlement Framework report. Neena was the Project Director and responsible for interaction with the Client and overall project execution.

Developing a Social Investment Strategy
Client: British Gas
ERM India was commissioned by BG, India to prepare a Social Investment and Sustainable Development Strategy for its subsidiary- Gujarat Gas Company Limited's operations in the state of Gujarat, India. The strategy aims to enable the company to respond to changing priorities and pressures from the state and country, utilize this strategy as a competitive means to differentiate GGCL as a socially responsible company to its customers and local communities, whose support is important for future expansion and enable the company to face increasing competition going forward. Neena was the project director and overall in charge of the assignment.

Indigenous People, Forestry and Biodiversity Conservation: India Case Study
Client: World Bank
ERM reviewed the World Bank Forestry Sector Projects to highlight implications and impacts on biodiversity and indigenous people. The desk based review involved research into project documents and assessment reports to demonstrate the extent to which the objectives and policies as laid down by the Operational Directives and Operational Policies were reflected in the field. Neena was the lead social expert for the assignment.

Assessing social performance of major oil and gas companies
Client: Confidential

In this desk based study, ERM looked at information available in the public domain for three major companies (BPCL, IOCL and HPCL) and made an assessment of the corporate commitment to social issues, of their social interventions and investments and the impacts of these interventions. The study also investigated the public image of the companies as reported in the media and as descried in their official websites. This information was supplemented by feedback from strategic interviews with relevant officials to prepare an overview of their social performance. Neena was the project director and over all in charge of the assignment.

Review and Assurance
Developing Policy and Systems for Environmental and Social Management and Monitoring and Evaluation

An increasing focus in preparing action plans to meet international standards has been to ensure that these actions get embedded in robust environmental and social management systems of the organization that improve performance over a period of time, and the process and outcomes can be monitored and reported. In some cases these assignments involve monitoring and advisory services, and in others developing policies and systems, and capacity building and training.

Independent monitoring and advisory support to Calcom Cements
Client: DEG and FMO
DEG and FMO have together invested in Calcom Cements in Assam. An earlier social and environmental due-diligence against IFC Performance Standards, also conducted by ERM, brought our several gaps, based on which a detailed Environmental and Social Action Plan (ESAP) was prepared. In this assignment ERM has been asked by DEG and FMO to provide independent monitoring services for the ESAP implementation as well as provide expert advice to Calcom on technical studies. ERM conducts quarterly monitoring and currently a 3-year monitoring is proposed. Neena is the project director for the assignment.

Independent Monitoring of the Environmental and Social Action Plan implementation of a slum rehabilitation and development project in Mumbai
Client: Ackruti City Limited
ERM has been asked by ACL and their financiers to independently review on a six-monthly basis, the implementation of an ESAP that came out as recommendation from a review and gap assessment of the project by ERM. ERM will undertake a detailed monitoring of the various commitments made on

environmental, health and safety and social parameters in the ESAP.

Preparing and Operational Manual and training on IFC Performance Standards for Infrastructure Development Finance Company (IDFC)
Client: International Finance Corporation

Environmental Resources Management (ERM), was in collaboration with Econ Pöyry assigned by the International Finance Corporation (IFC) to carry out environmental capacity building in IDFC. The main objectives of the assignment were to align IDFC internal processes and management systems for Environmental and Social Due Diligence (ESDD) with the IFC's Performance Standards (IFC PSs) and the Equator Principles (EPs); and to build the capacity within IDFC to undertake ESDD according to the updated processes and management systems.

Neena was the team from India and as one of the two lead trainers.

Environmental Capacity Building Phase II
Client: IFC

The IFC Advisory Services supports the development of the formal banking sector with a view to increasing access to finance for businesses and consumers in India and elsewhere. IFC Advisory Services implements its mandate through tailored, enterprise and organization-specific capacity building programs, training, and research and policy interventions

IFC, as a part of the Environmental Capacity Building Project, Phase II, asked ERM to develop a Generic Operational Manual (the Manual) that would be downloadable from the IFC website. The intent of the Manual was to provide more clear guidance on why and how to implement the IFC PSs. Once an organisation is interested in applying the PSs, the Manual could be used to transform that interest to action.

EHSS Protocol and Systems for Mine Life Cycle for a proposed Nickle mine in North Vietnam.

The project involved the development of operational protocols and systems and provision of ongoing support for environment, health, safety and social aspects during construction, operations and closure of the project. Neena was the Technical Advisor on resettlement.

Other Training

- Training to IDFC's financial and risk teams on the IFC Performance Standards
- Training to IFC's Financial Intermediaries, including Banks and Equity firms on Social and Environmental Due Diligence (SEDD) to meet IFC Performance Standards,
- Trainer on World Bank Safeguard Policies and Resettlement Implementation for Allahabad Bypass Project, organised by Project Implementation Unit, National Highways Authority of India, 2003, 2004.
- Training on Community Environment Management to NGOs and Women's Groups under the Mumbai Urban Transport Project, funded by the World Bank, 2005.
- Resource Person for Training Programme for Donor Agencies on Participation and Participatory Techniques in the Institute of Development Studies, Sussex, England, 1999
- Network Co-ordinator and trainer of the Infrastructure Development and Finance Corporation (IDFC) – ERM Joint Initiative on Resettlement & Rehabilitation, 2001.
- Training of Trainers Programme on New Economic Policies in the Lal Bahadur Shastri Academy of Administration, Mussoorie in 1993-94
- Training of NGOs on Wildlife Act, its proposed Amendments and Implications on People in Ahmedabad in 1997.

Other Assignments

- Documentation of Projects on Water & Sanitation in Rajasthan, UNICEF
- Performance review of state, divisional and district TSC Sanitation cells in the state of Uttar Pradesh for the Department of Panchayati Raj and UNICEF.
- Environmental Impact Assessment of Loktak Lake, Client : Indo-Canada Environment Facility (ICEF)
- The Swajal Project: Concurrent Monitoring of Batch 3 along Process Documentation of Project Management Unit / District Project management Unit., World Bank
- Performance Assessment of the Environment Improvement in Rainfed Areas Project, ICEF
- Impact Monitoring of the India Ecodevelopment Project in Buxa Tiger Reserve, World Bank
- Evaluation Studies for Aravalli Afforestation Project, Rajasthan, OECF supported
- Study on Participatory Approaches in Watershed

Management in the State of Andhra Pradesh, for International Institute for Environment and Development, London, and Institute of Development Studies, Sussex, UK

- Review of the World Bank-Global Environmental Facility funded Ecodevelopment Project in seven protected areas in India, 1996-97
- People-Park Conflicts: A study of eight major National Parks in India for the State of India's Environment: Fifth Citizen Report, Centre for Science and Environment, 1999.
- Study on the Global Environment Facility : History, Politics and Progress for the book "Green Politics: Global Environmental Negotiations", Centre for Science and Environment, 1999-2000
- Prepared a Resource Atlas of Karnataka as a part of the Masters course in geography

Publications

- Kothari A, N. Singh & S. Suri (eds) 1996. *People and Protected Areas: Towards Participatory Conservation in India*, Sage Publication, New Delhi
- Sarkar S, A. Kothari, N. Singh & S. Suri. 1995. *Joint Protected Area Management: Report of a Workshop*, IIPA, New Delhi
- *Struggling to Survive*, Down To Earth, Jan 1997
- *Conservation Boomerang*, Down To Earth, September 1995
- *Sowing Less, Reaping Bare*, Down to Earth, April, 1996
- *Community Participation in India GEF Projects: A Case of Ecodevelopment*, paper presented at the GEF Council Meeting, Washington, 1996.
- Contributed articles on forest and people's conflicts in the Ecologist, Economic and Political Weekly, as well as leading India Newspapers.

Manish Singh

Senior Consultant

Mr. Manish Singh is a Senior Consultant with post graduate degree in Social work and Economics, and Bachelors Degree in Law and is presently working as Senior Consultant with the Impact Assessment and Planning (IAP) Team of Environmental Resources Management (ERM) India Pvt. Ltd.

He has experience of working with Government establishments, engaging with donor supported programmes in tasks such as evaluation, monitoring and impact assessment both through large scale surveys and through community consultations and policy level engagement and with the private sector etc. He has worked in areas that include Rural Development, Natural Resource Management, Water and Sanitation (Urban and rural), Health, Governance, Municipal Sector Reforms, Urban Low Cost Housing, Infrastructure, Power, Climate Change and Adaptation, Renewable Energy, Vulnerability Assessment, **Social Impact Assessment** (SIA), **Rehabilitation and Resettlement (R&R)**, Dairy, Cooperatives, **Corporate Social Responsibility (CSR) Assessment**, Forest Rights, Mining, Solid Waste Management etc. He has experience in hard-core grass root level development interventions and overall programme level management.

Mr. Singh has carried out Impact assessment, Resettlement Planning Projects, and environmental and Social Due Diligennce in Kenya, Nigeria, Guinea, Liberia, Phillipines, Malaysia, Bangladesh, Nepal, Myanmar and and has done Desk based research for Mali, and Bhutan. Mr. Singh has worked with local, state and central government and a large number of Donor and Funding agencies like the World Bank, ADB, DFID, WSP-SA, Rockefeller Foundation and UNICEF. He is well versed with International Best Practices Standards and Governmental Regulations. He has been working on international Social and Environmental Standards including **World Bank (WB) Safeguards and Policies, International Finance Corporation (IFC) Performance Standards (PS), Equator Principals, ADB SPS Standards, AfDB standards** etc. He also has worked on financial institutions funded projects like FMO, DEG etc. His key private sector clients include Cairn Energy, Rio Tinto, Punj Llyod, SunEdison, Sunborne Energy, SIMRAN Energy, Ramky, BPCL, Amaya Capital, KISCOL, Western Cluster Limited etc. among other private and multinational companies and in doing so he has been regularly using, and is familiar with corporate policies, guidance manuals and global commitments in context to social and environmental realm of such companies. Manish's another core expertise lies in developing the Environmental and Social Management Framework (ESMF); he has recently worked with National Dairy Development Board(NDDB) on world Bank Funded project and with DFID on developing their Environmental and Social Framework for providing financing to small banking services in India (NDDB) and with support from World Bank. Apart from that he has been working on developing Social and Environmental management system for companies like Sunborne Energy, SIMRAN Energy, SunEdison, MEIL etc. In doing so he has developed his capacity as an institutional and system expert.

Social Impact Assessment and Rehabilitation and Resettlement are one of the core strengths of Manish. Manish has served as the content Manager for managing resettlement impacts along almost 500 Kms railway line in Guinea. Presently he is involved as in-country Manager, stakeholder specialist, SIA specialist and rehabilitation and resettlement specialist for a mining project in Liberia.

Fields of Competence

- Social Impact Assessments
- Vulnerability assessment
- Social Due diligence and social audit
- Resettlement & Rehabilitation
- Monitoring and Evaluation
- Community relations and stakeholder engagement
- Project Implementation
- Training and Capacity Building
- Sectoral reforms and policy studies.

Education

- Bachelor of Laws (LLB) from University of Delhi, 2014;
- Post Graduate Diploma in Environmental Law (PGDEL), National Law School (NLS) of India University, Bangalore, 2013;
- MA in Economics, IGNOU, India, 2009;
- MA in Social Work, Tata Institute of Social Sciences (TISS), Mumbai, India, 2005;
- BSc (H), Zoology, Hindu College, University of Delhi, India, 2003;

Key Sectors

- Oil and Gas
- Infrastructure (Power, Industry, Manufacturing & processing units, Water and Sanitation etc.)
- Mining
- Livelihood & related sectors like dairying etc.
- Local Government and sector reforms (Urban and rural)
- Climate Change and adaptation

Honours & Awards

- Junior Research Fellow (JRF) Qualified in Social Work awarded by University Grants Commission (UGC), India, 2008.
- National Eligibility Test (NET) Qualified in Criminology, awarded by University Grants Commission (UGC), India, 2006.

Employment Record

- *Oct 2011 to Present*: Senior Consultant with the Impact Assessment and Planning (IAP) vertical at ERM India Pvt. Ltd.

- *March 2010 to Sept 2011*: **Consultant** with the Social Development and Natural Resources Group at ERM India

- *May 2007 to March 2010*: **Specialist**, TARU Leading Edge, New Delhi
- *August 2005- April 2007*: **Assistant Project officer** (APO) on Deputation in Zila Panchayat (ZP) Bastar, as Young professional, Council for Advancement of People's Action and Rural Technology (CAPART), Ministry of Rural Development (MoRD), Government of India (GoI).
- *2005(Brief Period)*: **Research Associate**, TARU Leading Edge, New Delhi

Languages

- English
- Hindi

Key Projects

- ***Environmental & Social Impact Assessment (ESIA)***
- ***Resettlement Action Plan (RAP)***

Formulation of a "Plan d'action de reinstallation et compensation" for the Early Works Program of the Simandou Project, Guinea - Ongoing
Client: Rio Tinto/Simfer SA

ERM has been commissioned to undertake an Environmental and Social Impact Assessment as well as preparation of the Land Acquisition and Resettlement Framework for the Simandou Project and its key components of the mine, the port and the trans-Guinean railway corridor. ERM India is leading to resettlement process and as a team member ERM is currently engaged in the formulation of the PARC framework for the early works program that include the acquisition of land for access roads, worker camps and a marine offloading facility.

ESIA Studies and Resettlement Policy Framework (RPF) for the Western Cluster Iron Ore Project: Liberia
Client: Western Cluster Limited

ERM has been commissioned to undertake Environmental and Social Impact Assessment (ESIA) and associated studies including preparation of RPF for the development, operation and closure/handover of the Western Cluster iron ore assets in Liberia including the railroad corridor(s) connecting the port and mining developments, road for transportation in initial years

ERM through the ESIA has been asked to inform the Project's management of environmental and social risks and impacts; meet expectations of good international industry practice (GIIP) and Vedanta's internal corporate standards; and fulfil Liberian regulatory EIA requirements before commencing with the project. ERM India is playing an important role in the Project design too through environmental and social consideration identified in course of the baseline studies.

ERM is also preparing the Resettlement Plan Framework (RPF) for the client which is quite crucial in wake of the complex land issues in Liberia and the regulations which apart from being complex are still in the nascent stages, primarily due to civil war which spanned almost 20 years.

Presently, Manish is involved as in-country Manager, stakeholder specialist, SIA specialist and rehabilitation and resettlement specialist for a mining project in Liberia.

Developing a Resettlement Action Plan (RAP) for Azura power in Edo State, Nigeria
Client: Amaya Capital Partners (Amayacap)

In keeping with Amayacap's commitment to meeting World Bank standards, the client had requested ERM for the development of a RAP to handle the resettlement issues likely to emerge as the project gets implemented. The project is located in Benin, Edo state, Nigeria. Manish is working on the project as resettlement expert and is responsible for conducting stakeholder consultations, socio economic survey, overseeing enumeration and valuation of the properties leading to full-fledged resettlement action plan for the project. It also includes development of the income restoration strategies for the community likely to be displaced.

Mali Regulatory review, institutional Assessment, NGO assessment
Client: Gold Fields

Gold Fields Mali SARL (Gold Fields) is developing the Komana Advanced Mineral Exploration Project, located in the Yanfolila cercle of the Sikasso region of Mali on the country's southern border with Guinea and Côted'Ivoire. ERM has been commissioned to prepare resettlement framework for the project. Manish is responsible for conducting regulatory review of the existing laws related to mining, land acquisition with reference to IFC PS. The work also included institutional assessment and NGO assessment for implementation of the RAP.

Social Impact Assessment and Resettlement Action Plan (RAP) for Kwale International Sugar Company Limited, Kenya
Client: Kwale International Sugar Company Limited

KISCOL has ventured into the field of sugarcane plantation and has been in discussion with international donors like the IFC and AfDB for an upcoming Sugar Plant in Msambweni. The project involves land take that is likely to affect 40 villages and around 1000 families and much more in the indirect zone. ERM has been commissioned to undertake a social impact assessment and develop Resettlement action plans for the individual and community losses from the project. The SIA involves a baseline study of the villages within the project's area

of influence which included a 100% household survey for those directly impacted by land acquisition for the project. Assessment of the social impacts from the project and addressing their mitigation through management plants for stakeholder engagement, livelihood restoration and community development form part of this assessment.

As a core team member, Manish is involved in the census survey, field consultations reporting, client interface and preparation of the Resettlement action plans. The work also included audit of the existing resettlement mechanism and the grievance redressal mechanism and the community intervention process planned for the project.

Environmental and Social Impact Assessment (ESIA) & Resettlement Action Plan (RAP) for proposed Parallel Piped water Municipal supply System connected to Jaikwadi Dam of Aurangabad Maharashtra
Client: Aurangabad City Water Utility Company Limited (ACWUCL) -ongoing

Aurangabad Municipal Corporation (AMC) plans to implement its INR 750 crore water supply project through public private partnership with SGPL. As per the Environmental Impact Notification, 2006 of Ministry of Environment and Forests, Government of India, the municipal water supply scheme projects do not require environmental clearance, however, the Project is planning to tap water from the Jayakwadi Dam, which is notified as a Bird Sanctuary and as per the Wildlife Protection Act, 1972 and amendments thereof, permission would be required from MoEF.

Environmental and Social Impact Assessment (ESIA) is to be done for this project. The scope of work also includes an Environmental Audit of existing water supply facilities of Aurangabad Municipal Corporation. Subsequently the work also involves preparation for a Resettlement Action Plan (RAP) for this project. Manish is the project manager and key social specialist, resettlement specialist and stakeholder specialist for this Project.

EIA of proposed Exploratory drilling operations in offshore block AN-DWN-2003/2 in the union territory of Andaman and Nicobar Islands, June 2011-Ongoing,
Client: ENI

The work involved carrying out a desk-based EIA study for the proposed offshore exploration drilling activities in the block. The work involved stakeholder consultations, collection of secondary data and preparation of the SIA report for the project. Manish is the Social Impact Assessment and Stakeholder specialist for this project.

ESIA and Rehabilitation Plan for the Nirvana Hills Phase 2 Project in Pune, India
Client: ADB/Kumar Urban Developers Limited

ERM has been commissioned by KUL to develop an ESIA and Rehabilitation Plan for its ongoing slum rehabilitation project in the city of Pune at the behest of the Asian Development Bank. Manish is responsible for conducting detailed regulatory review for both ESIA and RAP keeping the Slum rehabilitation Scheme, Pune in perspective. As part of the Environmental and Social Management Plan (ESMP) Manish is also developing stakeholder management plan and Labour Management Plan.

Strategic Environmental and Social Impact Assessment (SESA) for World Bank supported National Dairy Support Project (NDSP) or National Dairy Plan –I (NDP-I), India
Client: National Dairy Development Board (NDDB)

The National Dairy Plan (NDP-I), a multi state initiative, is proposed to be implemented in phases by National Dairy Development Board (NDDB) with financial assistance largely from the World Bank. The first phase (NDP-I) would be from April 2011- March 2017. ERM is hired by NDDB to conduct Strategic Environmental and Social Assessment (SESA) for the project activities to be taken under NDP, and also to identify the external social and environmental factors which may possibly impact the dairy sector.

The assignment also includes survey of 8000 HHs in 300 villages spread across 8 districts in 4 states of India. On the basis of the finding of the survey and stakeholder consultations, the impacts (both positive and negative) and risks are to be identified. To manage these impacts Environmental and Social Management Framework (ESMF) is to be developed for the project activities under NDP-I.

As a part of the assignment Environmental and social audit of the facilities especially related to the milk collection and processing facilities at the village level (Bulk Milk coolers), cluster level (Chilling centres), District Level (Processing and Packaging plants) was completed.

Environment & Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) for Durgapur II

Taraiamer Coal Block project for BALCO, Chattisgarh, India
Client: Vedanta Resources Plc

The Ministry of Coal (Government of India) has allotted the "Durgapur II Taraimar", an independent coal block in the Mand Raigarh coal field with a reserve base of 211 million tonnes to meet BALCO's coal requirements for its proposed expansion. The Durgapur II Taraimar coal block is located in the Dharamjaigarh block of Raigarh district. BALCO is a part of Vedanta Resources Plc and located in Korba District i.e. about 78 km away from the proposed Durgapur Taraimer Coal Block.

ERM was commissioned to undertake ESIA and RAP in line with international standard by upgrading the existing EIA and SIA study which was based upon regulatory requirements merely. Tufail was involved in this project as a Social Specialist and had been responsible for carrying out socio-economic survey, stakeholder consultations, primary and secondary data collection and generating Social Impact Assessment Report and Resettlement Policy Framework (RPF). Besides these, Tufail was also involved in Social Management Plans which included Stakeholder Engagement Plan, Contractor Labour Management Plan, Community Development Plan, Tribal Development Plan etc.

Social Risk Assessment for potentially chromium contaminated sites in the Hooghly district, West Bengal
Client: West Bengal Pollution Control Board

ERM has been commissioned by the West Bengal Pollution Control Board to develop and plan remediation action plans for industrial hotspots with potential chromium contamination along the Delhi Road in Hooghly district. This project is funded by the World Bank.

Manish led the initial social assessment which included preparing a risk profile for each identified site.

Regulatory review and future Regulatory Risk assessment for coal mining and Thermal power plant
Client: Confidential

The client is getting engaged into coal mining and operating Thermal power plant at three locations. As a part of its SEDD the client also wants to identify any foreseeable risks from regulatory changes on environmental and social aspects in the mining and power sector that may have a risk for the project. Manish, as part of the team is analysing the possible regulations that may be upcoming in the country especially related to the mining and thermal power plant and what it impact it will have for the project.

IFC based Environmental and Social Impact Assessment for a 100.5 MW wind farm project site in in Ratlam and Mandsaur districts in the state of Madhya Pradesh, March 2014-Till date
Client: Orange Mamatkheda Wind Private Limited,

The role includes carrying out an Environmental and Social Impact Assessment for proposed wind farm project site based on IFC Performance Standards and General and specific EHS Guidelines and IREDA Guidelines. The study involved Environmental and Social Baseline Assessment, including the understanding of the scope for bird/bat monitoring , shadow flicker impacts of the entire project, identification of the impacts, evaluating the impacts; prepare the Impact Assessment and Mitigation Plan. Also involved in the preparation of Environment management Plans like Waste Water Management Plan, Solid Waste Management Plan etc.

IFC based Environmental and Social Impact Assessment for a 104 MW wind farm project site in Anantapur District in the state of Andhra Pradesh, December 2014-Till date
Client: Energon Resources Private Limited

The role includes carrying out an Environmental Impact Assessment for proposed wind farm project site based on IFC Performance Standards and General and specific EHS Guidelines. The study involved Environmental Baseline Assessment, including the understanding of the scope for bird/bat monitoring ,of the entire project, identification of the impacts, evaluating the impacts; prepare the Impact Assessment and Mitigation Plan. Also involved in the preparation of Environment management Plans like Waste Water Management Plan, Solid Waste Management Plan etc.

IFC based Gap Assessment for Environmental and Social Impact Assessment for Kayar Mines in Village Kayar , Maton and Zawar in Ajmer and Udaipur districts respectively in the state of Rajasthan. July 2012- Ongoing
Client: HZL

The role includes carrying out an Environmental Impact Assessment for an underground mines based on IFC Performance Standards and General and specific EHS Guidelines. The study involved undergoing a gap analysis task for the existing EIA and upgrading it to an international ESIA meeting Vedanta standard. The study involved Environmental Baseline Assessment, for the construction stage of the entire project, identification of the impacts, evaluating the impacts; prepare the Impact Assessment and Mitigation Plan. Also involved in the preparation of Environment management Plans like Waste Water Management Plan, Solid Waste Management Plan etc.

Environmental and Social Impact Assessment for an Integrated Aluminium Smelter Complex in Village Bargawan, Deosar Tehsil, Singrauli district in the state of Madhya Pradesh. January 2011- Ongoing
Client: Aditya Birla Group

The role includes carrying out an Environmental Impact Assessment for an integrated smelter complex based on IFC Performance Standards and General and specific EHS Guidelines. The study involved Environmental Baseline Assessment, for the construction stage of the entire project, identification of the impacts, evaluating the impacts; prepare the Impact Assessment and Mitigation Plan. Also involved in the preparation of Environment management Plans like Waste Water Management Plan, Solid Waste Management Plan etc.

Review of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 against IFC Performance Standard 5
Client: Kfw

The assignment included detailed review of the LARR Act provisions against IFC PS 5: Land Acqusition and Involuntary Resettlement and "UN Basic Principles and Guidelines on Development-based Evictions and Displacement" especially concerning the topics of forced evictions, immediate expropriation, etc.

- ***Corporate Social Responsibility***
- ***Need Assessment***
- ***Corporate Stakeholder engagement***
- ***Social Risk Assessment***
- ***Socio Economic Situational Assessment***
- ***Strategy for managing Community issues***

Review of Community Relations and Strategies and Social Impact Assessment for Chanda Cement works, ACC Chandrapur
Client: ACC, Chanda Cement Works

ERM is conducting "Review of Community Relations and Strategies and Social Impact Assessment for Chanda Cement works, located in the Chandrapur and Yavatmal districts of Maharashtra.

The company is keen to develop a more structured and consistent community engagement strategy and to also assess the influence of project impacts on stakeholders and hence has sought the assistance of ERM to help them develop such a strategy. In this regard it is intended to review the community relations and engagement strategies around Chanda Cement Works and to undertake a third party assessment of the impacts of its operations as well as community investment programs. Manish is the project manager for the assignment.

Socioeconomic Situational Analysis Orissa Joint Venture (OJV)
Client: Rio Tinto Plc

The Orissa Joint Venture (OJV) project has interests in the development of the- Malangtoli (ML T) and Sakradih-Dubna (S-D) leases in Keonjhar and Sundargarh Districts. In this context ERM has been asked by OJV to update the 2006 Socioeconomic Baseline Report and develop methodology and appropriate tools to support the OJV Communities team in the collection and documentation of preliminary socioeconomic baseline data.

The work includes analysing the Forest Rights Act, 2006 implications for the project, Stakeholder mapping and identification of issues, Regulatory review of Social, community, land compensation, R&R, Scheduled tribes etc. finally leading to the analysis of the risks for the project and suggesting the way forward. Manish as a Project Manager is responsible for undertaking the complete assignment and presenting the findings to the client for approval through engagement workshop.

Assessment of the CSP plans and Need assessment for further community engagement, BPCL, Mahul
Client: BPCL

BPCL has strengthened its community presence in the Mahul village near to its oil refinery in Mumbai. Community intervention programmes have continued since the last 20 years. BPCL has commissioned ERM to assess the impact of its CSP intervention in the Mahul village and conduct need assessment for the

future intervention in the community. Manish is in charge of field work, client interface and reporting.

The work entailed audit of the existing mechanism for community intervention and the existing intervention activities proposed for the community.

Assessment of Educational interventions of Universal Chemicals and Industries Limited (UCIL) in Jhunjhunu, Rajasthan, 2005.
Client: Universal Chemicals and Industries Limited (UCIL)

UCIL runs philanthropic activities and community based intervention across various areas. In Bagger, Rajasthan, it runs three schools and a Technological institute. The assignment entailed preparing Status report and perspective plan after evaluation of the Trust work in the intervention area and suggesting future expansion possibilities as well as possible funding opportunities to increase the capacity of the schools for providing better standard of education in the local intervention area.

- ***Environmental and Social Due Diligence (ESDDs);***
- ***Environment & Social Audits;***
- ***Labour Audits;***
- ***Independent Review; and***
- ***Annual Monitoring***

Manish's role in the various assignments revolves around labour, land, CSR, HR systems etc. Manish in course of designing and preparation of the SEMS for various clients has developed as a systems person and is quite adapt at reviewing systems for management of environmental and Social impacts at site/ facility level, corporate level, FI level etc.

IFC and EP requirements based Environment and Social Due Diligence Assessment for a 900 MW and a 300 MW hydro-power project in the state of Himachal Pradesh, November 2013
Client: Taqa capital Advisors Limited

The work involved the Environmental, Health and Safety and Social due diligence of the two hydro-power projects in the state of Himachal Pradesh covering the gap assessment with respect to IFC Performance Standards and EP requirements with more stress on the systems, labour, land, and environmental aspects, identification of the key gaps, and preparation of a Corrective Action Plan.

IFC based Environment and Social Due Diligence Assessment for Bikaji Package Foods, Bikaner in the state of Rajasthan for Lighthouse Funds, December 2013.
Client: Lighthouse Funds Advisory

The work involved reviewing the environmental and social risk assessment of the food processing facility of Bikaji Foods International Limited in the state of Rajastan and suggesting a corrective action Plan.

IFC and EP based Environment and Social Assessment of Healthcare facilities at Kolkata and Jamshedpur
Client: Quadria Capital Investment Services Private Limited, June 2013 –Ongoing,

The scope of work involved carrying out an Environment, Health and Safety Assessment for the hospital industry of Medica Group and recommends a comprehensive Corrective Action Plan for successful Business investment by Quadria Group. The project also involves funding from DEG and IFC.

IFC based Environment and Social Due Diligence Assessment of Garment manufacturing company in Bangalore and Bangladesh under CIEL textile, March 2014
Client: Proparco

The work involved the Environmental, Health and Safety and Social due diligence of the ready-made garment industry covering the gap assessment with respect to IFC Performance Standards with more stress on the systems, labour, land, and environmental aspects, identification of the key gaps, and preparation of a Corrective Action Plan.

IFC based Environment. Social, Health and Safety due Diligence Assessment of a 54 MW wind power plant in Rizal Province, Philippines for Equis Funds Group, April 2014.
Client: Equis Fund Group

The scope involved undertaking an independent environmental and social review of proposed 54 MW wind energy project located in Philippines.

IFC based environmental and Social Due Diligence of Mymensing Agro project of Mymensing Agro in Bangaldesh. May 2014- ongoing.
Client: Proparco and FMO

The scope involved Environment, Social, and Health & Safety Due Diligence Review for the juice manufacturing facility called as 'Mymensing Agro', a

subsidiary of PRAN group and one of the leaders in juice market in Bangladesh with over 70 percent share in the market has been provided below. Mymensing Agro is into manufacture of juices in Mango, Mixed juices, Litchi, orange, Strawberry flavours (44 % of sales), Carbonated drinks (34% of sales), flexible packaging (15 % of sales) & mineral water and energy drinks.

Environment and Social Due Diligence of Transfer Storage and Disposal Facilities (TSDF) in Gujarat, India
Client: M/s. Saurashtra enviro projects pvt. Ltd.

The Assignment included environmental and social due diligence of 3 Transfer Storage and Disposal Facilities (TSDF) in the various stages i.e. Operation, construction and mobilisation stages. The findings of the due diligence were to support the South Asia Clean Energy Management Fund (GEF) for a potential investment opportunity in Gujarat, and subsequently in the future in other states of Karnataka and Andhra Pradesh, India. Manish was the social and management system specialist for the assignment.

Environmental, Social and Governance Assessment (ESG Assessment) of Shikhar Dairy Private Limited (SDPL) against DFID ESG Framework.
Client: Shikhar Dairy Private Limited (SDPL)

ERM has been commissioned by Department for International Development, India (DFID) as third-party consultants to undertake an independent Environmental, Social and Governance Assessment (ESG Assessment) of Shikhar Dairy Private Limited (SDPL). The independent review was performed to assess the environmental, social and governance performance of the SDPL's planned operations against the DFID's ESG framework. The review also proposes an Environmental, Social and Governance Action Plan (ESGAP), based on the assessment which highlights key environmental, social and governance issues and gaps and proposed recommendations to comply with the ESG Framework requirements.

Environmental and Social Action Plan (ESAP) Monitoring for ASM and African Foundries Limited (AFL), Nigeria
Client: African Foundries Limited, Nigeria

ERM has been commissioned by African Foundries Limited (AFL) and Citibank International Plc. acting as Global Agent for all the lenders on the project for ESAP monitoring for ASM and AFL assets in Nigeria. The review was undertaken to assess the project sites compliance levels to specified IFC reference framework and Environment and Social Action Plan (ESAP) agreed between AFL and Lenders, keys gaps and risks associated with respect to the same as well as identify mitigation measures that AFL can implement to achieve compliance. Child labour, Community relations, labour management were some of the key issues covered as part of the ESAP monitoring.

Environmental, Social and Governance (ESG) Assessment of Glocal Healthcare System Private Limited (GHSPL) engaged in affordable Health care providing Primary and secondary treatment
Client: Local Healthcare System Private Limited (GHSPL)

ERM has been commissioned by Department for International Development, India (DFID) as third-party consultants to undertake an independent Environmental, Social and Governance Assessment (ESG Assessment) of a hospital chain under the entity "Glocal Healthcare System Private Limited" located in eastern India. As part of the ESG Assessment, two operational hospitals under Glocal Healthcare System Private Limited (GHSPL) were reviewed namely the facilities located at Bolpur and Sonamukhi in the state of West Bengal. As an outcome of the assessment Environmental, Social and Governance Action Plan has been prepared which describes the key observations, areas of conformance and highlights key issues of non-conformance along with proposed recommendations at corporate level and facility level.

Environmental, Social and Governance Due Diligence (ESGDD) of one of DFIDs Financial Intermediaries (FIs) National Housing Board (NHB) against DFID's Environmental Social and Governance (ESG) framework for their funding in implementation of Affordable Housing Policy, 2009 (AHP).
Client: Department for International Development (DFID).

The independent third party review was performed to assess the relevant environmental, social and governance (ESG) performance of the developer's present and planned operations against the DFID's ESG framework. The review also proposes an Environmental, Social and Governance Action Plan (ESGAP), based on the assessment which highlights key environmental, social and governance issues and related gaps along with proposed recommendations to comply with the ESG Framework requirements. The ESG assessment was conducted on seven (7) out of the 14 developers selected for the implementation of Affordable Housing Policy, 2009 (AHP). The details

of the policy, various stakeholders engaged in implementation of the project and interrelation between the various parties were covered apart from capturing the ESG aspects. .

Environmental and Social Advisory Support for supporting the Equis Funds Group (in the management of Environment, Health & Safety and Social (including community, labour) issues. Reviewing of the existing Environment and Social Management Systems, Policies and procedures. Gaps Assessment of the E&S performance of the hydro projects implemented by the Dans Group in Sikkim against IFC Performance Standards and EP requirements.
Client: Equis Funds Group & Dans Energy Group

The assignment entailed supporting the Equis Funds Group towards Environment and Social Advisory Support for two hydropower projects in the northeast of India. Equis as a part of its investment portfolio, has already invested in an independent hydro power developer named Dans Energy Group, an India-based run-of-the river hydro power developer, owner and operator. Dans is currently completing the construction of two hydro generation facilities in the state of Sikkim, totalling 193 MW. The work included review of the ESMP implementation and detailed IFC and EP requirements based due diligence with more stress on the systems, labour, land, and environmental aspects, identification of the key gaps, and updating of ESMP.

Environmental and Social Review (ESR) of 54 MW wind power project, Ananthpur, AP, India
Client: Energon Power and Energy Resources Limited

Environmental Resources Management (ERM) has been commissioned by Energon Power and Energy Resources Limited (Energon) to undertake an independent environmental and social review of proposed 54 MW wind energy project of Energon (which is part of the 100 MW Tagguparti wind energy project) ('Project Dossier') located in the Anantapur District of Andhra Pradesh, India. Manish is social and SEMS specialist for the Project.

Environment and Social Due Diligence (ESDD) of Intec Captial, India
Client: Intec Captial

The ESDD of the Intec Capital is required under the internal procedure of India Business Excellence Fund IIA (IBEF IIA), a private equity fund in order to evaluate any environmental or social risk from the proposed investment and identify mitigation measures. Intec Capital is reputed market leader in the in SME Financing and one of the leading players in the NBFC segment. The assignment included the portfolio review, lending pattern, financial products offered and the existing social and environmental system to manage any E&S risk associated with the type of investment.

Environmental, Social and Governance Assessment (ESG Assessment) of OMC operations.
Client: Omnigrid Micropower Corporation Private Limited (OMC)

The assignment included Environmental, Social and Governance Assessment (ESG Assessment) of Omnigrid Micropower Corporation Private Limited (OMC), a company engaged in production of solar power in rural remote areas with no or limited access to grid power has not reached. OMC builds, owns and operates micro solar power plants in rural areas. The independent review was performed to assess the environmental, social and governance performance of OMC's current operations and expansion plans against DFID's ESG framework.

ESAP Monitoring of RFL, Plastic Manufacturing units in Bangladesh, September 2013
Client: RFL group, Bangladesh

The assignment included Environmental and Social Action Plan (ESAP) monitoring of RFL group involved in production of various Plastic product lines having production and supply chain linkages with major retail brands like Walmart, Disney etc. ESAP was prepared as part of the review undertaken by DEG for proposed investment in the RFL group.

Environmental and Social Review of Portfolio of renewable Energy Projects of Wellspun Renewable Energy Limited (WREL)
Client: DEG

The Investors are considering providing financing at the Welspun Renewable Energy Limited (WREL) holding level in to further develop and expand their Solar and Wind Power Development Project. The investment will support reducing greenhouse gas emissions and help mitigate climate change through renewable power generation will. WREL is one of the leading renewable power developers in India and currently has 136 MW of operational solar projects and wind power projects, 320 MW under construction. Manish's role primarily revolved around preliminary site level E&S compliance and corporate specific E&S

management system review for managing impacts associated with portfolio of projects. The associated gaps and mitigation measures were further incorporated as part of the lending agreement.

Environmental, Health and Safety and Social Due Diligence (EHSSDD) of a 42.5 MW capacity wind power project, in Gadag, Karnataka, India.
Client: Amplus Infrastructure Developers

ERM was commissioned by Amplus Infrastructure Developers to undertake an Environmental, Health and Safety and Social Due Diligence (EHSSDD) of a 42.5 MW capacity wind power project. The Due Diligence process entailed the review of the environmental/social sensitivities and conformance gaps of the wind projects with reference to the local laws and regulations, IFC Performance Standards (2012), EHS guidelines) and suggests an Environment and Social Action Plan (ESAP) to close the gaps to be considered by Amplus and Equis Funds Groups.

Environmental and Social Audit for the proposed Integrated Municipal Solid Waste (MSW) Project under the Greater Hyderabad Municipal Corporation (GHMC).
Client: Ramky Enviro Engineers Ltd

The assignment included an environmental and social audit of completed and on-going activities at the Integrated MSW Management Project in Hyderabad and prepare an Environmental and Social Safeguards Audit Report and if necessary a corrective action plan in compliance to ADB's Safeguards Policy Statement (2009) and the IFC Performance Standards 2012 and Indian national, state and local statutory requirements. The assignment also intended to review the Environmental, Occupational Health & Safety aspects and Social Management Systems of the project proponent in comparison to the Applicable Environmental and Social Requirements. It was also intended to review and assess the current organizational set-up, staffing capacity and availability and status of waste recycling and solid waste equipment of the REEL to handle and manage environmental and social aspects of the project;

Environment & Social Due Diligence of Valley Iron & Steel Company, Himachal Pradesh
Client: Valley Iron & Steel Company (VISCO)

VISCO is seeking investment from a German based financial institution i.e. DEG. As part of the investment decision of DEG, VISCO was suggested to commission ERM India to do an ESDD for its existing as well as proposed expansion facility in Himachal Pradesh. Manish was involved in this due diligence study as social specialist to look into labour and other social issues associated with the project and assessed the project performance against requirements laid down in IFC Performance Standards.

Environmental and Social Audit (ESA), for Gadhvi Solar existing manufacturing unit at Valsad, Gujarat, India.
Client: Gadhia Solar

The objective of the ESA is to support the IFC investment decision and follow-up approach by independently reviewing and verifying the Gadhia Solar and its relevant facilities against the regulatory requirements, standards and good international industry practices (including identifying compliance gaps, necessary mitigation and follow-up actions, and outlining a managing/monitoring regime) and to give an overall opinion of GS/the Company meeting the applicable environmental and social requirements; and to develop the Action Plan to address non compliances as per the identified gaps.

Environmental and Social Due Diligence (ESDD) for Uttam Galva Metallics Limited Iron and Steel Plant located at Wardha, Maharashtra, July 2012

Scope included conducting the environmental due diligence (EDD) to assess the project site complince levels against the IFC performance standards, World Bank general Environment, Health and Safety (EHS), Guidelines and sector specific Integrated Steel Mills IFC EHS Guidelines. Manish was involved as social specialist.

Environment & Social Due Diligence for the Cement Plants of Ultratech Cement Ltd
Client: Ultratech Cement Ltd (UCL)

The objective of the Independent Environmental and Social Due-Diligence is to assess the compliance status of the two plants of Ultratech Cement Ltd named as Rajshree Cement Plant located at Gulbarga, Karnataka as per the environmental and social performance. The independent review is to assess foreseeable risks and mitigation measures with UCL's operations and to provide an opinion of the project to meet the required standards and the specified reference framework.

IFC and EP based Environment and Social Due Diligence Assessment of a textile industry and readymade garment Industry,

Client: Viyellatex Group at Bangladesh, October 2013 – Ongoing.

The scope of work involved an Environment, Health and Safety Assessment for the manufacturing facilities of Viyellatex Limited, InterFab Shirt manufacturing Limited and Eco-Couture and Eco-Fab and review of their implementation measures and its adherence to the CAP against the EP requirements and Performance Standards.

Environmental and Social Due Diligence of 5 Solar Photo Voltaic (SPV) asset installations in transmission towers in the state of Bihar
Client: Applied Solar Technologies Private Limited
November 2011- December 2011

The client AST had been requested by their prospective lender IFC to conduct a third party audit prior to the financial closure as per their guiding reference framework for Environmental and Social Protection, the Performance Standards for its SPV assets distributed across various locations in Bihar. AST commissioned ERM to undertake this assessment for any 5 of it 1100 assets in Bihar as well as also review the E&S legal compliance of their assets as per an earlier established compliance register. A two member team was mobilized by ERM to undertake the site assessment as well as prepare an Audit report based on the same which would become the financial closure document for the deal between AST and IFC.

Environmental and Social Due Diligence of 25 Solar Photo Voltaic (SPV) asset installations in transmission towers in the state of Bihar
Client: Applied Solar Technologies Private Limited
March 2012- April 2012

Based on the previous audit for 5 SPV sites in Bihar, ERM received an extension from AST to conduct third party audits for 25 more of their SPV sites in the same state. This was in continuation to the earlier due diligence conducted for the same client previously relatively on bigger scale.

Environmental and Social Due Diligence for three assets of Met trade India Pvt. Limited.
Client: Met Trade India Private Limited

The objective of the Independent Environmental and Social Due-Diligence is to assess the compliance status of its three assets as per the environmental and social performance. The independent review is to assess foreseeable risks and mitigation measures with MTIL's operations and to provide an opinion of the project to meet the required standards and the specified reference framework.

Environment and Social Due Diligence for SunEdison solar generated power plants in Gujarat
Client: SunEdison

SunEdison is operating a new plant through SPV at Dhama sit ein Gujarat. For the purpose of this project, SunEdison has taken loan from OPIC. OPIC wanted ESDD to be conducted for the site. As a result, to meet this requirement environment and social due diligence was conducted for those site by Sun Edison.

Third Party Monitoring for SWPPL wind Power assets, Tamil Nadu
Client: SWPPL

SWPPL has earlier got ESIA and ESAP preparation along with the SEMS manual for the wind farm assets in Tamil Nadu. As a part of the compliance to IFC, SWPPL requested ERM to conduct third party monitoring to assess the level of ESAP and SEMS implementation both at the corporate level as well as the Site level.

External Independent Audit of the Permanent Land Acquisition for the Mangla Development Project, Barmer, Rajasthan
Client: Cairn Energy

Cairn Energy India Pty Limited (CEIL), the principal operating subsidiary of Cairn has conducted intensive hydrocarbon exploration and appraisal programs in the block which has yielded significant discoveries including the world-class Mangala field. Land acquisition for Phases I and II had already commenced prior to IFC's involvement, Cairn's committed to the IFC PS and completion of the Rajasthan LACP.

Cairn commissioned ERM India for an independent review audit of the permanent land acquisition activities associated with Rajasthan Block, in order to provide an additional level of transparency to the implementation of its commitment to meet the intent of the Rajasthan LACP and the IFC – PS5. The assignment aimed to obtain an overall understanding, identify any key issues, possible major gaps or non-compliances with Performance Standard 5 and the LACP. As a core team member, Manish is in charge of the field consultations, client interface, reporting and preparation of the audit report.

Independent Environmental, Health & Safety and Social due diligence (ESDD) of the existing assets of DFL. Ludhiana
Client: Deepak Fasteners Limited

DFL has expansion plans and these include setting up a new production plant, the site for which has not yet been finalised. DFL has commissioned ERM to undertake an independent Environmental, Health & Safety and Social due diligence (ESDD) of the existing assets of DFL. Manish is a part of the team for the assignment and is in charge of field work, client interface and reporting

Independent Environment and Social Due Diligence of the existing assets of Dilip Chhabaria Design Pvt. Limited
Client: Dilip Chhabarai Design Pvt. Ltd.

Dilip Chhabaria designs (DCD) Private Limited is the leading automobile designer in the country and specialises in providing appropriate solutions through innovative styling

The objective of the Independent Environmental and Social Due-Diligence is to inform Banyan Tree on DC's environmental and social performance. The impendent review is to assess foreseeable risks and mitigation measures with DC's operations and to provide an opinion of the project to meet the required Standards and the specified reference framework.

- ***Social, Environmental, health and Safety Management System (SEHSMS);***
- ***Review & Updating of HR system as per IFC standards***

Development of an Environment, Social and Corporate Governance (ESG) Framework to support Private Sector Team (PST) of DfID India.
Client: Department for International Development India (DfID)

The assignment included review of the CDC Investment Code in the context of the DfID PST investment programs and to review the regulatory framework of the country and the IFC Performance Standards to identify the provisions that need to be included in an ESG framework for DFID. ESG framework is supposed to be supplemented with an Implementation Toolkit which can be provided to partners and supporting institutions that DfID chooses to engage with.

The ESG framework will be instrumental for all kind of financial instruments (debt, equity and hybrid) and financial intermediaries (funds, banking/non-banking institutions etc.) and covers all major sectors for investments (agriculture, manufacturing, infrastructure, energy and clean tech, skill development, housing etc.). Manish is instrumental in the review of the CDC and preparation of the ESG framework and subsequently the implementation toolkit.

IFC based Review and Development of Environment and Social Management Systems for TTPL and GJEL Toll Roads for Macquarie SBI. July 2013-Ongoing.
Client: SBI Macquarie

The assignment entailed providing professional assistance in the Developing and Implementing an integrated Environment, Health, Safety and Social Management System (EHS&S-MS) in accordance with IFC General EHS Guidelines, IFC Environmental, Health, and Safety Guidelines for Toll Roads, IFC Performance Standard 2 – Labor and Working condition and applicable Indian Regulatory Environmental, Health, and Safety Regulations.

Review of the SEHSMS system for Boxtrans Logistics India Services Private Limited and develop Corporate Policies and SEHSMS systems.
Client: Boxtrans Logistics India Services Private Limited

The work involved a complete review of existing Social and environment management system of Boxtran's operations and selected subsidiaries and on the basis of that a Social and environmental management system had to be developed for the client.

Social and Environmental Management System (SEMS) for IBEF IIA, a private equity fund.
Source: India Business Excellence Fund IIA (IBEF IIA)

India Business Excellence Fund IIA (IBEF IIA) is a private equity fund that has been established to enable select international institutional, corporate and high net worth individual investors to participate in investment opportunities in India or India related investment opportunities. The Social and Environmental Management System (SEMS) is a framework with the objective to integrate social and environmental risk management into IBEF IIA's business processes. The SEMS intends to describe a set of actions and procedures that are to be implemented concurrently with IBEF IIA's existing risk management and operational procedures.

Advisory Support for Preparation of Health, Safety and Environment Management Systems (HSEMS) & Social Management Procedures for Fourcee Infrastructure Equipments Private Limited, engaged in the business of providing end-to-end liquid logistics solutions in India- July 2014- Ongoing
Client: Fourcee Infrastructure Equipments Private Limited.

The work involved development of social and environmental management systems for a logistical service provider and the CMS and various storage yards for the ISO labelled containers and their transportation.

Technical Assistance Component for Environmental and Social Appraisal for Ireda. November 2013- Ongoing
Client: KfW and Ireda

The scope includes providing technical assistance for integrating social and environmental considerations into renewable energy projects which fall within the ambit of Ireda, to integrate requirements of IFC Performance Standards, Identification of gaps in the regulatory framework, and assessment of the resources needed to incorporate and implement those changes. It also includes assessment of its own capacity to implement changes and further capacity building to address those gaps.

Independent Environmental and social consultant ("Consultant") to carry out a Technical Assistance Project in the field of E&S Management for Bhoruka Power Corporation limited. April 2014-Ongoing
Client: Deutsche Investitions- und ntwicklungsgesellschaft (DEG) and Oesterreichische Entwicklungsbank (OeEB)

The scope includes providing training to various levels of the organization at (BPCL), to provide "on the job" coaching of the E&S department; and overall support to BPCL in developing and implementing more formal and more effective E&S management capabilities as well as relevant procedures, both at project (wind farm) level and at corporate level.

Review and Assessment of the Social and Environment Considerations in a Construction Company's Project Screening and Bid Decision Process
Client: The International Finance Corporation (IFC)

The International Finance Corporation (IFC) has invested in an Indian construction company, an engineering, procurement and construction ("EPC") company, which undertakes EPC contracts in India and other countries.IFC intends to review Company's existing bid screening and decision process and assess its efficacy as regards ensuring outcomes consistent with IFC Performance Standards. Further based on this assessment, IFC intends to recommend systemic improvements to enhance the efficacy of the said bid screening procedure as necessary. Manish is a key member of the team undertaking the review and suggesting systemic changes to E&S screening process for the Company.

Develop and implement a corporate wide Social and environmental Health and Safety Management System (SEHSMS) which is consistent with IFC's Performance standards including documentation of SEHSMS and review of the HR policy for up gradation to IFC PS.
Client: Kiran Energy Solar Power Private Limited (KESPPL)

KESPPL as a part of the funding requirement from DEG is expected to prepare a Social Environmental health and Safety Management System (SEHSMS) that will be oriented to the corporate level working framework. The SEHSMS will allow the company to screen its present project and other portfolio of projects with respect to environmental and social risks, undertake an impact assessment if necessary at the appropriate time, and implement measures emerging out of such an assessment to manage those impacts. Specifically the SEHSMS will help in complying with IFC requirement for an Environmental, Social and Health and Safety (H&S) management system at the corporate as well as site level. Manish is the project manager as as well as the over in charge of the SEHSMS development and HR policy up gradation.

Developing SEHSMS system at corporate level for Sunborne Energy private Limited.
Client: Sunborne Energy Private Limited

Sunborne Energy Services India Pvt. Ltd (SESIPL) is venturing into the field of solar thermal power projects. SESIPL intends to establish a detailed Social Environment Health and Safety Management System (SEHSMS) with the aim of developing a comprehensive management system at the corporate screening level by laying down streamlined procedure for assessing and managing social, environmental, health and safety issues at each phase of their activities that can be subsequently guide the implementation of company level systems, compliant to the standards as committed by SESIPL as a corporate entity. Manish is the Project Manager and is also looking at the social components of the SEHSMS system.

The work included audit of the existing Social, environmental, health and safety management system of the entity, which was followed by preparation and updating of the SEHSMS.

Developing SEHSMS system for SunEdison at Corporate level and for asset management
Client: SunEdison

SunEdison has recently embarked into the field of solar power. SunEdison has engaged ERM to develop a social, environmental, occupational health and safety system. As a part of the system, ERM did a complete review of existing Social and environment management system of SunEdiosn and on the basis of that a Social and environmental management system has been developed for the client.

Developing SEMS system at corporate level for TEECL (wind Power
Client: Techno Electric & Engineering Company Limited (TEECL)

Techno Electric & Engineering Company Limited (TEECL) entered into an agreement with Suzlon Energy Limited for developing and commissioning 200.80 MW of wind farms in a phased manner. The project is being implemented by its wholly-owned subsidiary Simran Wind Project Private Limited (Simran) – its green power company. TEECL wants to develop a Social Environmental Management System (SEMS) at the corporate level that will guide all its upcoming projects to address the social, environmental and health issues arising out of the project. Manish is responsible for the developing the SEMS system.

The work included audit of the existing Social, environmental, health and safety management system of the entity, which was followed by preparation and updating of the SEHSMS.

Developing SEHSMS system at corporate level for MEIL
Client: Mytrah Energy India Limited (MEIL)

CEL , an associate company of the Caparo Group has been established with the objective of achieving the status of one of the premier Independent Power Producers in India and seeks to generate predictable and long-term cash flows by building up a portfolio of wind power generating assets in the Indian Wind Energy Market. ERM has been engaged by Caparo Energy (India) Ltd (hereafter referred to as CEL) for providing support and advisory services for the development of a Social, Environment, Health and Safety Management System (SEHSMS). This proposal pertains to the development of SEHSMS manual, associated policies on social and environmental issues as defined subsequently and an optional task of SEHSMS implementation support**.**

- ***Climate Change Adaptation and Disaster Management:***
- ***Social Vulnerability Assessment***

Asian Cities Climate Change Resilience Network (ACCCRN), Rockfeller Foundation, 2008 in Surat and Indore.
Client: Rockefeller Foundation

The Rockefeller Foundation has recently embarked on a major climate change initiative that concentrates on building resilience to a changing, challenging natural environment. A component of this initiative focuses on developing new tools, techniques and strategies to address climate risk, poverty and precipitous urbanization with the objective to develop a network of cities in Asia that will have robust plans to prepare, withstand and recover from the predicted impacts of climate change. The ACCCRN is being implemented in four countries- India, Indonesia, Thailand and Vietnam. The project is currently ongoing in three cities of India- Surat, Indore and Gorakhpur.

The work included understanding of the water, energy and social foot print of the industries like Textiles, Diamond works, and institutions like hotels, hospitals, and variety of industries primarily engaged in manufacturing and processing. Manish is **Key Social science specialist** for this long term project.

Multi Hazard Risk Assessment and Zonation for Jamnagar and Neighbourhood, Gujarat State Disaster Management Authority (GSDMA), 2009 in Gujarat.
Client: Gujarat State Disaster Management Authority (GSDMA)

Government of Gujarat (GoG) being aware of the fact that risk and vulnerability to natural hazard is high in the state has commissioned this study. The main objective of this study is to develop hydro-metrological risk mitigation models (flood, cyclones, storm surge and Tsunami) and zoning for Jamnagar City and its neighbourhood (JADA limits). Jamnagar is a growing port city and the disaster impacts are likely to grow with increasing investments already done and new investments planned. This study

includes assessment of wind, storm surge, flood and Tsunami risk assessment and Zonation that can inform city development Authority to mitigate risks and vulnerability to these natural hazards. The assignment also includes analysis of secondary data followed by primary studies on natural hazards risks, demography, infrastructure and economy. Manish is k**ey social science specialist** for this project.

Water Transitions: Helping the Formal and Informal Urban Water Sectors in Developing Country Cities Adapt to Climate Change
Client: ISET

The project involved collaboration between two of the leading international NGOs working on the science and policy of climate, water resources, management, and adaptation: the Pacific Institute and ISET, working together with local partners in South and Southeast Asia. The goal of this project is to develop a framework as well as few key tools to guide water resource managers in the formal sector in understanding the potential impacts of climate change on water resources and in developing a process to address these impacts. Through detailed dialogues in an urban area in India, the project will bring together water stakeholders including water managers, NGOs, and the private sector to identify key needs that water stakeholders have in responding to climate change.

Manish working at TARU, one of the local partners for this project played a key role in developing the survey tools, training of the field researchers and preliminary analysis of the data collected and findings from a range of stakeholder consultations for this project.

- ***Monitoring and Evaluation of social projects***

Assessment of social welfare schemes and child sensitive schemes in Dungarpur district of Rajasthan
Client: Save the Children Finland (SCF), in 2009.

The purpose of this study is to better understand the scope of existing social protection programmes to assist chronically poor to come out of poverty and to ensure that moderately poor do not slide into poverty. In addition, the objective is to understand the implications of social protection programmes for children. Manish is the key **social science specialist** for this assessment.

Socio-economic Researcher for **Prospects to Reach the Poor in India through CSSs (June- July 2007) for DFID, New Delhi.**
Client: DFID

The project was an extension of the Review of the Government of India's (GoI) Centrally Sponsored Schemes (CSSs) undertaken in 2005. The Earlier project examined an USD 65 billion annual Centre-State transfer and their relevance to State finances and poverty reduction and identified opportunities to improve their effectiveness, efficiency and impact. Undertaken for DFID India, this was the first independent review of CSSs in India. This was followed by another study on Prospects to Reach the Poor in India through CSSs (June- July 2007) for the Eleventh and Twelfth Five Year Plans which reviewed ongoing CSSs by type, Millennium Development Goal (MDG) marker, institutional arrangements at the Central State levels and comprehensively mapped Centre-State transfers to provide strategic input on a possible DFID India engagement with the Government of India (GoI). The assignment involved assessment of fund flows, central state fund transfer mechanism, Allocation of fund to various development sectors and its utilisation with physical progress attained in Government sponsored development programmes.

Evaluation of Madhya Pradesh Rural Livelihood Project (MPRLP) Activities using the Madhya Pradesh Rural Employment Guarantee Scheme Funds.
Client: World Bank & MPRLP

The project was done for MPRLP in 2008. In its role as an Implementing Agency for the NREGS in MP, the MPRLP sees Watershed Management and Net Planning Approaches as an appropriate strategy, which if effectively implemented, could lead to potentially transformative infrastructure development and employment creation opportunities that enrich livelihood potential and hence the current assignment attempts to access the impacts and effectiveness of these approaches and lessons for scaling up in other MPRLP Phase-II. As a key socio- economic researcher evaluated the NREGS activities undertaken by MPRLP especially in context to the effectiveness of the planning processes, strategies adopted for convergence with NREGS-MP vis-à-vis net planning and watershed approach, fund utilization, provision of technical inputs, methods and processes followed to ensure quality of assets (both at the time of construction and maintenance); addressing social and gender provisions as given in the NREGA guideline,

role of community/ gram sabha/ self help groups during implementation; monitoring system followed including schedules of report, physical and financial, quality checks, audit, role of community/ gram sabha/ self help groups; impacts in generating sustainable livelihoods assets and its protection, and safeguards to promote greater transparency and accountability. Manish is the key **Socio-Economic Researcher** for the project.

Desk-based research for **SNV Asia for intervention strategy in the South East Asian Region, 2007**.
Client: SNV Asia

Preparing country strategy for Nepal, Bhutan and Bangladesh especially targeting the scope of intervention in context to Millennium Development Goals (MDG) pertaining to the areas of rural water supply and sanitation, adult literacy, smokeless chullas, cardamom plantation, and bamboo cultivation. The project was completed in partnership with Emerging Market Consultants (EMC) for SNV Asia, Professional Development Cooperation Organisation based in Netherland.

Review of the World Bank Financed Slum Sanitation Project (SSP) in Mumbai, 2005.
Client: World Bank

This assignment reviewed the $ 30 million World Bank financed Mumbai Slum Sanitation Program (SSP) and suggested an appropriate demand-responsive participatory approach to scale-up sustainable environmental sanitation services in Mumbai. Based on this review a proposed $ 100 million project was to be structured to provide services to up to 1.5 million slum dwellers and enable improvement in their quality of life, recognizing constraints of land availability, complex land ownership issues and existence of several supply-driven sanitation programs being implemented by various agencies in this mega-city. It also made an assessment of the SSP project design, its approach and process of project implementation with special emphasis on institutional, technical, social, environmental, financial, and monitoring aspects. A detailed study of land ownership and tenure arrangements and a participative appraisal of select community toilets and support agencies were also undertaken. The work included Collection of the data, filed visits, focused group discussion and household visits in the community. Manish is one of the key researchers and as a part of this assignment visited almost 45 slums and tried to unearth the mechanics of the Slum sanitation programme running in these slums. Data analysis and Preparation of the case studies for these slums was an integral part of the whole project.

Mid-term impact assessment of the Madhya Pradesh Urban sector Reforms (MPUSP), DFID, 2009.
Client: DFID

Madhya Pradesh Urban Services for the Poor is a five-year (2006-11) programme working with the Government of Madhya Pradesh and selected urban local bodies (ULBs) to build their capacity to deliver better services for the poor. To bring out the potential of ULBs to help their poorest citizens, MPUSP has been listening to ULB concerns and working with them to develop a programme of support. MPUSP is working with ULBs in an intensive action planning process, governed by principles of poverty-targeting, participation, consensus, responsiveness and transparency. An important part of MPUSP will be to improve citizen access to government through the introduction of 'e-governance' and other delivery systems which will simplify services. The mid term assessment exercise aimed at assessing the effectiveness in the MPUSP cities. **Manish is key researcher** for this project.

- ***Water supply and sanitation***

Impact Assessment of the Nirmal Gram Puraskar (NGP)-awarded Panchayats, UNICEF, 2008 in Andhra Pradesh (AP), Chattisgarh, Maharashtra, Tamil Nadu (TN), Uttar Pradesh (UP) and West Bengal.
Client: UNICEF

The study covered nearly 6,500 households from across 160 Gram Panchayats in six states. The Impact Assessment intended to assess the impact of interventions in NGP-awarded GPs, the extent and sustainability of behaviour change and local government involvement; and, verify the quality of facilities. At a larger level, the Impact Assessment aimed at enabling informed decisions on amendments needed to the NGP guidelines and practices. The work entailed evaluation of NGP awarded villages primarily to verify the status of villages in term of maintaining cleanliness, slippage if any and left out pockets in areas. Manish is the **Research Manager** for the states of Maharashtra & Chattisgarh.

Facilitating Rural Water Supply and Sanitation (RWSS) Service Providers in Bihar and Jharkhand to Plan for Change Management, New Delhi, 2007.
Client: UNICEF

This UNICEF-supported task is one of the first initiatives of its kind in the country where State-level service providers were engaged systematically to develop a Change Management Agenda and Plan for themselves- aimed at improving community participation, source and system sustainability and social equity. In undertaking the preparation of the State-level Change Management Action Plans, the TARU Team acted as the Secretariat to the State-level Change Management Core Groups (CMCGs) formed in the two States. **Manish is key socio-economic Researcher** for this project.

Other Assignments: Government

Worked in the capacity of **Assistant Project officer, Zila Panchayat, Bastar, Chattisgarh as Young Professional, of Council for Advancement of people's action and rural technology (CAPART), Ministry of Rural Development (MoRD), Government of India (GoI)** for two years.

Key activities included designing, implementation, monitoring and training under the following key projects:

- National Rural Employment Guarantee Scheme (NREGS)
- Swarnajayanti Gram Swarozgar Yojana (SGSY)
- Watershed Projects
- Backward Region Grant Fund (Erstwhile Rashtriya Sam vikas Yojana)

In the capacity of Assistant project officer in Zila Panchayat (ZP), simultaneously Manish worked on the three projects which were being run with the coordination of UNDP-GOI in Bastar District.

- **UNDP–GoI** sponsored **Rural Decentralisation and Participatory Planning for Poverty Reduction.**
- **UNDP-GoI** sponsored **Endogenous Tourism Project.**
- **UNDP-GoI** newly sponsored **District Public Private Community Partnership Project (DPPCP).**

Training & Capacity Building

- Training to MEIL on implementation of the Social Environmental, health and safety management system;
- Training to SunEdison on implementation of the Social Environmental, health and safety management system;
- Key Resource person for training of the Government Departments, and more than 100 trainings to Gram Panchayat representatives with regard to implementation of National Rural Employment Guarantee Scheme in Bastar, Chhattisgarh.

Select Clients/ Associations

Multilateral Organizations (MOs): UNICEF, World Bank (WB), UNDP

Bilateral Organizations: DFID (UK)

State Governments: Bihar, Chattisgarh, Gujarat, Jharkhand, Madhya Pradesh (MP), Maharashtra, Rajasthan, Punjab, West Bengal, Orissa, Andhra Pradesh, Uttar Pradesh,

Corporate Sector: Universal Chemicals and Industries Limited (UCIL), Cairn Energy, DFL, KISCOL, BPCL, SESIPL, Rio Tinto, Vedanta plc., KESPPL, MEIL, MTIL

INGOs: SNV Asia, Rockefeller Foundation

Countries: Kenya, Nigria, Guinea, Liberia, South Sudan, Bangladesh, Phillipines, Malaysia, Nepal

Nicci Ng

Consultant
Geographic Information Systems
ERM Hong Kong

Nicci Ng is a Consultant within ERM based in Hong Kong. Nicci is the GIS Team Leader in the Hong Kong office who is responsible for all the GIS work; she also provides GIS service to other ERM offices. Nicci has 7 years of professional experience; her key areas of expertise include spatial analysis and site selection, 3D modeling, database development and maintenance and using GIS for quantitative analysis. Nicci's project experience focuses on GIS for landscape visual impact assessment (LVIA) and planning, environmental impact assessment (EIA), marine studies, construction and engineering, mapping, and transport information system. She has worked on a variety of projects across the whole of Hong Kong, as well as doing international work, including in America, Brunei, Indonesia, Myanmar, Singapore, Vietnam, Abu Dhabi and projects in Africa (Ghana, Nigeria and Sierra Leone).

On joining ERM, Nicci immediately played an important role in GIS, she has involved into various EIA and GIS database related projects, e.g. *EIA and HLUS for North South Expressway – Package B and Package C*; *North East New Territories New Development Areas EIA*; *North New Territories Drainage Improvement Works – 'Package C – Remaining Works' EIA*; *Formation and Associated Infrastructural Works for Proposed Development of Columbarium, Crematorium and Related Facilities at Sandy Ride Cemetery – Feasibility Study*, and *GIS Database Design and Data Conversion* for Brunei Shell Petroleum.

Previously worked with AECOM Asia Co. Ltd., Nicci has hands-on experiences in GIS-related construction and engineering projects, e.g. the *Coastal Development at Hideriyyat, Abu Dhabi, UAE*; *the Hung Hom to Admiralty Section and Wong Tai Sin Section of Shatin-to-Central Link (SCL)*; *the Admiralty Section of South Island Line (SIL)*; and *the West Kowloon Terminus of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL)*. Environmental projects include *3D EIA for Sludge Treatment Plant in Tuen Mun*, and *Study of Major Industrial Air Pollution Sources in the Pearl River Delta Region*. Besides worked in private sector, Nicci has been also worked for the government sector. She has been involved in various government projects, such as *Transport Information System (TIS)* for the Transport Department, *Hong Kong Map Service (HKMS)* and *Enhanced Map Archived Retrieval Systems (EMARS)* for the Lands Department.

When Nicci was pursuing the post graduate studies in college, she was the GIS Cartographic Specialist of the Grey County Emergency Management System Co-op Project, where the project is offered by the Grey County and Sir Sandford Fleming College when she was in Canada.

Fields of Competence

- Geographic Information System
- Cartography
- 3D modelling and spatial analysis
- Remote sensing
- Database
- Web design
- Software:
  - Adobe (Illustrator, InDesign, Photoshop)
  - CAD (AutoCAD, MicroStation)
  - GIS (ArcGIS 9.x and up, MapInfo)
  - Macromedia (Dreamweaver, Flash)
  - MAPublisher for Adobe Illustrator
  - Microsoft Office (e.g. Access, Excel, SQL, Visio)
  - Programming (VB.NET)
  - Remote sensing (ERDAS, Idrisi, PCI Geomatica)
  - VRML
  - Web programming (e.g. Cold Fusion, PHP)

Experience

- Environmental Resources Management, Hong Kong
  Consultant – GIS (2011 – Present)
- Lands Department, HKSAR, Hong Kong
  Assistant Cartographer (2009 – 2011)
- AECOM Asia Co. Ltd., Hong Kong
  GIS Programmer (2008 – 2009)
- PCCW Solutions Ltd, Hong Kong
  GIS CAD Draftsman (2007 – 2008)

Education

- MGIS, Geographic Information Systems
  University of Hong Kong, Hong Kong, 2009
- PGCGIS, Geographic Information System – Cartographic Specialist
  Sir Sandford Fleming College, Canada, 2006
- BA (Hons), Geography with Economics
  University of Western Ontario, Canada, 2005

Languages

- Cantonese, native speaker
- English, fluent
- Mandarin, fluent

Nicci Ng

Consultant
Geographic Information Systems
ERM Hong Kong

Key Projects

GIS in Database and Data Management

GIS Database Update for Brunei Shell Petroleum, Brunei (2015).
Project Manager and GIS Specialist
To provide service to manipulate and also convert the new survey data to a new database. Update the existing database for the client to fulfil the client's needs. Create data standard document and data dictionary for the database.

Climate Change Risk Screening Tool for CLP Investments, CLP, Hong Kong (2015).
GIS Specialist
To develop a GIS database for identifying the natural hazards and climate change related risks on a global scale. Tasks include develop natural hazard and climate projection dataset and develop the climate change screening tool.

Provision of Services for the Updating of the Wetland Inventory with Field Verification and Digitization on GIS, Phase 2, Agriculture, Fisheries and Conservation Department, Hong Kong (2014).
Project Manager and GIS Specialist.
To provide service to update the records of the existing Wetland Inventory GIS database based on aerial photo images. Nicci is the project manager who is responsible for the updating works and all project management works include coordinate with client and ecological surveyors, data QC and ensure deliverables are submitted on schedule.

Glass Bottle Collection Study, Environmental Protection Department, Hong Kong (2014).
GIS Specialist
A project to GIS technology to present information on waste glass bottles arisings across the 18 districts (based on the District Council geographical boundaries). An interactive map will be produced which allows users to investigate the distribution of waste glass bottles for each district. Data will be overlaid on the GIS system and will take into account variables such as population density, residential property density, locations of food and beverage (F&B) establishments. Nicci is the task manager who is responsible to design and build the GIS database; she is also responsible to supervise other junior staffs to work on data collection and manipulation for the GIS database.

Provision of Services for the Updating of the Wetland Inventory with Field Verification and Digitization on GIS, Phase 1, Agriculture, Fisheries and Conservation Department, Hong Kong (2013).
Project Manager and GIS Specialist
To provide service to update the records of the existing Wetland Inventory GIS database based on aerial photo images. Nicci is the project manager who is responsible for the updating works and all project management works include coordinate with client and ecological surveyors, data QC and ensure deliverables are submitted on schedule.

GIS Database Design and Data Conversion for Brunei Shell Petroleum, Brunei (2013).
Project Manager and GIS Specialist
To provide service to convert the current survey data for the client and also to design the database for the current and future survey data to fulfil the client's needs. Create data standard document and data dictionary for the database.

GIS in Mapping

ESHIA Study for 1280MW USC Coal Fired Power Plant Project, Toyo-Thai Corporation Public Company Limited, Myanmar (2015).
GIS Specialist
Toyo-Thai is planning to develop a coal fired power plant in Ye Township, Mon State, Myanmar. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

EIS and ESIA for a proposed hydropower plant and pumped storage facility, SN Aboitiz Power Generation, The Philippines (2014-Ongoing).
GIS Specialist
ESIA and local Environmental Impact Statement (EIS) for a 130MW hydroelectric power plant and 250MW pumped storage facility in northern Philippines. As the GIS Specialist, Nicci is responsible for reviewing,

manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

Initial Environmental Examination (IEE) and ESIA for a proposed gas-fired power project, GMS Power and GPSC Group, Myanmar (2014-Ongoing).

GIS Specialist.

A preliminary E&S risk assessment for a 500MW combined cycle gas-fired power project in Kyaitlat, Ayeyarwady Region in Myanmar. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

Environmental, Social and Health Impact Assessment for Exploratory Drilling of Block 15/10 in the South China Sea, Chevron, China (2014-ongoing).

GIS Specialist

ERM is commissioned by Chevron to undertake an ESHIA Study for the proposed exploratory drilling of Block 15/10 in the South China Sea. Nicci is responsible for data processing and data management and delivering a series of maps for reports.

Coral Mapping for Sarawak Shell Berhad, Malaysia (2014).

GIS Specialist

To obtain survey results from surveyors and create a database for the survey and analysed results; and finally deliver a series of coral maps of the surveyed areas. Nicci is responsible to consolidate and normalize the survey data, apply different interpolation methods to interpolate the coral distributions in order to create coral mapping.

Coral Mapping for Brunei Shell Petroleum, Brunei (2014).

GIS Specialist

To obtain survey results from surveyors and create a database for the survey and analysed results; and finally deliver a series of coral maps of the surveyed areas. Nicci is responsible to consolidate and normalize the survey data, apply different interpolation methods to interpolate the coral distributions in order to create coral mapping.

Environmental, Social and Health Impact Assessment for Phase 2 Exploratory Drilling in Pearl River Mouth Basin, South China Sea, Chevron, China (2013).

GIS Specialist

ERM were commissioned by Chevron to undertake an ESHIA Study for the proposed Phase 2 Exploratory Drilling at Block 42/05 within the Pearl River Mouth Basin of South China Sea. Nicci is responsible for data processing and data management and delivering a series of maps for reports.

Environmental, Social and Health Impact Assessment for Marine 3D Seismic survey of Block 15/10 and Block 15/28 in the South China Sea, Chevron, China (2013).

GIS Specialist.

ERM were commissioned by Chevron to undertake an ESHIA Study for the proposed marine 3D seismic survey of Block 15/10 and Block 15/28in the South China Sea. Nicci is responsible for data processing and data management and delivering a series of maps for reports.

Biodiversity Consultancy Services for the Si Hong 100MW Photovoltaic Power Project, CLP, China (2013).

GIS Specialist

An Ecological Baseline Survey to verify the wetland habitat condition and wildlife utilization (especially avian fauna) at the project site and its vicinity. Measures based on the site conditions and potential ecological impacts are recommended. Nicci is responsible to prepare survey maps and process the survey data and deliver a series of maps for reports.

Ecological Survey for Proposed Muk Wu Sewage Treatment Plant - North District Sewerage Stage 2 (Remainder) and Sewerage to Chuen Lung, Kau Wa Keng Old Village and Lo Wai – Investigation, Design and Construction, Hong Kong (2013)

GIS Specialist

A baseline ecological survey is needed for the construction of the proposed Muk Wu Sewage Treatment Plant. Nicci is responsible to prepare survey maps and process the survey data and deliver a series of maps for reports.

Coc San Hydropower Project ESIA, Confidential Client, Vietnam (2013)

GIS Specialist

Nicci is responsible to work on all the maps for the project, tasks include consolidate the survey data

(survey location, points, and also habitats) and provide quantitative analysis for the project team.

Tai Tam Harbour Environmental Consultancy Services, Confidential Client, Hong Kong (2011-2013)
GIS Specialist
Nicci is responsible to deliver series constraint maps of the Tai Tam Harbour site. She has to prepare comprehensive environmental, physical and land use planning constraints analysis for potential new cable systems landing in Hong Kong.

New Submarine Cable System in Junk Bay, CLP, Hong Kong (2011)
GIS Specialist
Nicci is responsible to deliver series constraint maps of the Junk Bay area. She has to prepare comprehensive environmental, physical and land use planning constraints analysis for potential new cable systems landing in Hong Kong.

Constraint Analysis for Asia Submarine-cable Express (ASE) – Tseung Kwan O, NTT Com Asia, Hong Kong (2010-2011)
GIS Specialist
Nicci is responsible to offer a constraint mapping service for the route and landing point planning exercise. It is achieved through the use of GIS software through the collation of layers of mapped information showing features, constraints and engineering or planning proposals, to produce a multi-layered constraint map which forms the basis for the identification of unconstrained areas and thereby feasible route.

GIS in Environmental Impact Assessment

Cross Island MRT Line (EIA), Land Transport Authority, Singapore (2014).
GIS Specialist
A project to build a major MRT line, the 50 km Cross Island Line (CRL), which will run across the span of Singapore. Nicci is responsible to acquire, manipulate and consolidate the data from different sources, and deliver a series of maps to the surveyors, the Client and also for report submission.

Tseung Kwan O Desalination Plant, Water Supplies Department, Hong Kong (2013–2014)
GIS Specialist
A project profile and quantitative risk assessment was required for the application of EIA Study Brief. Nicci is responsible to deliver various maps including Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create figures for visual impacts by generating visual envelops for the selected project sites.

Environmental Impact Assessment (EIA) and Historical Land Use Surveys (HLUS) for North South Expressway – Package B – Ove Arup for Land Transport Authority, Singapore (2013)
GIS Specialist
The North-South Expressway (NSE) is Singapore's eleventh expressway. It will run parallel to the Central Expressway (CTE) to alleviate the traffic load on the heavily utilized CTE as well as nearby major arterial roads. Nicci is responsible to deliver a series of land use maps with the new alignments.

Environmental Impact Assessment (EIA) and Historical Land Use Surveys (HLUS) for North South Expressway – Package C – Ove Arup for Land Transport Authority, Singapore (2013)
GIS Specialist
The North-South Expressway (NSE) is Singapore's eleventh expressway. It will run parallel to the Central Expressway (CTE) to alleviate the traffic load on the heavily utilized CTE as well as nearby major arterial roads. Nicci is responsible to deliver a series of land use maps with the new alignments.

Agreement No. CE 15/2010 (DS) Upgrading of Cheung Chau and Tai O Sewerage Collection, Treatment and Disposal Facilities – Design and Construction (Ecological Baseline Survey), Hong Kong (2011-2013)
GIS Specialist
The project is to conduct terrestrial and marine ecological baseline surveys for Project. Nicci is responsible to deliver a series of ecological survey maps of the project areas, which includes habitat, Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create maps for survey transects and sampling points for terrestrial and freshwater fauna survey for the project sites.

Agreement No. CE 6/2002 (DS) Drainage Improvement in Northern New Territories – Package C – Investigation, Design and Construction, Drainage Services Department,

Hong Kong (2011-2013)
GIS Specialist
The project is to carry out an Environmental Impact Assessment (EIA) for the Project and identify, assess, resolve and advise on the environmental issues arising from the Project. Nicci is responsible to deliver a series of maps that includes habitat maps, NSR/ASR location maps, Landscape Character Areas (LCA), Landscape Resources (LR), and Outline Zoning Plans (OZP).

Environmental Impact Reassessment for the Revised Scheme of South East New Territories Landfill Extension, Environmental Protection Department, Hong Kong (2011-2013)
GIS Specialist
The objective of the assignment is to review and assess the environmental impacts of the revised scheme of South East New Territories (SENT) Landfill Extension and prepare documents for submission to the Environmental Impact Assessment Authority for variation of the existing Environmental Permit. Nicci is responsible to deliver a series of maps that includes habitat maps, NSR/ASR location maps, Landscape Character Areas (LCA), Landscape Resources (LR), and Outline Zoning Plans (OZP).

Agreement No. CE 61/207 (CE) North East New Territories New Development Areas Planning and Engineering Study – Investigation, Planning Department, Hong Kong (2011-2013)
GIS Specialist
An EIA study to provide information on the nature and extent of environmental impacts arising from the construction and operation of the developments proposed under the Project and related works that take place currently. Nicci is responsible to deliver various maps including Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create figures for visual impacts by generating visual envelops for the selected project sites.

Agreement No. CE 33/2011 (CE) Planning and Engineering Study on Future Land Use at Ex-Lamma Quarry Area at Sok Kwu Wan, Lamma Island – Feasibility Study, Ove Arup for CEDD, Hong Kong (2012 – 2013)
GIS Specialist
The project is to carry out an Environmental Impact Assessment (EIA) for the Project and identify, assess, resolve and advise on the environmental issues arising from the Project. Nicci is responsible to deliver a series of maps that includes habitat maps, Landscape Character Areas (LCA), Landscape Resources (LR), and Outline Zoning Plans (OZP).

Weda Bay Nickel, Environmental Management and Monitoring Plan for Pre-Construction Minerals Conservation Programme (2011-2012)
GIS Specialist
Nicci is responsible to process all the survey data and present them in maps, and deliver series habitat maps of the Weda Bay to the client.

Hong Kong Offshore Wind Farm in Southeastern Waters - Cable Route Desktop Study, CLP, Hong Kong (2011-2012)
GIS Specialist
Nicci is responsible for delivering series constraint maps of Southeastern waters region in Hong Kong. She has to prepare comprehensive environmental, physical and land use planning maps for the constraints analysis of the potential new cable systems landing in Hong Kong.

Agreement No. CE 43/2010 (HY) Central Kowloon Route – Design and Construction, Highways Department, Hong Kong (2011-2012)
GIS Specialist
The project is to construct and operate a dual-3 lane tunnel, across the Kowloon Peninsula linking the West Kowloon Reclamation in the west and the proposed Kai Tak Development in the east. An EIA study is conducted to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and related activities taking place concurrently. Nicci is responsible for the data presentation for the landscape visual impact assessment phase. She is responsible to deliver maps of Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and visual impacts figures for the affected works areas.

Agreement No. CE 4/2010 (TP) Planning Study on Future Land Use at Anderson Road Quarry – Feasibility Study, Planning Department, Hong Kong (2011-2012)
GIS Specialist
The feasibility study aims to identify and assess the potential cumulative environmental impacts arising from the land use proposals and other planned/committed developments within the Study Site and Study Area. Nicci is responsible to deliver

various maps including Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create figures for visual impacts by generating visual envelops for the project site.

Agreement No. CE35/2009 (HY) Elevated Walkway System Along Gloucester Road – Investigation, Highways Department, Hong Kong (2011-2012)
GIS Specialist
A landscape and visual impact appraisal (LVIA) is conducted to the establishment of the elevated walkway along Gloucester Road, which is one of the busiest areas in Hong Kong. Nicci is responsible to deliver various maps including Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create figures for visual impacts by generating visual envelops for the selected project sites.

3D Environmental Impact Assessment for CLP Sludge Treatment Plant – Design Phase, CLP, Hong Kong (2008)
GIS Programmer
Nicci is responsible to process aerial photo, data processing, and programming VRML models for the unmitigated and mitigated 3D models of the CLP Sludge Treatment Plant.

GIS in Web Service

Enhanced Map Archived Retrieval Systems (EMARS), Lands Department, Hong Kong (2010-2011)
Assistant Cartographer
The Enhanced Map Archived Retrieval Systems (EMARS) is an enhancement of the current HKMS at Lands Department; with the enhancement service, it aims to provide both digital and paper map sales online service. Nicci plays a role as a project coordinator to get user requirements and prepares documents to get quotation from contractors. She is also responsible to work on the feasibility study on the enhancement features in the new system.

Hong Kong Map Services (HKMS), Lands Department, Hong Kong (2009-2010)
Assistant Cartographer
The Hong Kong Map Service (HKMS) is a system providing round-the-clock service for e-ordering, e-payment and e-delivery of digital map products to the public as well as Government Bureau/Department. Nicci is responsible for testing, checking, and comment on the final stage of the HKMS with contractor. She plays a role as a project coordinator to fine tune the final product and deliver to users. Nicci is also responsible to communicate with other government departments, private companies to promote the new online map sales service.

GIS in Construction & Engineering

Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) Preliminary Design, Hong Kong, MTR Corporation (2008)
GIS Programmer
The Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) is to provide high speed rail services from Hong Kong to Guangzhou and a connection to the national high-speed passenger rail network serving major mainland cities outside Guangdong province. Nicci is responsible to process the aerial images, work with geologists to process rock head contour data, station information and other land information in order to create 3D models and flythrough videos to demonstrate the landscape and the structure of the station of West Kowloon Terminus. GIS and programming skills such as 3D analysis, spatial analysis, and ArcGIS tools customization techniques are also applied throughout the project.

Shatin-to-Central Link (Hung Hom to Admiralty Section and Wong Tai Sin Section) Design Phase, MTR Corporation, Hong Kong (2008)
GIS Programmer
The Shatin to Central Link (SCL) is a strategic railway line that stretches from Tai Wai to Admiralty, connecting several existing railway lines and passing through multiple districts in Hong Kong, and it will serve areas in East Kowloon that currently do not have any MTR service. Nicci is responsible to process the aerial images, work with geologists to process rock head contour data, pile information and other land information in order to create 3D models and flythrough videos to demonstrate the overview of the landscape and designated rail elevations for the selected construction sites. GIS and programming skills such as 3D analysis, spatial analysis, and ArcGIS tools customization techniques are also applied throughout the project.

South Island Line (East) Preliminary Design, MTR Corporation, Hong Kong (2008)
GIS Programmer
The South Island Line (East) is responded to

longstanding calls from the Southern District residents for improved and alternative transport services. Nicci is responsible to process the aerial images, work with geologists to process rock head contour data, station information and other land information in order to create 3D models and flythrough videos to demonstrate the overview of the landscape and structure of the proposed station in the Admiralty and Wanchai area. GIS and programming skills such as 3D analysis, spatial analysis, and ArcGIS tools customization techniques are also applied throughout the project.

Mubadala – South Hydayriat Islands, Abu Dhabi – Project Management – Design Phase, Abu Dhabi Urban Planning Council, United Arab Emirates, Abu Dhabi (2008)
GIS Programmer
Abu Dhabi is planned to develop another island off the coast; it is to make the capital a city of islands connected by dozens of bridges and tunnels. Nicci is responsible to manipulate the Lidar and bathymetric data from the Contractor in order to perform 3D and spatial analysis, meanwhile she has to process the aerial photos and CAD drawing data with the purpose of to create 3D models and flythrough videos to demonstrate the overview of the selected development site, the before reclamation and dredging scenario, and the completed construction scenario. Volume change calculation is also conducted for island reclamations and channel dredging.

HKHA Agreement No.: CB20070002 – Term Geotechnical Consultancy for Natural Terrain Hazard Study, CEDD, Hong Kong (2007 – 2009)
GIS Programmer
Nicci is responsible for data manipulation in order to create 3D models for perform analysis of the study area of Mt. Davis presentation. She is also responsible to produce fly through videos and maps to demonstrate the outputs for public consultation.

Agreement No. CE 9/2007 (GE) – Natural Terrain Hazard Mitigation Works at North Lantau Expressway & Yu Tung Road Near Tung Chung Eastern Interchange – Design & Construction, CEDD, Hong Kong (2008)
GIS Programmer
Nicci is responsible to ortho-rectified and georeference images for map displaying and 3D models. Process survey data and topo-map data in order to generate 3D model and calculate volume change of the before landslide and after landslide circumstances. She is also responsible to produce maps to demonstrate the outputs.

Agreement No. CE 41/2007 (GE) – Study of Landslides Occurring in Kowloon and the New Territories in 2008 and 2009 – Feasibility Study, CEDD, Hong Kong (2008)
GIS Programmer
Nicci is responsible to process Lidar and survey data in order to generate 3D models and calculate volume change for before landslide and after landslide. She is also responsible to produce maps to demonstrate the outputs.

GIS and Remote Sensing

Study of Major Industrial Air Pollution Sources in the Pearl River Delta Region – Design Phase, China (2008)
GIS Programmer
Nicci is responsible to data searching on China provincial boundary, georeferencing maps, and image processing for the Guangdong region by applying photogrammetry techniques in order to generate maps to demonstrate the pollutant concentrations for the designated areas.

GIS in Transportation

Transport Information System (TIS), GLD Contract No.:C0162/2006, Hong Kong, Transport Department (2007-2008)
GIS CAD Draftsman
The Transport Information System (TIS) is a centralized data warehouse for the collection, processing and dissemination of comprehensive traffic and transport information using Geographical Information Systems (GIS) platform. TIS is a value added system, it provides functions such as driving route search, car navigation, fleet management, public transport enquiry and other intelligent system services. Nicci was initially responsible on data conversion, data cleansing, and data manipulation where the data is acquired from the Transport Department, Lands Department, and public transit companies such as MTR, GMB and KMB with different data format.
She was then participated in the Intelligent Road Network (IRN) package design implementation and problem solving after the data conversion phase is done. Tasks in this stage include maintain data consistence when transferring data to the sub-contractor and during data submission to the

Transport Department. Meanwhile, she is also responsible on the IRN data accuracy and maintenance for all stages.

Other than applying technical skills, Nicci meets up with the sub-contractor to provide training on creating the IRN package dataset, where the IRN package includes typical features such as road segments, turning movements at road junctions, traffic directions, stopping restrictions, speed limit, parking locations, and etc. Other data in the IRN packages include public transport routes, schedule of services, stops, and traffic statistical data. She also provides QA/QC for the returned data from the sub-contractor.

Besides deals with the sub-contractor, she was scheduled to have regular meetings with Transport Department staffs to discuss the data requirement and project progress, and therefore to preserve the data quality.

SOE THURA TUN

Personal Data

Date of Birth	12 May 1970
Gender	Male
Marital Status	Married; one son and one daughter
NRC Number	12/Ya Ka Na (Naing) 046617
Employment	Joint General Secretary, Myanmar Geosciences Society Research Associate/Secretary, Myanmar Earthquake Committee Asst. Lecturer (1995-2004), Resigned from Dept of Geology, Yangon University
Postal Address	B-401, Delta Plaza Building, Shwegondaing Rd., Bahan, Yangon, Myanmar
Contacts: **Tel/ Fax/ e-mail**	+959-5144005/ +951-552901/ soethuratun@gmail.com / soethuratun@enviromyanmar.net

Educational Achievement

B.Sc.(Geology), M.Sc.(Geology), A+(Passed with Distinction)

Employment Record

2012- to date **Myanmar Environment Institute**

Vice Chairman

- Lecturing Environmental Students/Researchers (Hazards; Eco DRR)
- Natural Hazard Research; Pollution and Soil disintegration Research

2006- to date **Resource & Environment Myanmar Co. Ltd.**

Managing Director

- Environmental Assessment and Management
- Management of the Company

1995-2004 **University of Yangon Yangon, Myanmar**

Assistant Lecturer in Geology

- Lecturing Geology Students in Undergraduate level (Petrology of Igneous Rocks)
- Lecturing Geology Students in graduate level (Structural Geology & Tectonics, Remote Sensing and Geological Data Processing)

Professional Experiences

Disaster Related Research	- National Consultants for the Multi Hazard Risk Assessment in the Rakhine State (Strengthening Disaster Risk Reduction Practice in Myanmar through Research and Enhanced Inter-Agency Coordination) United National Development Programme (UNDP) Myanmar (2011-2012) - Principal Investigator for Identification of Seismic Source in Myanmar (part of the

Myanmar's Seismic Risk Assessment Project funded by Norwegian Ministry of Foreign Affairs) (2010-2011)

- Seismic Hazard Assessment of Shweli-3 Hydropower Project (with Myanmar Geosciences Society) (Dept. of Hydropower Implementation, Myanmar) (2010)

- Geological Hazard Assessment of Manipur and Yazagyo Dam Sites (with Myanmar Geosciences Society) (Dept. of Irrigation, Myanmar) (2010)

- Technical Director, Myanmar Earthquake Committee, for Continuous Global Positioning System (cGPS) Project for the assessment of active faulting and earthquake potential in Central Myanmar (with Earth Observatory of Singapore) (2009 to date)

- Mapping Potential Storm Surge Hazard for Ayeyarwaddy Delta of Myanmar (Natural Disaster Mitigation Research Group, Myanmar Engineering Society) (2008)

- Principal Investigator, Active Fault Research Project (collaborative project of Myanmar Engineering Society, Myanmar Geosciences Society, Dept. of Meteorology and Hydrology, Earth Observatory of Singapore, Kyoto University, Geological Survey of Japan, National Taiwan University and California Institute of Technology) (2007 to date)

Environmental Research

- Satellite Imagery and Aerial Photo Interpretation along the Thanlwin (Salween) River, Shan State, eastern Myanmar (MDX Group Co., Thailand)

- Marine Environmental Baseline Survey for the Shwe and Mya North Gas Fields, Rakhine Offshore (with ERM Hong Kong Ltd.) (Daewoo E&P)

- Terrestrial Ecological Survey for the Onshore Midstream Facilities and Pipeline Landing, Rambye (Ramree) Island, western Myanmar (with ERM Hong Kong Ltd.) (Daewoo E&P)

- Marine Environmental Baseline Survey for the Offshore Midstream Gas Line (with ERM Hong Kong Ltd.) (Daewoo E&P)

- Forest, wild life and bird survey for the Onshore Midstream Pipeline, Tanintharyi Division, Myanmar (with Professional Engineering Technology Ltd., Thailand) (PTTEP)

- Environmental, Social and Health impact assessment for Mong Hkok Coal-fire Power Plant (460MW) Project (with TEAM Consultant Ltd., Thailand) (Italian-Thai Development)

- ESHIA for Myanmar-China Gas Pipeline Project (Myanmar Section) (with IEM Thailand Ltd.) (CNPC)

- (in proposition) EIA of the Dawei Port Project (Italian Thai Development)

- Environmental Geology of Chaungtha Beach, Southern Rakhine Coast

Geological Research

- Mineralogical Aspect of Precious Metals Occurrence and Geology of the Indawgyi area, Mohnyin Township, Myitkyina District (Graduate Thesis)

- Aerial Photo Interpretation for Feasibility study of Ta Sang Hydropower Project. (MDX Group Company Ltd.)

- Photogeological interpretation of Kun Dam-site, Phyu Township Preliminary Feasibility Study for Hutgyi Hydropower Project, Union of Myanmar (2006) (Site selection survey along Thanlwin River in Karen State, Eastern Myanmar)

- Study on Tectonic Boundary along the western Myanmar (2006-2008); Fieldwork across the Rakhine (Indoburman) Range along Pyay-Taunggok Road and mud volcanoes of the Rambye Island

Other Professional Activities

- Paleoseismological Trenching Survey, Bago and Phyu sections of the Sagaing Fault, Central Myanmar
- Paleoseismological Survey, Northern Rakhine Shoreline
- Member of the Myanmar Geosciences Society
- Post-Tsunami Survey along the Tanintharyi Coast, Myanmar
- Pondaung Primate Expedition, Myanmar (collaborative research with French, Japan, and American Universities)

Attendance of International Meetings/ Conferences

- (July 1999) Asian Science Seminar on Biodiversity, Primate Research Institute, Kyoto University, Japan
- (Nov 2005) Conference of Asean Federation of Engineering Association (CAFEO 2005) Yangon, Myanmar
- (June, 2006) PACON 2006 (Pacific Congress on Marine Sciences and Technology in Asia) Yangon, Myanmar
- (July 2006) 3rd Annual Congress of Asia Oceania Geosciences Society (AOGS), Singapore
- (Jan 2007) 1st International Workshop on Seismotectonics in Myanmar and Earthquake Risk Management (SMERM 2007), Yangon, Myanmar
- (July 2007) 4th Annual Congress of Asia Oceania Geosciences Society (AOGS), Bangkok, Thailand
- (Feb, 2008) Regional Congress on Tectonics of Northeastern Indochina (TNI 2008), Chiang Mai, Thailand
- (Nov, 2008) GREAT 2008 – IGCP Congress, Bangkok, Thailand
- (April, 2009) 2nd International Workshop on Seismotectonics in Myanmar and Earthquake Risk Management (SMERM 2009), Yangon, Myanmar
- (June, 2009) GEOSEA 2009 Regional Geological Congress, Kuala Lampur, Malaysia
- (July, 2009) 6th Annual Congress of Asia Oceania Geosciences Society (AOGS), Singapore
- (Nov, 2009) Project Formulating Meeting on Myanmar's Earthquake Risk Assessment Project (Norwegian Ministry of Foreign Affairs and ADPC) (Bangkok, Thailand)
- (October, 2010) International Workshop on Resource and Environment towards Sustainable Development in the Great Mekhong Region (Kunming, China)
- (May, 2011) 3rd International Workshop on Seismotectonics in Myanmar and Earthquake Risk Management (SMERM 2011), Yangon, Myanmar
- (March, 2012) GeoMyanmar 2012, International Conference on Geology of Myanmar, (Sedona Hotel, Yangon, Myanmar)
- (July, 2012) Myanmar Mining Summit 2012 (Sedona Hotel, Yangon, Myanmar)

Award Received

- Medal (Second Class) for Excellent Performance in Social Field (2008 January, Government of Myanmar)

Some Recent Publications

Soe Thura Tun and Maung Thein (2012) Tectonic Map of Myanmar 2012, Paper read at Myanmar Mining Summit 2012, 22-25 July 2012, Yangon, Myanmar

Soe Thura Tun, Saw Ngwe Khaing, Wang Yu, Nyunt Htay, Yin Myo Min Htwe, Myo Thant, Than Myint and Kerry Sieh (2012) Surface Ruptures of the 2011 Tarlay Earthquake and Their Relationship to the Active Tectonics of Eastern Myanmar (Paper submitted to Bulletin of the Seismological Society of America)

Yu Wang, Kerry Sieh, Thura Aung, Soe Min, Saw Ngwe Khaing, and **Soe Thura Tun** (2011) Earthquakes and slip rate of the southern Sagaing fault: insights from an offset ancient fort wall, lower Burma (Myanmar), Geophys. J. Int.

Maung Thein, Than Myint, Soe Thura Tun, and Tint Lwin Swe (2009) *Earthquake* and Tsunami Hazard in Myanmar *Journal of Earthquake and Tsunami***, 3,** 2, 43–57

Win Swe and **Soe Thura Tun** (2009) Marine Terraces along the Myanmar Coast and their active tectonic significance *Journal of Earthquake and Tsunami***, 2,** 4, 267– 277

Than Tin Aung, Satake. Kenji, Okamura, Yukinobu, Shishikura, Masanobu, Win Swe, Hla Saw, Tint Lwin Swe, **Soe Thura Tun** and Thura Aung [2008] Geologic evidence for three great earthquakes in the past 3400 years off Myanmar: *Jour. Earthquakes and Tsunami*, **2, (4)**, 259-265

Soe Thura Tun (2006) The Sagaing Fault: a desk study report for seismotectonics implication in Myanmar, Local Publication, Myanmar Earthquake Committee, Myanmar Engineering Society.

Satake, K., Aung, T. T., Sawai, Y., Okamura, Y., Wing, K. S., Swe, W., Swe, C., Swe, T. L., **Tun, S. T.**, Soe, M. M., Oo, T. Z. and Zaw, S. H. (2006) Tsunami heights and damage along the Myanmar coast from the December 2004 Sumatra-Andaman earthquake, *Earth Planets Space* **58**, 243–252.

GS)

WIN NAING TUN
Director and Principal Consultant
Legal System

A. Personal Particulars:

Date of Birth	:	01-01-1969
Gender/ Sex	:	Male
Passport. No.	:	551047, Date of Expiry 18-01-2008
Marital Status	:	Married
Nationality	:	Myanmar
Present Address	:	No.(440), Block (D), Maydarwi Road, North Okkalapa Tsp, Yangon.
Telephone	:	95-1-699975
E-mail	:	kokowinnaingtun@gmail.com; winnaingtun@enviromyanmar.net

B. Educational Qualifications

1. B.Sc.(Geology), University of Yangon
2. Diploma in Business Law, University of Yangon
3. M.A. (Archaeology)
4. M.P.A. (first year)

C. Other Qualifications

1. Microsoft Certified Professional (Exam No. 70-290) Managing and Maintaining a Microsoft Windows Server 2003 Environment
2. Certificate in Cisco Certified Network Associate 640-607
3. Certificate in Linux System / Network Administration Training Program LPIC and Vendor neutral Certification Track
4. Certificate in Visual Basic
5. Certificate in Accpac Plus 6.1A (Multi Currency) General Ledger and Financial Reporter
6. Can speak, read, write and understand English and German Languages.

WORKING EXPERIENCE

Position : Director
Company : Resource & Environment Myanmar Ltd., Myanmar
Period : 2007 August to present
Job Duties/ Achievements:

Site Investigation in Geotechnical and Environmental Field Survey
GIS Mapping in Environmental Baseline Data collection for proposed PTTEP Gas line route (2008-9)
Logistical Management for Environmental Baseline Data collection for Shwe Gasline (onshore/offshore) (2007-8)

Position : Data Manager, Legal Advisor
Company : EIA Study Group, Yangon University, EIA for Ta Sang Hydropower Project
Period : 2003 to 2007
Job Duties/ Achievements:
Environmental Data Management
Personnel for Regulatory System Monitoring

OTHER EXPERIENCE

Position : GIS/Remote Sensing Lecturer, **Geotechnical Engineering Course**
Myanmar Geosciences Society: 2009 August to present

- IT Consultant
    1. Myanma Oceanwin Services Co., Ltd. (Yangon)
    2. Aung Pyi Tan Company Limited (Yangon)
    3. Golden Galon Company Limited & Meemosa Boutique Shop
    4. Padonmar Fine Dining Restaurant
    5. Caravan Travels & Tours
    6. Elephant House Co., Ltd.
    7. Myintmo Trading Co., Ltd.
    8. Victory Land Furniture Shop
    9. San Yi Co., Ltd.
    10. Nautilus Marine Services (Yangon)

KHIN OHNMAR HTWE
Principal Consultant
Social Survey and Impact Assessment

Personal information	
Name	Khin Ohnmar Htwe
Address	No.1 (b), Shwemann Road, Mandalay University Campus, Maha Aung Myay Township, Mandalay City, Mandalay Region, The Republic of the Union of Myanmar
Telephones	952-21131 (Res.), Mobile: 0949301881
Email	khinohnmarhtwe@gmail.com
Date of Birth	25 July 1965
Gender	Female
Nationality	Myanmar
Race	Bamar
Religion	Buddhism

Work experience	
Position	Head of Section
Date	2011 to present
Main activities and responsibilities	Lecturing Social Survey, Social Impact Assessment, Social Action Plan in Development Projects Research on Social Issue related to Environment
Type of business	Myanmar Environment Institute (MEI)

Work experience	
Position	Senior Consultant
Date	2009 to present
Main activities and responsibilities	Social Impact Assessment Specialist, managing and preparing for the SIA field observations and reports
Type of business	Resource and Environment Myanmar (REM)

Work experience	
Position	Administrator and Instructor
Date	2007 to 2009
Main activities and responsibilities	Management, Office Work, Assistant Lecturer
Type of business	Shinpo Japanese Language School

Work experience (Government Staff)	
Position	Tutor , Department of Geography, University of Yangon
Date	1995 to 1998
Main activities and responsibilities	Teaching and doing research
Type of business	Department of Higher Education, Ministry of Education

Work experience	
Position	Principal
Date	2001 to 2006
Main activities and responsibilities	Management and Instructor
Type of business	Century Childcare, Computer and Language Centre

Additional information	
Contact person	Dr Saw Pyone Naing
Address	No.1 (b), Shwemann Road, Mandalay University Campus, Maha Aung Myay Township, Mandalay City, Mandalay Region
Telephones	952-72615, Mobile: 096-505228
Email	sawpyonenaing@gmail.com

Study Abroad

Country	Contents	Sponsorship	Duration and venue
Japan	As Dependent in Tokyo, Japan	Monbusho, Japan	1998 to 2000, Tokyo, Japan
Japan	Practice-Oriented Area Study on Re-vitalization of Networking Societies by "Zaichi (Village Communities) and Local Towns (Rural Urban) of CSEAS, Kyoto University	CSEAS, Kyoto University	25-2-10 to 13-3-2009 Kyoto, Japan

Education career

Duration		Degree	Institution
From	To		
1982-1983	1985-1986	BA(Geography)	University of Pathein
1987-1988	1994-1995	MA(Geography)	University of Yangon
2003-2004	2004-2005	Diploma in English	University of Yangon

Research projects

Duration		Title
From	To	
1995	1995	An Evaluation of Myanmar Climate for Tourist Industry by Applying the TCI Method
2002	2004	Solid Waste Disposal in Yangon City
2003	2005	Analysis on Periodic Market System in Rural Shan State, The Case of Inle Lake
2003	2005	Environmental Images and Conservation Practices of Rural Society, The Case of Inle Lake
2003	2005	Spatial and Seasonal Variation of Agriculture in Inle Lake
2007	2009	Adaptation to Nature: House Types and House Styles in Inle Lake
2008	2011	Peoples' Wisdom Against Disasters: Case Study in Some Villages of Maubin Township, Ayeyarwaddy Region, Myanmar
2009	2011	Integrated Study on Agriculture and Rural Development in Central Dry Zone, Myanmar
2010	2011	Networking of NGO and CBO in Mandalay City
2010	2011	Rural Development of ShanlayKyun, AmarapuraTownship, Mandalay Region
2010	2011	Rural Development of Thanbo Island in Ayeyarwaddy River , Mandalay Region

EIA and SIA Experiences

Sr.	Period	Title
1	Jan, 2010	Traffic Survey in ESHIA for Myanmar-China Gas Pipeline Project, CNPC, 2009
2	2010	ESHIA for Mong Hkok Coal-fire Power Plant Project
3	Aug, 2011	Multi-hazard Risk Assessment in Rakhine State , UNDP Project
4	2011	EIA and SIA of Yeywar-Shwesaryan Power Transmission Line
5	2011	EIA and SIA of Baluchaung-Shwemyo Power Transmission Line
6	2012	EIA and SIA of the Dawei Deep Sea Port and Industrial Development Project
7	April, July, 2012	Public Meeting (SIA) of the Dawei Main Road Project

8	2011	SIA for Tharkayta Gas Turbine Project
9	April, May 2012	IEE for Small Scale Gold Processing Plant, Modi Taung Project, Yamethin
10	July 2012	SIA of Shweli River II Hydropower Project
11	September 2012	Urban Environmental Issues in Yangon City Area, Joint Study of Japan International Cooperation Agency and Yangon City Development Committee
12	December 2012	Social Baseline Data Collection for Dawei Special Economic Zone
13	January 2013	Social Impact Assessment for Hlawga 500 MW Combine Cycle Power Plant

CURRICULUM VITAE

Name:	**NAN THAZIN OO**
Father's Name	U Khin Maung Lay
Date of Birth	01-03-1991
N.R.C	13/MaMaTa(N)042769
Marital Status	Single
Sex	Female
Nationality:	Myanmar
Position	Social Consultant
Specialisation:	• Social surveyor in REM Co.ltd
Qualifications:	• BA (Geography) • Certificate in Level II, Book-kepping and Accounts, LCCI (UK), • Certificate in Environmental Studies(MEI) • Certificate of Microsoft Office • Certificate of SPSS software application (Noble Management Academy,Yangon)

Profile

- Ms. Nan Thazin Oo received her Bachelor degree in Geography from University of Dagon in 2010. Start from 2011 to 2014 March part time social surveyor of REM Co.ltd. From 2012 to 2013 studied LCCI level I, II received Certificate in Level II, Book-keeping and Accounts, LCCI (UK), At 2014 April became social member staff in Resource and Environment Myanmar Co.,Ltd. She attended Certificate Course on Environmental Studies at MEI. In 2014, received certificate of SPSS software application course.

Countries of Work Experience: Social survey and data collect in

- Shwe Li II Hydropower Project 2012
- Electric Power Development In Thilawa Area (Phase 1)project,April 2014.
- National Electrification Plan in Myanmar (WB) project,March 2014.
- Coal Fire power plant Project, Tarchilake,April 2014.
- Tae Kwang Shoes Factory Project, Denso Cable Project,June 2014.
- Bago Industrial Zone Project,

- Lake View Project, May 2014.
- Tama 1.2 MW Small Hydropower Project,Auguest,2014
- ShweAyeyarnaddy soap factory project, October 2014.

- Ngaw Chang Hka Hydropower Project, May 2014.
- ESIA Cement Import Terminal, Thilawa Port Project,(REM),October 2012.
- Environmental Baseline Survey of Dawei Deep Sea Port and Industrial Development, May 2012(REM)
- ESIA of 500 MW CCPP at Hlawga Township, Yanagon, February, 2013(REM)
- Insein Gas Turbine Project(REM),February 2013.
- ESIA of MCC Cement Plant, Mawlamyaing Township, Mon State, Myanmar, April, 2013(REM)
- Taungoo Education College Project(REM),May 2013.
- Thilawa special Economic Zone Project(REM),July 2013.
- Supplemental Socio-Economic Survey and Inventory of Loss for Development of Thilawa Special Economic Zone (SEZ) ,Auguest 2013.
- Oil factory LonglonеProject(REM),Auguest 2013.
- ESHIA of Baluchaung- Shwemyo 23o kV Transmission Line project, November, 2011(REM)
- ModiTaung Gold Mining Project(REM),December 2013.
- Coner Stone Zinc Factory Project(REM),January 2014.
- Eindu to Kawkareik Road Improvement ADB Project(REM),March 2014.
- Mong Wa Hydropower Project, January 2015

Selected Relevant Experience in Present Employment Since 2010

2011 to 2013: Part time social surveyor in REM Co.ltd
2012 to 2013: Study LCCI Course
2014 to date ：Social member staff in REM Co.ltd

Language

1. Burmese as mother tongue and Shan.
2. English (read/write/understand/speak)

Contacts

Contact Adress; No.7/ 6 floor, Thukha Street,Kyaukmyaung Gyi Ward, Tamwe Township,Yangon.
Contact Phone; 09-425302677
Email; thazinoo.nan@gmail.com

CURRICULUM VITAE

NAME:	May Thu Htet
Father's Name:	U Aung Min Lwin
N.R.C No. :	12/LAMANA (N) 144329
Date of Birth:	November 11, 1993
Religion:	Buddhist
Nationality:	Myanmar
Gender:	Female
Marital Status:	Single
Membership:	Myanmar Engineering Society (MES)
Hobby:	Travelling, Reading and Drawing
Education:	AGTI (Electronic & Communication), BSc (Physics)
Other Qualification:	Environmental Studies Level -1, I – Office 2007, Microsoft Excel in Business Application, AUTOCAD, NK-GIS
	Research (Owned): Electronic Circuit for traffic control, elevator, LED Lighting (West Yangon Technology University)
Work Experience:	2012- Present
	Social Consultant for Environmental and Social Impact Assessment (**Resource and Environment Myanmar Co., Ltd.**)

Base line data collection and data assessment for house hold Survey and co-operate the public consulting meeting Environmental Impact Assessment and Environmental Management on:

- Thilawa Special Economic Zone Project at Thanlyn Township (2012)
- Oil factory Longlone Project at Longlone Township (2012)
- 500 KV and 230 KV Transmission Line Project at HlaingTharyar to Bago Township (2013)
- Eindu toKawkareik Asian Main Road Improvement (ADB) Projectat Kayin State (2014)
- Oil & Gas Enterprise IOR-4 & IOR-6 Project at Pyay&Manaung Townships (2014)

- Oil & Gas Enterprise C-1 Project at Maw Lite, Ta Mue Township, Sagaing Region (2014)
- Oil & Gas Enterprise MOGE – 4 Project at Myanaung, KyanKhinn, and Pantaung Townships in Ayeyarwaddy and Bago Regions (2015)
- KyeikHteeYoe Cable Car Project (Sky Star Co. Ltd) at Mon State (2015)
- Dawei special Economic Zone Project at Tanintharyi Region (2015)
- Oil & Gas Enterprise A-4 & AD-02 Projectat Rakkhine State (2015)
- Oil & Gas Enterprise A-5 Projectat Rakkhine State (2015)
- Oil & Gas Enterprise AD-10 Project at Rakhine State (2015)
- 225MW Combined Gas Turbine Cycle Project at Mandalay State (2015)

: Sale marketing for GIS software and Satellite Image

- (**Imago Global Co. Ltd._ JV with Hexagon International Company)** _Part Time (2013-2014)

Professional: Social Surveyor

Proposed Position: Field Researchers

Contact Address: No (1), Timber Housing, Okkyin, Hlaing Township and Yangon

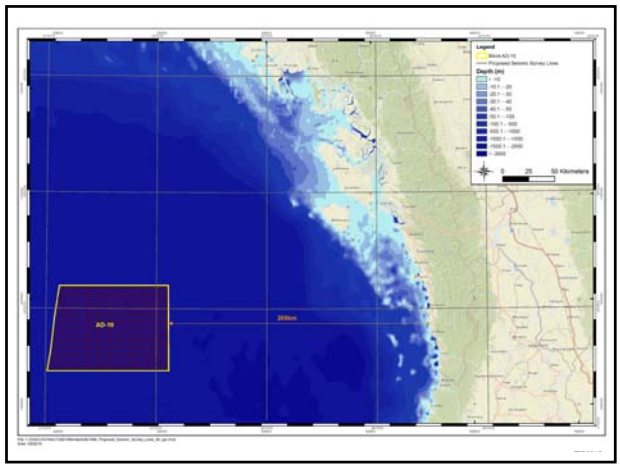
Contact Phone No. : 09-43198451, 09-972254894

Email: cherryko.cherryko@gmail.com

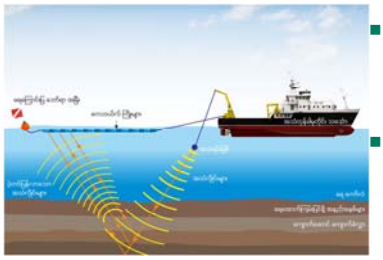
Annex 7.1: Project Poster and Project Flyer Used During Public Consultations in June, 2015

Statoil ကုမ္ပဏီမိတ်ဆက်နှင့် လုပ်ငန်းရည်ရွယ်ချက်

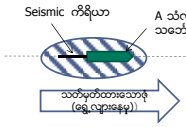
- Statoilသည်နိုင်ငံသုံးဆယ့်ခုနှစ်နိုင်ငံတွင်လုပ်ငန်းလုပ်ကိုင်လျက်ရှိသောနိုင်ငံတကာအဆင့်မီ စွမ်းအင်ကုမ္ပဏီကြီးတစ်ခုဖြစ်သည်။
- နောဝေနိုင်ငံတွင်အခြေစိုက်၍ကမ္ဘာ့နိုင်ငံအနှံ့အပြားတွင်ဝန်ထမ်းပေါင်း ၂၃၀၀ ဦးရေဖြင့်လည်ပတ်လျက်ရှိပါသည်။
- တစ်ရက်လျှင်ထုတ်လုပ်မှု ပျမ်းမျှတန်ချိန်ပေါင်း တစ် ဒဿမကိုးနှစ် ခုနှစ်သန်းခန့် ထွက်ရှိပါသည်။
- နောဝေနိုင်ငံ၏ ကမ်းဦးရေတိမ်ပိုင်းတွင် နှစ်၃၀ကျော်ကြာ သဘာဝဓါတ်ငွေ့နှင့် ရေနံတူးဖော်ခဲ့သည့်အတွေ့အကြုံကောင်းများရှိပါသည်။
- မတ်လ ၂၀၁၄တွင်မြန်မာနိုင်ငံအတွင်းရှိလုပ်ကွက်AD-10တွင်တူးဖော်ခွင့်ရရှိ၍MOGEနှင့် ၂၀၁၅ ဖြင့်လ ၃၀တွင် စာချုပ် ချုပ်ဆိုခဲ့ပါသည်။
- ယခုလုပ်ကွက်တွင် ပထမဦးဆုံးပြုလုပ်ရန်လျာထားသည့်A စီA စဉ်မှာ နှစ်ဖက်မြင် ဘူမိရုပ်သွင်စစ်တမ်းဖြစ်သည်။



စစ်တမ်းကောက်ယူမည့်ပုံစံ



- Statoilကုမ္ပဏီသည်လုပ်ကွက် AD10တွင်ပင်လယ်ရေ ၆A ၁၀၀နှစ်ဖက်မြင်ဘူမိရုပ်သွင်စစ်တမ်းကောက်ယူရန် ပြင်ဆင်လျက်ရှိပါသည်။
- လုပ်ကွက်AD10သည် ပင်လယ်ကမ်းရိုးတန်းနှင့် ၂၀၀ ကီလိုမီတာ၊ရေA နက် ၂၀၀၀ မီတာကျော်တွင်တည်ရှိပါသည်။



စစ်တမ်းကောက်မည့်A စီA စဉ်	ကောက်ယူမည့်A ရိပ်နိ	ကာလ	ကောက်ယူမည့် ဧရိယာ
နှစ်ဖက်မြင် ဘူမိရုပ် သွင် စစ်တမ်း	ဒီဇင်ဘာ ၂၀၁၅ မှ ဖြင့်လ ၂၀၁၆ A ထိ	၄၅ ရက်	၉၀၀၀ ကီလိုမီတာ

ဖြစ်နိုင်ခြေရှိသော A ကျိုးသက်ရောက်မှုများနှင့် ဘေးA နွှံရာယ်လျော့ပါးရေး စီမံချက်

ဖြစ်နိုင်ခြေရှိသော သက်ရောက်မှုများ	စက်မှုလုပ်ငန်းများA တွင် ဘေးA နွှံရာယ် လျော့ပါးရေးတိုင်းတာချက်များ
လှုများA ပေါ် သက်ရောက်မှု(ငါးဖမ်းလုပ်ငန်းများA ပေါ် ယာယီA နောင့်A ယှက်ခြင်းမှ နှင့်ရေယာဉ်များတိုးတိုက်နိုင်မှုA နွှံရာယ်)	• ငါးဖမ်းလုပ်သားများကိုလုပ်ငန်းမစတင်မီကြိုတင်A သိပေးခြင်း။ • A ထောက်A ကူပြုပေးမည့်ယာဉ်တွင်မြန်မာစကားပြောနိုင်သည့် သူထားရှိခြင်း။ • A သံလိုင်းတိုင်းတာသည့်ယာဉ်A နီးတဝိုက်ကိုတားမြစ်ရုံ A ဖြစ် ကန့်သတ်ခြင်း။
တိရွစ္ဆာန်များA ပေါ် သက်ရောက်မှု (ဓမြေA ၁၀၀ရေထဲတွင်ဆူညံသံဖြစ်ပေါ်စေမှုကြောင့်လိပ်နှင့်A ခြားသည့်ထိပါများ A ပေါ် A နောင့်A ယှက်ခြင်းနှင့်)	• A သံထွက်ပေါ်မှကိုနေးကွေးခြင်းဖြင့်တိရွစ္ဆာန်များဘေးလွတ်ရာ သို့ပြေးနိုင်ရန် A ချိန်ပေးခြင်း။ • A နီးA နားပတ်ဝန်းကျင်ရှိ သက်ရှိသတ္တဝါများကိုစောင့်ကြည့်ခြင်း။ • ကိရိယာများကြောင့်လိပ်များA နွှံရာယ်သက်ရောက်မှုမရှိစေရန် ကာကွယ်စောင့်ရောက်ပေးခြင်း။

ဆက်သွယ်ရန်လိပ်စာ

စီမံကိန်းနှင့်ပတ်သက်၍သိလိုသည်များ၊ A ကြံပြုချက်များနှင့် မေးခွန်းများကိုလွှပ်လပ်စွာ မေးမြန်းပြောကြားနိုင်ပါသည်။

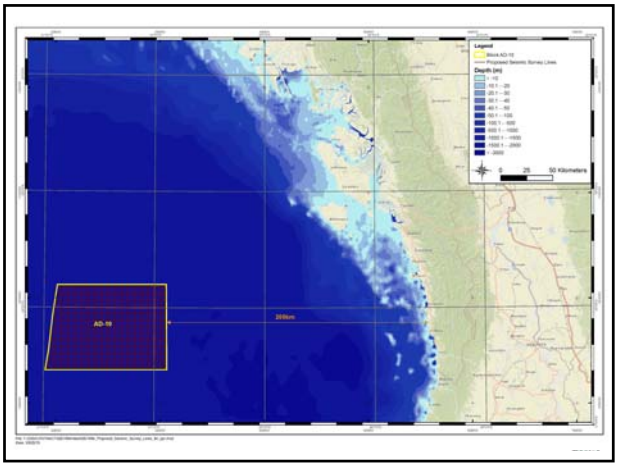
Statoil:

A°ေဒမေးလ် : gm_mmaoffice@statoil.com

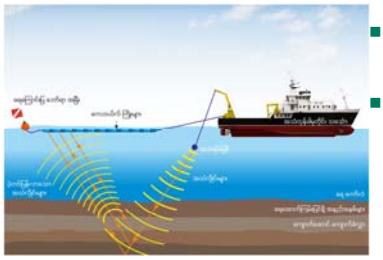
စီမံကိန်းဆိုင်ရာကိစ္စရပ်များနှင့် ပတ်သက်၍A ကြံပြုချက်များကို ၂၀၁၅ ဂျူလိုင် A ထိ လက်ခံသွားမည်ဖြစ်ပါသည်။ ပရောဂျက်ပြီးသွားပါကလည်း သိလိုသည့်A ချက်A လက်များကိုစုံစမ်းလိုပါကA ထက်ပါလိပ်စာA တိုင်းသာလိပ်မူ၍ဆိုက်ရိုက်ဆက်သွယ်နိုင်ပါသည်။

Who is Statoil and Why are we here?

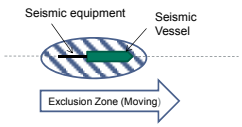
- Statoil is an international energy company with operations in 37 countries
- Statoil is headquartered in Norway, with 23,000 employees worldwide
- Statoil's equity production is 1.927 million boe per day (2014)
- Statoil builds on 40 years experience from oil and gas exploration and production on the Norwegian Continental shelf, where it is the largest operator
- Statoil was awarded Block AD-10 in Myanmar in March 2014, and signed contract with MOGE 30 April 2015
- The first activity in the block is the 2D seismic survey that is now being planned



Proposed Survey



- Statoil intends to undertake a 2D seismic survey in Block AD-10.
- Block AD-10 is located 200 km from the mainland coast in water depths of >2,000m.



Survey Program	Proposed Schedule	Duration	Area covered
2D Seismic Survey	Between December 2015 and April 2016	45 days	9,000 km^2

Potential Impacts & Mitigation

Potential Impacts	Standard Industry Mitigation Measures
Impacts on humans (short-term disturbance to fishing activities & risk of collision with vessels)	• Notification of fishermen prior to operations • Myanmar speakers on vessels • Support vessels
Impacts on animals (disturbance from underwater sound & risk of collisions with turtles and other animals	• Slow build-up of sound so animals move away • Monitoring for animals nearby • Guards to prevent turtle entrapment by equipment.

How to contact us

Comments, concerns, queries and questions on the above and the Project in general are welcomed.

Statoil:

Email: gm_mmaoffice@statoil.com

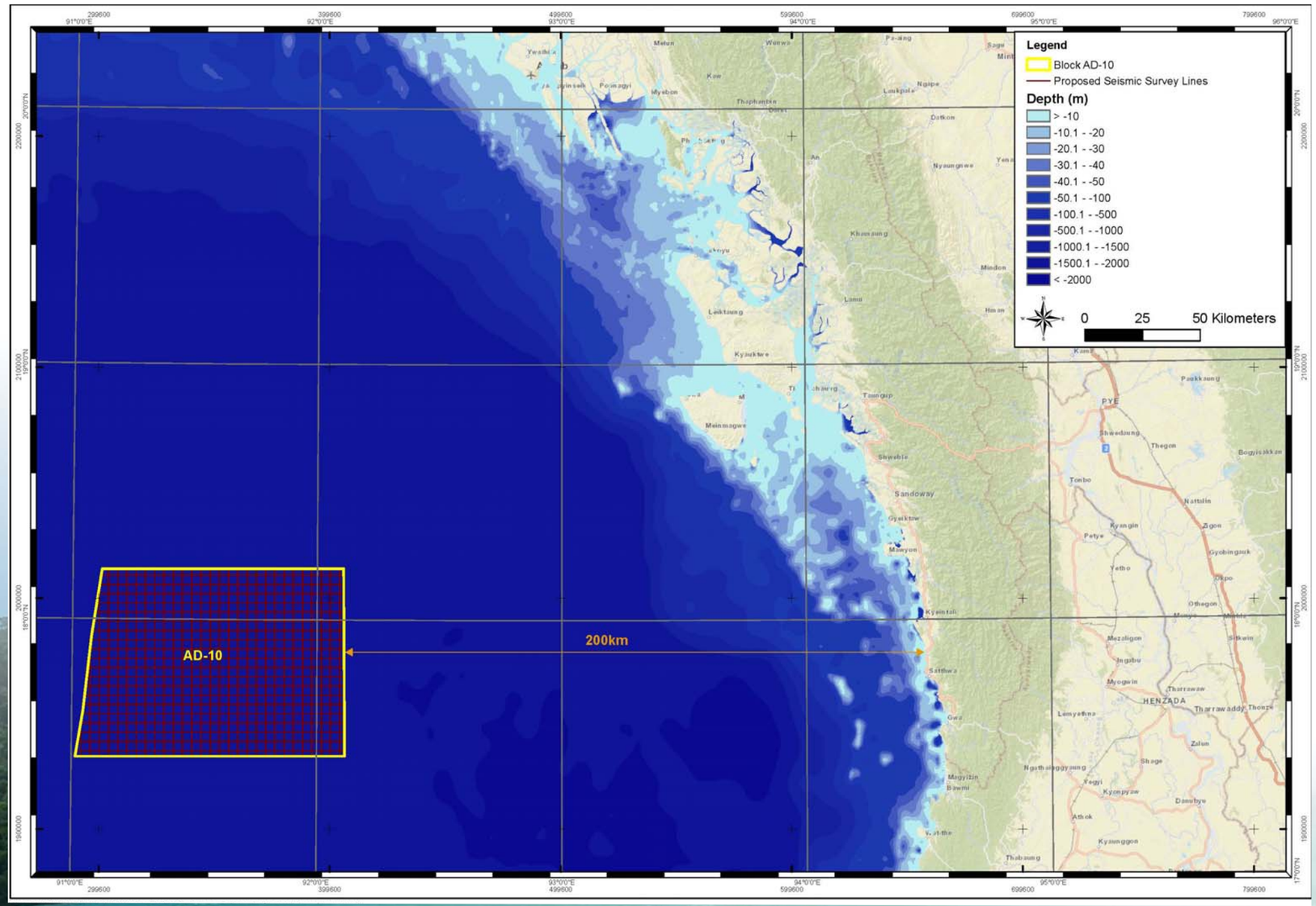
Comments on the seismic project can be received up until July 2015.

Queries after the project commences can also be directed to the same contact details.

မြန်မာ

မြန်မာ့ကမ်းလွန်ပင်လယ်ပြင်လုပ်ကွက် **AD-10** တွင်ပြလုပ်မည့်နှစ်ဖက်မြင်ဘူမိရုပ်သံစစ်တ

သတင်းအချက်အလက် အနှစ်ချုပ်စာလွှာ

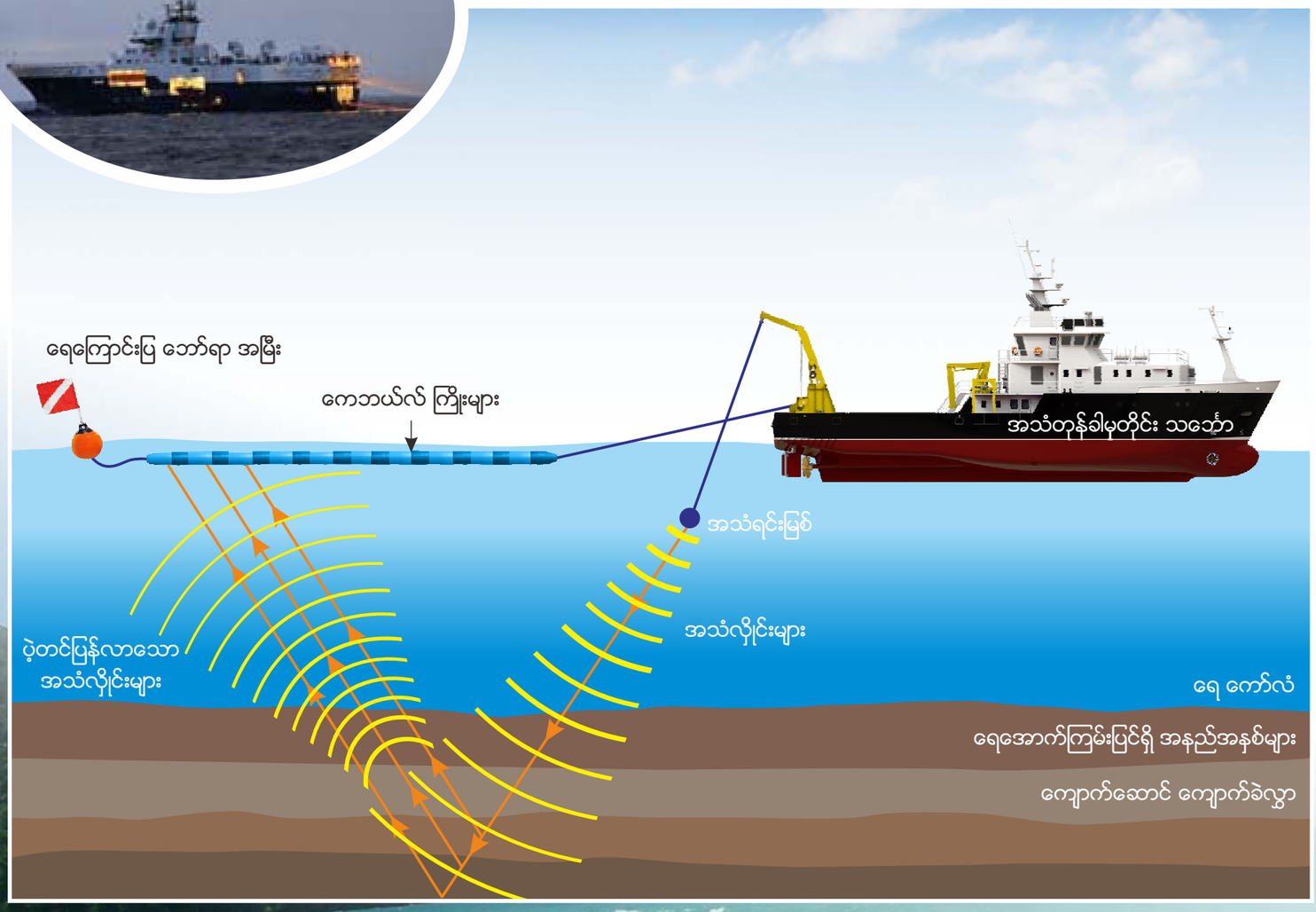


Statoil သည် မြန်မာ့ကမ်းလွန်ပင်လယ်ပြင်လုပ်ကွက် AD 10 တွင်စစ်တမ်းအဆင့်ဆင့်ကောက်ယူ၍ သဘာဝဓါတ်ငွေ့ထုတ်လုပ်နိုင်မှုအလားအလာကိုလေ့လာရန်စီစဉ်ထားပါသည်။ယခုစစ်တမ်းကောက်ယူမှုသည်၄၅ရက်တာကြာမြင့်မည်ဖြစ်၍၂၀၁၅ဒီဇင်ဘာတွင်စတင်မည်ဖြစ်ပါသည်။ ယခုစစ်တမ်းကောက်ယူမှုအစီအစဉ်တွင်မည်သည့်ရေနံနှင့်သဘာဝဓါတ်ငွေ့ကိုမှတူးဖော်မည်မဟုတ်ပေ။ Statoil သည်မြန်မာ့ ဥပဒေများနှင့် နိုင်ငံတကာကျင့်ထုံးများအရ သဘာဝပတ်ဝန်းကျင် နှင့် ပြည်သူလူထုကိုမထိခိုက်စေရန် အတွက်လူမှုရေးရာနှင့်သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာစစ်တမ်းကိုသဘာဝပတ်ဝန်းကျင်သယံဇာတစီမံခန့်ခွဲမှု (ERM) နှင့် ဒေသခံပညာရှင်အဖွဲ့အစည်းဖြစ်သည့် သယံဇာတနှင့်ဝန်းကျင် မြန်မာ (REM) တို့ကိုလုပ်ငန်းအပ်နှင်ပြီးဖြစ်ပါသည်။ အကယ်၍လိုအပ်ပါကလည်း လာမည့်တူးဖော်ရေးလုပ်ငန်းစဉ်တွင် လူမှုရေးရာနှင့်သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာစစ်တမ်းကို သီးခြားထပ်မံပြုလုပ်မည်ဖြစ်ပါသည်။ စစ်တမ်းကောက်မည့်လုပ်ကွက်AD10သည်ပင်လယ်ကမ်းရိုးတန်းနှင့်၂၀၀ကီလိုမီတာ၊ရေအနက် ၂၀၀၀ မီတာကျော်တွင်တည်ရှိပါသည်။

ERM

မြန်မာ့ကမ်းလွန်ပင်လယ်ပြင်လုပ်ကွက် **AD-10** တွင်ပြလုပ်မည့်နှစ်ဖက်မြင်ဘူမိရုပ်သံစစ်တ

Statoil



ƒÞ ဘူမိရုပ်သွင်တိုင်းတာသည့် ေလ့လာမှုတွင်အသံလှိုင်းကို အသုံးပြုပြခင်းအားဖြင့် ပင်လယ်ကြမ်းပြင်အောက်ရှိဘူမိဗေဒဆိုင်ရာအချက်အလက်များကိုရရှိနိုင်မည်ဖြစ်ပါသည်။ အသံလှိုင်းသည်ဘူမိရုပ်သွင်တိုင်းတာသည့် ေရယာဉ်အေနာက်မှ ချိတ်ဆွဲထားသည့် ကိရိယာမှ ထွက်ေပါ်လာမည်ဖြစ်သည်။ ယင်းအသံလှိုင်းသည် ပင်လယ် ရေအောက်ကြမ်းပြင်ရှိ ေကျာက်တုံးများကို ရိုက်ခတ်လျက်ပဲ့တင်လာပြီး ေနာက် ေရယာဉ်အေနာက်ဘက်တွင် ချိတ်ဆွဲထားသည့် ကေဘယ်လ်ကြိုးများမှဖမ်းယူမည်ဖြစ်ပါသည်။

ကျွန်ုပ်တို့ကို ဘယ်လို ဆက်သွယ်ရမှာလဲ။

ဆက်သွယ်ရန်လိပ်စာ

စိမံကိန်းနှင့်ပတ်သက်၍သိလိုသည်များ၊ အကြံပြုချက်များနှင့် မေးခွန်းများကိုလွပ်လပ်စွာ မေးမြန်းပြောကြားနိုင်ပါသည်။

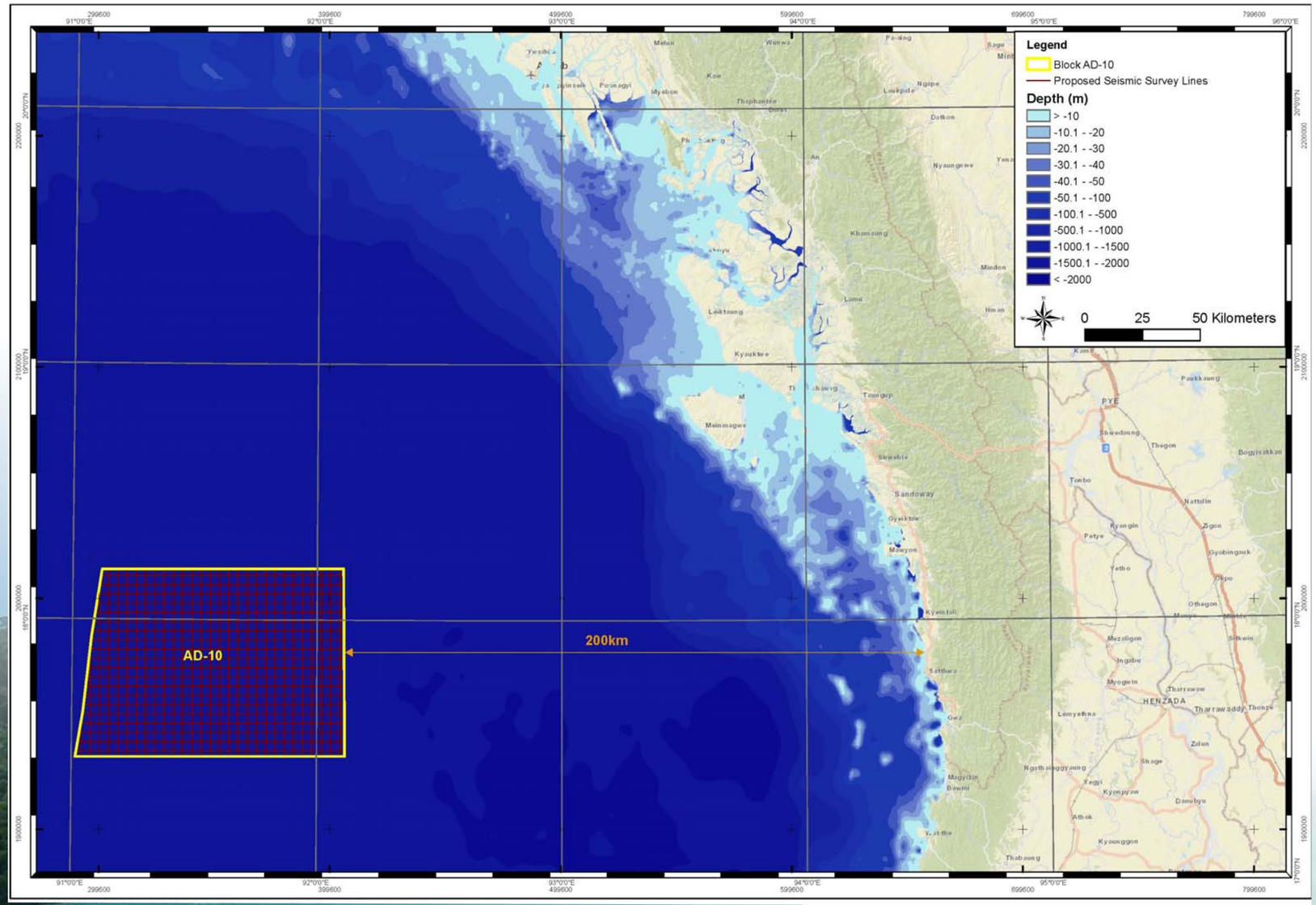
Statoil:

အီးမေးလ် : gm_mmaoffice@statoil.com

MYANMAR | 2D Seismic Survey in Block AD-10, Offshore Myanmar

ERM

Information Fact Sheet



Designated areas AD-10 offshore Myanmar

Statoil is planning to evaluate the potential for gas in designated area AD-10 offshore Myanmar through a series of offshore surveys.

This survey is scheduled to start in December 2015 and last for 45 days. No oil and gas exploration drilling is proposed as part of the current survey program.

Statoil has commissioned Environmental Resources Management (ERM) and local Myanmar experts Resource and Environment Myanmar Ltd (REM) to undertake an environmental and social assessment of these studies, in accordance with Myanmar laws and international best practice to avoid and minimise any harm to the environment and people. A separate environmental and social assessment would be carried out if any future exploration drilling is required.

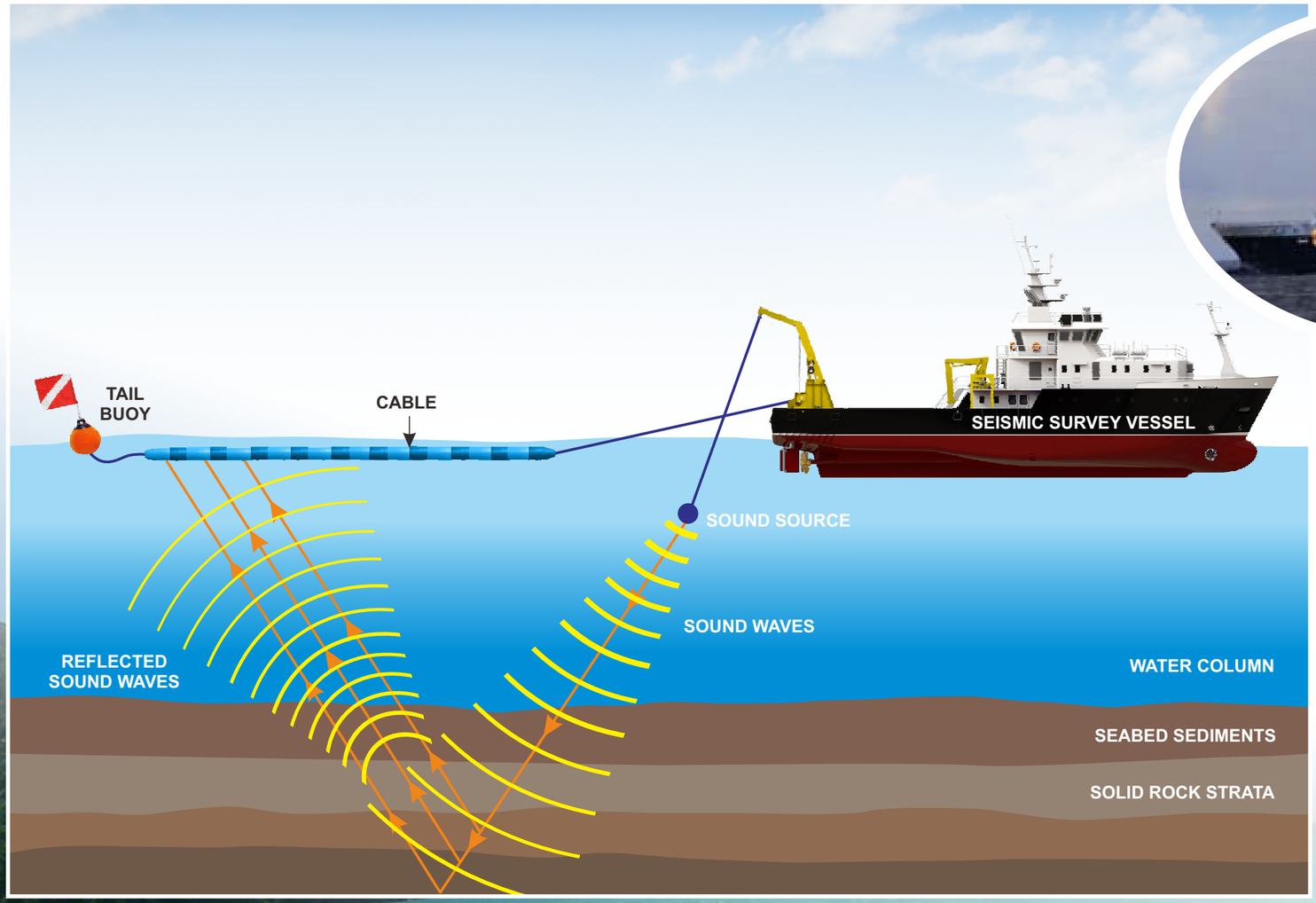
The survey in Block A-4 will be carried out within waters deeper than **2000 m** and will take place over **200 km** from the mainland coast.

MYANMAR | 2D Seismic Survey in Block AD-10, Offshore Myanmar

ERM

Information Fact Sheet

A typical survey vessel carrying out a seismic survey.



A seismic survey uses sound waves to provide information about the geology beneath the seabed. The sound is generated by equipment towed behind the seismic survey vessel. The sound waves are reflected back from the rocks beneath the seabed, and recorded on very long cables, which are towed behind the seismic vessel.

How to Contact Us:

Comments, concerns, queries and questions on the above and the Project in general are welcomed.

Statoil:

Email: gm_mmaoffice@statoil.com

Annex 7.2: Attendees List and Minutes of Question and Answer Sessions During Public Consultations in June, 2015

Thandwe Township Meeting **Date.15.6.2015**

No	Name	Address/Position	Department
1	U Myo Oo	Administrator (district)	district administrator
2	U Than Zaw Hun	Administrator (town)	Administrator
3	U Kan Win	Police officer	Police officer
4	U Khin Mg Yee	Fishery department	(district) administrator
5	U Tin Thein	(district) project	(district) administrator
6	U Khin Zaw	Police officer	Police officer
7	U Soe Myint	Police officer	Police officer
8	Dr.Soe Myint	Administrator /development (town)	Department(development)
9	U Khin Aung	Khamaungtone village	Administrator
10	U Kyan Win	Singaung	Administrator
11	U Naing Naing Tun	Gaut quarter	Administrator
12	U Than Naing	Jaungtaw quarter	Administrator
13	U Thein Kyaw	Zephyukone quarter	Administrator
14	U Htun Min Lat	Kyeekanyea quarter	Administrator
15	U Naung Naung	Mya pyin	Administrator
16	U Soe Naing	Owner	Fishery department
17	U Myint Tun	Owner	Fishery department
18	U Than Aung	Owner	Fishery department
19	Mg Nan Win	Representative	Fishery department
20	Dr.Soe Myint	Officer	Administrator
21	U Kyaw Win Sein	Junior manager	General officer (town)
22	U Kyaw Zay Ya		MOGE
23	Rebecca Summons	Environmental Specialist	ERM
24	U Saw Lin	Interpreter	Consultant
25	Helge Gabrielsen	Country manager	STATOIL
26	Jon Rytter Hasle	Environmental Manager	STATOIL
27	U Win Naing Htun	Environmental Specialist	REM
28	Ma Nan Thazin Oo	Social Specialist	REM
29	May Thu Htet	Social Specialist	REM

Date: 15.6.2015(MON)

Time: 1:00PM

Venue: THANDWE GAD Office

Attendees: refer to the signature sheet

Q (1) District National Planning Officer

What is the contract with MOGE? What is the profit split with the MOGE?

A (1) Statoil & MOGE

At this stage, this project only covers the 2D seismic survey. Based on the results Statoil will decide whether they will drill an exploration well and if it is commercially feasible. As this is a deepwater well it will be very expensive to drill. At the drilling stage, another detailed EIA study will be required. We are undertaking this Initial Environment Examination (IEE) for the requirement of the Environmental Conservation Law 2012 and we have to submit the IEE report to MOECAF. Block AD -10 is far away offshore (>200km). According to contract with MOGE, the profit sharing amounts are Myanmar Government 90% and Statoil 10%.

Q (2) District National Planning Officer

How will Statoil undertake the CSR program? Are there any CSR programs included at the current stage or will programs only be considered if the overall activity is commercially feasible?

A (2) Statoil

This phase covers only the seismic survey and it excludes CSR programs. However, Statoil need to conduct more detailed surveys if we find gas and will have to do more research. If a found is made, a new EIA will be required and Statoil would consider community investment. This stage would involve a field development plan which would include social investment. As with field developments in other countries, Statoil will be cooperating with public. If Statoil make a discovery, production could start in 2030, and social investment would be part of the business with associated investment in infrastructure.

Thabyugyaing Village Meeting **Date.16.6.2015**

No	Name	Adress/Position	Department
1	U Htun Kyi	Village supporting committee	Local Community
2	U Tin Htun Aung	Half of post authority Thandwe	Port Authority
3	U Ba Zaw	Port	Port Authority
4	U Nyunt Zin	Port	Port Authority
5	U Moe Zaw Win	Port	Port Authority
6	U Kyaw Win	Port	Port Authority
7	Daw Yee Than Sein	Thabyugyaing	Local Community
8	U Htun Tin	Half of post authority Thandwe	Port Authority
9	U Win Htun	Village supporting committee	Local Community
10	U Soe Tin	Thabyugyaing	Local Community
11	U Aye Myint	Thabyugyaing	Local Community
12	U Htun Aye Kyaw	Off shore fishermen	Local Community
13	U Aung Phon Myint	In shore fishermen	Local Community
14	U Khin Than	Village supporting committee	Local Community
15	U Kyaw Zay Ya		MOGE
16	Rebecca Summons	ERM	ERM
17	U Saw Lin	Consultant	Consultant
18	Helge Gabrielsen	STATOIL	STATOIL
19	Jon Rytter Hasle	STATOIL	STATOIL
20	U Win Naing Htun	Environmental Specialist	REM
21	Ma Nan Thazin Oo	Social Specialist	REM
22	May Thu Htet	Social Specialist	REM

Date: 16.6. 2015

Venue: Thabyugyaing Port Authority Office

Attendees: refer to attendance sheet

Concern - Villager

Our region (Rakhine) relies mostly on fishing activity. We are worried about the impact of seismic activities on our fishing business. We will like this project to not affect our fisheries.

Q (1) - Villager

According to your information, when the sound wave is emitted, fish and sea animals will swim away from the sound and, after short a while, they will come back. How about the other animals such as sea cucumber and snails which are not mobile?

A (1) ERM

The water depth of Block AD10 is more than 7,000 ft and those above mentioned animals cannot live in these water depth. However, sea snails, crabs, sea cucumber are less able to sense sounds than animals like mammals and fish as they have less hearing ability and are therefore unlikely to be significantly impacted.

Gwa Township Meeting **Date.17.6.2015**

No	Name	Address/Position	Department
1	U Myint Zaw	Junior Administrator	General Officer
2	U Myint Htay	Police officer	Police officer
3	U Htun Nyine	Half officer	La Wa Ka
4	U Ponnnya	Judge	Judge
5	U Aung Min Kyi	Half Officer	Law
6	U Min Thu	Immigration Department	Bank
7	U Ko Ko Naing	Agricultural	Agricultural
8	Daw Thida Myint	Half Officer	Statistics
9	U Sein Htun Mya	Half Officer	Agricultural
10	Dr.Min Min Bo	Half Officer	Agribusiness
11	Daw Mar Mar Lay	Administrator	Trade
12	U Htun Shwe	Half office	Road and communication
13	U Zaw Win Htun	Administrator	Information
14	U Mg San Thein	Executive Officer	Prosper
15	U Aye Naing	Half Officer	village officer
16	U Kyaw Myint	TMO	Healthy
17	U Tin Aung Moe	Senior officer(electric)	Electric
18	Daw Oo Aye Khin	School Teacher	Education
19	U Zaw Naing	Half Officer	revenue
20	U Man Zaw		Copper wire
21	Daw Khin Win Min	Responsibility	Telephone
22	Daw Myint Myint Kyi	Librarian	Librarian
23	U Aung Kyaw Myint	Officer	Project
24	U Min Min Htun	Half Officer	statistics(land)
25	U Nyi Htay	Fishery department	Fishery department
26	U Khin Mg Htay	Half Officer	State of weather
27	Daw Khin Than Htay	Clerk	Coalesce
28	U Than Htay	Factory	machine department
29	U Aung Kyaw	Officer	Environment
30	U Kyaw Zay Ya	Responsible	Broadcast department
31	U Swe Lin Aung	Half officer	Fire Bridge
32	U Aung Naing Oo	Manager	Factory
33	U Tin Yu	Administrator	
34	U Lay Naing	Administrator	
35	U Tun Aung	Administrator	
36	U Myint Naung	Administrator	
37	U Htun Shwe	Prosperous state	Prosperous state
38	U Kyaw Soe Aung	Half Officer	
39	U Kyaw Zay Ya		MOGE
40	Rebecca Summons	Environmental Specialist	ERM
41	U Saw Lin	Interpreter	Consultant
42	Jon Rytter Hasle	Environmental Manager	STATOIL
43	U Win Naing Htun	Environmental Specialist	REM
44	Ma Nan Thazin Oo	Social Specialist	REM
45	May Thu Htet	Social Specialist	REM

Sat Thwar Village Meeting **Date.18.6.2015**

No	Name	Address/Position	Department
1	U Kyaw Win	Farm	Local Community
2	U Tin Han	Farm	Local Community
3	U Shwe Thar	Farm	Local Community
4	U Kyaw Win	Local citizen	Local Community
5	U Htay Myint	Village Supporting committee (San Thwar)	Local Community
6	Mg Htea	Village supporting committee (ZeKune)	Local Community
7	U Soe Win	Jyinggaut fishermen	Local Community
8	U Htin Paw	Jyinggaut fishermen	Local Community
9	U Tin Aune	Zekune fishermen	Local Community
10	U Tun Yee	Zekune fishermen	Local Community
11	U Aung Min Tun	Jyinggaut fishermen	Local Community
12	U Zaw Lin Naing	Jyinggaut fishermen	Local Community
13	U Khin Mg Htay	Jyinggaut fishermen	Local Community
14	U Kyi Win	Middle village	Local Community
15	U Saw Myint	Middle village	Local Community
16	U Phyo Zaw Zaw	Middle village	Local Community
17	U Win Shwe	Satthyar village	Local Community
18	U That Soe	Satthyar village	Local Community
19	U Win Naing	Satthyar village	Local Community
20	U Kyaw Kyaw	Satthyar village	Local Community
21	U Hla Min Aung	Satthyar village	Local Community
22	Daw Khin Than Nu	Satthyar village	Local Community
23	U Kan Myint	Jyinggaut fishermen	Local Community
24	U Min Thu	Satthyar village	Local Community
25	U Myint Aye	Jyinggaut fishermen	Local Community
26	Rebecca Summons	ERM	ERM
27	U Saw Lin	Consultant	Consultant
28	Jon Rytter Hasle	STATOIL	STATOIL
29	U Win Naing Htun	Environmental Specialist	REM
30	Ma Nan Thazin Oo	Social Specialist	REM
31	May Thu Htet	Social Specialist	REM

Date: 18.6.2015

Venue: Sat Thwar Administrative Office

Attendees: refer to attendance sheet

Q (1) –Villager

Fisheries play a vital role in our livelihoods. Could we tell us exactly where the project site is? If the project site and our fisheries areas are the exactly same or overlapping, what will you do to avoid impacts to fishermen?

A (1) - Statoil

Statoil are going to conduct a 2D seismic survey in this stage and Statoil will be issuing the notice to the public with the exact location of the project activity area prior to commencement of operations. The survey period will be starting between December 2015 and April 2016 and the survey will last for only 45 days. Block AD-10 is located over 120 miles from the mainland coast and from previous consultation with stakeholders in Rakhine, this is not considered to be an area where local fishing occurs.

Q (2) Villager

We noticed that the area is 120 miles from Rakhine coast if so it will also effect onshore?

A (2) UWNT (REM) and Statoil

No, there are no activities onshore and only on offshore area. There will be a crew change with one boat coming to shore once a month (every 4 weeks). The port base used could potentially be in Rakhine.

Q (3) Villager

If a discovery is made, we would like to get community investment for the development of GWA Township. How will you do for CSR programs?

A (3) UWNT (REM) and Statoil

If a find is made, a new EIA will be required and Statoil would consider community investment. This stage would involve a field development plan in which Statoil would consider options for social investment.

Q (4) Villager

I would like to know, if a find is made in Block AD10, whether negative impacts on marine creatures in the area which is 120 miles away from onshore.

A (4) UWNT (REM) and ERM

If they found oil and gas and thought that potential for commercial, they need to go exploration drill, in that stage, it is required to conduct another detailed EIA study. The EIA study would be bigger than the IEE study that is being conducted for this seismic survey. Impacts from drilling on the marine environment would also be mitigated through the adoption of international best practices for drilling.

Q (5) Villager

If oil and gas is found, will there be any effects on villages or the fishing operations they are conducting in the sea?

A (5) UWNT (REM) and ERM

If Statoil found the oil or gas, they are required to conduct another EIA. This would assess environmental and social impacts on local communities including their fishing activities. However, given the distance of Block AD-10 from the coast, there is unlikely to be any impact on fishing activities.

Q (6) Villager

As you know our livelihood is fisheries. That's why I want to know how the exploration can affect our fishing activities? After exploration, what would you do if fish and prawn were depleted? Are there any onshore impacts from operations? If you don't find any oil and gas in the offshore and will you start looking in the near shore area? There was an example in Kyaukphyu where fishermen have been affected by a gas-pipe line project. That project affected offshore and onshore. The fishermen faced with a shortage of fish and prawn and when they caught fish, most of fish had wounds. If a similar thing happens, how would you solve it? Finally, I would like to know how this project will impact our fishing activities.

A (6) Statoil and ERM

As this project is not yet at the drilling stage it is hard to answer queries directly related to drilling. Prior to any drilling, a detailed environmental and social impact assessment will be conducted. This would assess any impact on fishing and fish stocks and would ensure that all potential impacts are mitigated to have as low as possible an impact on the environment and people. At the drilling stage, Statoil would need a supply base on the coast.

Given the distance of Block AD-10 from the coast (>120 miles), there is unlikely to be any impact on fishing activities from the planned seismic survey.