

ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINES FOR FISHERIES (AQUACULTURE)



Department of Environment
Ministry of Environment and Water, Malaysia



ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINES FOR FISHERIES (AQUACULTURE)



Department of Environment
Ministry of Environment and Water, Malaysia

THIS PAGE WAS LEFT INTENTIONALLY BLANK

**Department of Environment
Ministry of Environment and Water, Malaysia**

Copyright 2019 DOE

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder; provided acknowledgement of the source is made and a copy is sent to the Department of Environment. No use of this publication may be made for resale or any other commercial purpose without prior permission in writing from the Department of Environment.

e ISBN 978-967-2845-30-0

Published by:

DEPARTMENT OF ENVIRONMENT
Ministry of Environment and Water
Level 1-4,
Podium 2&3, Wisma Sumber Asli,
No. 25, Persiaran Perdana, Presint 4,
62574 Putrajaya

Design by

**GSR ENVIRONMENTAL CONSULTANCY SDN BHD
TRI ECOEGDE SDN BHD**

Photo Credit:

Front Cover: Pham Hung (istockphoto)

Mr. Gopinath Nagaraj, Ms. SS Puvanes of ***Fanli Marine & Consultancy Sdn Bhd***

ACKNOWLEDGEMENT

The Department of Environment (DOE) wishes to express its gratitude to all stakeholders who have provided valuable input in the development of this guideline. They include representatives from Federal and State government agencies, the private sector and non-government agencies (NGOs). Contributions from all individuals who have shared their knowledge and experience are much appreciated.

The Department is also grateful to all DOE staff for their efforts and passion in steering the Guidelines into reality for the benefits of streamlining and improving EIA report preparation in the country.

Finally, DOE also hopes that the Guidelines will be used in the context of EQA 1974 for the betterment of Environmental Management in the country.

PREFACE

The **Environmental Impact Assessment Guidelines for Fisheries** have been prepared to account for the latest amendments in the **Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015**, a subsidiary legislation of the **Environmental Quality Act (EQA) 1974 (Act 127)**.

Projects that are deemed prescribed activities are listed in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 and will require an Environmental Impact Assessment (EIA) to be undertaken by qualified persons, i.e. EIA Consultants, and approved by the Department of Environment (DOE).



The DOE has been streamlining the EIA process to align with the scope, functions, and vision of its Environmental Management Strategic Plan. As part of this plan, the DOE issued the **Environmental Impact Assessment Guidelines in Malaysia (EGIM)** in 2016, to guide industries, project developers and EIA consultants on the general requirements of the EIA. EGIM also stresses the early adoption of Environmental Mainstreaming and Guided Self-Regulation principles in project planning. Similarly, this guideline, to be read in conjunction with the complementary EGIM, shall aid in the undertaking of EIA studies pertaining to Fisheries projects.

Land-based projects such as Fisheries activities could have devastating environmental impacts including, but not limited to, indiscriminate primary and secondary forest removal that could lead to loss of livelihoods of people dependent on forest-based economies and increase in human-wildlife conflict. Apart from these, there could be impacts due to erosion, additional pollutant loads on rivers and other water bodies, soil contamination, improper waste disposal, and dust and noise due to vehicular movement. Therefore, identifying and quantifying the relevant impacts must be an integral part of the assessment process and proposing the mitigation measures. This will establish the basis for the commitment of the Project Proponent to ensure

that mitigating measures are adhered to during the implementation of the project and not to adversely affect the ecology or the surrounding human environment. The objectives of this guideline are:

- ❖ Defining environmental requirements for managing the project.
- ❖ Providing relevant tools and methods to avoid and/or to reduce and minimise the sources of environmental pollution to an acceptable level.
- ❖ Guiding the selection and application of these tools and methods to maintain a healthy environment during different phases of project implementation.

The Guideline shall provide guidance to various stakeholders such as Government Agencies, approving authorities, Project Proponents, Qualified Persons including DOE-registered EIA Consultants, Subject Specialists, and other EIA-related practitioners in the preparation and submission of EIA reports for Fisheries activities.

The Guidelines shall only be used within the framework of the EQA 1974 including its future updates and its subsidiary regulations. Although it is not legally applicable to the states of Sabah and Sarawak, the Guidelines can still be used as a reference and guide for similar projects in these two states.

NORLIN BINTI JAAFAR

Director General

Department of Environment, Malaysia.

TABLE OF CONTENTS	I
LIST OF APPENDICES	III
LIST OF TABLES	III
LIST OF FIGURES	IV
LIST OF ABBREVIATIONS	V
GUIDELINES OVERVIEW	O-1

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION

1.1	PURPOSE OF THE EIA GUIDELINE FOR FISHERY	2
1.2	APPLICABILITY OF GUIDELINE	2
1.3	USING THIS GUIDELINE.....	3
1.4	OVERVIEW THE ENVIRONMENTAL ASSESSMENT PROCESS.....	4
1.5	INCORPORATING EIA INTO THE PROJECT PLANNING FRAMEWORK.....	7
1.6	KEY NOTES	10
1.7	OBJECTIVES OF THE EIA GUIDELINES	12
1.8	STRUCTURE OF THE GUIDELINES	13

CHAPTER 2. POLICIES, LEGISLATIONS, AND OTHER INSTRUMENTS

2.1	NATIONAL AND STATE POLICIES AND PLANS	16
2.2	GOVERNING LAWS, REGULATIONS, AND OTHER INSTRUMENTS	18
2.3	STATE ENACTMENTS	18
2.4	REGULATIONS.....	18
2.5	GUIDELINES AND GUIDANCE DOCUMENTS	18
2.6	SUSTAINABLE FISHERIES CERTIFICATION	20

CHAPTER 3. SCREENING AND SCOPING

3.1	INTRODUCTION	22
3.2	SCREENING PROCEDURES.....	22
3.3	PRESCRIBED ACTIVITIES FOR FISHERIES	23
3.4	ENVIRONMENTAL SCOPING	24
3.5	TERMS OF REFERENCE AND ENVIRONMENTAL SCOPING INFORMATION ..	37

CHAPTER 4. DETERMINING ENVIRONMENTAL BASELINE CONDITIONS

4.1	BASILINE STUDY	40
4.2	ESTABLISHMENT OF STUDY REQUIREMENTS FOR EIA	43

CHAPTER 5. PREDICTING AND EVALUATING IMPACTS

5.1	IMPACT ASSESSMENT AND EVALUATION OF SIGNIFICANCE	58
5.2	TYPICAL IMPACTS OF FISHERY PROJECTS	59
5.3	ENVIRONMENTAL IMPACTS OF FISHERIES PROJECTS	61
5.4	TYPICAL IMPACTS AT VARIOUS STAGES OF FISHERIES PROJECTS	67
5.5	PREDICTIVE METHODS AND TOOLS	69
5.6	CRITERIA AND STANDARDS	74
5.7	OUTCOMES FROM IMPACT ASSESSMENT	74

CHAPTER 6. IDENTIFICATION OF MITIGATION MEASURES

6.1	ADDRESSING IMPACTS	78
6.2	KEY MITIGATION MEASURES	78
6.3	WATER RESOURCES AND QUALITY FOR PRODUCTION PROCESSES	90
6.4	BIOSECURITY	94

CHAPTER 7. DEVELOPING OUTLINE OF ENVIRONMENTAL MANAGEMENT PLAN

7.1	INTRODUCTION	96
7.2	EMP FRAMEWORK	96
7.3	SELF-REGULATION (SR)	97
7.4	MONITORING AND AUDIT PROGRAMMES	99

CHAPTER 8. PREPARING THE EIA REPORT, SUBMISSION AND REVIEW PROCESS

8.1	INTRODUCTION	104
8.2	EIA REPORT	104
8.3	EIA REPORT SUBMISSION AND REVIEW PROCESS	110

REFERENCES	R-1
GLOSSARY	G-1

LIST OF APPENDICES

Appendix 1	Generalised Pathway for Planning Fisheries Projects
Appendix 2	Impact Assessment Matrix For Fisheries Projects
Appendix 3	Specific Standards And Limits For The Fisheries Project

LIST OF TABLES

Table 1-1	Quick Reference Of The Main Steps In The EIA Process.....	4
Table 2-1	Relevant Guidelines and Guidance Documents Related to Development Planning Coastal Areas.....	19
Table 3-1	Schedule of Prescribed Activities: Activity 4 - Fisheries	23
Table 3-2	Key information for Site Suitability Analysis	25
Table 3-3	List of Typical Project Activities with Issues of Concern During Pre-Construction Phase	29
Table 3-4	List of Typical Project Activities with Issues of Concern During Construction Phase	30
Table 3-5	List of Typical Project Activities with Issues of Concern During Operational and Closure/Exit Phase	32
Table 3-6	Advantages and Disadvantages of Impact Identification Methods	34
Table 3-7	Key Stakeholders and their Roles and Responsibilities	35
Table 4-1	Environmental Baseline Information and Data Sources	44
Table 4-2	Recommended Sampling Requirements for EIA Studies.....	48
Table 4-3	Additional Sampling Requirements and Study Requirements.....	51
Table 4-4	Study Areas For First Schedule and Second Schedule EIA.....	54
Table 5-1	Fisheries and Aquaculture-Related Activities and Potential Environmental Impacts	59
Table 5-2	Examples of Prediction Methods for Environmental Impacts	71
Table 5-3	Criteria and Standards for Environmental Parameters.....	75
Table 6-1	Standard Requirements for the Submission of LD-P2M2.....	80
Table 6-2	Aquaculture Water Quality Maintenance Standard	91
Table 6-3	Discharge Limit for Treated Effluent.....	92
Table 7-1	Proposed Environmental Monitoring Parameters.....	101

Table 8-1	Recommended Project Description in EIA Report.....	106
Table 8-2	Comparison of the Submission and Review Process for the First and Second Schedule EIA.....	110

LIST OF FIGURES

Figure 1-1	Project Phases And Integration Of Environmental Activities	7
Figure 2-1	Policies and Plans Relevant to Development in Coastal Areas	17
Figure 3-1	Study Boundaries for Coastal Projects	27
Figure 6-1	Flow of Aquaculture Water Management and Treatment.....	90
Figure 6-2	Example of Process Block Flow Diagram for Aquaculture Wastewater Treatment	93

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
API	American Petroleum Institute
BOD	Biochemical Oxygen Demand
BOMBA	Fire Department
CAD	Computer Aided Design
CEQ	Council on Environmental Quality
CITES	Convention on International Trade for Endangered Species
COD	Chemical Oxygen Demand
DAF	Dissolved Air Flootation
dB	Decibel
dB(A)	A-weighted decibel
DCA	Department of Civil Aviation
DID	Drainage & Irrigation Department
DO	Dissolved Oxygen
DOE	Department of Environment
DOH	Department of Health
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EQA 1974	Environmental Quality Act 1974
ERA	Environmental Risk Assessment
ERP	Emergency Response Procedure(s) or Plan
ESA	Environmentally Sensitive Area
ESR	Institute of Environmental Science & Research
EXCO	State Executive Committee
FAO	Food & Agricultural Organisation of the United Nations
FAR	Fatal Accident Rate
FS	Feasibility Study
GIS	Geographical Information System
ICAD	Integrated Conversion and Development
IPTUM	Institut Penggajian Tinggi Universiti Malaya
IUCN	International Union for Conservation of Nature
IWMS	Industrial Waste Management System
JKR	Jabatan Kerja Raya (Public Works Department)
JPBD	Jabatan Perancang Bandar & Desa
JPS	Jabatan Pengairan dan Saliran
kg.	kilogram
km	Kilometre
kW	kilowatt
Kwh	Kilowatt per hour
LC₅₀	Concentration of toxic substance (gaseous or liquid) at which 50% of the test population usually (mice) die within a certain period of time
Ldn	Day-night Sound Level (for assessing 24-hour exposure)

Leq	Equivalent Sound Level (used to describe 8-hour exposure)
LO	Land Office
m	Metres
m³	cubic metres;
MAMPU	Unit Pemodenan Tadbiran Malaysia
mg/l	milligram per litre
MIDA	Malaysian Industrial Development Authority
MSL	Mean Sea Level
NATMANCOM	National Mangrove Committee
NEPA	National Environmental Policy Act
NGO	Non-Government Organisation
NMHC	Non-Methane Hydrocarbons
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
PAN	Peroxy AcylNitrate
PCB	Poly Chlorobiphenol
ppb	parts per billion
ppm	parts per million
ROC	Reactive Organic Compounds
ROW	Right of Way Clearing
SBR	Sequential Batch Reactors
SEI	Significant Environmental Impact
SS	Suspended Solids
TMB	Telekom Malaysia Berhad
TNB	Tenaga Nasional Berhad
TNRD	Tenaga Nasional Research & Development
TOR	Terms of Reference
UNEP	United Nations Environmental Protection
USEPA	United States Environmental Protection Agency
USLE	Universal Soil Loss Equation
VOC	Volatile Organic Compounds
WHO	World Health Organisation
WWF	World Wide Fund for Nature
WWTP	Wastewater Treatment Plant
°C	degree Celsius
µg/l	microgram per litre



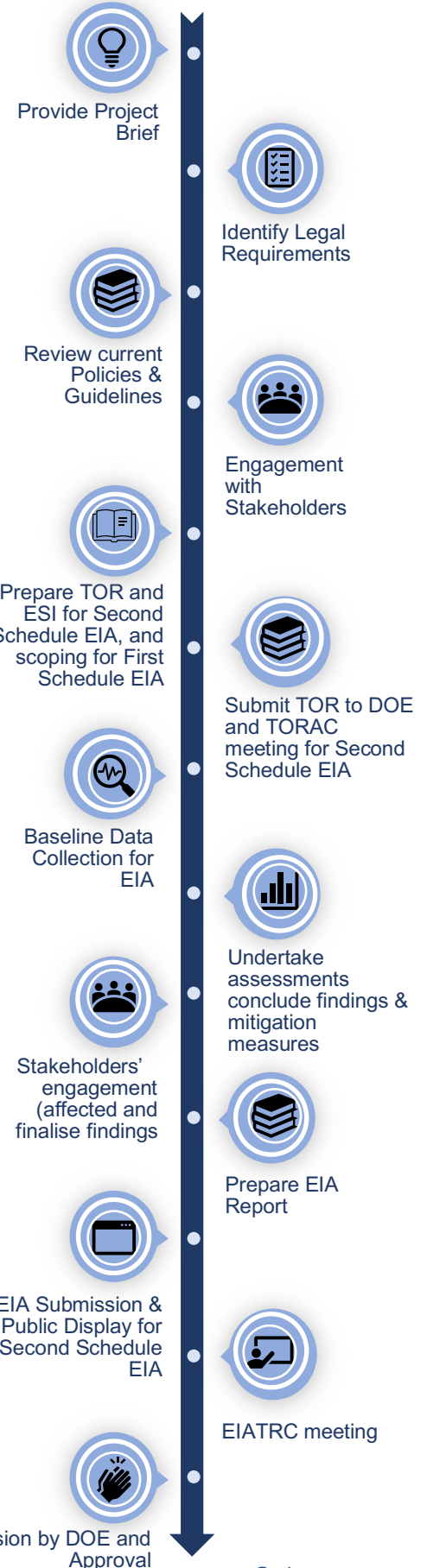
PURPOSE OF THE GUIDELINE

To provide clear and concise guidance on the preparation of Environmental Impact Assessments (EIA) for agriculture projects and activities defined as **prescribed activity** in the EIA Order 2015.

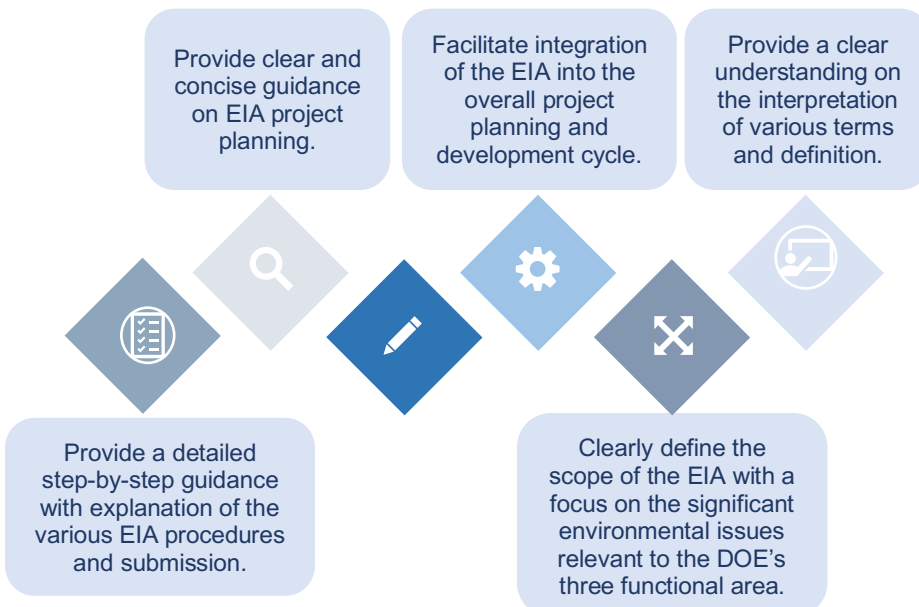
APPLICABILITY

- ❖ Applicable to fisheries projects that qualify as a **prescribed activity** in Peninsular Malaysia
- ❖ Use this document as a guide for non-prescribed activities.
- ❖ Guidelines to be read with EGIM 2016.

OVERVIEW OF THE EIA PROCESS

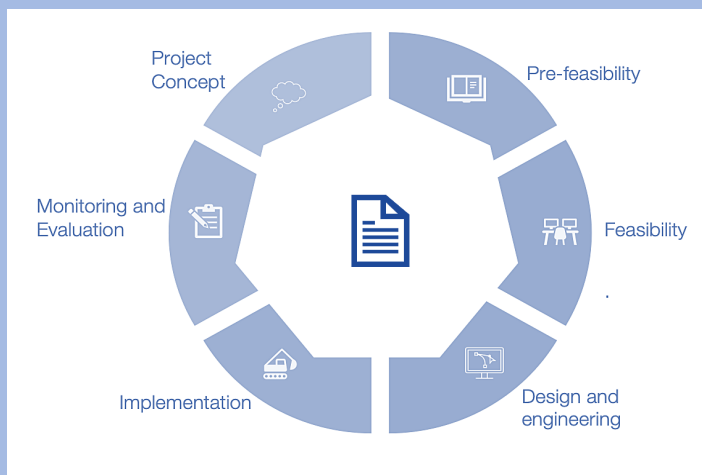


OBJECTIVES



Project Phases in EIA

Incorporation of EIA study at an early of project planning at the Project Concept and Pre-feasibility stages provides significant benefits.

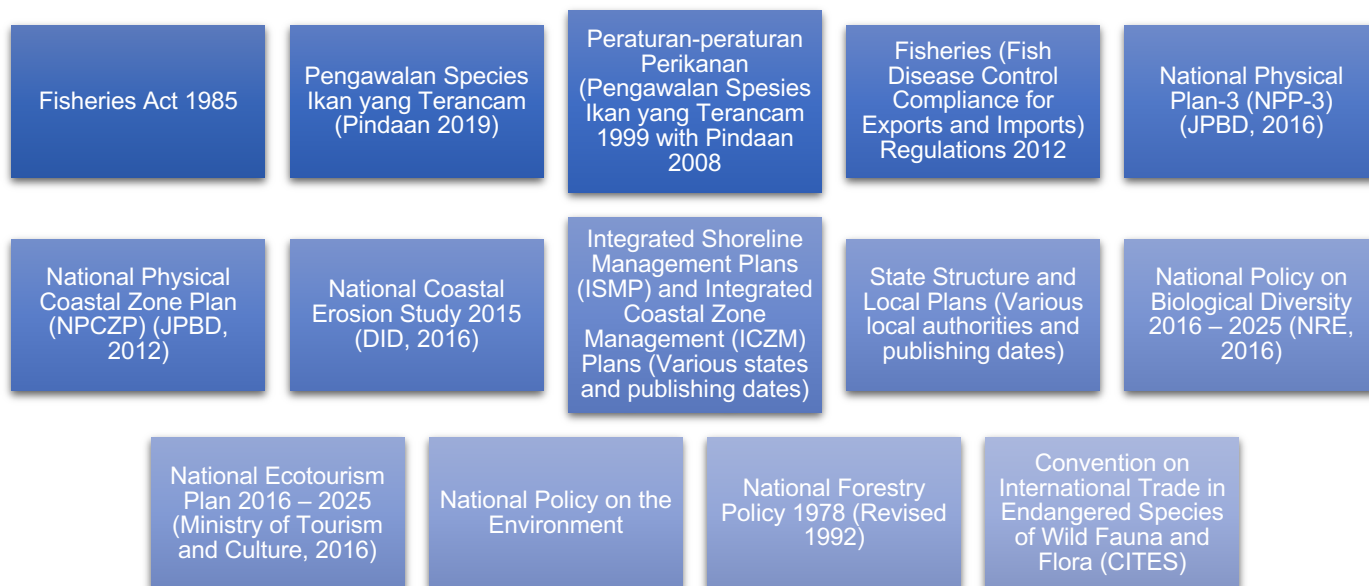




DEFINITION OF AQUACULTURE

Under Section 2 Fisheries Act 185 (Act 317) “aquaculture” means the propagation of fish seed or the raising of fish through husbandry during the whole or part of its life cycle (and relevant Regulations)

LAWS APPLICABLE FOR SUSTAINABLE FISHERIES



Relevant Guidelines Related to Aquaculture Activities

<i>Garis Panduan Perancangan Kawasan Sensitif Alam Sekitar</i> (PLANMalaysia, 2017)
Environmental Impact Assessment Guidelines in Malaysia (EGIM) (DOE, 2016)
Guidance Document for the preparation of the Document on Land-Disturbing Pollution Prevention and Mitigation Measures (LDP2M2) (DOE, 2016)
<i>Manual Panduan Pemeriksaan BMPs untuk Kawalan Hakisan dan Sedimen</i> (DOE, 2015)
Guidelines for Erosion and Sediment Control in Malaysia (DID, 2010)
DID Manual Volume 2 – River Management (DID, 2009)
DID Manual Vol. 3 – Coastal Management (DID, 2009)
Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia (DOE, 2008)
<i>Garis Panduan dan Piawaian Perancangan Kawasan Pantai</i> (JPBD 6/2000) (JPBD, 2002)
Guidelines for the Preparation of Coastal Engineering Hydraulic Study and Impact Evaluation (DID, 2001)
Guidelines on Erosion Control for Development Projects in the Coastal Zone (JPS 1/97) (DID, 1997)










ENVIRONMENTAL QUALITY (PRESCRIBED ACTIVITIES) (ENVIRONMENTAL IMPACT ASSESSMENT) ORDER 2015

First Schedule	Second Schedule
<p>Activity 4</p> <p>Land-based aquaculture projects accompanied by clearing of mangrove forest, peat swamp forest or fresh water swamp forest covering an area of 20 hectares or more but less than 50 hectares</p>	<p>Activity 4</p> <p>Land-based aquaculture projects accompanied by clearing of mangrove forest, peat swamp forest or fresh water swamp forest covering an area of 50 hectares or more</p>

ENVIRONMENTAL SCOPING

Rapid desktop assessment conducted to gain a preliminary understanding of the key attributes and environmental impacts of a proposed project.

-  Site Suitability Analysis
-  Determination of Study Boundary
-  Baseline Data Review
-  Determination of Key Project Activities
-  Identification of Significant Impacts and Priority Setting
-  Establishment of Study Requirements for EIA
-  Selection of Mitigation Measures

Second Schedule
EIA
Terms of Reference and Environmental Scoping Information

First Schedule
EIA
Scoping exercise for internal use



DETERMINING ENVIRONMENTAL BASELINE CONDITIONS

To document the existing environment within Project site and its Zone of Study (ZOS) prior to Project development, and to determine suitable approaches & methodologies for impact assessments.

Primary Data :
Ground truthing, field sampling and monitoring, site survey & investigations



Secondary Data :
Published plans, maps, data, reports, research and statistics from reliable sources, data from DOE monitoring stations.

Baseline Data Collections

Physico-chemical	Human	Biological
Topography	Land Uses, Zoning	Habitat mapping of ESA and conservation areas
Geology	Land tenure & classifications	Species Inventory
Soil types & classes	Demographic profile	Terrestrial Fauna
River Network & Hydrology	Displacement of people	Terrestrial Flora
Water Availability & Quality	Awareness & perceptions	Rare, endemic, endangered species
Waste	Settlements	Aquatic Flora
Air Quality	Public Health	Aquatic Fauna
Noise & Vibration	Traffic	Natural or man-made events (red tide, fish kills)
Climate		



☑ *Collecting existing data is first step in the collection of baseline information.*

☑ *Must review for its relevance to the proposed site, its accuracy, and used as a basis for determining what primary field investigations may be required to 'fill the gaps'.*

☑ *Baseline data collection should be carried out at appropriate time of year.*



PREDICTING AND EVALUATING IMPACTS

To predict and evaluate how the project will affect the physio-chemical, ecological, and human components within the landscape.

Typical Impacts from Fisheries Projects	Typical Breakdown of Project stages	Predictive Methods	Criteria and Standards
<ul style="list-style-type: none"> Ecological Impact Hydrology & Hydraulics Erosion and Sedimentation / Coastal Erosion Water Quality Socio-Economic Impacts Air Quality and Noise Waste Management Land Traffic Safety and Health 		<ul style="list-style-type: none"> Checklist Matrices Spatial Analysis Expert Opinion Carrying Capacity Analysis Mathematical and Computer Modelling Network and System Analysis Consultations and Questionnaires Case Studies 	<ul style="list-style-type: none"> ❖ <i>Relevant laws or regulations</i> ❖ <i>Accepted national or international standards and limits</i> ❖ <i>Relevant policies and plans</i> ❖ <i>Consultation with subject experts and acceptability with relevant decision makers</i> ❖ <i>Consultation with stakeholders – impact receptors</i>



ADDRESSING IMPACTS



• *Modifications to the project design or layout to avoid the impact*

• *Implementation of BMPs or technology to reduce the impact*

• *Remedial measures such as reforestation, replanting of mangroves, development of vegetated buffers or forest rehabilitation*

• *Such as resettlement, payment for loss of income*

• *Such as replanting forest elsewhere to ensure no net loss of forest*

KEY MITIGATION MEASURES

Objectives

Avoidance of negative impacts through selection of best options/alternatives

When an impact cannot be avoided, to adopt appropriate preventive measures and best management practices (BMPs) to reduce and minimise the impacts

Ensure residual impacts are kept within acceptable levels

Enhanced and amplify the beneficial impacts

Mitigation Considerations

Ecological Management

Hydraulics and Hydrodynamics

Erosion and Sediment Management

Water Pollution Control

Air Pollution Control

Noise and Vibration Control

Waste Management

Safety and Health

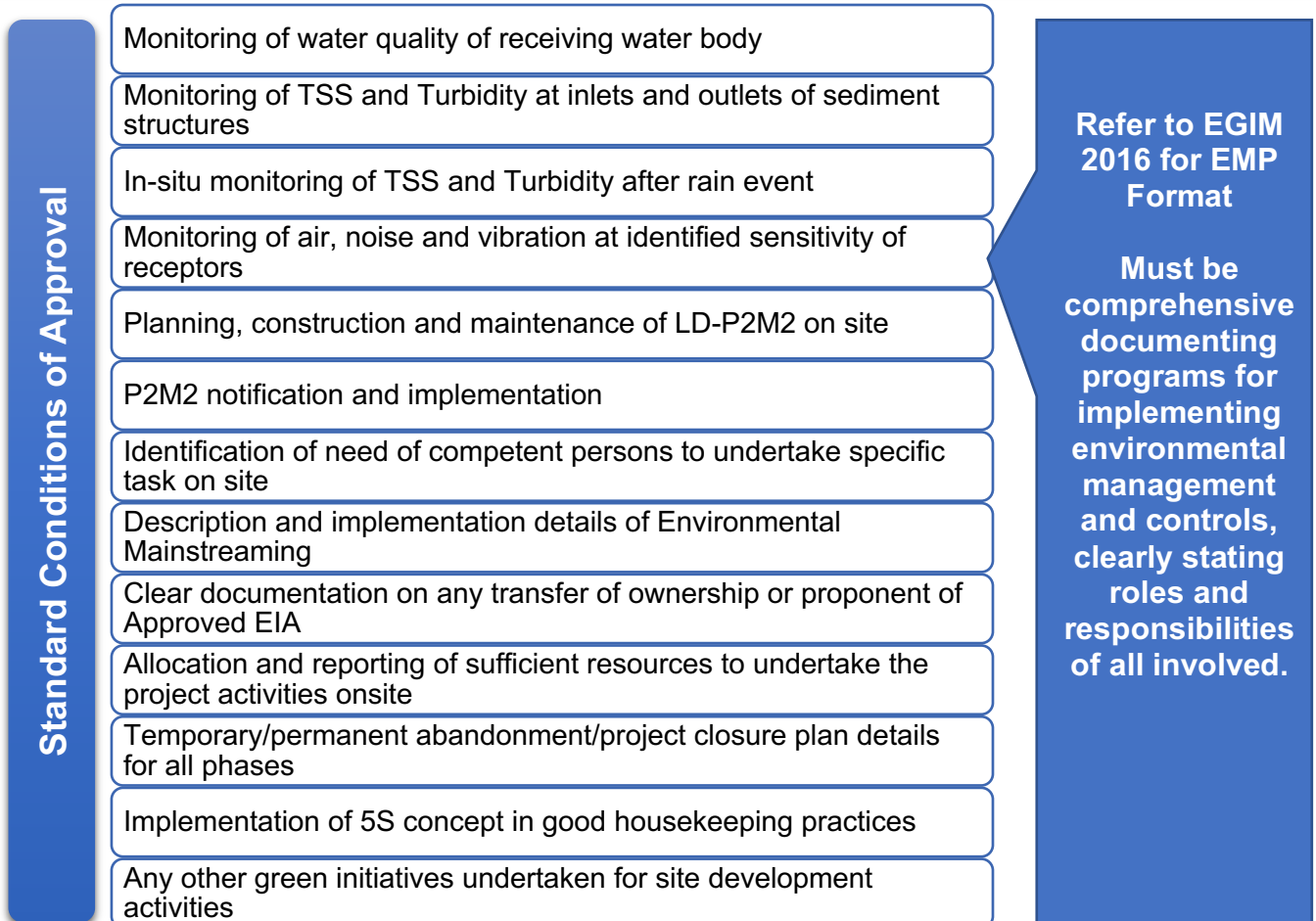
Land Traffic Management

Visual

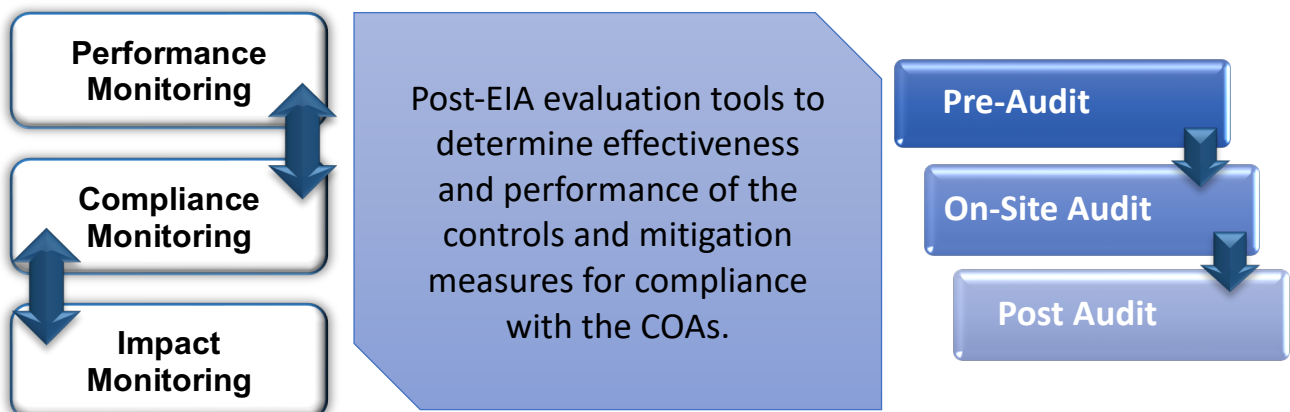


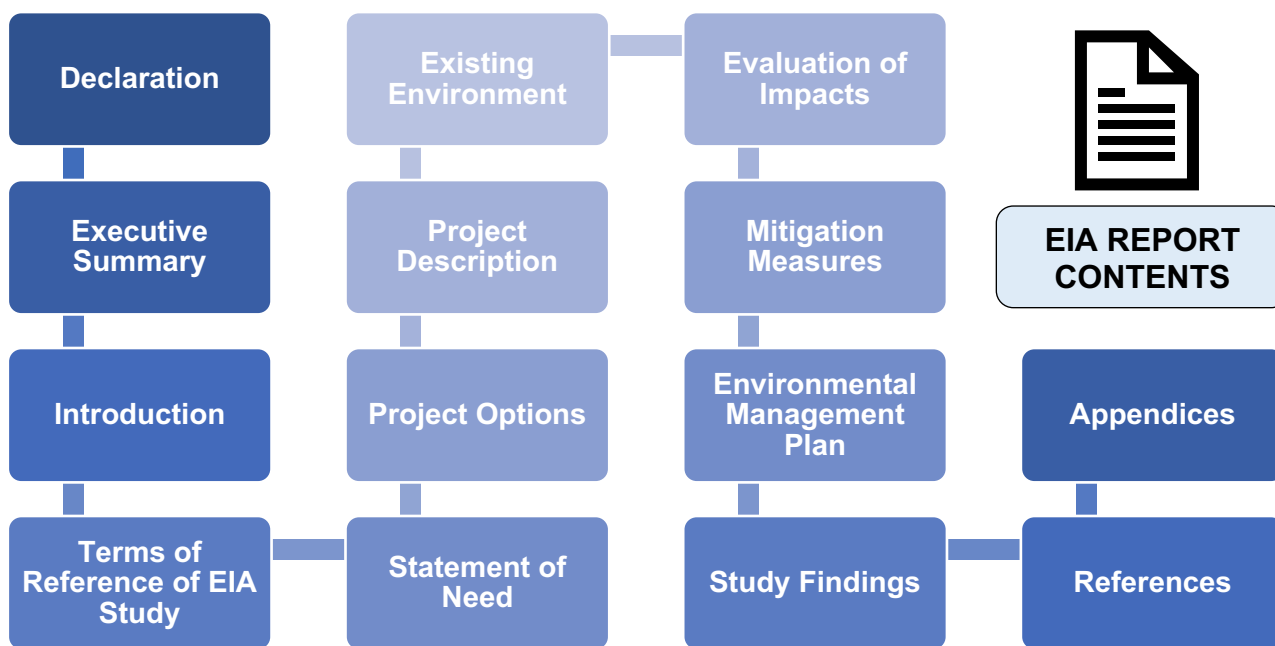
DEVELOPING OUTLINE OF ENVIRONMENTAL MANAGEMENT PLAN

EMP is a legal document prepared by the Project Proponent incorporating pollution prevention and mitigation measures and best management practices stipulated in the Conditions of Approval by the Department of Environment



Environmental Monitoring & Auditing





Data Deliverables

- ☑ All relevant data collected during the EIA should be made available.
- ☑ Sampling results, modelling databases, baseline data, metadata

Conclusion to EIA Report

- ☑ When concluding the report, Qualified Person should provide fair and unbiased conclusion of the EIA study based on the expert opinion of the impact assessment for the purpose of informed decision-making.

Stakeholder Engagement & Public Display

Engagements should be ongoing from planning stage until Project development.

Second Schedule EIA

- | | |
|---|--------------------------|
| ❖ Public Briefing | ❖ Online Display |
| ❖ Public Display & Review of EIA Report | ❖ Additional Engagements |
| ❖ Display Locations | ❖ Documentation |

**Good Practices
in Stakeholder
Engagements**

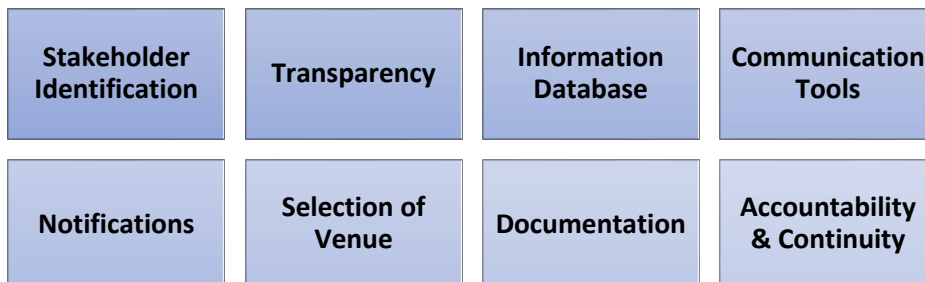




Photo Source: Fanli Marine & Consultancy Sdn Bhd

INTRODUCTION

CHAPTER 1. INTRODUCTION

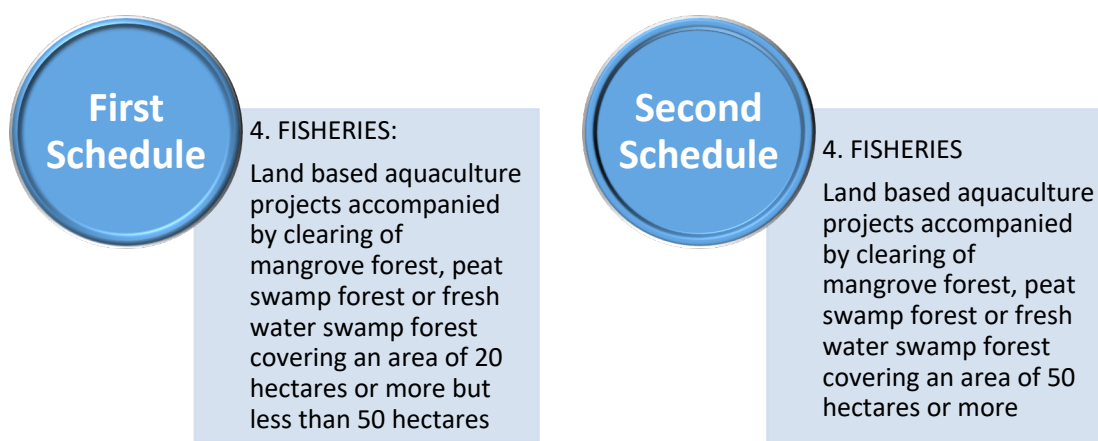
1.1 PURPOSE OF THE EIA GUIDELINE FOR FISHERY

The purpose of the **EIA Guideline for Fisheries** is to provide clear and concise guidance on the preparation of Environmental Impact Assessments (EIA) for **land based fisheries projects**. The guideline is a subset of the ***Environmental Impact Assessment Guideline in Malaysia (EGIM) (DOE, 2016)***.

The main target audience of this guideline are Project Proponents, Department of Environment (DOE) officers, registered EIA consultants (hereinafter referred to as 'Qualified Persons') and other EIA-related practitioners.

1.2 APPLICABILITY OF GUIDELINE

This guideline is applicable to fisheries projects that qualify as a prescribed activity under the ***Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015***. Prescribed activities that require an EIA are listed under the First Schedule and Second Schedule of the ***Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 (EIA Order 2015)***.



Fisheries projects herewith cover **land-based aquaculture projects** involving clearing of mangrove or freshwater swamp forests or loss of other forest or agricultural lands. The EIA Order, 2015 does not include cage aquaculture at sea and has no specific citation for cage culture in inland waters.

If a project falls under more than one prescribed activity and if one of the prescribed activities falls under the Second Schedule, then the project is deemed to fall under the ambit of the Second Schedule.

Legal adherence to the EQA 1974 (as of 5 February 2015) is based on the following subsections:

Section 34A (1)	The Minister, in consultation with the council, may by order prescribe any activity which may have significant environmental impacts as a prescribed activity.
Section 34A (2)	Any person intending to carry out any prescribed activity shall appoint a Qualified Person to conduct an EIA and submit a report thereof to the Director General in the manner as the Director General may prescribe.

The DOE has rationalised the EIA process to make it more reflective of the scope, functions, and visions of the Department in line with its Environment Strategic Plan, with a focus on **Environmental Mainstreaming Tools (EMT) to achieve Self-Regulation (SR)**.

APPLICABILITY AND COVERAGE OF GUIDELINES

- ❖ Activity 4: Fisheries under the EIA Order 2015 only applies to fisheries projects in Peninsular Malaysia.
- ❖ It does not apply to Sabah and Sarawak, where EIAs for land-based aquaculture projects are subject to the respective State legislations. In Sabah, EIAs for fisheries activities are prescribed under the ***Environment Protection Enactment, 2002 (Enact. 12/2002)*** and approved by the Environmental Protection Department (EPD). In Sarawak, EIAs for land-based aquaculture activities are prescribed under the ***Natural Resources and Environment Ordinance, 1993*** and approved by the Natural Resources and Environment Board (NREB).

TERMS AND DEFINITIONS

- ❖ The proposed terms and definitions that will be adopted in the guideline are based on interpretation and relevant documents published or to be published by DOE and other related government agencies, registered bodies, and institutions. The legal definitions and interpretations are based on the *Interpretation Acts 1948 and 1967 (Act 388)*.

1.3 USING THIS GUIDELINE

This guideline **should be read together with the Environmental Impact Assessment Guideline in Malaysia (EGIM)** (DOE, 2016). The EGIM sets out in greater detail the procedures and requirements to be complied with at each stage of the EIA process for all prescribed activities, whereas this guideline provides specific additional guidance on prescribed activities pertaining to fisheries projects. This Guideline is to assist the Project Proponent when planning and developing new or expanding existing projects.

According to the EGIM, there are 10 main steps involved in the EIA process (**Table 1-1**). This guideline expands on the 10-step process by providing further detail on fisheries projects.

Table 1-1 Quick Reference Of The Main Steps In The EIA Process

No.	Steps	Refer to:	
		Chapter in EGIM	Chapter in this EIA Guideline
1	Screening	Chapter 3,4	Chapter 3
2	Scoping towards formulation of Terms of Reference	Chapter 3,4	Chapter 3
3	Baseline Study	Chapter 3,4	Chapter 4
4	Impact Assessment and Evaluation of Significance	Chapter 3,4	Chapter 5
5	Identification of Mitigation Measures	Chapter 3,4	Chapter 6
6	EIA Report Preparation	Chapter 3,4	Chapter 8
7	EIA Report Review	Chapter 5	
8	Decision Making	Chapter 5	
9	Project Implementation and Environmental Monitoring	Chapter 6	Chapter 7
10	Environmental Audit	Chapter 6	Chapter 7

1.4 OVERVIEW THE ENVIRONMENTAL ASSESSMENT PROCESS

The step-by-step guide to the environmental assessment process is as follows:



STEP 1: PROVIDE THE PROJECT BRIEF

- (a) The Project Proponent must provide sufficient information about the Project to enable the Qualified Person to understand and carry out the screening and initial assessment.
- (b) This is to assist in determining which prescribed activity the project falls under (First or Second Schedule) based on the ***Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015***.



STEP 2: IDENTIFY THE LEGAL REQUIREMENTS

- (a) During the Environmental Screening Process, the Qualified Person shall identify the legal requirements of the project based on the information provided by the Project Proponent.
- (b) Qualified Person to advise the Project Proponent on the standards and limits for compliance for the pollution generation by the project.



STEP 3: EXISTING POLICIES AND GUIDELINES

- (a) The Project Proponent is required to clear all policy matters related to the project prior to submitting the EIA report has been adhered to.
- (b) Qualified Person can advise Project Proponent on the current policy matters related to project development and requirements for the EIA study.



STEP 4: ENGAGEMENT WITH STAKEHOLDER

- (a) Early in the EIA process, the Project Proponent and the Qualified Person should engage with the DOE (via the designated officer in charge) and the relevant Government Agencies (GAs) to determine the requirements to be included in the TOR and EIA.
- (b) The Qualified Person can also engage with other relevant stakeholders to obtain site information and data for the scoping.



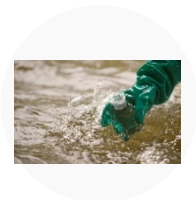
STEP 5: PREPARATION OF THE TOR AND ESI

- (a) If the Project is a Second Schedule EIA, the Environmental Scoping Information (ESI) and Terms of Reference (TOR) must be prepared for approval by the DOE.
- (b) The Qualified Person shall obtain secondary data to assist in the Environmental Scoping. At this point of the study, qualitative data is sufficient for scoping of significant impacts for the TOR.
- (c) Relevant information required for the TOR and ESI that the Qualified Person is required to furnish includes:
 - ✓ Site Suitability Assessment (SSA).
 - ✓ Determination of the study boundary (Zone of Study) and anticipated Zone of Impact (ZOI).
 - ✓ Overview of the baseline data required.
 - ✓ Identification of key project activities.
 - ✓ Identification of significant impacts and priority setting.
 - ✓ Selection of mitigation measures.



STEP 6: SUBMISSION AND REVIEW OF THE TOR

- (a) The Qualified Person shall review all data obtained during scoping to prepare the TOR report based on DOE requirements in the EGIM (DOE, 2016).
- (b) For the Second Schedule EIA, the TOR and ESI shall be submitted to DOE State/HQ for review and endorsement.
- (c) A TOR Adequacy Check (TORAC) meeting will be conducted (based on needs) for further clarification and endorsement of TOR.
- (d) Once approved, the TOR has a validity of 1 year from the date of endorsement for the EIA report to be submitted.



STEP 7: BASELINE DATA COLLECTION FOR EIA

- (a) After the TOR endorsement, baseline data collection, either primary or secondary data, shall be carried out to obtain and document detailed

information of the existing environment of the project site and its surroundings.



STEP 8: COMPLETION OF EIA STUDY

The major studies and components of the EIA report shall cover the following:

- (a) Identify and predict significant environmental issues and impacts.
- (b) Perform a detailed environmental assessment only on the most significant issues.
- (c) Identify the suitable pollution prevention and mitigation measures (P2M2s) to minimise any negative impacts arising from the development of the projects.
- (d) Provide the Environmental Management Plan (EMP) framework in line with the Self-Regulation concept.



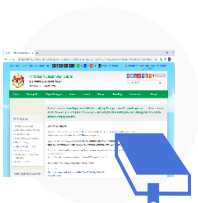
STEP 9: PREPARING EIA REPORT

- (a) All assessments and findings must be included in the EIA report. Take note that the results of studies required by other GAs must be incorporated into the EIA report but not to append the individual reports. These reports must, however, be reviewed and approved by the respective GAs.
- (b) The EIA report must be thoroughly reviewed by the Project Proponent and with agreement to undertake the proposed P2M2 and EMP. By signing the Declaration in the EIA report, the Project Proponent shall assume responsibility in implementation of the P2M2 and adhere to EQA 1974.



STEP 10: STAKEHOLDER ENGAGEMENT

- (a) During preparation of the EIA report, the Project Proponent and Qualified Person shall undertake an engagement with the relevant stakeholders (those who will be affected by the project, e.g., communities or institutions, businesses, etc.).
- (b) The objective is to inform these stakeholders about the project, what it involves, potential environmental issues and the proposed P2M2, with the aim of seeking their thoughts and feedback. All findings from stakeholder engagement shall be incorporated into the EIA report.



STEP 11: EIA SUBMISSION AND PUBLIC DISPLAY

- (a) The EIA report shall be submitted to the DOE State / Headquarters for review.
- (b) The Qualified Person shall note the difference in requirements for a First Schedule and Second Schedule EIA and follow the required procedures.
- (c) The major difference to note is that the Second Schedule EIA shall require a public display of the EIA for the public to provide comments and feedback within the review period to DOE HQ.



STEP 12: PRESENTATION EIA TO DOE

- (a) The EIA report must be presented to DOE State/HQ by the EIA Team Leader with the participation of the Project Proponent.

- (b) In the meeting, the arising concerns will be discussed and decided on the need for additional information or assessment, or improvements to the overall EIA Report. Resubmission of the EIA may be required within the time frame provided, normally within the Client Charter.



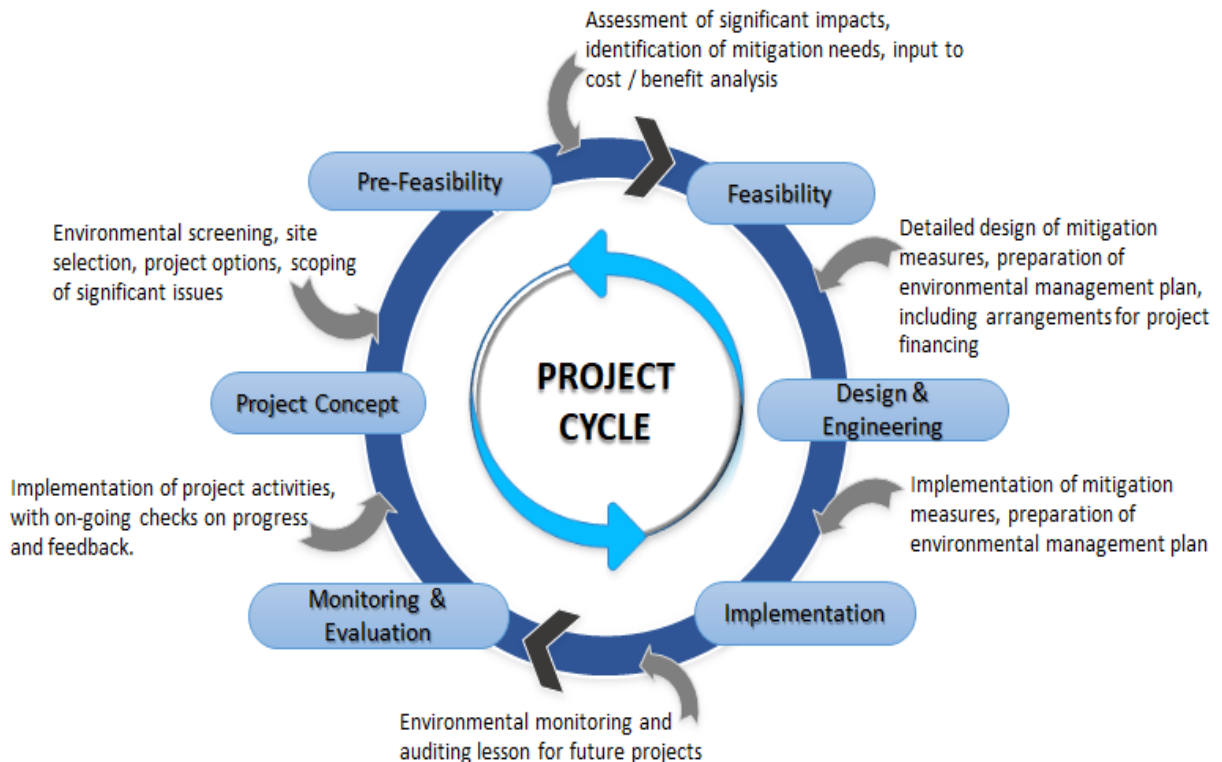
STEP 13: DECISION BY DOE AND EIA APPROVAL

- (a) Decision will be made by the DOE on the EIA Report once the information, assessment, and concerns are satisfactorily met and in line with the EQA 1974.
- (b) The EIA approval letter will be issued by the DOE, in conjunction with the EIA approval conditions, which are mandatory compliance for the Project.
- (c) Project Proponent must proceed with implementation of the EIA Approval Conditions in all Project stages prescribed.

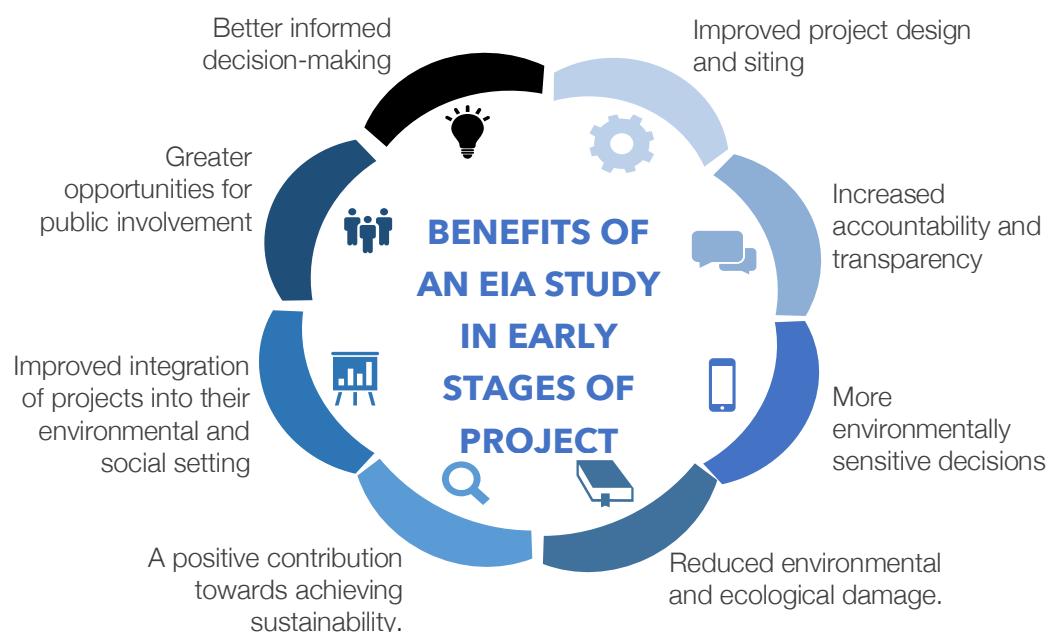
1.5 INCORPORATING EIA INTO THE PROJECT PLANNING FRAMEWORK

A project cycle generally has six major phases, i.e. Project Concept, Pre-feasibility, Feasibility, Design and Engineering, Implementation, Monitoring and Evaluation. The EIA should be considered an integral part of the project planning and development process, with the appropriate steps of the EIA carried out in each phase (Figure 1-1).

Figure 1-1 Project Phases And Integration Of Environmental Activities



Incorporation of an EIA study at an early of project planning at the Project Concept and Pre-feasibility stages will have significant benefits and value add to the project and is as illustrated on the following page.



A typical project cycle involves many phases that require the input of various technical specialists and consultants to provide reports for submission to the approving authorities. Throughout the ambit of this project cycle, incorporation of environmental compliance can be carried out in three phasing steps as follows:

Step 1: Planning Phase

The Project Proponent is surmised to have an initial feasibility assessment of suitable sites for development. Once a suitable site has been identified and selected, the Project Proponent will need to request for land alienation (if state or federal land) or through acquisition of private land for development of the project. The Project Proponent must ensure that all national and state policies and administrative matters relating to the project are addressed with the relevant authorities.

Environmental Screening: The Project Proponent, working closely with the Qualified Person, shall carry out a screening exercise to determine type of prescribed activity, specifically under which Schedule category the project will fall under within the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, or not at all.

Environmental Scoping: After the screening exercise, there is a need to gauge the potential environmental significance of the project to the site and the surrounding areas; and to identify potential Pollution

Prevention and Mitigation Measures (P2M2s) that can be incorporated into the project design early to avert any serious environmental and engineering problems/damage later on, such as from coastal erosion, water pollution, coastal flooding, etc. These findings should be documented in a Scoping document. For Second Schedule EIA, the Environmental Scoping Information (ESI) document forms the basis to develop the Terms of Reference (TOR) for DOE's approval.

Step 2:

Feasibility and Detailed Project Design Phase

The technical engineering designs of the Project would need to be submitted to the relevant approving authorities for approval, e.g. via the One-Stop Centre (OSC). Often, various Government Agencies (GAs) may require additional technical studies and reports to be submitted as part of the technical submissions. In the case of DOE, this may include the EIA report.

Environmental Impact Assessment (EIA): If a project is a prescribed activity under the Environmental Quality (Prescribed Activities) (EIA) Order 2015, an EIA is mandatory for approval by the DOE before a project can proceed for development. The Project Proponent and the Qualified Person would need to carry out the EIA based on the endorsed TOR. The EIA must incorporate major findings from the relevant sectoral studies, such as hydraulic studies, hydrographic survey and studies; wetlands and coastal studies; coral surveys and mapping; fishery resources assessment; Social Impact Assessment (SIA); tourism surveys, marine traffic assessment etc., as required by the other GAs.

Recommendations to manage the significant environmental impacts advocated in the EIA should be incorporated into the project design. For example, clearing mangroves will cause coastal erosion and would require mitigation to reduce impacts in coastal areas.

Step 3:

Construction and Operational Phase

Construction and operational activities have to comply with the Conditions of Approval (COA) issued by the DOE on the approval of the EIA report. The COA would contain mitigation requirements for activities that may include site access establishment, mobilisation of machineries and equipment, and in the case of coastal areas for coastal areas, the setting up base camp, land clearing, earthworks, and structural works.

Post-EIA: Environmental controls and management would be done through the Environmental Management Plan (EMP). The EMP and the environmental monitoring and audit plans must accompany all construction and operation works. These plans provide the integrative elements to ensure the least degradation to coastal areas/marine parks during work activities.

Specifically, the monitoring section of the EMP will set out the following.

- | | |
|--|---|
| <p>(a) specific monitoring measures, including the parameters to be measured and methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions;</p> | <p>(b) monitoring and reporting procedures to ensure early detection of conditions that necessitate mitigation and furnish information on the progress and results of the mitigation.</p> |
|--|---|

1.6 KEY NOTES

Reclassification of Projects

The classification of a project may need to be changed as circumstances dictate. For example, if there is a major modification to the project design or a new activity is added, then a change in category (either upward or downwards) may be warranted. It is also possible that new information arrives after initial project identification work. For example, a First Schedule project may be reclassified as Second Schedule if new information reveals that the project involves a bigger area and an activity may have significant adverse environmental impacts.

Furthermore, the original project implementation schedule may be delayed, especially if assessment activities must be undertaken after project implementation has started.

Participatory Consultations

As early as possible in the project formulation process, all efforts must be made to engage project stakeholders and beneficiaries, including indigenous people and vulnerable groups, in analysis and decision making with respect to potential environmental and social impacts of the project. Stakeholders' participation including indigenous people and vulnerable groups will be ensured in designing, implementing, and monitoring avoidance and mitigation measures and compensation & benefits including establishing appropriate and accessible grievance mechanisms.

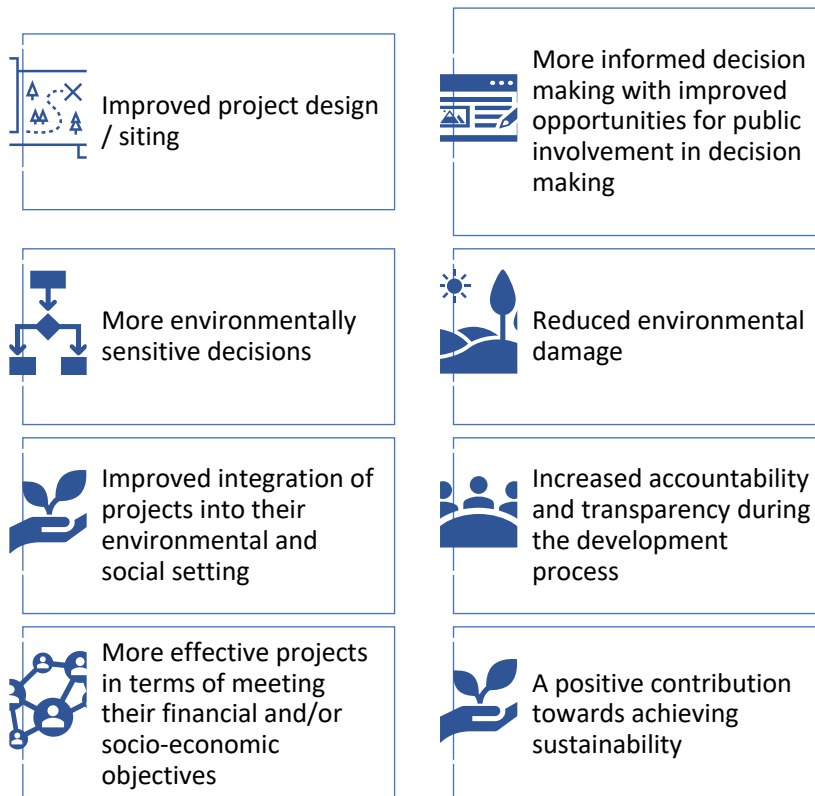
Requirements for Public Disclosure

Second Schedule projects require public disclosure. During the formulation process, the Project Proponent will arrange for timely provision of information on potential environmental and social impacts as well as of draft EA/EIA (including EMP and IPP) to stakeholders and beneficiaries – with particular attention to indigenous peoples and vulnerable groups – in a language and format to be accessible and understandable.

This consultation will be governed by the “free, prior and informed consent principle”. Once the pertinent documentation has been completed (i.e. the environmental analysis for **Second Schedule** projects, the Project Proponent will ensure that it is made available to the public, The Project Proponent will ensure stakeholder involvement and public disclosure of relevant documentation during all the phases of the project and EIA Cycle

1.6.1 Benefits of the EIA Process

The EIA process entails studies to identify, predict, evaluate, and quantify the impacts (both beneficial and adverse) on the environment of a proposed project or development and to communicate the said information to those concerned. The EIA study process to facilitate decision-making for both the DOE and the Project Proponent from an environmental perspective. The EIA report shall assist stakeholders in identifying significant environmental impacts; appropriate abatement and mitigating measures; programmes for monitoring environmental compliance; within the development plan before and/or during project implementation. The main benefits of conducting the process of an EIA study include the following.



The results of all studies are compiled into a comprehensive, coherent, balanced, impartial and technically acceptable report for the submission to the authorities. The EIA report will contain important information for

- The DOE and other authorities to make an informed decision on the project, including preparation of the conditions of approval (COA)
- The Project Proponent to implement the mitigation measures in an environmentally and socially responsible manner.
- The public to understand the project and its potential impacts on the environment

It is also important to highlight that there were weaknesses in some EIA studies that both the Project Proponents and the EIA consultants must be aware of. Some of the failings include:

- ❖ Difficulties in ensuring adequate and useful public involvement or stakeholder participation;
- ❖ Insufficient integration of EIA work at key decision points in relation to feasibility and similar studies in the project cycle; with some major decisions being made even before EIAs are completed;
- ❖ Lack of consistency in selection of developments requiring specific environmental impact assessment studies;
- ❖ Inadequate understanding of the relative roles of baseline description and impact prediction;
- ❖ Poor integration of biophysical environmental impacts with social, economic and health effects also added to the problems in Environmental Impact Assessment;
- ❖ Production of EIA reports that are not easily understood by decision makers and the public because of their length and technical complexity;
- ❖ Lack of mechanisms to ensure that EIA reports are considered in decision making;
- ❖ Weak linkages between environmental impact assessment report recommendations on mitigation and monitoring and project implementation and operation; and
- ❖ Limited technical and managerial capacities to implement EIAs result in problems in carrying out Environmental Impact Assessment.

Both the Project Proponent and EIA consultant can overcome these failings if they conduct the EIA study early in the project cycle, incorporating all the requirements of the EGIM, EESIM, and this Guideline.

1.7 OBJECTIVES OF THE EIA GUIDELINES

OBJECTIVES	<input checked="" type="checkbox"/> Provide clear and concise guidance on EIA project planning and preparation to the stakeholders, Project Proponents, Qualified Persons (i.e. DOE-registered Environmental Consultants), Government Agencies (GAs), Enforcement Officers and other EIA-related practitioners.
	<input checked="" type="checkbox"/> Facilitate integration of the EIA into the overall project planning and development cycle in order to ensure compliance with and adherence to legal environmental requirements and the framework on environmental sustainability.
	<input checked="" type="checkbox"/> Provide a detailed step-by-step guide with an explanation of the various EIA procedures and submissions, comprising of: (a) Environmental Scoping Information (ESI), (b) Terms of Reference (TOR), and (c) EIA Report.
	<input checked="" type="checkbox"/> Clearly define the scope of the EIA with a focus on the significant environmental issues relevant to the DOE's three functional areas (water, air and wastes), whilst also taking into consideration the environmental requirements by other authorities or agencies, to facilitate overall decision making and project approval.
	<input checked="" type="checkbox"/> Provide a clear framework for DOE to assess and approve the EIA reports.
	<input checked="" type="checkbox"/> Provide a clear understanding on the interpretation of various terms and definitions as contained in the prescribed activities pertaining to Agriculture and to determine whether the Project falls under any prescribed activity based on the <i>Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015</i>

1.8 STRUCTURE OF THE GUIDELINES

CHAPTER	1	<i>Introduction</i>	<ul style="list-style-type: none"> • Introduction to the Guidelines covering the objectives, scope, and structure.
	2	<i>Policies, Legislations, And Other Instruments</i>	<ul style="list-style-type: none"> • Provides a concise review of legislation, policies, and guidelines relevant to the development of sustainable fisheries and how they relate to the EIA process
	3	<i>Screening, Scoping & Preparation of TOR</i>	<ul style="list-style-type: none"> • Provides the terms and definitions associated with fishery area development and their interpretations. • Outlines the necessary requirements for the project to undergo initial screening and assessment. • Provides the procedures to conduct screening and scoping of significant issues.
	4	<i>Determining Baseline Conditions</i>	<ul style="list-style-type: none"> • Provides an outline of the relevant baseline information required for incorporation into the EIA report.
	5	<i>Predicting and Evaluating Environmental Impacts</i>	<ul style="list-style-type: none"> • Provides the methodology and tools to identify, predict, evaluate, and assess the significant environmental impacts.
	6	<i>Proposing Measures to Mitigate Impacts</i>	<ul style="list-style-type: none"> • Identifies appropriate P2M2s to minimise any negative impacts arising from the development of the project; and the types of measures to manage any residual impacts.
	7	<i>Developing Outline for The Environmental Management Plan</i>	<ul style="list-style-type: none"> • Provides an EMP framework for post-EIA. • Details out the GSR process for a project. • Provides environmental monitoring and audit programmes for post-EIA.
	8	<i>Preparing the EIA Report and Review Process</i>	<ul style="list-style-type: none"> • Presents the structure and content for EIA reporting, including an overview of the review and approval process.

THIS PAGE WAS LEFT INTENTIONALLY BLANK



Photo Source: Fanli Marine & Consultancy Sdn Bhd

POLICIES, LEGISLATIONS, AND OTHER INSTRUMENTS

CHAPTER 2. POLICIES, LEGISLATIONS, AND OTHER INSTRUMENTS

2.1 NATIONAL AND STATE POLICIES AND PLANS

The current national policies and plans for aquaculture development in coastal areas are shown in **Figure 2-1**. They serve as references for the Project Proponent and the Qualified Person when undertaking the project.

Any change or amendment to existing policies and plans (i.e. updating, revision, new edition, etc.) should be taken into account in the EIA by the Qualified Person.

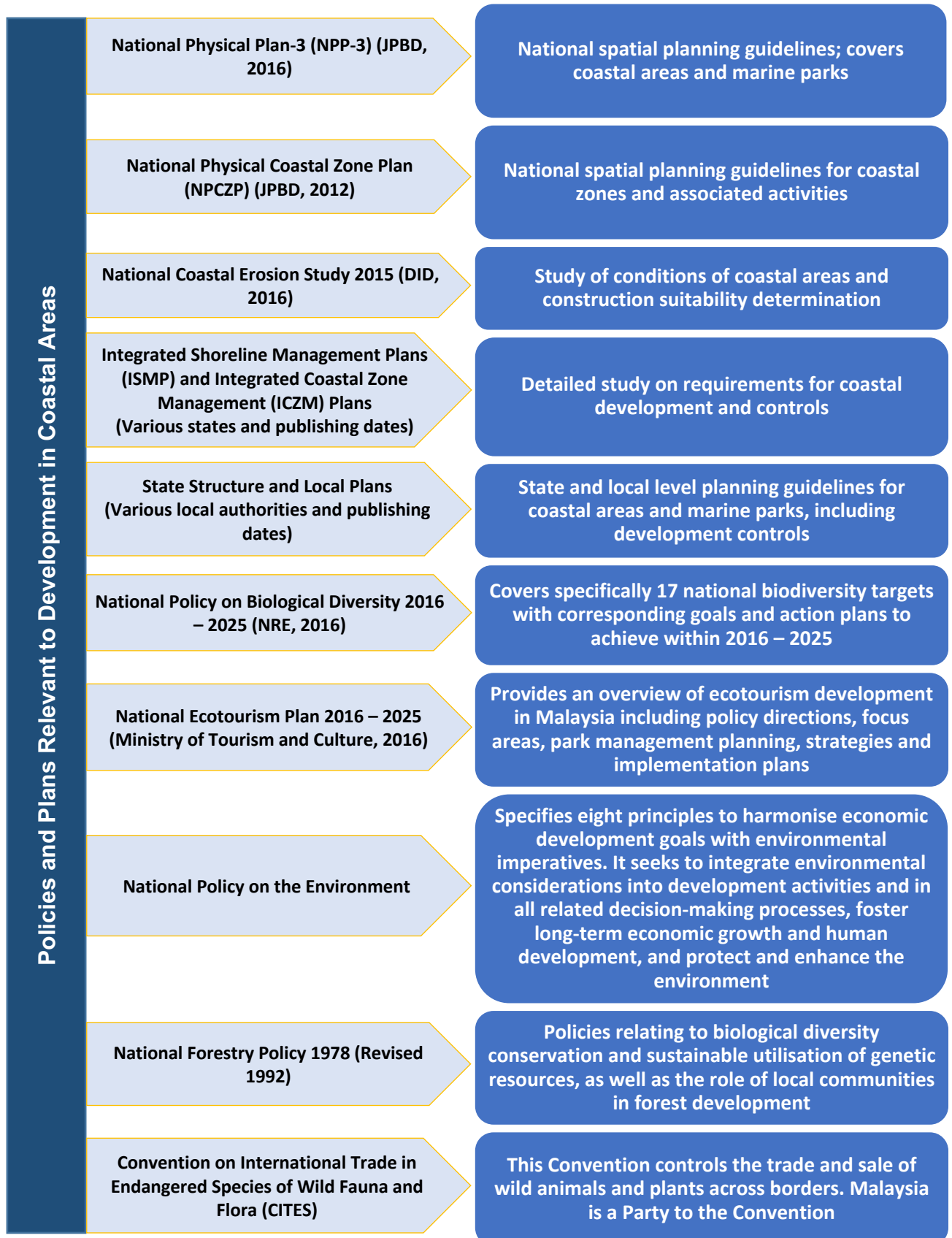
Box 1

The Food and Agriculture Organisation (FAO) of the United Nations defines aquaculture as the farming of aquatic organisms: fish, molluscs, crustaceans, aquatic plants, crocodiles, alligators, turtles, and amphibians. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. (FAO, 1988). A number of different aquaculture systems have evolved for the cultivation of the large variety of aquatic organisms in marine, brackish and freshwater environments. Systems may be land or water based.

Land-based systems comprise mainly ponds, rice fields, and other facilities built on dry land. Ponds are the most common of all aquaculture systems, and range from small, rudimentary, gravity-fed facilities to large geometric ones, constructed using machines and with sophisticated water management regimes. Carps and tilapias, both widely cultivated fish species, are commonly grown in freshwater ponds, whereas shrimp and finfish tolerant to more saline waters are cultivated in brackish water ponds. (FAO, 1988).

Under Section 2 **Fisheries Act 185 (Act 317)** “aquaculture” means the propagation of fish seed or the raising of fish through husbandry during the whole or part of its life cycle (and relevant Regulations). The definition of “fish” excludes reptiles (alligators, crocodiles) and amphibians (frogs) and the long-necked turtle (which come under other Acts and defined differently). Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.

Figure 2-1 Policies and Plans Relevant to Development in Coastal Areas



2.2 GOVERNING LAWS, REGULATIONS, AND OTHER INSTRUMENTS

2.2.1 National Acts

The governing act for aquaculture is the ***Fisheries Act 1985***, linked to ***Akta Perikanan (Pindaan) 2012*** and ***Kaedah-kaedah Perikanan P.U.(A) 65, Akta Makanan Haiwan 2009 (Akta 698)*** and ***Akta Perdagangan Antarabangsa Mengenai Spesies Terancam 2008 (Akta 686)***. Only marine aquaculture is licensed under these acts. Inland aquaculture (i.e. anything done on land) is a state matter and subject to state enactments.

2.3 STATE ENACTMENTS

At present time, only Sabah and Sarawak have enacted regulations relating to aquaculture development which are ***Enakmen Perikanan Darat dan Akuakultur 2003*** and ***Sarawak Inland Fisheries Rules 1997*** for both States respectively. Other states are currently in the process of passing their respective enactments. The Qualified Person would need to ascertain the current legal status of inland aquaculture in the respective states.

2.4 REGULATIONS

There are fisheries regulations that are linked to aquaculture, which are ***Pengawalan Spesies Ikan yang Terancam (Pindaan 2019)***, ***Peraturan-peraturan Perikanan (Pengawalan Spesies Ikan yang Terancam 1999 with Pindaan 2008*** and ***Fisheries (Fish Disease Control Compliance for Exports and Imports) Regulations 2012***.

There are also regulations specifically for Kelantan and Terengganu regarding *Kerapu* (grouper) fry catch during November to December in the ***Fisheries (Closed Season to Catch Kerapu Fry) Regulations 1996*** and for West Coast Malaysia in ***Fisheries (Prohibition of Method of Fishing for Kerapu Fry) Regulations 1996***. Although both concerns towards fishing rather than aquaculture, these indirectly affect the supply of grouper fry to the aquaculture industry.

2.5 GUIDELINES AND GUIDANCE DOCUMENTS

The EIA report must also refer to the relevant guidelines and guidance documents issued by DOE and other Government Agencies (GAs) pertaining to environment-related system and management, and any other documents and notices issued from time to time related to the EIA process and procedures.

Apart from the legislations, regulations, policies, and plans mentioned above, **Table 2.1** provides a list of guidelines and guidance documents for EIA reporting.

Table 2-1 Relevant Guidelines and Guidance Documents Related to Development Planning Coastal Areas

	Guidelines and Guidance Documents	Governing Technical Agency	Type of consultation
1	<i>Garis Panduan Perancangan Kawasan Sensitif Alam Sekitar</i> ,(2017)	PLANMalaysia	Provides the requirements for development in ESAs.
2	Guidance Document for Addressing Soil Erosion and Sediment Control (ESC): Aspects in the EIA Report as per Appendix 3 of the Environmental Impact Assessment Guidelines in Malaysia (EGIM) (2016)	DOE	EIA reporting format concerning section on soil erosion and sediment control.
3	Guidance Document for the preparation and submission of Environmental Management Plan (EMP) as per Chapter 6 of the EGIM (2016)	DOE	Guidance for the preparation of the EMP post-EIA including translating into action, the pollution prevention and mitigation measures (P2M2s) recommended in the EIA and the Conditions of Approval (COA).
4	Guidance Document for the preparation of the document on Land-Disturbing Pollution Prevention and Mitigation Measures (LDP2M2) as per Appendix 4 of the EGIM (2016)	DOE	Only for landward development components, in the preparation of the LD-P2M2 document, which is to be included as part of the EMP to be submitted to DOE for approval.
5	<i>Manual Panduan Pemeriksaan BMPs untuk Kawalan Hakisan dan Sedimen</i> (2015)	DOE	A manual on inspection procedures including checklists, of the erosion and sediment control BMPs.
6	Guidelines for Erosion and Sediment Control in Malaysia (2010)	Department of Irrigation and Drainage	Guidelines for prevention and control of soil erosion and siltation for specific projects including examples of control measures and BMPs.
7	DID Manual Volume 2 – River Management (2009)	Department of Irrigation and Drainage	Provides methods to assess, manage, and mitigate measures for river conservation, rehabilitation, and restoration.
8	DID Manual Vol 3 – Coastal Management (2009)	Department of Irrigation and Drainage	Provides planning requirements and management measures for coastal erosion control; river mouth/tidal inlet; hydraulic study methodology; tidal wave inundation and coastal drainage; coastal zone;

	Guidelines and Guidance Documents	Governing Technical Agency	Type of consultation
			and shoreline monitoring and maintenance.
9	Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia (DOE, 2008)	DOE	Guidelines for the prevention and control of soil erosion and siltation for specific projects, including examples of control measures and BMPs.
10	<i>Garis Panduan dan Piawaian Perancangan Kawasan Pantai</i> (JPBD 6/2000) (2002)	PLANMalaysia	Provides the requirements for development in coastal areas.
11	Guidelines for the Preparation of Coastal Engineering Hydraulic Study and Impact Evaluation (2001)	Department of Irrigation and Drainage	Provides requirements for the preparation of hydraulic reports for coastal projects.
12	Guidelines on Erosion Control for Development Projects in the Coastal Zone (JPS 1/97) (1997)	Department of Irrigation and Drainage	Guidelines for setback requirements, types of allowable coastal projects, and submission requirements for approvals of coastal development projects.

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.

2.6 SUSTAINABLE FISHERIES CERTIFICATION

There are several sustainability certification systems for the aquaculture industry. International standards include GLOBAL GAP issued by FoodPLUS GmbH a limited liability cooperation registered in Cologne, Germany and widely recognised throughout Europe and Best Aquaculture Practice Certification issued by the Global Aquaculture Alliance. The Best Aquaculture Practices is the only third-party aquaculture certification program to be compliant with the Global Food Safety Initiative (GFSI), Global Social Compliance Programme (GSCP) and Global Sustainable Seafood Initiative (GSSI). Both these standards encompass food safety and traceability, environment (including biodiversity), workers' health, safety and welfare, animal welfare, Quality Management System (QMS), and Hazard Analysis and Critical Control Points (HACCP). Locally, the Department of Fisheries issues MyGAP certification which is based on MS 1998:2007 – Good Aquaculture Practice (GAP) – Aquaculture arm General Guidelines and MS 2467:2012 – Code of Practice for Seaweed Cultivation.

It is important to note that certification is voluntary though, if the farmed product is exported, the importing countries often demand that it be certified. However, the kind of certification recognised by the importing countries would depend on the country involved.



Land Fish Farms in Tawau,
<http://www.etawau.com/Life/Gallery/TigerPrawn.html>

3

SCREENING AND SCOPING

CHAPTER 3. SCREENING AND SCOPING

3.1 INTRODUCTION

The two main activities that should be undertaken during the pre-submission stage before the EIA study proper is carried out, namely Screening and Scoping. In order to facilitate the screening and scoping, the Project Proponent should provide the Qualified Person a Project Brief that contains basic details of the proposed project, such as concept, objectives, main activities, location, layout plan, etc.

3.2 SCREENING PROCEDURES

The Qualified Person should carry out a screening exercise to determine whether the proposed project qualifies as a prescribed activity under the EIA Order 2015; and if so, whether it falls under the First or Second Schedule.

Environmental screening is carried out to determine whether a proposed project is a prescribed activity under the ***Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015***.

Screening is important, as there are a large number of projects and activities that are potentially subjected to an EIA. It is also important that any project be screened to have complied with all federal and/or state policy matters before proceeding with an EIA.

If the proposed project has components falling within both First and Second Schedule prescribed activities, the Second Schedule EIA shall prevail and shall encompass all EIA requirements required of those activities. In which case, all other relevant EIA Guidelines must be referred to. The potential outcome criteria of project screening is shown in **Box 2**.


Box 2: Potential Outcomes from Project Screening

1. No EIA is required: If the project does not fall within any prescribed activities under the First or Second Schedule, and/or has insignificant impacts on the environment.
2. EIA is required: If the project will have potentially significant environmental impacts and/or falls within the prescribed activity under the First or Second Schedule.
3. Further studies and clarification from DOE: If the potential impacts from the project are uncertain, indeterminate, ambiguous or may not fall neatly within any prescribed activities, i.e. involving new technologies, DOE shall be consulted upon on the need for an EIA.

3.3 PRESCRIBED ACTIVITIES FOR FISHERIES

An **Environmental Impact Assessment (EIA)** is a statutory requirement for activities, which have been prescribed under Section 34A of the EQA 1974. The activities that are listed in **Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015**, either as **First Schedule** or **Second Schedule** as shown in **Table 3-1** below.

Table 3-1 Schedule of Prescribed Activities: Activity 4 - Fisheries

First Schedule	Second Schedule
Land based aquaculture projects accompanied by clearing of mangrove forest, peat swamp forest or freshwater swamp forest covering an area of 20 hectares or more but less than 50 hectares.	Land based aquaculture projects accompanied by clearing of mangrove forest, peat swamp forest or freshwater swamp forest covering an area of 50 hectares or more.
DEFINITION	
<p>Aquaculture projects on land or known as “land-based aquaculture” involving clearing of mangrove forest or fresh water swamp forest covering an area of 20 hectares or more. It does not include cage aquaculture.</p> <p>“Aquaculture” means the propagation of fish seed or the raising of fish through husbandry during the whole or part of its life cycle (Section 2 Fisheries Act 185 (Act 317) and Regulations).</p> <p>Aquaculture is the farming of aquatic organisms: fish, molluscs, crustaceans, aquatic plants, crocodiles, alligators, turtles, and amphibians. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc¹. Several different aquaculture systems have evolved for the cultivation of a wide variety of aquatic organisms in marine, brackish and freshwater environments. Systems may be land or water based.</p> <p>Land-based systems comprise mainly ponds and other facilities built on dry land. Ponds are the most common of all aquaculture systems and range from small, rudimentary, gravity-fed facilities to large geometric ones, constructed using machines and with sophisticated water management regimes. Carps and tilapias, both widely cultivated fish species, are commonly grown in freshwater ponds, whereas shrimp and finfish tolerant to more saline waters are cultivated in brackish water ponds.</p> <div style="display: flex; align-items: flex-start; margin-top: 10px;"> <div style="margin-right: 10px;">  </div> <div> <p>Aquaculture projects are not usually undertaken within a peat swamp or freshwater swamp area because the conditions are not ideal for most production systems. The Qualified Person would need to ensure that the proposed project is compatible with site conditions if projects within these swamps are proposed.</p> </div> </div>	

¹ Source: Food and Agriculture Organization of the United Nations (FAO)

If the proposed project has components falling within both First and Second Schedule prescribed activities, the Second Schedule EIA shall prevail and shall encompass all EIA requirements required of those activities. In which case, all other relevant EIA Guidelines must be referred to.



If the proposed aquaculture project does not fall under Activity 1, however, it may still require an EIA study under other prescribed activities in the EIA Order 2015. The Project Proponent is required to check with the latest policies and legislation requirements.

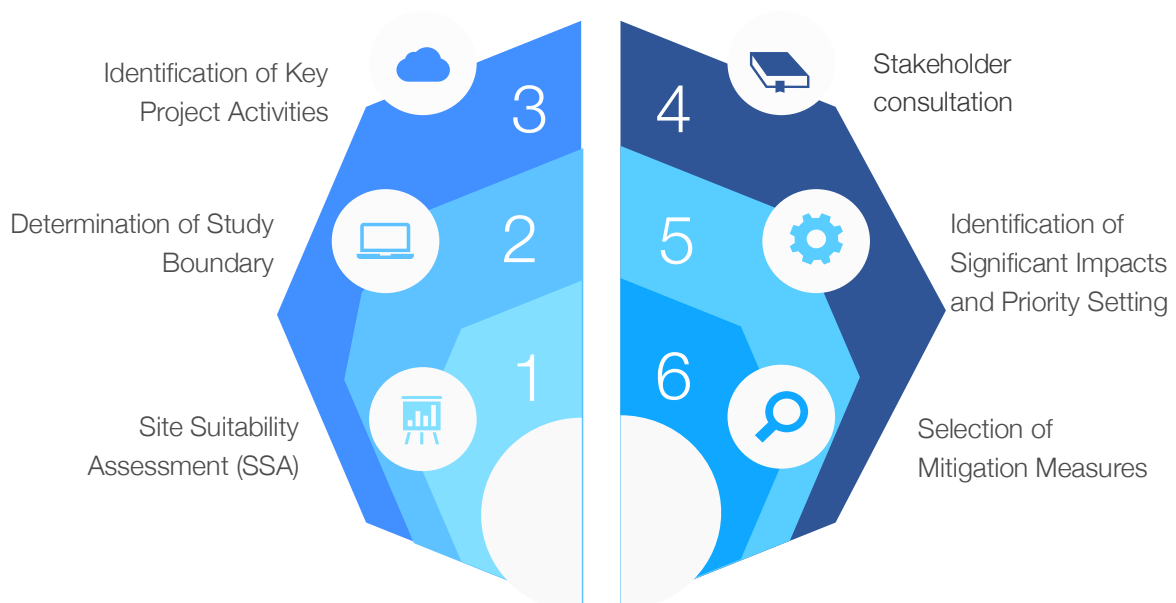
Project Proponents and Qualified Person preparing the EIA report must carry out screening to confirm the if the project intended falls under the “prescribed activity” list.

3.4 ENVIRONMENTAL SCOPING

Scoping is essentially a rapid desktop assessment conducted to gain a preliminary understanding of the key attributes and environmental impacts of a proposed project. The scoping process is important because it determines the focus and depth of the EIA study, which in turn influences the study time, personnel and cost requirements. Thus, it should be carried out at an early stage of the project cycle to enable the EIA to focus on the significant issues, impacts, and sensitive receptors.

Collection of secondary data as well as preliminary discussion with the various stakeholders may be conducted during the scoping. While the scoping exercise is largely dependent on secondary data, a field visit is advisable in order to gain a better understanding of the proposed project site.

The main components of the scoping exercise are as follows:



3.4.1 Site Suitability Analysis

The Qualified Person shall assess whether the site is suitable for the proposed project, or if there are any constraints in relation to the relevant national and state policies and plans as well as directives and guidelines. Some of the key information for SSA is listed in **Table 3-2**, as a reference guide to be reviewed.

While the background information on the proposed project should be provided by the Project Proponent, other relevant information may be obtained from various other sources such as Fisheries Department and other GAs, Non-government Organisations (NGO).

The scoping exercise will value add to this SSA through recommendations of pragmatic mitigation measures such as P2M2s and best management practices (BMPs), where potential environmental degradation is anticipated when developing aquaculture projects.

As the impacts on mangroves and mudflats could be significant, greater emphasis should be given to SSA for this category of prescribed activity. In this, the design principles of managing biodiversity at the landscape level should be adhered to. This includes concepts such as ecological connectivity and edge effects and the impacts of location and layout of projects on the landscape.

Table 3-2 Key information for Site Suitability Analysis

Type	Key Information
Legal status of the proposed project and the project site	<ul style="list-style-type: none"> • Legal status and land ownership. • Licences and permits. • Records of alienation and use rights. • Concessionaire and/or lease agreements.
Areas of forest land diverted. (if any)	<ul style="list-style-type: none"> • Discuss, if the project site or adjoining areas (such as the buffer zone) support any unique habitat, endemic, threatened or declining species or species of high economic/ecological value • Identify any unique habitat, endemic, threatened, or declining species or species of high economic/ecological value. • List of flora and fauna in the project area, duly authenticated by a government-approved organisation or GAs. • Presence of any wildlife corridors or locations favoured by migratory birds or animals at the project site or in the buffer zone, if any.
Sensitive receptors	<ul style="list-style-type: none"> • Proximity to Human settlements, forest areas, wildlife sanctuaries, national and state parks, geological park, biological corridors. • Water intake points and other beneficial uses of the rivers and critical water-shed areas. • Sites of cultural or religious significance to indigenous communities.

Type	Key Information
	<ul style="list-style-type: none"> • Forest resources used by local indigenous communities. • Tourist attractions and recreational areas. • Archaeological sites. • Important installations and sites of religious importance.
<p>Current and future land use</p>	<ul style="list-style-type: none"> • Current land cover from satellite images and topographic maps. • Current land use pattern of area acquired for aquaculture and land use pattern of study area based on the Local Plan. • Future land use pattern of area acquired for aquaculture and land use pattern of study area based on from the Local Plan. • Land ownership pattern of acquired land. • Distance of the project from human settlements, tourism products, and key infrastructure installations, if applicable. • Catchment area characteristics of the study area, such as environmental sensitive areas, water recharge potential and drainage pattern. • Identification of areas vulnerable to erosion in the core area and the buffer area separately. • If forest land or agricultural land are likely to be diverted, the impact on the availability of fodder, fuel, food, and livelihoods, if applicable.
<p>Information on landscape-level biodiversity management</p>	<ul style="list-style-type: none"> • Rivers and river basins, based on topographic maps. • Protected areas based on Master List of Protection Areas (KATS, 2019). • Environmental Sensitive Areas (ESA) identified in the National Physical Plan, State Structure Plan, Local Plan, or Special Area Plan. • Coastal Environmental Sensitive Areas (CESA) identified in the National Physical Plan for the Coastal Zone (NPPCZ/RFZPPN). • HCVF assessment reports for the site or adjacent areas • Wildlife corridors, including those identified in the Central Forest Spine: Masterplan for Ecological Linkages. • Wetlands designated as of international importance under the Ramsar Convention (Ramsar Sites). • Important Bird and Biodiversity Areas (IBAs) (BirdLife International).

Note: The list is not exhaustive and to be suited according to the project.. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.

3.4.2 Determination of Project Study Boundary

The Qualified Person should determine the spatial extent of the EIA study area through a mapping exercise, using the findings from the SSA.

The EIA study area encompasses two study zone categories (**Figure 3-1**):

- i) The **Zone of Study (ZOS)** is inclusive of the Project area and extends up to a radius of 5 km that is measured from the Project boundary.
- ii) **The Zone of Impact (ZOI)** defines the spatial area of potential impacts to extend beyond the ZOS. The ZOI may decrease or extend further afield, depending on the attributes of the river basin, terrain, alignment of hills, and mountain ranges amidst deep valleys, among other factors.

Especially for coastal areas, the ZOS main focus should be along the coastal waters and the coastline with less focus on the inland areas, i.e. <5-km requirement. The ZOI will likewise, mainly focus on the coastal regions and impacts that may spread out into the marine environment (of which the Hydraulic Study can assess the extent).

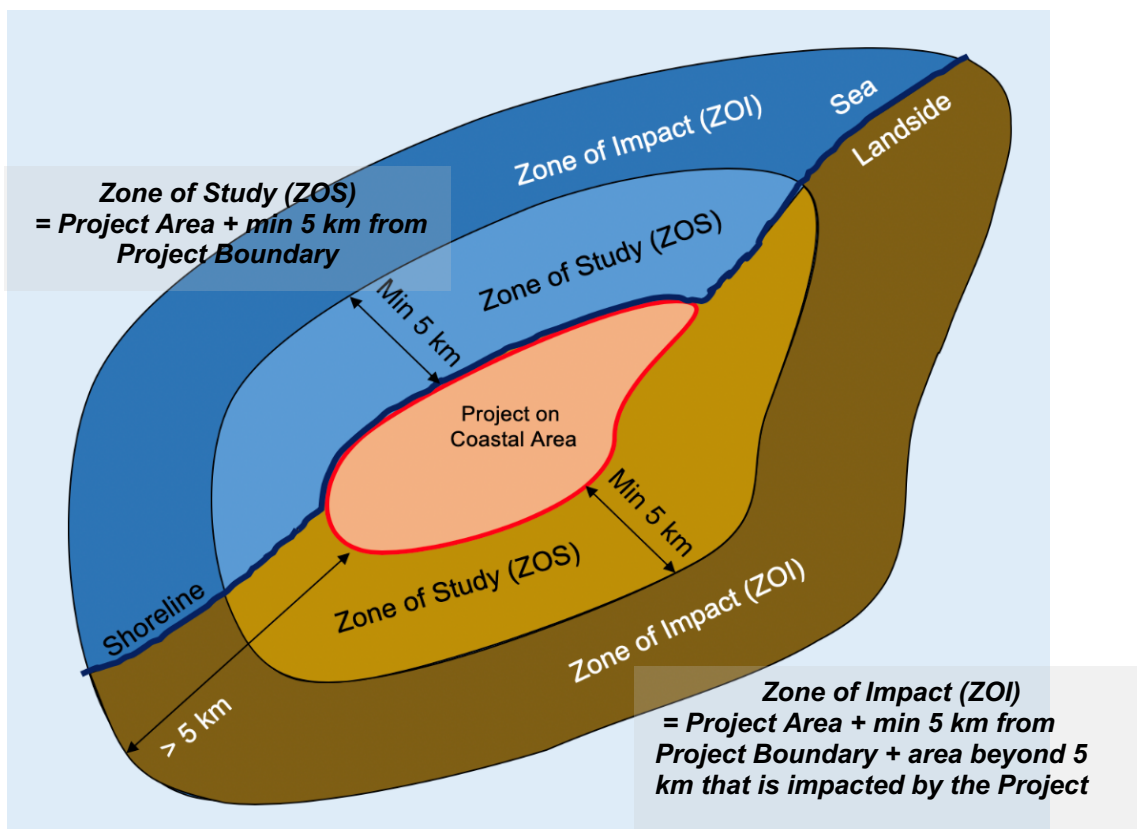


Figure 3-1 Study Boundaries for Coastal Projects



3.4.3 Identification of Key Project Activities

Project activities are a key basis for predicting and addressing the potential impacts of a project. As such, the Project Brief provided by the Project Proponent must include a description of all the activities that will be carried out during the various stages of the proposed project.

In general, the EIA Order 2015 identifies fishery projects as “Land based aquaculture projects accompanied by clearing of mangrove forest, peat swamp forest or freshwater swamp forest”.

Project activities are the basis for assessing potential impacts. **Table 3-3** to **Table 3-5** provide a summary list of activities in a typical coastal area and/or marine park development project by phases. The list is not exhaustive, and the Qualified Person shall add or delete to the list, whenever and wherever necessary.

Table 3-3 List of Typical Project Activities with Issues of Concern During Pre-Construction Phase

Activities	Issues of Concern
<p><u>Site access</u></p> <ul style="list-style-type: none"> ➤ Vegetation and biomass clearing. ➤ Establish a temporary stream/river crossing. 	<ul style="list-style-type: none"> ➤ Soil Erosion ➤ Water pollution [silt, oil, and grease (O&G)] ➤ Loss of wetlands, coastal and marine biodiversity ➤ Air and Noise Pollution
<p><u>Site surveys</u></p> <ul style="list-style-type: none"> ➤ Commissioning of land and bathymetry surveys. ➤ Establishment of temporary camp sites. ➤ Survey works. <p><u>Soil Investigation and Hydraulic Studies</u></p> <ul style="list-style-type: none"> ➤ Commissioning of surveys. ➤ Establishment of temporary camp sites. ➤ Survey works. ➤ Obtain site samples. ➤ Lab analysis of samples. <p><u>Environmental assessment</u></p> <ul style="list-style-type: none"> ➤ Site assessment. ➤ Collection of samples. ➤ Analysis of samples. 	<ul style="list-style-type: none"> ➤ Soil Erosion ➤ Water pollution [silt, oil, and grease (O&G)] ➤ Loss of wetlands, coastal and marine biodiversity ➤ Air and Noise Pollution
<p><u>Land acquisition (if any) under Social Impact Assessment (SIA) and local authorities' scope</u></p> <ul style="list-style-type: none"> ➤ Identification of affected lots and population. ➤ Issue notice and undertake compensation. ➤ Develop relocation plans through consultation. ➤ Acquire property. ➤ Demolition of structures and buildings. 	<ul style="list-style-type: none"> ➤ Socio-economy (relocation) as part of the SIA requirement by PLANMalaysia ➤ Landuse change. ➤ Wastes (demolition)

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.

Table 3-4 List of Typical Project Activities with Issues of Concern During Construction Phase

Activities	Issues of Concern
<p><u>Establish access road</u></p> <ul style="list-style-type: none"> ✦ Cut a new path to the project site using existing roads on land in coastal areas. ✦ Establish drainage and culverts. ✦ Levelling and compacting of the road surface. ✦ Laying of aggregates. 	<ul style="list-style-type: none"> ✦ Loss of biodiversity and wildlife disturbance ✦ Soil Erosion ✦ Water Pollution (Silt) ✦ Air and Noise Pollution
<p><u>Establish vessel facilities</u></p> <ul style="list-style-type: none"> ✦ Construct temporary jetties and vessel anchorage areas. ✦ Establish fuel storage and refuelling areas. ✦ Establish a vessel management plan. 	<ul style="list-style-type: none"> ✦ Coastal traffic ✦ Water quality (suspended solids, O&G, ballast, sewage) ✦ Coastal and marine ecology deterioration (physical damage, water pollution, boat strike) ✦ Safety and health (collision) ✦ Noise (underwater noise)
<p><u>Base camp and site facilities establishment</u></p> <ul style="list-style-type: none"> ✦ Construct site office, worker quarters, canteen, toilets and bathing areas, stockpile areas, storage facilities, and workshops. ✦ Establish utilities and infrastructure: power supply, water, telecommunications, etc. ✦ Provide temporary treatment systems, e.g., septic tanks for toilets, waste collection areas. 	<ul style="list-style-type: none"> ✦ Loss of biodiversity and wildlife disturbance ✦ Water pollution (TSS, sewage and sullage) ✦ Drainage (runoff from the site) ✦ Air and Noise Pollution ✦ Waste (municipal wastes) ✦ Safety and health (vector-borne disease)
<p><u>Worker recruitment, mobilisation of equipment and materials</u></p> <ul style="list-style-type: none"> ✦ Employ workers to carry out construction work. ✦ Transport equipment and materials required for construction to storage areas. ✦ Setup workshop areas for servicing and maintenance work. 	<ul style="list-style-type: none"> ✦ Socio-economy (employment, social conflicts, from SIA) ✦ Safety and health (communicable diseases, sanitary conditions, accidents, and injury) ✦ Air and Noise Pollution ✦ Waste (municipal and construction wastes) ✦ Traffic (congestion from heavy vehicle transport)
<p><u>Earthworks (cut and fill)</u></p> <ul style="list-style-type: none"> ✦ Excavation, filling, and drilling works. ✦ Import and export of fill material. 	<ul style="list-style-type: none"> ✦ Soil erosion/sediment plume ✦ Hydrology and drainage (Increased runoff)

Activities	Issues of Concern
<ul style="list-style-type: none"> ☛ Platform formation for construction. ☛ Construction of erosion and sediment control measures. ☛ Slope and exposed areas protection works (compaction, turfing, lining, etc.). 	<ul style="list-style-type: none"> ☛ Water pollution (silt and debris) ☛ Air (dust) and Noise Pollution ☛ Wastes (spoil disposal) ☛ Ecological Deterioration (Silt) ☛ Safety and health (accidents) ☛ Visual/aesthetics
<p><u>Structural works (onshore and offshore) and facility establishment</u></p> <ul style="list-style-type: none"> ☛ Piling and foundation works. ☛ Batching plant establishment/concrete mixing. ☛ Formwork and concrete pouring for building structures. ☛ Brickwork, roofing and finishing. ☛ Construction of associated facilities (power supply, water supply, telecommunications, waste disposal, etc.). 	<ul style="list-style-type: none"> ☛ Soil erosion/sediment plume ☛ Water Pollution (Silt) ☛ Air and Noise Pollution ☛ Hydrology and drainage (Increased runoff) ☛ Waste (construction wastes)
<p><u>Site Clearing and Biomass Removal</u></p> <ul style="list-style-type: none"> ☛ Cut, removal, and disposal of vegetation. ☛ Establish a temporary biomass disposal site. 	<ul style="list-style-type: none"> ☛ Loss of coastal ecology and habitats ☛ Soil erosion and hydrology and drainage (Increased runoff) ☛ Water pollution (silt and debris) ☛ Air (dust) and Noise Pollution ☛ Safety and health (respiratory effects of dust inhalation) ☛ Waste (biomass) ☛ Visual/aesthetics ☛ Human-Wildlife Conflict (HWC) and Wildlife Relocation
<p><u>Drainage Works</u></p> <ul style="list-style-type: none"> ☛ Diversion of streams and existing drainage. ☛ Establish temporary drainage lines, sediment basins/silt traps and outlets. ☛ Drainage protection works (lining, check dams, compaction, etc.). 	<ul style="list-style-type: none"> ☛ Bank and coastal erosion. ☛ Water Pollution (Silt) ☛ Aquatic/marine habitat deterioration (river/estuary alteration, silt) ☛ Flood Risk
<p><u>Waste disposal</u></p> <ul style="list-style-type: none"> ☛ Provision of temporary waste collection and disposal sites. 	<ul style="list-style-type: none"> ☛ Waste (spoil, municipal, scheduled wastes) ☛ Air Pollution (Odour) ☛ Health impact (disease, vectors, accidents)

Activities	Issues of Concern
<ul style="list-style-type: none"> ☛ Collection of accumulated waste for disposal at designated disposal sites. ☛ Sewage management. 	<ul style="list-style-type: none"> ☛ Water pollution (floatable, sewage, leachate)
<p><u>Establishment of permanent access</u></p> <ul style="list-style-type: none"> ☛ Construction of a permanent access road. ☛ Closure of temporary access. ☛ Removal of temporary structures, e.g., temporary jetty 	<ul style="list-style-type: none"> ☛ Soil Erosion ☛ Water Pollution (Silt)
<p><u>Final finishing and landscaping</u></p> <ul style="list-style-type: none"> ☛ Installation of street lighting, utilities, and amenities. ☛ Planting of trees and vegetation in completed areas. 	<ul style="list-style-type: none"> ☛ Visual/aesthetics (enhancement)

Note: The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.

Table 3-5 List of Typical Project Activities with Issues of Concern During Operational and Closure/Exit Phase

Activities	Issues of Concern
<p><u>Occupation and operation of project</u></p> <ul style="list-style-type: none"> ☛ Management of impacts of human activities in the project area. ☛ Traffic management. ☛ Solid waste management. 	<ul style="list-style-type: none"> ☛ Air and noise pollution (traffic, human activities) ☛ Traffic (congestion) ☛ Waste (municipal wastes) ☛ Socio-economy (employment, economic growth) ☛ Human-Wildlife Conflict (HWC)
<p><u>Vessel management and maintenance of marine facilities</u></p> <ul style="list-style-type: none"> ☛ Management of marine traffic. ☛ Maintenance of vessel facilities. ☛ Waste management. 	<ul style="list-style-type: none"> ☛ Water quality (O&G spills, vessel discharge) ☛ Marine traffic (congestion, underwater noise) ☛ Safety and health (collision, accidents) ☛ Coastal and Marine Ecology Deterioration
<p><u>Infrastructure, utility, and amenities maintenance</u></p> <ul style="list-style-type: none"> ☛ Maintenance of the sewage treatment system. ☛ Monitoring of effluent quality. ☛ Conduct repairs as necessary. 	<ul style="list-style-type: none"> ☛ Water pollution (sewage and sullage) ☛ Air and Noise Pollution ☛ Safety and Health ☛ Waste (municipal wastes)

Activities	Issues of Concern
<ul style="list-style-type: none"> ☛ Maintenance of infrastructure: roads, drainage, power supply, telecommunications, etc. ☛ Maintenance of landscaping. 	<ul style="list-style-type: none"> ☛ Visual/aesthetics
<p><u>Site decommissioning</u></p> <ul style="list-style-type: none"> ☛ Demolition of unwanted temporary structures and buildings. ☛ Removal of machinery, materials, and workers from the site. ☛ Fill in depressions and holes. ☛ Removal of waste. <p><u>Rehabilitation works</u></p> <ul style="list-style-type: none"> ☛ Erect hoarding. ☛ Establish protection measures for slopes and exposed areas (compaction, turfing, and structural measures). ☛ Provide coastal protection measures. ☛ Revegetation or landscaping. ☛ Coral rehabilitation and regeneration 	<ul style="list-style-type: none"> ☛ Soil erosion ☛ Water Pollution (Silt) ☛ Air and Noise Pollution ☛ Safety and Health Waste (demolition wastes)

Note: The list is not exhaustive and to be suited according to the project.. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.

3.4.4 Selection of Scoping Method

There are many methods and tools to conduct the scoping exercise. These include checklists, matrices, or any other accepted methods, to assist in systematically organising, collating, and analysing the data for the project. At the TOR stage, qualitative assessment is adequate but quantitative data can be provided to support the assessment.

Table 3-6 lists the advantages and disadvantages of the various common methods used. The list given is not exhaustive, and any other suitable method can be used, if relevant.

A useful tool is the Environmental Scoping Matrix (ESM) that amalgamates the scores from a series of criteria; ranging them from major to minor negative and positive formats of environmental impacts (see **Appendix 3** for an example of the matrix used for fisheries projects).

The Qualified Person and the Project Proponent’s input is vital at this stage as their knowledge and experience would ensure appropriate weightage is given to the issues under assessment (see **Box 3**). From the scoping output, a priority list of environmental impacts is determined for in-depth studies and assessments in the EIA.

Table 3-6 Advantages and Disadvantages of Impact Identification Methods

Methods	Advantage	Disadvantages
Checklists	<ul style="list-style-type: none"> • Easy to understand and use. • Good for site selection and priority setting. • Simple ranking and weightages. 	<ul style="list-style-type: none"> • Do not distinguish between direct and indirect impacts. • Do not link action and impact. • The process of incorporating values can be controversial.
Matrices	<ul style="list-style-type: none"> • Link action to impacts. • Good method for displaying EIA results. 	<ul style="list-style-type: none"> • Difficult to distinguish direct and indirect impacts. • Have potential for double counting of impacts.
Networks	<ul style="list-style-type: none"> • Link actions to impacts. • Useful in simplified form to check for second order impacts. • Handles direct and indirect impacts. 	<ul style="list-style-type: none"> • Can be very complex if used beyond simplified version.
Overlays	<ul style="list-style-type: none"> • Easy to understand. • Focus and display spatial impacts. • Good siting tool. 	<ul style="list-style-type: none"> • It can be cumbersome. • Poorly suited to address the duration or probability of impact.
GIS and Computer Expert Systems	<ul style="list-style-type: none"> • Good for impact identification and spatial analysis. • Good for experimentation. 	<ul style="list-style-type: none"> • Heavy reliance on knowledge and data. • Often complex and expensive.

Source: EIA Training Resource Manual Second Edition (UNEP, 2002).

Note: *The list is not exhaustive and to be suited according to the project.. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.*

Box 3:
Criteria for Determining Significance of Environmental Impacts

- i. **Magnitude:** Defined as the degree and scale of an impact (may be detrimental or beneficial) towards sensitive receptors due to a proposed activity.
- ii. **Permanence:** Defined as to whether the effects are temporary in nature (e.g. only during certain work activities or only during the construction stage), or may result in permanent effects (e.g. landform alteration due to cut and fill)
- iii. **Reversibility:** A measure of whether mitigation measures can be implemented in rehabilitating the site back to its original state or better.
- iv. **Cumulative Effects:** A measure of whether the effects will be accumulative singly or in combination with other effects from nearby sites/activities (that may be detrimental or beneficial) over a time period.

3.4.5 Stakeholder Consultation

Stakeholder consultations should begin during the scoping process. The purpose of this is to notify the relevant stakeholders about a proposed project prior to its development and to obtain their initial feedback and concerns. These preliminary consultations will form the basis for further and more focused consultations later on in the EIA process.

Stakeholder groups that should be consulted for fisheries projects include the local community and community-based organisations (CBO), as well as relevant researchers, NGOs as and Government agencies. Depending on the target group, this initial stakeholder consultation may be done via town hall meetings, focus group discussions, e-mail, and other relevant methods that enable effective consultation. In any case, it is important that all relevant stakeholders should be provided sufficient opportunities to share their unbiased views, and these views are recorded officially and given due consideration. For indigenous communities, the principles of Free, Prior and Informed Consent (FPIC) applies and must be upheld in the consultation process, as Malaysia is a signatory to the UN Declaration on the Rights of Indigenous Peoples (UNDRIP).

The **Table 3-7** presents an indicative, but non-exhaustive, list of stakeholders for engagement with, for fisheries projects.

Table 3-7 Key Stakeholders and their Roles and Responsibilities

Stakeholder	Roles and Responsibilities
Department of Environment (DOE)	<ul style="list-style-type: none"> • Administrator of the EIA process under the EQA 1974. • Responsible for the issuance of the COA for the EIA. • Post-EIA approvals, monitoring, and enforcement.

Stakeholder	Roles and Responsibilities
Project Proponent	<ul style="list-style-type: none"> • The party to carry out development and responsible for obtaining all necessary approvals for the site. • Involved in the management of the project at all stages of development.
Relevant GAs	<ul style="list-style-type: none"> • GAs which have roles and functions in the project and are responsible for the issuance of approvals for studies, technical reports, and plans for the project. • Engagements shall assist in determining GA requirements for the project that needs to be addressed by the Project Proponent, and also to assist in obtaining information under their respective agencies relevant for the project. • The possible GAs to be considered for engagements are the following: <ul style="list-style-type: none"> ○ State Economic Planning Unit ○ Public Works Department (JKR) ○ Local Authorities ○ Department of Drainage and Irrigation (DID) ○ Fisheries Department ○ Marine Department ○ Port Commission/ Port Authority ○ Forestry Department Peninsular Malaysia • Department of Town and Country Planning (PLANMalaysia) at Federal and State
Affected Public and Local Population	<ul style="list-style-type: none"> • The public or local population that may be directly or indirectly affected by the project and whose concerns and interests need to be addressed as part of the EIA. • Preliminary engagement may include identifying public concerns about the project that need to be addressed and feedback on mitigation measures. These may include: <ul style="list-style-type: none"> ○ Local residents/community ○ Fishermen ○ Landowner ○ Ports/ Marine operators ○ Recreation/ water sport activity operator
NGOs	<ul style="list-style-type: none"> • Provide input and feedback on issues of special interest. These may include: <ul style="list-style-type: none"> ○ NGOs related to environment and ecology ○ Other related NGOs

Note: The list is not exhaustive and to be suited according to the project.. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.

3.4.6 Identification of Significant Impacts and Priority Setting

Based on the findings from above steps, the Qualified Person should now identify and prioritise the potentially significant impacts that warrant greater attention in the EIA study. Once the key environmental impacts have been identified and prioritised, the next step is to establish the appropriate study requirements to address these significant impacts.

The scope of EIA studies depends on the scale and extent of the development, its relationship to adjacent land uses and nearby sensitive receptors, the type of planning and study approvals as required by the relevant GAs, which will be generally determined in consultation and engagement with these agencies, and other relevant criteria.

The Qualified Person should provide the methodologies, assessment/modelling tools, and expected outputs derived from the assessment of the significant impacts, as part of the TOR. **Chapter 5** provides a list of applicable issues of environmental concerns that need to be studied. Information provided is only indicative and non-exhaustive as site conditions can vary from project to project. Hence, it is the responsibility of the Qualified Person to check and verify the applicability and extent of the relevant studies to be conducted for a specific project.

3.4.7 Selection of Mitigation Measures

Depending on the nature of the site and the potentially significant impacts identified, the Qualified Person should assess the best available technologies (BATs) and options for Pollution Prevention and Mitigation Measures (P2M2) to address the identified key environmental issues determine the type of mitigation measures that may be required. Mitigation measures only need to be outlined in general terms at this juncture, with further details to be added in the EIA report.

3.5 TERMS OF REFERENCE AND ENVIRONMENTAL SCOPING INFORMATION

The scoping exercise shall define the proposed scope, boundaries, methodology, and schedule of the EIA study (among other things). For the First Schedule EIA, the scoping exercise will determine the EIA study requirements and set study boundaries that need to be assessed. Scoping for the First Schedule EIA is encouraged to be carried out as an internal exercise.

For the Second Schedule EIA, the scoping exercise shall produce two outputs, i.e., the Terms Of Reference (TOR), which defines the proposed scope, boundaries, methodology, and schedule of the EIA study (among other things) and the Environmental Scoping Information (ESI), which contains supporting information collected from the scoping exercise. The TOR (along with the ESI) is to be submitted to DOE for review and approval following the set review procedures for the Second Schedule EIA. Refer to **Chapter 4.2 of the EGIM 2016** for a description of the procedures and **Appendix 8 OF EGIM 2016** for detailed guidance on preparing the TOR and ESI.

THIS PAGE WAS LEFT INTENTIONALLY BLANK



Google Earth

Photo : Aerial View Aquaculture Farms in
Tanjung Dawai, Kedah.
Source: Google Earth

Image © 2023 CNES / Airbus

DETERMINING ENVIRONMENTAL BASELINE CONDITIONS

CHAPTER 4. DETERMINING ENVIRONMENTAL BASELINE CONDITIONS

4.1 BASELINE STUDY

EIAs are essentially studies to predict how a particular project will affect the physio-chemical, ecological and human components within the landscape. A strong understanding of the existing environment, otherwise known as the “baseline condition” prior to the implementation of the project, is crucial in order to make accurate predictions.

Typically, a combination of primary and secondary data is collected to develop the baseline. Standard baseline data requirements for fisheries projects are listed in **Table 4-1**. Note that data collection should not be limited to the project site or ZOS, but must also include the Zone of Impact (ZOI).

4.1.1 Primary Data Collection

Field surveys will be required to collect primary data for various physical and ecological parameters. While time and resources are limiting factors, the surveys must be designed to derive data that are reliable, robust, and relevant. This entails, for example, selecting methodologies, tools, timing, and layout of sampling points/plots that are appropriate to the site characteristics, including topography and size.

Samples collected must be analysed by a *Skim Akreditasi Makmal Malaysia* (SAMM) Accredited Laboratory or equivalent. Details of sampling (person in charge, time, date, and location of sampling) must be clearly stated. All test certificates and data shall be included in the Appendix of the EIA as supporting evidence (DOE Notice 1/2012 dated 6 January 2012).

The scope and requirement for such studies are to be determined by the respective GAs and reports are to be approved by the said GAs before incorporation as part of the EIA. Stakeholder consultation methodology may include dialogues, rapid rural appraisal, focus group discussion, questionnaire survey, and other methods that suit the situation. A combination of two or more of these methods may be applied, depending on the level of assessment required.

4.1.2 Secondary Data Collection

Secondary data may be available from previous studies or monitoring programmes conducted at the study site, if any. Secondary data sources may include study reports (published or unpublished), scientific papers, etc. These documents may be available in the collections of government agencies, research institutions, NGOs or online. In any case, the secondary data sources must be reliable and cited in the report.

Sources of information and statistics must be clearly referenced and acknowledged along with the date of publication in the EIA. References for all maps, photos, and diagrams will also need to be included in the EIA.

4.1.3 Environmental Components and Indicators

The collected environmental baseline must be appropriate to provide sufficient grounds to draw up the potential impacts for which mitigation measures will be planned for any negative impacts. Data collection should cover three major environmental components:

(a) Physico-chemical Environment

In line with the DOE's environmental mainstreaming, the EIA study should focus on the core aspects of pollution in the physico-chemical environment, which are water, air, and wastes. Baseline information on these three core aspects is needed to determine the state of the terrestrial and marine environment before, during, and after project implementation when benchmarked against the DOE standards.

A baseline sampling plan, which includes locations, methods of sampling, and parameters to be sampled, shall be decided based on the project site. Details of the sampling plan and schedule (person in charge, time, date, and location of sampling) must be clearly stated in the EIA.

Table 4-2 provides a range of baselines for sampling and studies. The recommended parameters for water, air, noise, and vibration, and the standards to benchmark them against, are provided as reference. **Table 4-3** also presents the additional studies that maybe applicable to the EIA with regards to the Hydrology, geology and Soil, and Hydraulic Study.



*Example of river water sampling
Photo By: Tri EcoEdge Sdn Bhd*

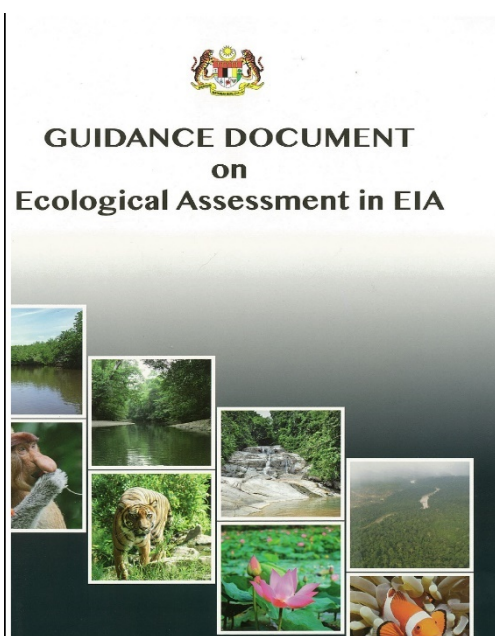
(b) **Biological Environment**

The biological environment has a wide range of scope and is the most important component in land-based aquaculture projects in close proximity to marine parks and coastal areas. The relevant agencies such as the Department of Fisheries (DOF), Forestry Department of Peninsular Malaysia (JPSM), and the Department of Wildlife and National Parks Peninsular Malaysia (PERHILITAN) must be consulted prior to carrying out data collection, surveys, and assessments.

For coastal areas and marine parks, a lot of general information already exists in various agencies, which can be referred to as secondary data. Similarly, other organisations such as the World Wide Fund for Nature (WWF), National Hydraulic Institute of Malaysia (NAHRIM), Reef Check Malaysia, Coral Triangle Initiative, etc. have many published research and inventories of flora and fauna in marine areas, islands, sanctuaries, and conservation zones.

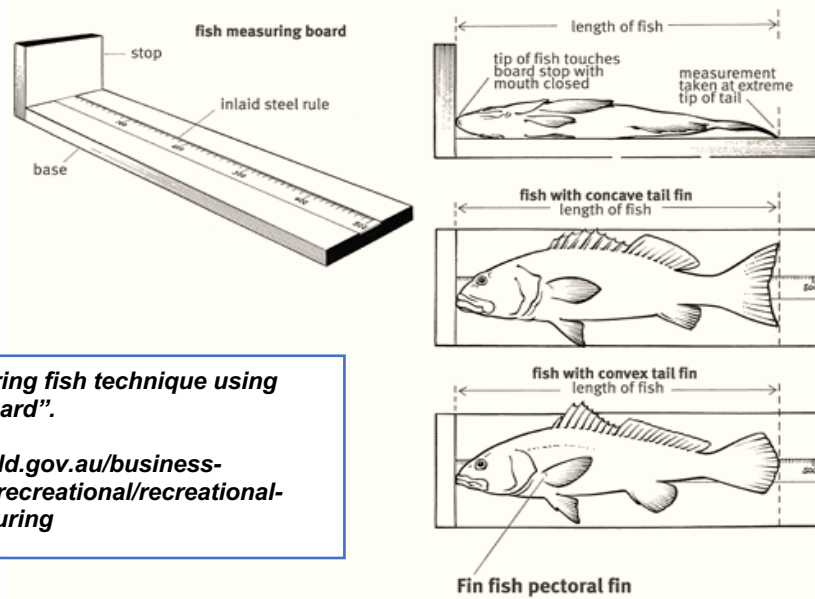
Specific to the project site when secondary data is unavailable, primary data shall be collected because construction activities will cause direct impacts to the marine fauna in the area.

*Guidance Document on
Ecological Assessment in EIA*
*Publication by DOE Malaysia,
2012*



On the landward side, the survey should include types of fauna found in the area or vicinity, so that a wildlife management plan can be developed if needed. In the sea, especially in the case of coral reefs and seagrasses, these must be surveyed and mapped to provide a means to avoid them in the design of the project.

The scope and requirement for the terrestrial and marine biological environment are determined by the respective government agencies (GAs). The assessment reports are to be approved by the said GAs before incorporation of the findings in the EIA report (refer to **Table 4-1** and **Table 4-3**). If the biological impact of the Project is not significant, secondary data would suffice.



Example of measuring fish technique using “fish measuring board”.
Source: www.daf.qld.gov.au/business-priorities/fisheries/recreational/recreational-fishing-rules/measuring

(c) Human Environment

Relevant data collection will be required for the section on socio-economic environment in the EIA or in the SIA. Secondary data include the population census, but for an accurate population statistic, these data are best collected from the local authorities, district offices (PTD), village heads, fishermen associations, etc. Socioeconomic data such as their profiles will have to be obtained from focal group discussions (FGDs) and direct person-to-person interviews.

The Project Proponent shall abide by the requirements, guidelines, and procedures of PLANMalaysia in carrying out a Social Impact Assessment (SIA). PLANMalaysia shall review, endorse, and enforce the requirements of the SIA. For the purpose of the EIA, only the main findings of the SIA shall be incorporated.

Other aspects that may affect communities within the vicinity of the project site must be considered if they are deemed significant issues. The requirements may include, but not be limited to, public health, heritage and culture, archaeology, and traffic (refer to **Table 4-3**). The findings of these studies must be incorporated into the EIA.

4.2 ESTABLISHMENT OF STUDY REQUIREMENTS FOR EIA

Table 4-4 provides a list of the studies for the EIA study. The list is indicative and not exhaustive, and the Qualified Person's judgement is needed since all land-based aquaculture projects in coastal areas and/or marine parks differ considerably from one another.

The table also provides a List of Indicative studies that may or may not be required by other GAs related to the land-based aquaculture project in coastal and associated marine areas.

Table 4-1 Environmental Baseline Information and Data Sources

	Scope	Baseline Information	Primary sources	Secondary sources
Physico-chemical	Land use (map and description)	<ul style="list-style-type: none"> • Description of existing and future land use within the ZOI • Identification of ESAs & impact receptors. • Land use compatibility assessment. 	<ul style="list-style-type: none"> • LiDAR survey, if required • Unmanned aerial vehicle 	<ul style="list-style-type: none"> • PLANMalaysia • JUPEM
	Coastal Morphology	<ul style="list-style-type: none"> • Bathymetry report. • Description of coastal areas and landforms. • Description of accreting or erosional areas. 	<ul style="list-style-type: none"> • Remotely Operated Vehicles (ROV) • LiDAR survey, if required 	<ul style="list-style-type: none"> • Nautical charts of the National Hydrographic Centre (NHC). • National Coastal Erosion Study 2015.
	Soil and Terrain	<ul style="list-style-type: none"> • Geotechnical report. • Description of local and regional soil and geology. • Description of the existing topography based on land surveys. • Analysis of the soil profile obtained from soil investigations. • Locations of aquifer and groundwater abstraction wells. 	<ul style="list-style-type: none"> • Geological Terrain Mapping • Soil Investigation (SI) • LiDAR survey, if required • Drone mapping 	<ul style="list-style-type: none"> • DOE • JUPEM • JKR • DID • JMG
	Climate	<ul style="list-style-type: none"> • Obtain long-term (minimum 5-year) climate data to define the weather patterns for the project site. 		<ul style="list-style-type: none"> • Malaysian Meteorological Department (METMalaysia)
	Hydrology and Hydrodynamics	<ul style="list-style-type: none"> • Description of hydrological systems within and surrounding the project site (marine, rivers, streams, and drainage). • Flood risk analysis, if required. 	<ul style="list-style-type: none"> • Stream flow measurement 	<ul style="list-style-type: none"> • DOE • DID

	Scope	Baseline Information	Primary sources	Secondary sources
		<ul style="list-style-type: none"> For marine, obtain long-term (minimum 5 year) data on tides, current flow and speed, wave conditions, littoral drifts, sediment transport offshore winds, etc. Obtain data on high and low water mark lines in relation to the project site. 		<ul style="list-style-type: none"> State Water Authorities Marine Department METMalaysia Integrated River Basin Management (IRBM) Studies
	Water Quality	<ul style="list-style-type: none"> Sampling and analysis of water quality from waterways and water bodies within the ZOI. Identification of downstream receptors such as water intake points (WIPs) and water treatment plants (WTPs). Identification of water pollution sources, if any. 	<ul style="list-style-type: none"> DOE National Environmental Monitoring Programme Water quality sampling at site & sensitive receptors² 	<ul style="list-style-type: none"> DOE reports State Water Authorities
	Air Quality	<ul style="list-style-type: none"> Sampling and analysis of ambient air quality of the project site and nearby sensitive receptors. Identification of water pollution sources, if any. 	<ul style="list-style-type: none"> Ambient air quality sampling at site and sensitive receptors. 	<ul style="list-style-type: none"> DOE
	Soil Quality	<ul style="list-style-type: none"> Sampling and analysis of soil quality of the project site Identification of soil pollution sources, if any. 	<ul style="list-style-type: none"> Soil quality sampling at site 	<ul style="list-style-type: none"> DOE
	Noise and Vibration Level	<ul style="list-style-type: none"> Measurement and analysis of ambient noise and vibration levels at the project site and nearby sensitive receptors. 	<ul style="list-style-type: none"> Ambient noise levels at site & sensitive receptors 	<ul style="list-style-type: none"> DOE
	Waste	<ul style="list-style-type: none"> Estimation of biomass waste generated from site clearing. 	<ul style="list-style-type: none"> Land survey Topographical survey 	<ul style="list-style-type: none"> DOE Local Authority

	Scope	Baseline Information	Primary sources	Secondary sources
		<ul style="list-style-type: none"> • Identification of the potential scheduled wastes generated from the project site. • Identification of future spoil disposal areas. 	<ul style="list-style-type: none"> • Earthworks plan • ESCP for project 	<ul style="list-style-type: none"> • SW Corporation
Biological	Ecology	<ul style="list-style-type: none"> • Description of existing ecology and habitats. • Habitat mapping of ESAs and conservation areas (forest reserves, wetlands, mangroves, fisheries, turtle landings area, etc.). • Provide an inventory and assess the terrestrial and aquatic biodiversity within the Project site. • Identify any endemic, rare, endangered, threatened and near extinct species within the project site and surrounding ZOI. • Identify any of the occurrence of natural or man-made events such as red tide, fish kills, or natural disasters. 	<ul style="list-style-type: none"> • Flora survey • Faunal survey³ • Ecosystem Assessment • High-Conservation Value Forest Assessment • Rapid biodiversity assessment tools 	<ul style="list-style-type: none"> • Forest Department of Peninsular Malaysia (JPMS) • PERHILITAN • Department of Fisheries (DOF) • DOE
	Socioeconomic	Socio-economy	<ul style="list-style-type: none"> • Data on demography, and socioeconomic profiles of stakeholders within the ZOI. • Level of dependence of the local community on forest and forest resources. • Community maps or other documents showing locations of customary land, important cultural or religious sites, etc.⁴ • Human-wildlife conflict in the ZOI. 	<ul style="list-style-type: none"> • Local community consultation⁴ • SIA
Public Health		<ul style="list-style-type: none"> • Existing public health status. • This shall be based on the findings of the Health Impact Assessment (HIA), if any. 	<ul style="list-style-type: none"> • Local community consultation⁵ • Clinics 	<ul style="list-style-type: none"> • Ministry of Health (MOH)
Land Traffic		<ul style="list-style-type: none"> • Existing traffic within and surrounding the project site. • This shall be based on the findings of the TIA, if any. 	<ul style="list-style-type: none"> • TIA 	<ul style="list-style-type: none"> • JKR

	Scope	Baseline Information	Primary sources	Secondary sources
	<p>Infrastructure, Utilities and Amenities</p>	<ul style="list-style-type: none"> • Availability of existing and future utilities (water, electricity, sewerage, waste management, road networks, telecommunication, etc.). • Discharge points of sewage and effluent. • Coastal jetties, if any. 		<ul style="list-style-type: none"> • Water Supply Authority/Provider • Indah Water Konsortium (IWK) • Tenaga Nasional Berhad (TNB) • JKR • Local Authorities (PBT) • PLANMalaysia

Notes:

- 1 The list above is not exhaustive and must be suited to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.
- 2 Water quality samples collected must be analysed by a *Skim Akreditasi Makmal Malaysia* (SAMM) accredited laboratory. Details of sampling (person in charge, time, date, and location of sampling) must be clearly stated. All certificates and data shall be included.
- 3 Ensure that all necessary permits are obtained from DWNP before wildlife surveys are conducted, especially if it entails netting or trapping of wildlife. As far as possible, the timing of surveys should be planned taking into account seasonal variations. A combination of survey methods including camera traps, point counts, line transects, mist nets, pitfall traps, bat detectors, pond nets, and fishing may be utilised to detect the different taxonomic groups present. Apart from direct observation, secondary signs such as scratch marks, tracks, calls, and scat may provide confirmation of the presence of a species. Note, however that the non-detection of the species does not imply the species is genuinely absent.
- 4 While not official or professional maps, community maps produced by the Orang Asli may be admitted as a rough visual guide to the spatial extent of the ancestral lands.
- 5 For local indigenous communities, the principles of Free, Prior and Informed Consent (FPIC) principles should be incorporated into the consultation process, because Malaysia is a signatory to the UN Declaration on the Rights of Indigenous Peoples (UNDRIP).

Table 4-2 Recommended Sampling Requirements for EIA Studies

Aspect	Recommended Parameter		Guidelines/Standards	Recommended Requirements
River Water Quality	<u>In-situ Measurements</u> <ul style="list-style-type: none"> Dissolved Oxygen (DO) Temperature Conductivity pH <u>Ex-situ Analysis</u> <ul style="list-style-type: none"> Biochemical Oxygen Demand (BOD) Chemical Oxygen Demand (COD) Total Suspended Solid (TSS) Ammoniacal Nitrogen (AN) Mercury (Hg) Cadmium (Cd) Chromium Trivalent (Cr³⁺) Chromium Hexavalent (Cr⁶⁺) 	<u>Ex-situ Analysis (cont'd)</u> <ul style="list-style-type: none"> Arsenic (As) Cyanide (CN) Lead (Pb) Copper (Cu) Manganese (Mn) Nickel (Ni) Tin (Sn) Zinc (Zn) Boron (B) Iron (Fe) Phenol Free Chlorine (Cl₂) Sulphide (S²⁻) Oil and Grease (O&G) Total coliform Faecal coliform 	National Water Quality Standards of Malaysia (NWQS)	<ul style="list-style-type: none"> One-time composite sampling. Upstream and downstream of major rivers and streams within the ZOI. Minimum two sampling locations (depending on river type). Multi-depth sampling for deep rivers (>1 m deep). Heavy metal testing required if the activity involves industrial and/or mining projects. Pesticide testing required for agricultural and/or forestry projects. The water quality parameters shall be selected based on the site conditions.
Estuarine and Marine Water Quality	<u>In-situ measurements</u> <ul style="list-style-type: none"> (DO) Temperature 	<u>Ex-situ Analysis (cont'd)</u> <ul style="list-style-type: none"> CN Ammonia (Unionised) 	Malaysian Marine Water Quality Criteria and Standards (MMWQCS)	<ul style="list-style-type: none"> Only if the site is adjacent to coastal areas.

Aspect	Recommended Parameter		Guidelines/Standards	Recommended Requirements
	<ul style="list-style-type: none"> • Conductivity • pH • Turbidity • Salinity <p><u>Ex-situ Analysis</u></p> <ul style="list-style-type: none"> • Arsenic (As) • TSS • Heavy Metals As, Cd, Cr⁶⁺, Cu, Pb, Hg, Zn 	<ul style="list-style-type: none"> • Nitrite (NO₂) • Nitrate (NO₃) • Phosphate (PO₄) • Phenol • O&G • Faecal coliform • E.coli* • Enterococci* 		<ul style="list-style-type: none"> • Sampling must be at least 100 m from the coastline. • Sampling done for high tide and low tide and spring and neap tides, once each. • Multi-depth sampling (top, middle, and bottom). • Minimum of five sampling locations. <p>Note: * DOE Notice 3/2014 dated May 2014 for projects located near recreational and/or tourist beaches</p>
Air Quality	<ul style="list-style-type: none"> • PM_{2.5}*¹ • PM₁₀*¹ • Carbon Monoxide (CO)*² • Sulphur Dioxide (SO₂)*² • Nitrogen Dioxide (NO₂)*² • Ozone (O₃)*^{2*3} <p>Source: DOE Notice 1/2015 dated Mar 2015</p> <p>Note: *1 24-hrs *2 1-hr *3 Ozone needs to be measured for selected projects only. Justification must be provided for its omission.</p>		Malaysian Ambient Air Quality Standards (MAAQS)	<ul style="list-style-type: none"> • Parameters to be sampled are dependent on-site conditions. • One-time sampling at minimum two stations (upwind and downwind). • Project boundary and nearest receptors.

Aspect	Recommended Parameter	Guidelines/Standards	Recommended Requirements
Noise Level	<ul style="list-style-type: none"> • LAeq • LMax • LMin • L10 • L50 • L90 	Guidelines for Environmental Noise Limits and Control (DOE)	<ul style="list-style-type: none"> • Parameters to be sampled are dependent on-site conditions and need. • One-time sampling (24-hrs for daytime and night time). • Project boundary and nearest receptors.
Vibration	<ul style="list-style-type: none"> • Requirements according to Schedules 1 through 6 of the Planning Guidelines for Vibration Limits and Control 	The Planning Guidelines for Vibration Limits and Control	<ul style="list-style-type: none"> • Parameters to be sampled are dependent on-site conditions and need. • One-time sampling (1-hr for daytime and night time). • Project boundary and nearest receptors.

Note:

- 1) The list above is indicative and non-exhaustive, and to be suited according to the project.. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.
- 2) The Project Proponent and Qualified Person shall include and provide any additional baseline sampling, including parameters, as required by DOE, other GAs and/or deemed necessary for the project.

Table 4-3 Additional Sampling Requirements and Study Requirements

Aspect	Recommended Parameter	Reference	Sampling Requirements	Approving Authority
Geology and Soil	Site topography based on land surveys. Soil profile analysis including the K value for erosion analysis.	<ul style="list-style-type: none"> JMG/JKR requirements 	<ul style="list-style-type: none"> Soil Investigations (SI). Hang auger (determine K-value). 	<ul style="list-style-type: none"> JMG JKR
Hydrology	Stream flow. Riverbed cross section	<ul style="list-style-type: none"> DID requirements 	<ul style="list-style-type: none"> Site survey to verify the river system and drainage. Stream gauging to ascertain flow and riverbed cross-section. Identification of downstream sensitive receptors. 	<ul style="list-style-type: none"> DID
Hydraulic Study	Bathymetry. Baseline data on conditions of the coastal and sea parameters, e.g., waves, tides, current speed, wind, etc. Simulation using accepted hydraulic and hydrodynamic models under various monsoon and tidal conditions. Shoreline changes and monitoring requirements Determine and delineating the high/low water mark within the project area.	<ul style="list-style-type: none"> Guidelines for Preparation of Coastal Engineering Hydraulic Study and Impact Evaluation (DID, 2001) Limits set by the World Association for Waterborne Transport Infrastructure (PIANC) 	<ul style="list-style-type: none"> Hydrographic survey according to the International Hydrographic Organisation (IHO) Standards for Hydrographic Surveys (S-44) 5th Edition (Feb 2008) and led by at least one IHO Category A Hydrographic Surveyor. Coastal parameters details. Sediment grab sampling, suspended sediment sampling. Simulation of various conditions and scenarios (tidal and monsoon). Data sampling shall be based on requirements of DID and NHC. 	<ul style="list-style-type: none"> DID NHC

Aspect	Recommended Parameter	Reference	Sampling Requirements	Approving Authority
Ecological Assessment	Habitat mapping Species inventory (including photographs) Abundance and diversity assessment Terrestrial Flora and Fauna Flora Inventory Mammals Avian Herpetofauna Aquatic and Marine Flora and Fauna Mangroves, coral reefs, and seagrass beds Turtle landing areas and sanctuaries Fishery Resources Phytoplankton and zooplankton Benthic Organisms Marine flora & fauna	<ul style="list-style-type: none"> International Union on the Conservation of Nature (IUCN) Red List Wildlife Conservation Act 2010 (Act 716) Fisheries Act 1985 (Act 317) 	<ul style="list-style-type: none"> <u>Terrestrial</u>: Surveys within the project site and adjacent. <u>Aquatic and marine</u>: Within coastal project site and ESAs (Planktons, coral reefs, seagrass beds, artificial reefs, etc.) Fishing grounds and reserves. 	<ul style="list-style-type: none"> Department of Marine Park Malaysia JPSM. PERHILITAN. DOF
Land use	Current landuse Future and committed land use Sensitive receptors Zoning and Compatibility	<ul style="list-style-type: none"> Structure /local plans Marine Park Management Plans 	<ul style="list-style-type: none"> Site surveys. Mapping to update information. Within the ZOI. 	PLANMalaysia Dept of Marine Park Malaysia
Social Impact Assessment (SIA)	Population profile Identification of Stakeholders Perception survey	<ul style="list-style-type: none"> Manual for SIA of Project Development 	<ul style="list-style-type: none"> Carried out as part of the SIA. Surveys on target groups potentially affected by the project. 	PLANMalaysia

Aspect	Recommended Parameter	Reference	Sampling Requirements	Approving Authority
			<ul style="list-style-type: none"> Surveys represent the stakeholders in ZOI. Stakeholder engagement conducted. 	
Public Health	Population profile Public health status	<ul style="list-style-type: none"> Guidance Document on Health Impact Assessment (HIA) in EIA 	<ul style="list-style-type: none"> Carried out as part of the HIA. Surveys on target groups potentially affected by the project. Surveys represent stakeholders in ZOI. Stakeholder engagement be conducted. 	Ministry of Health (MOH)
Traffic	Traffic count for peak traffic periods	<ul style="list-style-type: none"> Public Works Department (JKR) requirements 	<ul style="list-style-type: none"> Carried out as part of the Traffic Impact Assessment (TIA). Traffic surveys at major intersections leading to the project site. 	JKR
Waste	Estimation of biomass from site clearing. Potential waste generation (municipal, construction & demolition, scheduled wastes) generation.	<ul style="list-style-type: none"> DOE and local authority (PBT) requirements 	<ul style="list-style-type: none"> Site surveys to ascertain existing site conditions. 	DOE PBT

Note: 1)The list above is indicative and non-exhaustive, and to be suited according to the project.. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.

Table 4-4 Study Areas For First Schedule and Second Schedule EIA

Study Reference	Approving Agency	First Schedule Activity 12 (a): Land-based aquaculture of more than 20 hectares but less than 50 hectares		Second Schedule Activity 12 (a): Land-based aquaculture of more than 50 hectares	
		Landward Only	Coastal & Sea	Landward Only	Coastal & Sea
<ul style="list-style-type: none"> ○ Slope Analysis (Landward) ○ Terrain and slope classification 	JMG JKR	√	√	√	√
<ul style="list-style-type: none"> ○ Erosion and Sediment Control (Landward) ○ LD-P2M2 ○ Erosion and Sediment Control Plan (ESCP) 	DOE DID	√	√	√	√
<ul style="list-style-type: none"> ○ Pollution Study ○ Sewage ○ Wastes (Biomass, Scheduled Waste, Construction and Demolition, Domestic, etc.) 	DOE National Solid Waste Management Department (JPSPN) Local Authority (PBT)	√	√	√	√
<ul style="list-style-type: none"> ○ Baseline Sampling ○ Water (estuarine/marine), air, noise, and/or vibration 	DOE	√	√	√	√
<ul style="list-style-type: none"> ○ Bathymetric Survey¹ 	National Hydrographic Centre (NHC)/DID	-	√	-	√
<ul style="list-style-type: none"> ○ Hydraulic Study (Incl. Water Quality Modelling, e.g., Sediment Plume) 	DID	-	√	-	√

Study Reference	Approving Agency	First Schedule Activity 12 (a): Land-based aquaculture of more than 20 hectares but less than 50 hectares		Second Schedule Activity 12 (a): Land-based aquaculture of more than 50 hectares	
		Landward Only	Coastal & Sea	Landward Only	Coastal & Sea
○ Shoreline Assessment ²	DID	-	√	-	√
○ Ecological Habitat Mapping ³ ○ Coral Reefs ○ Seagrass beds ○ Mangroves ○ Wetlands ○ Forest reserves	Department of Marine Park Malaysia PERHILITAN JPSM Department of Fisheries (DOF)	√	√	√	√
○ Flora and Fauna Assessment ○ Terrestrial, aquatic, and/or marine	Department of Marine Park Malaysia/ PERHILITAN JPSM DOF	√	√	√	√
○ Carrying Capacity Study ⁴	PLANMalaysia	As required by the relevant Government Agencies (GAs).			
○ Soil Investigations (SI)	JMG/JKR				
○ Geotechnical Report	JMG/JKR				
○ Fisheries Resource Assessment	DOF				
○ Marine Risk Assessment (MRA)	Marine Department, Peninsular Malaysia Port Authority				

Study Reference	Approving Agency	First Schedule Activity 12 (a): Land-based aquaculture of more than 20 hectares but less than 50 hectares		Second Schedule Activity 12 (a): Land-based aquaculture of more than 50 hectares	
		Landward Only	Coastal & Sea	Landward Only	Coastal & Sea
○ Land use Compatibility	PLANMalaysia				
○ Social Impact Assessment (SIA)	PLANMalaysia				
○ Traffic Impact Assessment (TIA)	JKR				
○ Health Impact Assessment (HIA)	MOH				
○ Heritage Impact Assessment	Department of National Heritage				

Notes:

- (i) ¹ Requirements to be based on the Guidelines for Preparation of Coastal Engineering Hydraulic Study and Impact Evaluation (DID, 2001).
- (ii) ² Requirements to be based on DID Manual Volume 2 – Coastal Management (DID, 2009).
- (iii) ³ Studies to be carried out if the project site is adjacent to ESAs as defined by PLANMalaysia.
- (iv) ⁴ Carrying capacity shall be based on PLANMalaysia criteria and requirements (physical; infrastructure and utilities; and beach area) as defined in the Laporan Tahap Tampungan dan Garis Panduan Pembangunan Pulau (JPBD, 2006) or similar methodologies for tourism and recreational projects only.

The list above is indicative and non-exhaustive, and to be suited according to the project.. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.



5

*Photo Source: Floating Freshwater Farm, Batang Ai, Sarawak
Fanli Marine & Consultancy Sdn Bhd*

PREDICTING AND EVALUATING IMPACTS

CHAPTER 5. PREDICTING AND EVALUATING IMPACTS

5.1 IMPACT ASSESSMENT AND EVALUATION OF SIGNIFICANCE

At this stage of the study, the physical and ecological characteristics of the study site, as well as the sensitive receptors present will be known following the collection and analysis of baseline data. At the same time, details of key project activities would also be confirmed from discussions with the Project Proponent.

The next step would be to predict and evaluate the environmental impacts that are likely to occur due to the implementation of the particular fishery project in a particular environmental setting. An accurate and balanced evaluation will allow appropriate measures to be prescribed to mitigate impacts to acceptable levels, as well as compensation mechanisms for permanent significant impacts that cannot be mitigated.

The spatial and temporal attributes of each impact should be described. This includes the location, spatial extent, duration, permanence, and magnitude. As far as possible, the cumulative impacts that factor in adjacent developments, as well as secondary / derivative impacts, should also be evaluated.

There are many methods to assess environmental impacts. Generally, all methods of impact assessment seek to compare the existing environment against a predicted future environment caused by various project activities during different phases of project implementation.

Predictions and assessments are made through qualitative or quantitative approaches and methods that form the basis of evaluation. While there is no one method that fits all requirements, the predictive and assessment method chosen must have at least the following attributes

<p>Established and proven methods and models</p>	<p>Adequate, accurate and up-to-date data for assessment</p>	<p>Results can be replicated and is reproducible by independent evaluators</p>	<p>Cost-effective and for any software, it can be purchased (propriety software and tools can also be used). If possible, widely accepted freeware is encouraged</p>
--	--	--	--

The Qualified Person is tasked to select the best method to conduct the assessments and/or generate practical scenarios from reliable datasets to ascertain the magnitude, extent and significance of impacts from the project. Only significant issues shall be assessed in detail in

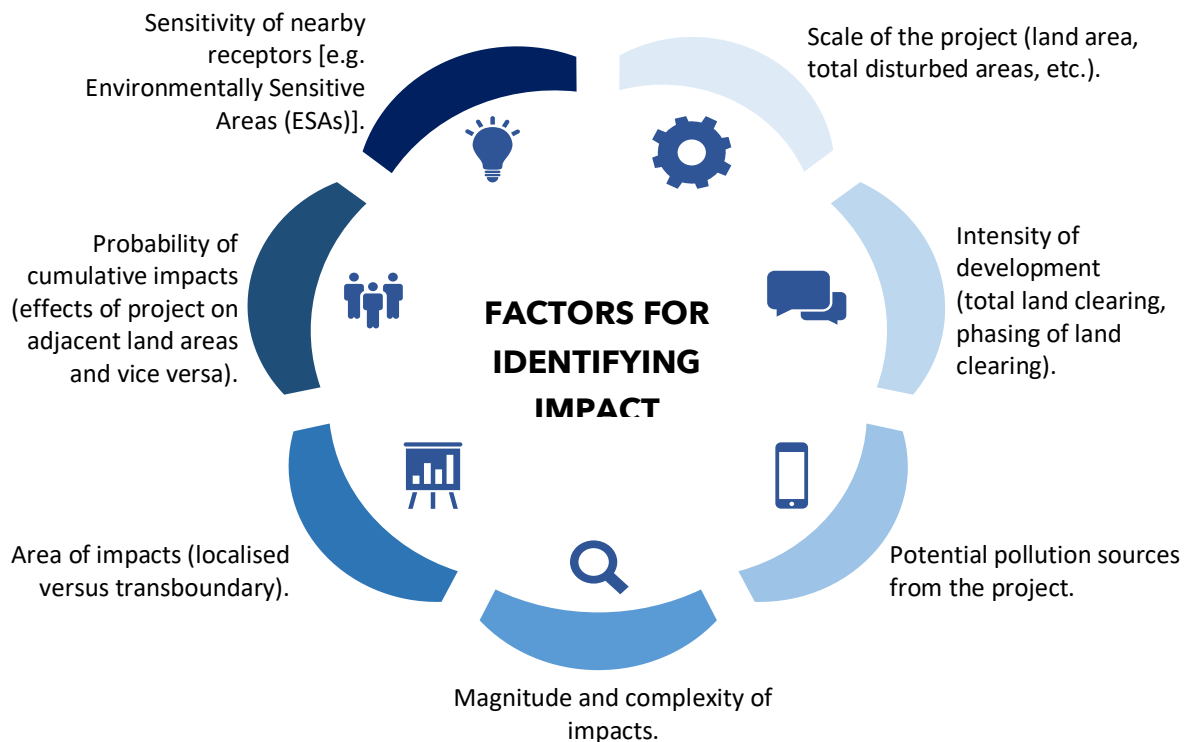
the EIA. Issues that are not significant should only be addressed qualitatively, with justifications of its non-significance.

5.2 TYPICAL IMPACTS OF FISHERY PROJECTS

The Scoping Exercise would have determined the types of studies that need to be carried out during the EIA stage. Hence, the endorsed TOR need to be referred in order to ensure the EIA is focused.

5.2.1 Determining the Impacts Due to the Prescribed Activity

The level of details in the impact identification shall commensurate with the following factors:



Typical Issues and impacts, and their respective issues of concern are as listed in **Table 5-1**.

Table 5-1 Fisheries and Aquaculture-Related Activities and Potential Environmental Impacts

Activity	Potential Impacts	Issues of Concern
Site clearing	<ul style="list-style-type: none"> Land acquisition: Displacement and loss of livelihood. Civil works such as earth moving: Dust pollution, noise pollution, loss of biodiversity. 	<ul style="list-style-type: none"> Soil Erosion Loss of flora and fauna. Water pollution (silt). Air and noise pollution.

Activity	Potential Impacts	Issues of Concern
	<ul style="list-style-type: none"> • Site runoff: Increase in erosion/sediment deposition. • Influx of construction workers: Pressure on local resources and amenities. • Heavy equipment movement and operation: Noise pollution, dust generation, annoyance, and health impacts on workers. • Habitant fragmentation and loss of habitat. 	<ul style="list-style-type: none"> ○ Groundwater contamination. ○ Social concerns. ○ Loss of biodiversity.
Overburden and stockpiles	<ul style="list-style-type: none"> • Land degradation. • Land instability from incorrect earth removal or unstable deposition of spoil, leaving landslides or erosion. • Discharge of sediment into water courses affecting aquatic habitat. • Dust emissions affecting amenity and health. 	<ul style="list-style-type: none"> ○ Waste management. ○ Soil erosion. ○ Air and noise pollution. ○ Loss of biodiversity.
Material handling (loading / unloading, transfer, storage, etc.)	<ul style="list-style-type: none"> • Air pollution, public nuisance, and occupational health hazard. 	<ul style="list-style-type: none"> ○ Air and noise pollution. ○ Waste (municipal wastes). ○ Safety and health (vector-borne disease).
Noise and vibration from machinery and traffic	<ul style="list-style-type: none"> • Annoyance/disturbance. • Damage to structures due to ground vibrations. 	<ul style="list-style-type: none"> ○ Scheduled waste management. ○ Air and noise pollution.
Storage and use of fuel and chemicals.	<ul style="list-style-type: none"> • Contamination of local water resources. 	<ul style="list-style-type: none"> ○ Waste (spoil, municipal, scheduled wastes). ○ Air pollution (odour). ○ Health impact (disease, vectors, accidents). ○ Social concerns.
Altering Water flow	<ul style="list-style-type: none"> • Reduced water flow from streams. • Changes in water flow direction. • Increased stormwater runoff. 	<ul style="list-style-type: none"> ○ Hydrological changes. ○ Water pollution (silt).
Site Restoration	<ul style="list-style-type: none"> • Erosion and landscape scarring after project abandonment. • Weed infestations. 	<ul style="list-style-type: none"> ○ Visual / aesthetics.

Note:

The list is not exhaustive and is usually specific to the Project and site conditions. For the study, it is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance

5.3 ENVIRONMENTAL IMPACTS OF FISHERIES PROJECTS

Some of the main environmental impacts of fisheries projects are given below. A sample environmental assessment matrix to assist to identify significant impacts of projects is given in **Appendix 3**.

5.3.1 Ecological Impact

Assessment Requirements	<ul style="list-style-type: none"> (i) Ascertain the extent and conditions of reefs, seagrass meadows, and other important habitats. If it involves a large area, sonar methods and other mapping techniques can be carried out to determine the substrate and live coral cover, supplemented with spot diving to verify the findings. In marine parks, coral transects may have to be laid to gather data. (ii) Development of an inventory of existing flora and fauna (terrestrial, aquatic, estuarine, and marine) in the project area and surrounding impact zones to ascertain the level of biodiversity. (iii) Identification of critical species benchmarked with the lists published by the International Union for Conservation of Nature (IUCN) red list or similar references. The assessment can be based on field surveys (coral transects, dive observations, animal trapping, baiting, camera traps, and observations of secondary animal signs) or literature review to produce the inventory. (iv) Recommendation of mitigation measures if there is important flora and fauna that need relocation or protection.
Evaluation of Impacts	<ul style="list-style-type: none"> (i) Determine the level of encroachment into ESAs such as permanent reserved forests (PRF) or ecologically rich habitats (mangroves, coral reefs, seagrass beds, mudflats, fishery zones, etc.). (ii) Indication of possible loss of habitat and its flora and fauna, which may include endemic, rare, endangered, threatened, and/or near extinct species. (iii) Identify project activities that could disturb animal behaviour, leading to their dispersal or limiting their range. (iv) Impacts from pollution such as nutrients, sewage, and oil spills on the ecosystem. (v) Effects of increased accessibility to the project site and opening up of pristine areas, e.g., to establish access roads, leading to poaching risks. (vi) Impacts of increased human-wildlife conflicts (HWC). (vii) Impacts from operational activities to the integrity of the coastal ecosystem.
Output	<ul style="list-style-type: none"> (i) Highlight important areas (through the habitat map) that should not be built on, or if there is no other option, to determine suitable mitigation measures to minimise the impacts or replace the lost area. (ii) Identification of critical areas to incorporate mitigation measures such as viaducts to allow safe passage of animals or the need to translocate important species of corals at risk from the project and how to go about it. (iii) Develop a wildlife management plan.

5.3.2 Hydrology and Hydraulics

Assessment Requirements	<ul style="list-style-type: none"> (i) Determination of the level of change due to construction on the local hydrology and hydraulics in terms of waves, water level, etc. (ii) Determination of the extent of pollutant dispersal, such as fine sediments, to the surrounding waters and areas that impact environmentally sensitive areas (ESA). (iii) Assessment of the extent of impacts on ESAs, economic activities, and ecosystem services due to the changes.
Evaluation of Impacts	<ul style="list-style-type: none"> (i) Conduct a hydraulic study to develop a model of the regional and local hydrological and hydrodynamic conditions of the coastal areas around the project site. (ii) Develop scenarios to assess the impacts from the project activates under different conditions such as the level of development, tidal conditions, and seasonal changes. (iii) Simulate the extent of change for waves, water level, currents, etc. and their impacts on ESAs based on these scenarios. (iv) Assess the effectiveness of proposed best management practices (BMPs) in reducing impacts.
Output	<ul style="list-style-type: none"> (i) Visual maps representing the degree of change of the coastal parameters under different conditions. (ii) Determination of the level of change at the sensitive receptors to determine potential impacts. (iii) Identification of the best construction method, layout, and conditions that will minimise impacts.

5.3.3 Erosion and Sedimentation / Coastal Erosion

Assessment Requirements	<ul style="list-style-type: none"> (i) Assessment of the scale of land clearing and removal of vegetative cover at the site to determine the rate of erosion. (ii) Assessment of the conditions of the hydrological and drainage systems and how they may be altered as streams and rivers are diverted and/or become silted up or filled in, leading to increased runoff volume and velocity while their retention time and infiltration rates are reduced. (iii) Assessment of the extent of erosion and sedimentation that will also affect aquatic ecology and water pollution downstream. (iv) Determination of existing coastal morphology and landforms, to determine erosional and accretion areas. (v) Identification of suitable BMPs and mitigation measures to reduce the effects of erosion and sedimentation.
-------------------------	--

Evaluation of Impacts	<ul style="list-style-type: none"> (i) Calculate the rate of soil erosion and sediment yield using standard formulae and site-specific information (surveys, soil particle analysis, terrain characteristics, hydrological data, etc.), to determine the extent of erosion and sedimentation as a result of land clearing. (ii) Provide erosion scenarios such as with or without mitigation measures in the assessment. (iii) Run simulation to determine the best management practices (BMPs) that shall be adopted to minimise the negative effects
Output	<ul style="list-style-type: none"> (i) Adoption of avoidance principles in the design and layout of the project to avoid sensitive areas or in designing technical and engineering solutions to minimise erosion and sediment plume. (ii) Identify suitable BMPs to be incorporated in the project through the land-disturbing and pollution prevention and mitigation measures (LDP2M2) based on the modelling results and also P2M2 for sediment plume control. (iii) Identify buffers and setbacks for structures due to changes in the coastline.

5.3.4 Water Quality

Assessment Requirements	<ul style="list-style-type: none"> (i) Assessment of the types and scale of impairment to water quality of the rivers and coastal waters at the project site and the surrounding areas. (ii) Determination of potential sources that include siltation from land clearing and earthworks, sewage and sullage discharge from worker quarters and oil and grease (O&G) spills. (iii) Determination of the extent of sediment plume spread under the different coastal conditions and their impacts on aquatic sensitive areas. (iv) During operations, improper treatment of sewage can also contribute to increased nutrients into the nearby waters, leading to their ecological degradation and thus its impacts on users need to be ascertained.
Evaluation of Impacts	<ul style="list-style-type: none"> (i) There are a variety of models to determine the pollution loadings in rivers and waterways. Choose the most suitable model to simulate the loading and determine the magnitude and extent of the impacts further downstream, especially for key water pollutants indicators [biochemical oxygen demand (BOD), ammoniacal nitrogen (AN), and coliform]. (ii) At the project site, identify potential water polluting sources (toilets, etc.). This will determine the development of BMPs for the site. (iii) Determine impacts from sediment plume (see also Erosion and Sedimentation) at the project site and surrounding areas. (iv) Determine whether the pollution load will affect any sensitive receptors.
Output	<ul style="list-style-type: none"> (i) Suitable BMPs and treatment systems identified to minimise the effects of discharges to the waterways, e.g., silt traps (on land only), sewage treatment systems, silt curtain, etc. (ii) Effectiveness of the BMPs can be simulated to estimate load reductions, ensuring pollutants are controlled at-site to reduce off-site impacts to meet the requirements and standards of various agencies.

5.3.5 Socio-Economic Impacts

Assessment requirements	<ul style="list-style-type: none"> (i) The key feature is to determine whether there is land and property acquisition and relocation of communities. These issues often cause psychological, emotional, and impacts to those who are affected and have to be handled with great care. (ii) Assessment of the views and perception of the affected stakeholders (fishermen, aquaculture farmers, tourism operators, etc.) and if their inputs, recommendations and requirements of the project and mitigation measures to address their concerns. (iii) The determination of the carrying capacity of coastal and marine parks is crucial. Future activities shall not exceed the carrying capacity, which may result in deterioration of the environment, increase in utility and amenity demand, impair natural resources, and degrades the quality of tourism and recreational services.
Evaluation of Impacts	<ul style="list-style-type: none"> (i) Identify the extent of land acquisition and affected stakeholders. (ii) Delineate the survey catchment and statistically determine the number of representative surveys required to ensure reliability and representativeness of stakeholders. For the EIA, the impacts are evaluated mainly on the communities living within the Zone of Study (ZOS). If necessary, those in the ZOI will also be assessed in terms of the impacts on them. (iii) Data for surveys can be obtained through FGDs, interviews, and site questionnaire surveys. Findings shall be analysed, and the output assessed. (iv) The main findings of the Social Impact Assessment (SIA) shall be incorporated in the EIA.
Output	<ul style="list-style-type: none"> (i) Land and property acquisition and relocation of communities must be first be settled by the Project Proponent prior to EIA commissioning and submissions. (ii) The findings from the social impacts, mainly from surveys and focal group discussions (FGDs) can be contentious and often skewed. Therefore, the assessments should have overall on-the-ground reviews even after the surveys are interpreted by the Qualified Person. (iii) Assessment of the carrying capacity of the coastal areas to determine any exceedance, including the increase in infrastructure, amenities, and utilities to sustain the increase in people and tourists during and post-construction.

5.3.6 Air Quality and Noise

Assessment requirements	<ul style="list-style-type: none"> (i) Air Quality: Identification of potential air pollution generating sources from the project site and nearby sensitive receptors that may result in elevated dust levels and dispersions from construction works. (ii) Noise Levels: Assessment of high ambient noise environment and activities that pose impairment hazards to the workers and any nearby receptors from machineries and equipment on-site. Underwater noise impacts shall also be ascertained if there are any underwater project activities that may result in increase in noise levels, e.g., piling, dredging, etc.
-------------------------	--

Evaluation of Impacts	<ul style="list-style-type: none"> (i) Air Quality: Air quality models are mainly Gaussian-based, and many are available in the market. Use the most suitable one to simulate the air pollutant dispersion patterns and map them to determine the range of impacts. The level of pollutants pre- and post-development shall be assessed for the major sensitive receptors. (ii) Noise levels: This again can be modelled or calculated based on the increase in noise levels, mapped as noise contours over a given area.
Output	<ul style="list-style-type: none"> (i) Both model simulations shall identify the extent of the effects from a pollution source, the level of pollutants at nearby receptors, and the potential effects of these pollutants. (ii) Critical levels for pollutants at sensitive receptors shall be identified to be mitigated to ensure the levels are within acceptable limits and to ensure those working in such areas are protected against.

5.3.7 Waste Management

Assessment Requirement	<ul style="list-style-type: none"> (i) Identification of the types of wastes generated during construction and operations such as biomass, scheduled, construction, domestic and municipal wastes, and their impacts. (ii) Assessment of the impacts from these wastes and required management measures required to be carried out.
Evaluation of Impacts	<ul style="list-style-type: none"> (i) Identify and estimate the quantum of all waste sources with the assistance of technical and engineering consultants. (ii) Assess the severity of impacts from improper management of such wastes on water quality (leachate), odour, air quality and public health. (iii) Identify the locations of temporary storage areas within the project site. (iv) Identify locations where the wastes will be eventually disposed off.
Output	<ul style="list-style-type: none"> (i) Identification of proper temporary disposal sites and storage facilities for waste generated on-site, including mitigation measures against spillage and other impacts. (ii) Mitigation measures for proper waste management to be incorporated into project site management to ensure that all wastes are properly managed and disposed of at designated locations so as not to pollute the environment.

5.3.8 Land Traffic

Assessment Requirement	<ul style="list-style-type: none"> (i) Description of how construction materials, workers, and machinery are mobilised to/from the construction site. Higher vehicle volumes can cause congestion, damaged roads, material spillage, and an increased risk of road accidents. (ii) Identify the need for mitigation measures during construction and operational phases for traffic management.
------------------------	---

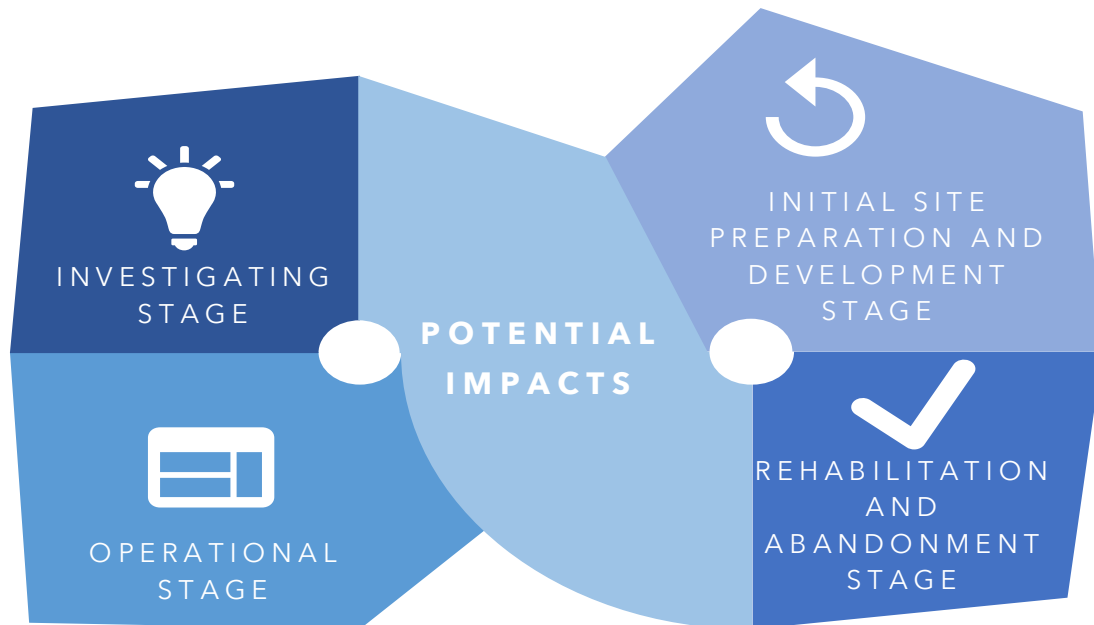
Evaluation of Impacts	<ul style="list-style-type: none"> (i) Review and incorporate the main findings from the land traffic assessments in the EIA. The Traffic Impact Assessment (TIA) is carried out separately by a Traffic Consultant and endorsed by the Public Works Department (JKR). (ii) The main concern in the EIA (risk to accidents, air quality, public health), are communities living along the coastal areas during construction. (iii) During the operation phase, the extra volume of traffic generated by the project will also affect the same communities and will be evaluated.
Output	<ul style="list-style-type: none"> (i) Potential issues related to land traffic and incorporation of structural and non-structural measures to address the issues as proposed in the TIA. (ii) Identification of risk factors from various activities to communities such as from accidents, health, etc.

5.3.9 Safety and Health

Assessment Requirements	<ul style="list-style-type: none"> (i) Construction entails higher risks to the safety and health of the workers and any surrounding communities from pollution, diseases, accidents, and hazards, and these risks are to be assessed. (ii) The risk assessment should be correlated with land transport, as there are risks to the public and the environment.
Evaluation of Impacts	<ul style="list-style-type: none"> (i) Use risk assessment models to determine the level of risk from specific activities. (ii) Determine the level of risk to neighbouring receptors to determine whether the level is within acceptable levels. (iii) In terms of health, surveys on existing health conditions of receptors can assist in monitoring for sudden decrease in community health during pre- and post- project implementation. (iv) For workers, possible impacts on their safety and health in the line of work shall be assessed, e.g., working in high noise areas, handling hazardous materials, confined spaces, at height, etc.
Output	<ul style="list-style-type: none"> (i) The qualitative/quantitative risk to receptors can assist to determine the types of BMPs necessary to reduce the risks. (ii) The findings of the Health Impact Assessment (HIA) can also provide possible preventive and mitigation measures to protect worker and community health during construction and operation.

5.4 TYPICAL IMPACTS AT VARIOUS STAGES OF FISHERIES PROJECTS

Breaking down a project into its basic components or activities is a systematic means of identifying the primary sources of environmental impacts. The impacts that typically occur during the various stages of fisheries projects are detailed below.



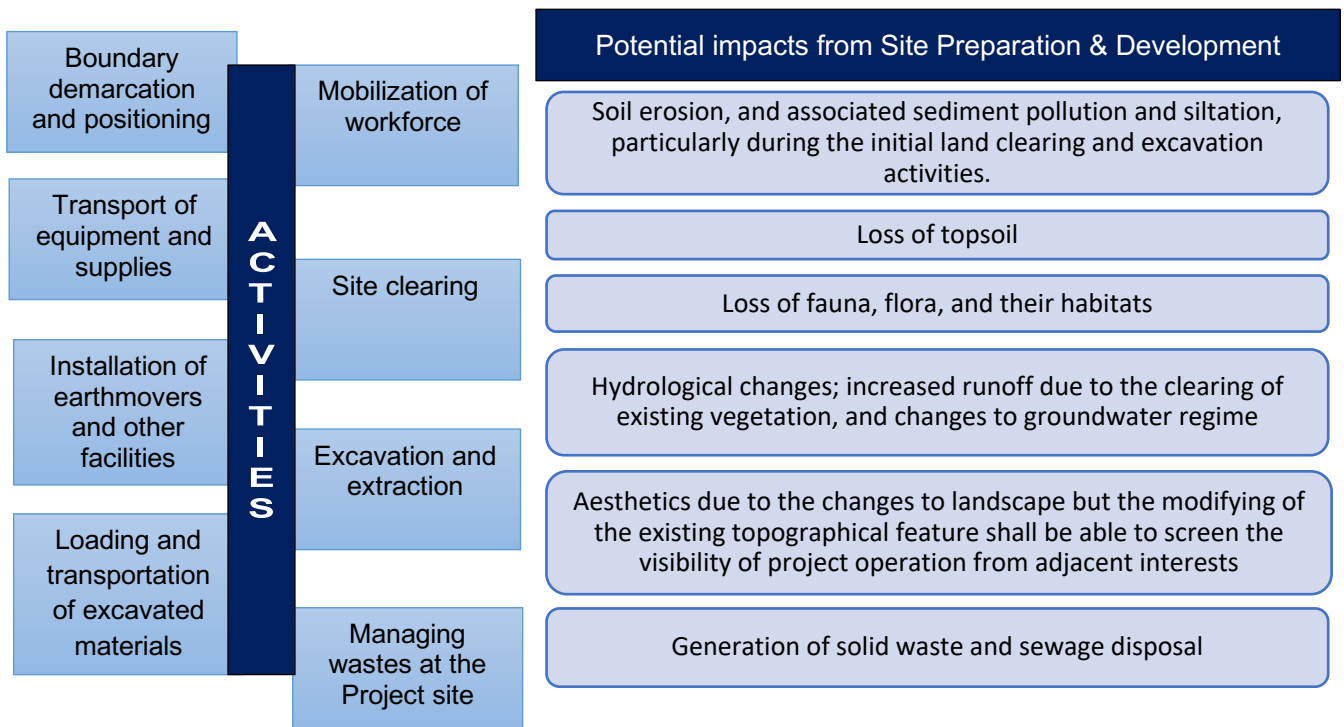
5.4.1 Potential Impacts During the Investigating Stage

The main activity during the investigation stage is the prospecting exploration study and the EIA. The exploration stage normally requires mobilisation of manpower and equipment involving the movement of vehicles, primarily along existing roads. During the actual exploration, the main activities are field reconnaissance, surveying, and mapping.

Site-specific investigation requires limited establishment of access tracks and paths and the stationing of equipment and personnel at locations throughout the study site for a limited period of time. All these activities involve the use of portable equipment and tools that can be easily transported to the site. Small clearings and narrow trails in primary vegetation are also required for field reconnaissance and surveying purposes. In a hot and humid climate, it normally takes only a few months for an abandoned clearing to be recolonised by the vegetation.

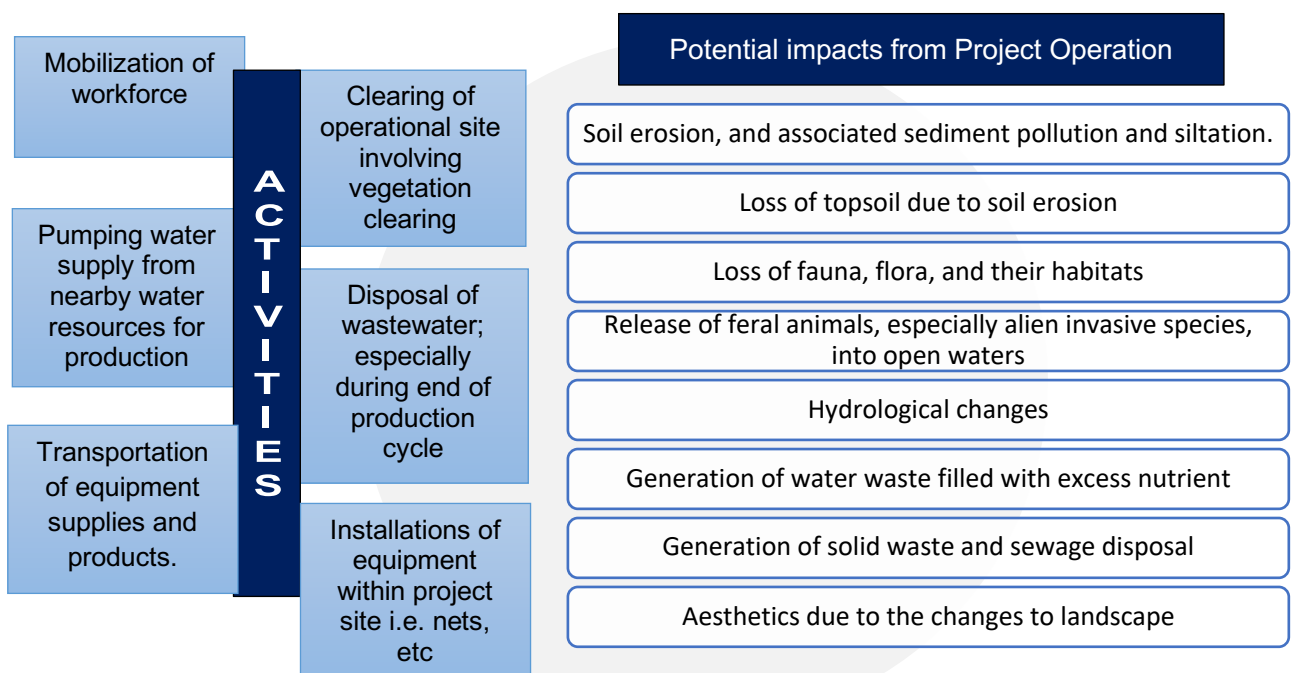
5.4.2 Potential Impacts During Initial Site Preparation and Development Stage

The initial stage of site preparation and development should involve several main activities, which may have potential impacts on the environment. Main activities from site preparation and development stage are:



5.4.3 Potential Impacts During Operational Stage

The operational stage of the project shall be a continuous lifelong activity. The main activities during the operational stage include the following:



5.4.4 Potential Impacts During Rehabilitation and Abandonment Stage

Environmentally, restoration and rehabilitation are perhaps the most important activities of a fisheries and aquaculture project for the abandonment stage. The main activities involved in this stage are as follows:

- Open up the bund to allow the access of river/sea water into the worked area.
- Afforestation by re-vegetate the worked-out area or any identified area which are affected by project activities with mangrove trees or any suitable plants

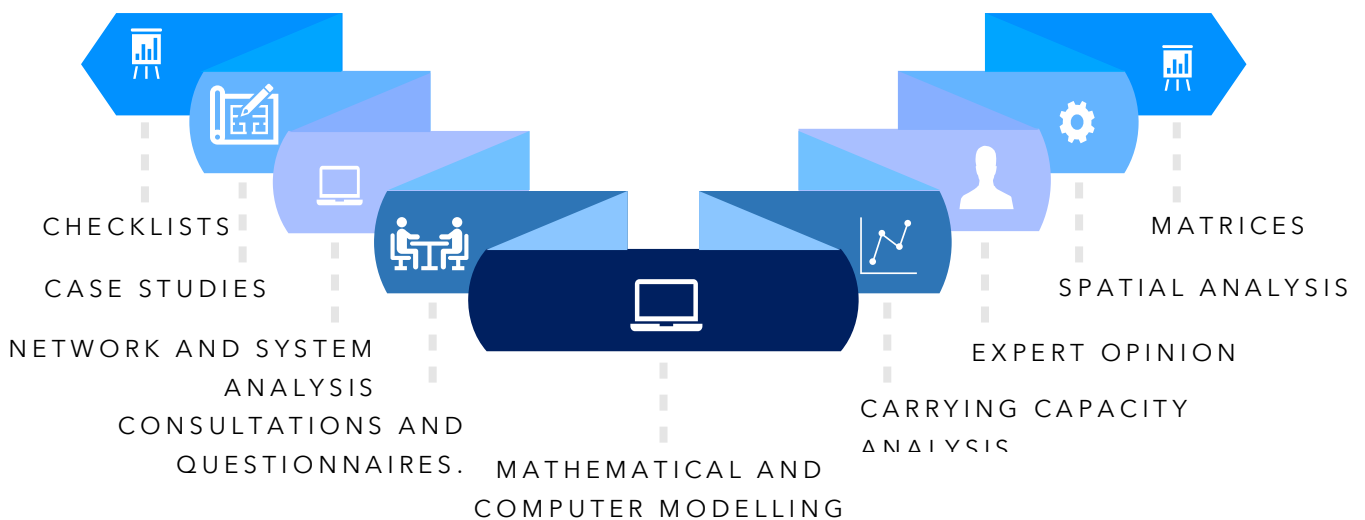
The rehabilitation programme of any aquaculture operation is designed to restore the disturbed site. However, some adverse impacts may arise during the process of rehabilitation, or if the affected area are simply abandoned without any restoration. Such potential impacts include the following:

- Soil erosion and associated sediment pollution and siltation. However, once tasks are completed, these adverse impacts will be neutralised.
- Fauna, flora, and their habitats; if the worked-out area is not rehabilitated, it will eventually be filled with stagnant water, thus changing the habitat of the area concerned; if the areas are properly restored and revegetated, the forest environment may be re-created, and the fauna may return.



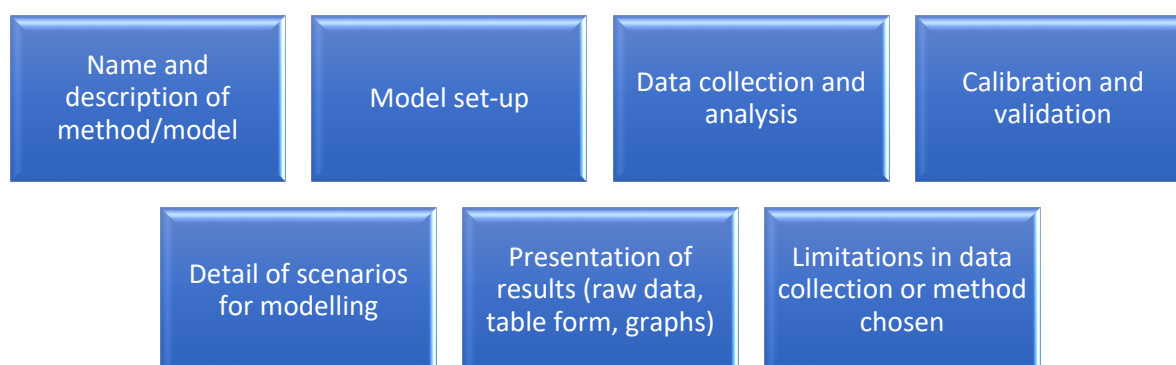
5.5 PREDICTIVE METHODS AND TOOLS

There is a wide range of predictive tools and models for prediction, evaluation, and assessment of impacts. Among the methods and tools are:



A simple methodology is preferred, although this depends on the complexity of the impacts. Whichever method is chosen, it must be appropriate to address the problem taking into account the local conditions of the site.

The EIA report must be scientifically and technically sound, and when necessary, quantitative impact prediction on the most significant impacts should be carried out. If computer modelling is carried out, e.g. for water and air quality assessment, flooding etc., the following information is required:



All modelling exercises carried out should capture the impacts under various scenarios, either for short-, mid- to long-term for the worst-case scenario. The modelling studies shall undergo verification, calibration, and validation. The outputs of the modelling studies shall be presented in a concise manner and all uncertainties shall be discussed. Technical reports, data analysis, tables, and raw data, where necessary, shall be included as an appendix in the EIA to support the impact assessment methodology.

Ultimately, the main text for impact assessment in the EIA shall be the predictive results and outputs of the studies, which must be in sufficient technical details to support the assessment. It must also be written in a manner that is easily understood by decision makers and the public.

Tables 5-2 summarise examples of the available and accepted prediction methods for impact assessment and expected results.

Table 5-2 Examples of Prediction Methods for Environmental Impacts

Impacts	Prediction Methods	Output
Hydraulic and Hydrodynamics	<ul style="list-style-type: none"> • Use of hydraulic and hydrodynamic models that meet the requirements of the Department of Irrigation and Drainage (DID). • 2D/3D modelling software, e.g., Delft3D including D-Flow module to investigate hydrodynamics pattern, dispersion of sediment transport and coastal morphological processes. 	<ul style="list-style-type: none"> • Dispersion of sediments (concentration and extent) from construction works. • Changes in the wave, water level and current condition at the project site during and after project implementation.
Erosion and Sedimentation	<ul style="list-style-type: none"> • Revised Universal Soil Loss Equation (RUSLE). • Modified Universal Soil Loss Equation (MUSLE). • Computer models. 	<ul style="list-style-type: none"> • Soil loss rates and sediment yield. • Erosion risk and potential soil loss maps.
Hydrology	<ul style="list-style-type: none"> • Hydrological Procedures (DID). • Computer models for estimating peak flood, runoff, watershed analysis, flood plain hydraulics, etc. Examples include HEC-HMS, HECRAS, FLO-2D, TUFLOW, EXTRAN, and Storm Water Management Model (SWMM). • Hydrological analysis according to Manual Saliran Mesra Alam Edisi-2 (MSMA-2) and approved by DID. 	<ul style="list-style-type: none"> • Estimation of pre-construction and post-construction runoff. • Flood risk map.
Water Quality	<ul style="list-style-type: none"> • Mathematical models (one, two, or three-dimensional) analysis of pollution loads and dispersion in the waterways, such as QUAL2K, MIKE11, etc. • Simple mass balance models, e.g., Streeter-Phelps Model. • Operational sewage discharge modelled using Qual2K or Delft3D or MIKE11. 	<ul style="list-style-type: none"> • Estimation of TSS (erosion) and BOD and AN (sewage) concentration affecting a stretch of river and downstream sensitive areas. • Estimation of pollution load and extent of effect on sensitive receptors.
Air Quality	<ul style="list-style-type: none"> • Gaussian plume dispersion model to assess dust generation and gas dispersion over an area under the worst-case scenario. 	<ul style="list-style-type: none"> • Dispersion contour map indicating levels at sensitive receptors. • Comparison of computed values with the Malaysian Ambient Air Quality Standards (MAAQS).

Impacts	Prediction Methods	Output
		<ul style="list-style-type: none"> • Determination of the location of the maximum air pollution concentration.
Noise Level	<ul style="list-style-type: none"> • Mathematical models to assess noise levels for point source or linear sources. • Noise modelling software such as SoundPlan, CadNa or Geographic Information System (GIS) acoustic models. • Traffic noise models. 	<ul style="list-style-type: none"> • Quantitative values of noise level at sensitive receptors. • Noise contour map that indicates levels in sensitive areas. • Comparison of computed values to DOE's permissible noise limits.
Ecology	<ul style="list-style-type: none"> • Comparative assessment of conservation status and sensitivity of habitat, flora, and fauna. • Ecological models for species diversity and population change. • Limit of Acceptable Change (LAC). • Spatial models such as GLOBIO3. • Impacts of feral release, especially of alien invasive species 	<ul style="list-style-type: none"> • Habitat map. • Species inventory, especially of rare, endangered, threatened, and near-extinction species that may require protection.
Social Impacts	<ul style="list-style-type: none"> • Social and economic surveys of the affected population. • Perception survey to ascertain the acceptance of the project. • Social Impact Assessment (SIA). 	<ul style="list-style-type: none"> • Socio-economic profiling. • Public opinion survey results. • Stakeholder feedback for EIA including possible mitigation measures.
Land use	<ul style="list-style-type: none"> • Compatibility assessment based on structure plan, local plan, and other guidelines. • Adherence to the required setback based on national and state guidelines. 	<ul style="list-style-type: none"> • Landuse compatibility and buffer requirements
Public Health	<ul style="list-style-type: none"> • Qualitative/quantitative health risk assessment (HRA) encompassing hazard identification, exposure assessment and risk characterisation. 	<ul style="list-style-type: none"> • Potential health impacts to the nearby population.
Biomass	<ul style="list-style-type: none"> • Estimation of total biomass based on vegetation types and values of published studies. 	<ul style="list-style-type: none"> • Predicted biomass waste generation.

Impacts	Prediction Methods	Output
Scheduled Waste	<ul style="list-style-type: none"> • Identification of the potential generation of scheduled waste during construction and operations based on project activities. 	<ul style="list-style-type: none"> • Predicted scheduled waste generation.
Solid Waste	<ul style="list-style-type: none"> • Waste generation estimation based on population. 	<ul style="list-style-type: none"> • Predicted scheduled waste generation.
Traffic	<ul style="list-style-type: none"> • Traffic impact assessment including simulation of peak traffic flows under various scenarios and junction analysis, e.g., Signalised and unsignalised Intersection Design and Research Aid (SIDRA). 	<ul style="list-style-type: none"> • Comparison of traffic scenarios before and after the project and need for road improvements.
Infrastructure and Utilities	<ul style="list-style-type: none"> • Existing demand estimation methods by regulators, e.g., population equivalent (P.E.) calculations [National Water Services Commission (SPAN)]. • Comparison of existing supply to meet future demand to determine suitability. 	<ul style="list-style-type: none"> • Estimates of Demand
Aesthetics	<ul style="list-style-type: none"> • Visual assess. • Document the scenic and aesthetic value of the area. • 2-D and 3-D Viewshed Analysis. • Economic valuation. 	<ul style="list-style-type: none"> • Before and after scenarios.

Note: The list above is non-exhaustive and provides as a guide for consideration when undertaking the impact assessment. It is important that suitable assessment methods for the intended output are carefully identified and selected relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant method required for environmental assessment and compliance.

5.6 CRITERIA AND STANDARDS

The significance of an environmental impact can be gauged by benchmarking the assessment findings and predictions against relevant standards and criteria, including:



The method to determine the level of significant impact is to benchmark the results against the stipulated current criteria and standard limits imposed under the EQA 1974 and other governing policies, standards and limits. **Table 5-3** provide a list of the evaluation criteria for various environmental components to be used as a guide. On the basis of the prediction methods and tools, the outcomes shall be derived. In situations where there are no local standards or limits, regional and international examples of limits and adherence levels can be adopted based on expert opinion of the Qualified Person. However, the chosen criteria and standards must be suitable and relevant to local conditions.

5.7 OUTCOMES FROM IMPACT ASSESSMENT

NO IMPACT

This scenario occurs when there are very low to no sensitive receptors in the vicinity of the project to receive the impacts. Examples are communities that live very far away and are only indirectly affected, such as by increases in traffic on the main roads. Another example is when there are terrain constraints such as steep slopes, but the Project Proponent has decided to redesign the layout without affecting these areas

SIGNIFICANT IMPACT

This scenario is based on the predictive results. In the assessment, if the results showed that the project will generate detrimental impacts, then mitigation measures will have to be provided to address the issues. Any residual impacts should also be clearly stated in the EIA

NON-SIGNIFICANT IMPACT

Impacts will inevitably occur in project development, but they may not result in a significant exceedance of the accepted criteria or standards. An example is TSS from erosion and sedimentation. If the TSS emanating from land clearance that abides by standards stipulated for Class II waters of the NWQS, the impact is classified as nonsignificant, with the level of impact abiding by the stipulated criteria and standards

Table 5-3 Criteria and Standards for Environmental Parameters

Impacts	Evaluation Criteria
<p>Erosion and Sedimentation</p>	<p><u>Guidance Documents</u></p> <ul style="list-style-type: none"> • Guidance Document for Addressing Soil Erosion and Sediment Control Aspects in the EIA Report (DOE, 2016). • Guidance Document for the Preparation of the Document on LDP2M2 (DOE, 2016). • Guidelines for Erosion and Sediment Control in Malaysia (DID, 2010). • Manual Saliran Mesra Alam Edisi-2 (MSMA-2) (DID, 2012). <p><u>Sediment basin/silt trap discharge</u></p> <ul style="list-style-type: none"> • TSS: 50 mg/L or 100 mg/L, depending on locality. • Turbidity: 250 NTU. <p><u>Silt curtain</u></p> <ul style="list-style-type: none"> • TSS: 50 mg/L. • Turbidity: 250 NTU.
<p>Water Quality and Pollution Control</p>	<ul style="list-style-type: none"> • <u>Ambient water quality</u>: National Water Quality Standards (NWQS). • <u>Ambient marine water quality</u>: Malaysia Marine Water Quality Criteria and Standards (MMWQCS). • <u>Sewage discharge</u>: Environmental Quality (Sewage) Regulations 2009. • <u>Toilets and septic tanks</u>: SPAN approved design and requirements.
<p>Flood/Runoff Management</p>	<ul style="list-style-type: none"> • MSMA-2 (DID, 2012) requirements.
<p>Air Quality</p>	<ul style="list-style-type: none"> • Environmental Quality (Clean Air) Regulations 2015. • Malaysian Ambient Air Quality Standards (MAAQS). • MARPOL Annex VI on ship emissions.
<p>Noise Level</p>	<ul style="list-style-type: none"> • The Planning Guidelines for Environmental Noise Limits and, Control 3rd Edition (DOE). • Factories and Machinery (Noise Exposure) Regulations 1989. • UNEP/CBD/SBSTTA/20/INF/8: Scientific Synthesis of the Impact of Underwater Noise on Marine and Coastal Biodiversity and Habitats (UNEP, 2016).
<p>Vibration</p>	<ul style="list-style-type: none"> • The Planning Guidelines for Environmental Vibration Limits and Control 2nd Edition (DOE).
<p>Ecology</p>	<ul style="list-style-type: none"> • International Union on the Conservation of Nature (IUCN) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) listing. • Fisheries Act 1985. • Wildlife Conservation Act 2010. • Forestry Act, 1972 • Feedback from Departments of Fisheries (DOF), Wildlife (PERHILITAN) and Forestry (JPSM).

Impacts	Evaluation Criteria
Land use	<ul style="list-style-type: none"> • Structure Plans and Local Plans. • Environmental Sensitive Area (ESA) Listing under the National Physical Plan-3 (NPP-3) (JPBD, 2016). • Marine Park Management Plan. • Requirements in the National Physical Coastal Zone Plan (NPCZP) (JPBD, 2012). • Local authority requirements.
Land Traffic	<ul style="list-style-type: none"> • Acceptable level of service (LOS) for traffic flows. • Local authority requirement.
Safety and Health	<ul style="list-style-type: none"> • Occupational Safety and Health Act 1994. • Factory and Machinery Act 1967. • Department of Occupational Safety and Health (DOSH) requirements. • International Labour Organisation (ILO) and other guidelines. • Guidance Document on HIA in EIA (DOE, 2004). • EIA Guidelines for Risk Assessment (DOE, 2004).
Treatment Systems	<ul style="list-style-type: none"> • Technical Guidance Document on the Design and Operation of Industrial Effluent Treatment Systems (DOE, 2015). • Technical Guidance Document on Performance Monitoring of Industrial Effluent Treatment Systems (DOE, 2015). • Technical Guidance Document on Performance Monitoring of Air Pollution Control Systems (DOE, 2006).
Social Impacts	<ul style="list-style-type: none"> • Public perception on acceptability. • Social Impact Assessment (SIA) requirements in the context of the Town and Country Planning Act (Amendment) 2017 (Act A1522) for three categories:
Waste	<ul style="list-style-type: none"> • <u>Scheduled wastes</u> • Environmental Quality (Scheduled Wastes) Regulations 2005. • <u>Other wastes</u> • Solid Waste and Public Cleansing Management Act 2007. • Local authority requirements.
Visual Aesthetics	<ul style="list-style-type: none"> • Public perception on acceptability.

Notes:

- (i) **See Appendix 4 for details on specific standards and limits.**
- (ii) **The list above is not exhaustive and to be expanded where required for the specific project and areas of concern. The selection of relevant environmental parameters must be determined to ensure it covers the impacts identified and to be studied. The Project Proponent and Qualified Person shall make reference to the latest standards and requirements by the authorities**



Recirculating Aquaculture System
Source: <https://www.linkedin.com/pulse/recirculating-aquaculture-system-market-global-industry-shivam-singh-1f/>

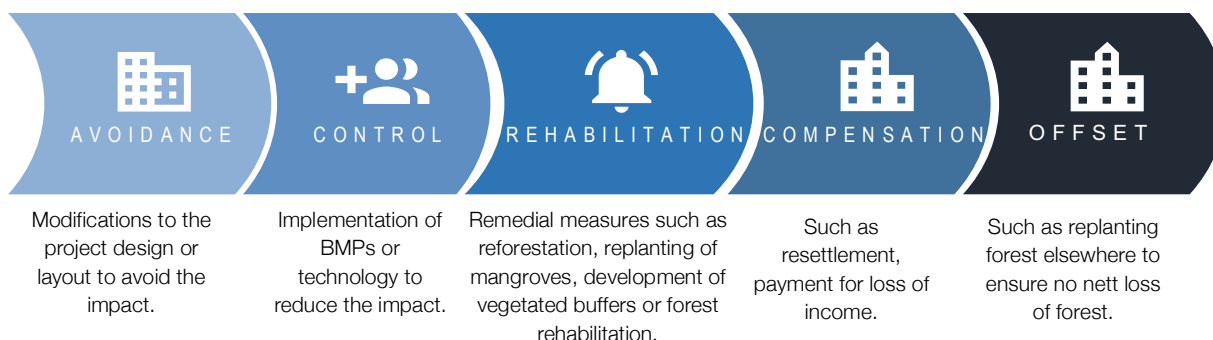


IDENTIFICATION OF MITIGATION MEASURES

CHAPTER 6. IDENTIFICATION OF MITIGATION MEASURES

6.1 ADDRESSING IMPACTS

In general, there are five ways in which an impact can be mitigated.

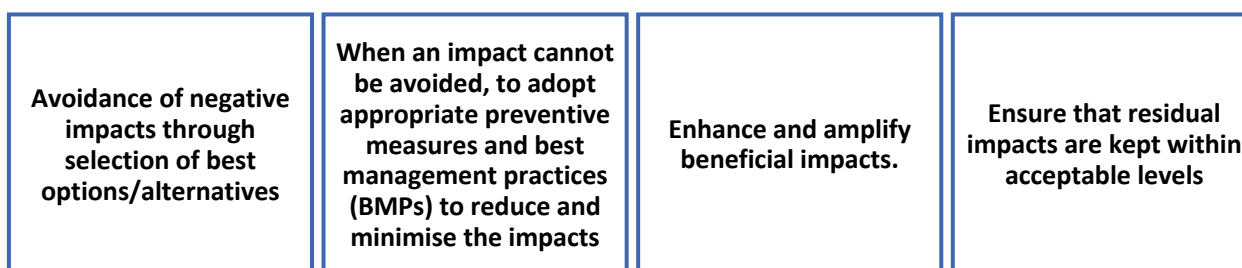


In any case, the Project Proponent should agree and commit to undertake the mitigation measures proposed in the EIA. When cumulative impacts caused by neighbouring developments arise, it may be beneficial to design and coordinate shared mitigation measures amongst the different projects.

6.2 KEY MITIGATION MEASURES

This chapter focuses on Pollution Prevention and Mitigating Measures (P2M2) that serve to address the significant adverse environmental impacts identified during the scoping exercise and impact assessment phases of the EIA. The mitigation measures provided in this chapter serve as a guide only.

The implementation of P2M2 is intended to achieve the following:



6.2.1 Approaches Towards P2M2 Adoption

The Project Proponent and Qualified Person shall recommend alternative measures and/or introduce newer technology whenever these are proven more effective. At the EIA stage, the P2M2 shall be detailed out as best as possible and reported in the EIA Report.

6.2.2 General P2M2s and Best Management Practices (BMPs)

The Qualified Person shall identify and incorporate into the EIA, any additional P2M2 and BMPs required to mitigate significant impacts from the project site. The key P2M2 that are applicable include Ecological Management, Hydraulics and Hydrodynamics, Erosion and Sediment Management and Water Pollution Control. Other minor mitigation measures that may be required include Air pollution control, Noise and Vibration control, Waste management, Safety and Health, Land Traffic, and Visual Aesthetics.

Underpinning principles of P2M2 are to reduce environmental degradation and pollution through management measures best suited to the site conditions & locations to preserve the integrity of the site and to ensure public safety.

Key Approaches:

Extent of the P2M2s shall correspond to the degree of significance of the predicted impact. Once an impact is identified as significant, P2M2s shall be recommended in the EIA (e.g., installation of silt curtains as a means to entrap and contain the spread of the sediment plume during construction, etc.). For minor issues, simple management actions will suffice, e.g., water browsing for dust control at site and hoardings for noise.

Priority shall be given to control at source (e.g., reducing the sediment plume effects within the project site), than to rectify the impacts later on (e.g., maintenance of silt traps and removal of accumulated silt from clogged drainage).

Mitigation must be site- and project-specific. The P2M2s need not be complex and costly, but instead should be practical, easy to implement, and effective.

The P2M2 shall include adequate explanations based on the design and function; and supported by diagrams, illustrations, photos and maps. The technical reports and specifications of the P2M2 shall be included as an Appendix in the EIA.

The use of new technology is encouraged if it can be proven to be effective in mitigating impacts. The Project Proponent or the Qualified Person is responsible to provide proof and supporting evidence that the proposed technology is tried and tested and capable of addressing the impacts.

P2M2s require regular inspection, maintenance, and rehabilitation. These must be incorporated as part of the environmental management requirements of the project, including the allocation of sufficient budget for such a purpose.

The effectiveness of P2M2s shall be recorded and documented as part of the monitoring and audit programmes (**Chapter 7**).

The Qualified Person shall propose best management practices (BMPs), if deemed necessary.

P2M2 and BMP shall be incorporated early into the overall design of the project and as part of the LD-P2M2 document.

The submission of the EIA and the pledge given by the Project Proponent shall reflect a commitment towards ensuring the LD-P2M2s are implemented during all stages of work activities. These efforts shall include, but not limited to, measures, actions, or due diligence in accomplishing the overarching goal of protecting the terrestrial and marine environment and in mitigating the adverse environmental impacts in the process of the proposed project development.

6.2.3 Land Disturbing - Pollution Prevention and Mitigating Measures (LD-P2M2)

The development of the project faces many land and sea-based constraints. LD-P2M2 is used to reduce adverse land impacts, if these cannot be avoided.

- (i) LD-P2M2 is a mandated requirement by DOE under the mainstreaming environmental agenda to affect a paradigm shift toward a culture of guided self-regulation (GSR), placing the onus of environmental protection and management clearly on the Project Proponent to implement and comply.
- (ii) The LD-P2M2 is required as long as there are any land disturbing activities, or land-based activities that interface with the seas; subject to Section 34A of the Environmental Quality Act (EQA) 1974, carried out during project development.
- (iii) LD-P2M2 is an integral part of the EIA process and must be taken into account during the project planning cycle to ensure that the recommendations in the document are incorporated into the project.
- (iv) During project implementation, it should act as key reference document for the Project Proponent, Contractors, and Environmental Officer (EO) in implementing P2M2s and BMPs on-site, and in facilitating monitoring, audit, and enforcement.
- (v) The Guidance Document for the Preparation of the Document on LDP2M2 in Appendix 4 of the EGIM 2016 and “Guidelines on LDP2M2 by DOE” (2017) shall be referred in the preparation of the LD-P2M2.

The LD-P2M2 report shall include all required information according to the LDP2M2 standard requirements for submission (refer to **Table 6-1**) and accompanied by relevant technical drawings and maps.

Table 6-1 Standard Requirements for the Submission of LD-P2M2

Requirements	Information to be Included
Project Activity and Implementation	<ul style="list-style-type: none"> ➤ Phasing plan. ➤ Project implementation schedule. ➤ Description of construction activities. ➤ Construction schedule complete with timeline or charts for the P2M2s installation. ➤ Construction method statements.

Requirements	Information to be Included
<p>Information and Analysis on Project Development</p>	<ul style="list-style-type: none"> ➤ Selected weather and rainfall data. ➤ Site runoff velocity and flow rates (pre and post-development). ➤ Description of site soil and geological characteristics (type, erodibility, hydrologic group, percentage dispersible material, excavation depth, etc.). ➤ Description of adjacent areas that may be affected by land disturbance. ➤ List of drainage, streams and river onsite as well as receiving streams and rivers. ➤ List of P2M2s proposed. ➤ Access roads and project components located outside the project boundary. ➤ Earthworks cut and fill volume. ➤ Availability of rocks materials. ➤ Biomass management. ➤ Solid waste (construction waste) and domestic waste management. ➤ Spill prevention and control plan. ➤ Hazardous waste management. ➤ Soil loss prediction (pre, during and post-development) for with and without LD-P2M2 implementation scenarios. ➤ Calculation of sediment traps/basins and projected runoff flows.
<p>Map of the Site Plan with Existing Conditions</p>	<ul style="list-style-type: none"> ➤ Topographic survey map. ➤ Geological Terrain Map. ➤ Erosion risk map. ➤ Land use map. ➤ Site development plan map.

Source: Guidance Document for the Preparation of the Document on LD-P2M2, DOE, 2016

6.2.3.1 Ecological Management

<p>Objective</p>	<p>To protect critical habitats and biodiversity of important coastal and marine flora and fauna from degradation during pre- and post-project implementation.</p>
<p>Implementation Steps</p>	<p>(i) The coastal areas and associated marine areas are home to a diverse and dynamic ecosystem. It is important to safeguard these existing habitats by adopting the avoidance principle with redesigning the orientation of the project avoid environmentally sensitive areas (ESAs). If it is not possible to avoid the ESAs, to minimise the loss of such areas through proper selection of mitigation measures.</p> <p>(ii) Providing adequate buffers is one way to reduce impacts. Incorporating the project as part of the natural environment and conserving the area as much as possible is beneficial. Although this may require more planning and time, it is worthwhile as a conservation strategy.</p>

P2M2 Checklist	<p>(iii) Rehabilitation measures can also be implemented, such as translocating corals to alternative sites, carrying out coral replanting schemes, replanting coastal mangroves, etc.</p> <p>(iv) During operations, consideration of human-wildlife conflicts (HWC) should be taken into account and managed.</p>
P2M2 Checklist	<p><u>During Earthworks and Construction</u></p> <p>Measures to minimise disturbances to wildlife and flora. Examples include:</p> <p>(i) Apply the avoidance principle in construction.</p> <p>(ii) Ban on poaching.</p> <p>(iii) Delineate the work area.</p> <p>(iv) Designate vessel traffic lanes and anchorage areas.</p> <p>(v) Notify the relevant authorities of any sighting of rare, endangered, threatened, and near-extinct wildlife such as the Department of Marine Park Malaysia, Forestry Department of Peninsular Malaysia (JPSP), Department of Wildlife and National Parks Peninsular Malaysia (PERHILITAN), and/or Department of Fisheries (DOF) for appropriate actions.</p>
P2M2 Checklist	<p><u>During Operation</u></p> <p>(i) In areas with important ESAs, the following measures may be required:</p> <p>(ii) Coral, seagrass, mangrove replanting/rehabilitation programme.</p> <p>(iii) Human-Wildlife Conflict (HWC) resolution mechanism.</p>

6.2.3.2 Hydraulics and Hydrodynamics

Objective	To ensure that any construction and structures built along the coast and marine park waters does not cause significant change to the coastal processes, which may lead to accelerate coastal erosion and sedimentation of river mouths and the sea.
Implementation Steps	<p>(i) The findings of the hydraulic study shall help select the best layout and/or construction method to minimise changes in the coastal conditions of the project site.</p> <p>(ii) Where areas are at risk of erosion or sedimentation, mitigation measures must be identified to reduce such impacts, which can include the use of structural measures to prevent erosion or the need for maintenance dredging to maintain waterways.</p> <p>(iii) The shoreline monitoring programme shall also be identified to help monitor changes post-construction and identify the need for further mitigation measures.</p>
P2M2 Checklist	<p>Prior to construction, the hydraulic study shall assess all aspects of the project (layout, design, components, etc.) to assess the impacts. The recommendations of the study shall form the basis for the mitigation measures, which can be structural and non-structural in nature.</p> <p>The measures can include structural measures such as the construction of berms, groynes, coastal barriers, breakwaters, etc. to reduce the impacts from</p>

Objective	erosion and/ or maintaining or planting coastal forests, mangroves, etc. to serve as wave breakers.
Implementation Steps	Monitoring post-construction will assist in identifying areas requiring protection or mitigation works.

6.2.3.3 Erosion and Sediment Management

a) Site Clearing and Earthworks

Objective	To address soil erosion and sediments at source to reduce the impacts downstream affecting lowland communities and environmental sensitive areas (ESAs) near rivers and waterways.
Implementation Steps	<ul style="list-style-type: none"> (i) Establish proper scheduling and phasing of P2M2 implementation in accordance with the project implementation schedule. (ii) Retain much of the natural vegetation by reducing the total worked area. Demarcate the site and buffer areas. (iii) Reduce the period of slope and cleared areas exposure. (iv) Stabilise the bare slopes and apply protective covers when not working on them. (v) Properly protect stockpile areas. (vi) Implement P2M2 for erosion and sediment control measures to reduce soil erosion and surface flows downstream.
P2M2 Checklist	<p><u>Earthworks and Construction</u></p> <p>Erosion and sedimentation management include:</p> <ul style="list-style-type: none"> (i) Phased construction. (ii) Erosion, sediment, and drainage controls in LD-P2M2. (iii) Stabilised entrance and access roads. (iv) Slope turfing. (v) Temporary cover for exposed areas, e.g., erosion control mats, mulching, etc.

b) Runoff and Stormwater Management

Objective	To properly manage runoff from the project site to prevent localised flooding and the risk of flooding downstream, especially during the rainy seasons
Implementation Steps	<p>The EIA should assess the impacts of the drainage system to intercept the rapid conveyance of stormwater by using a series of retardation methods from P2M2 and <i>Manual Saliran Mesra Alam Edisi-2 (MASMA-2)</i> designed to manage the volume of flows down the slopes. These include, but are not limited to, the following:</p> <ul style="list-style-type: none"> (i) Installation of temporary drains to minimise concentrated water flows during construction. In area constraint sites, pipe slope drains (PSD) can be used to convey runoff into sediment containment system.

P2M2 Checklist	<ul style="list-style-type: none"> (ii) Channelling discharges via a series of check dams to a sediment pond to reduce velocity and peak flows. Temporary energy dissipater structures used to reduce flow velocity. (iii) The size and capacity of the drains must be sufficient to take in at least a storm of a 10-year ARI event (see also MSMA-2). (iv) All drainage and waterway banks shall be stabilised, e.g., rock cover, turf reinforcement mats, etc. (v) Proper stream crossings and culverts are required along waterways to prevent blockage or restriction in flows.
P2M2 Checklist	<p><u>Erosion Flooding and drainage issues.</u></p> <p>Measures to minimise such occurrences include:</p> <ul style="list-style-type: none"> (i) Temporary drainage system based on MSMA-2. (ii) Cascading and PSD along berms and steep slopes. (iii) Inlet and outlet protection. (iv) River buffer provision. (v) Stream crossing. (vi) alteration of the river to have approval from the DID.

c) Sediment Control

Objective:	To ensure effective control of sediments at-site, using tools in P2M2 (both structural and non-structural) to reduce water pollution and sedimentation of rivers.
Implementation Steps	<ul style="list-style-type: none"> (i) Installation of sediment control devices and structures such as silt fences, silt traps, sediment basins, barriers, and use of active treatment systems. (ii) Retardation/capture structures and devices are to be designed to accommodate the calculated runoff volume to allow adequate time for suspended sediments to settle before the runoff is conveyed further. (iii) The use of active treatment systems (ATS) such as flocculants, anionic polymers, etc. in space constraint locations to accelerate entrapment and settlement of fine sediments. (iv) Regular inspection and maintenance of structures to ensure their performance efficiency, especially after heavy storm events. (v) Sediment control also extends to spillage of materials and mud trekking from vehicles, and measures to address these must be put in place, including tyre washing facilities, entrance stabilisation, road cleaning, and dust control.
P2M2 Checklist	<p><u>Erosion Flooding and drainage issues.</u></p> <p>Measures to minimise such occurrences include:</p> <ul style="list-style-type: none"> (i) Sediment basin/silt trap. (ii) Active Treatment System (Anionic). (iii) Wash trough/wheel washing at main entrance/exit. Road cleaning. (iv) BMP inspection and maintenance.

	<p>(v) Use appropriate construction methods for marine construction.</p> <p>(vi) Deploy mitigation measures such as sand barrier, silt curtains, and sheet piles.</p>
--	---

d) Sediment Plume Effect

Objective	For construction in coastal areas and marine parks, the aim is to reduce the spread of the suspended sediment plume in the surrounding waters of the project site that could affect the corals and marine life.
Implementation Steps	<p>(i) Use appropriate construction methods such as sand bunds and eco-friendly piles to reduce generation of silt.</p> <p>(ii) Deploy mitigation measures to entrap and confine the silt, e.g., sand barrier, silt curtains, sheet piles, etc. to reduce the plume effect.</p> <p>(iii) BMPs should be inspected regularly to ensure their effectiveness after heavy rains or storms.</p>
P2M2 Checklist	Erosion and sedimentation will not be major impacts, and no mitigation measures are necessary with the exception of coral rehabilitation or translocation. Permanent drainage network and retention systems (e.g. detention ponds, dry ponds, rain harvesting system, etc.) to be installed at-site to capture runoff from site.

6.2.3.4 Water Pollution Control

Objective	To prevent water pollution in estuarine areas and coastal waters within the surrounding areas of the project site. Where possible, to maintain water quality at baseline conditions or better within the DOE-prescribed limits.
Implementation Steps	<p>(i) Potential water pollutants are constituents of silt, sewage, sillage, machinery discharges, nutrients, oil and grease (O&G), etc. Silt traps and sediment ponds will be able to trap most of these physical constituents, such as sediments, except for dissolved materials and O&G before final discharge.</p> <p>(ii) Proper storage areas including adequate bunding are to be provided for scheduled wastes, chemicals, spoils, fuel tanks, and waste disposal areas.</p> <p>(iii) Suitable treatment system especially for sewage and sillage shall be utilised to ensure that the discharge quality meets the agencies and local authority’s standards during the construction and operational phases of the project.</p> <p>(iv) Vessels must abide by all authority requirements in terms of pollution discharge and ensure that no pollutants enter the waters, i.e., sewage, oil and grease, scheduled waste, solid waste, etc.</p> <p>In case of accidental release, measures are to be in place to contain, remediate, and remove the contaminants from the waterways.</p>

P2M2 Checklist	<p><u>Earthworks and Construction</u></p> <p>Measures to prevent TSS and O&G from entering estuaries, rivers, and sea.</p> <ul style="list-style-type: none"> (i) Implement LD-P2M2. (ii) Septic tank and toilet facility to follow the requirements of the National Water Services Commission (SPAN). (iii) Establish a suitable workshop area. (iv) Bunded area for scheduled waste and chemical storage and fuel tank area. (v) For batching plants, include measures to prevent the release of concrete wastes and washouts outside the project boundary. (vi) Vessel management and requirements for pollution control measures. (vii) Oil spill management plan and provision of an oil spill kit.
	<p><u>Operation</u></p> <p>Pollution control systems are to be implemented to control the discharge of effluent and other contaminants into coastal waters. Similarly, vessel activities must control the discharge of pollutants and wastes along coastal waters.</p> <ul style="list-style-type: none"> (i) Loadings of sewage and sullage to be treated to the stipulated standards. (ii) O&G traps required in commercial areas, canteens, and kitchens. (iii) In case of accidental release, measures are to contain, remediate, and remove the contaminants. (iv) Develop an oil spill management plan in case of emergencies.

6.2.3.5 Other Minor Mitigation Measures

a) Air Pollution Control

Objective	Minimising fine dust dispersion from construction activities and transport of materials to and from the site.
Implementation Steps:	<ul style="list-style-type: none"> (i) Clean up all spills along logistic roads and clean-up of entrances / exits. (ii) Potential emission sources such as fuel burning equipment must comply with the requirements and limits of the relevant agencies. (iii) Regular housekeeping to remove mud trekking on roads. (iv) All emissions shall be ensured to meet the DOE emission standards, while open burning is prohibited at all times.
P2M2 Checklist	<p><u>Earthworks and Construction</u></p> <p>The measures to include dust suppression methods, especially if dust pollution affects sensitive receptors. Some examples include:</p> <ul style="list-style-type: none"> (i) Wet suppression along main logistic routes and earth stockpiles. (ii) Measures to reduce equipment and vehicular emissions. (iii) Measures during blasting operations should include supervisions and adherence to safety measures, among others, to prevent injuries and safety concerns, e.g., from fly rock, vibration, and noise.
	<p><u>Operation</u></p>

	Most of the emissions will be from vehicles and fuel-burning equipment, if any. All emissions must comply with the DOE emission standards and install air pollution control systems (APCS) as needed.
--	---

b) Noise and Vibration Control

Objective	To minimise noise and vibration disturbance to nearby receptors as well as to protect workers in high noise environment.
Implementation Steps	<ul style="list-style-type: none"> (i) Noise and vibration impacts can be addressed through measures such as phasing construction work; use of measures to reduce, enclose, and suppress machinery; use of physical barriers; or maintaining natural ones. (ii) Designate appropriate vessel traffic lanes and berthing areas to reduce underwater noise, ideally, such activities should be away and also prohibited in areas important for marine organisms.
P2M2 Checklist	<p><u>Earthworks and Construction</u></p> <p>Examples of measures include the following:</p> <ul style="list-style-type: none"> (i) Perimeter hoarding. (ii) Regular maintenance of machinery and vehicles. (iii) PPE for workers. (iv) Scheduling of the piling and blasting work. (v) Vessel management plan.
	<p><u>Operation</u></p> <p>Landscaping and natural buffers can help to reduce the noise of human activities. For noisy machineries such as gen-sets, these can be enclosed to reduce noise.</p>

c) Waste Management

Objective	To minimise the amount of waste generated from the site and to ensure proper collection, storage, and disposal of the different types of waste generated during construction and operations.
Implementation Steps	<ul style="list-style-type: none"> (i) Wastes comprise biomass, municipal, construction and demolition (C&D) and scheduled waste, all of which require specific management strategies. (ii) The key approach is to ensure that proper storage facilities or disposal sites are provided on site and regular collection and disposal of such wastes to their designated sites. (iii) General housekeeping of the construction site is also important. No open burning of waste is allowed.
P2M2 Checklist	<p><u>Solid Waste</u></p> <p>The measures for proper solid waste management include:</p>

	<ul style="list-style-type: none"> (i) Temporary disposal area. (ii) Waste bins in active work areas. (iii) Regular housekeeping. (iv) Disposal at a local authority licensed landfill. (v) Control vessel's discharge near coastal waters.
	<p><u>Scheduled Wastes</u></p> <p>The measures must include proper scheduled waste management controls in adherence to the Environmental Quality (Scheduled Wastes) Regulations 2005. Some examples include:</p> <ul style="list-style-type: none"> (i) Scheduled waste storage area with bunding. (ii) Scheduled waste inventory. (iii) Proper scheduled waste labelling. (iv) Oil spill management plan. (v) Spill kit. (vi) Competent person trained in scheduled waste management.
	<p><u>Operation</u></p> <p>Adequate bins and disposal sites need to be provided to collect and store wastes. Regular disposal services are required.</p>

d) Safety and Health

Objective	To ensure the safety and health of workers, the general public, and tourists during construction work.
Implementation Steps	<ul style="list-style-type: none"> (i) Safety & health measures are intended to address issues such as workplace conditions and worker health. This includes preventive checks on any communicable diseases among the workers, provision of personal protective equipment (PPE), firefighting equipment, safety trainings, and having an emergency response plan (ERP) in place. (ii) Proper work procedures are designed on site and off site to prevent unauthorised entry from the public into the active work site to reduce the risks of accidents and injuries. (iii) The management of vessels is important to reduce the risk of collisions and accidents. (iv) Operators must ensure the safety of tourists in all recreational and tourist activities. Adequate medical and treatment facilities shall be provided in case of emergencies.
P2M2 Checklist	<p><u>Earthworks and Construction</u></p> <p>The measures for safety and health are:</p> <ul style="list-style-type: none"> (i) Emergency Response Plan (ERP). (ii) Safety officer employed. (iii) PPE requirements. (iv) Workers to have CIDB green card. (v) Workers' health checks to prevent the spread of communicable diseases.

	(vi) Training.
	<p><u>Operation</u></p> <p>(i) Vessels shall abide by all safety requirements from the Marine Department of Malaysia, e.g., maximum passenger load, safety devices, etc.</p> <p>(ii) The monitoring of water quality shall be carried out on recreational beaches to ensure that the waters are safe for body contact. Beach closure is an option if high levels of coliform, red tide, or other health risks are detected.</p>

e) Land Traffic Management

Objective	To manage traffic along logistic roads to reduce the risk of accidents and inconvenience for the general public.
Implementation Steps	<p>(i) A traffic management plan is necessary along logistics roads to accommodate heavy vehicular traffic to and from the project site throughout the construction and operation period.</p> <p>(ii) P2M2, such as improvements in road infrastructure, will be necessary to ensure future traffic to and from the project site is smooth.</p>
P2M2 Checklist	<p><u>Earthworks and Construction</u></p> <p>Measures should include proper land traffic control and management plans to minimise traffic problems.</p> <p>(i) Schedule heavy vehicle traffic.</p> <p>(ii) Have a transportation plan to and from the project.</p> <p>(iii) Impose speed limits.</p>

Note: The contractor shall comply with local authorities and JKR requirements for traffic management and transportation requirements.

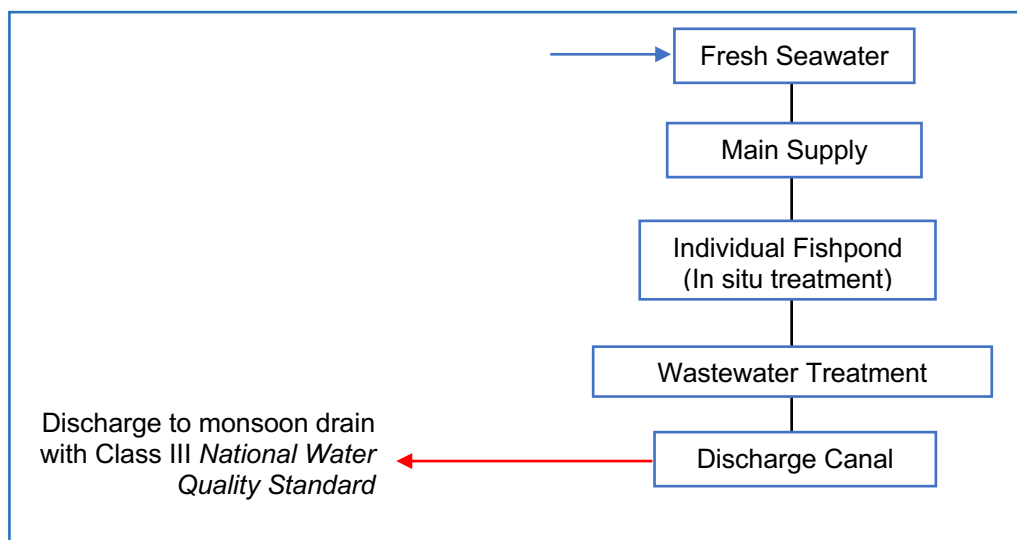
f) Visual

Objective	To reduce the impact of visual intrusions during and after construction.
Implementation Steps	<p>(i) Where possible, natural areas that are not affected by construction should be preserved. This includes all river estuaries, mangroves, unique rocks and coastal features, coral reefs, etc.</p> <p>(ii) The use of hoardings or barriers can also reduce direct visual impacts.</p> <p>(iii) Rehabilitation of the site through landscaping and replanting will help soften and even reverse some of the impacts during construction.</p>

6.3 WATER RESOURCES AND QUALITY FOR PRODUCTION PROCESSES

The flow of the proposed aquaculture water management and treatment is conceptually depicted in **Figure 6-1**.

Figure 6-1 Flow of Aquaculture Water Management and Treatment



6.3.1 Abstraction

Water would need to be drawn from the sea on a periodic basis for replenishment, refilling, and replacement of manipulative losses. The volume required would depend on the production system, the husbandry regime, and the productive area. In terms of pond farms, the productive area is the water surface area of the ponds and not necessarily the entire size of the farm.

Aquaculture water quality in the production ponds would be influenced by appropriate husbandry regimes that emphasise minimum raw water use, the reuse of treated water, and using *in situ* treatments such as effective microorganisms. Treating the farming pond with effective microorganism solution regularly will keep enough beneficial microbes in the system that keep nutrient levels low enough to improve overall water clarity.

The quality of the aquaculture water in the farming pond will be maintained to meet the quality standards presented in **Table 6-2**.

Table 6-2 Aquaculture Water Quality Maintenance Standard

	Parameter	Standards
1	Colour, offensive smell.	Fish, shrimp, shellfish, and kelp should not have an odd colour, an odd offensive smell.
2	Floating material.	No oil film or floating foam should appear on the water surface.
3	Suspended material (mg/l).	The amount added to human beings should not surpass 10, and the suspending materials sunk to the bottom of the water should not be harmful to fish, shrimp and shellfish.
4	pH value.	Freshwater 6.5-8.5, seawater 7.4-8.5.
5	Dissolved oxygen	In successive 24 hours, above 16 hours should be higher than 5 mg/l, & the other time should not be lower than 3 mg/l.
6	Biochemical Oxygen Demand (5 days, 20°C).	Should not surpass 5 mg/l, frozen period should not surpass 3 mg/l.
7	Total colonial bacillus.	Should not be greater than 5000/L (and should not exceed 500 pieces/L)
8	Mercury	<0.0005 mg/l
9	Cadmium	<0.005 mg/l
10	Lead	<0.05 mg/l
11	Nobelium	<0.1 mg/l
12	Copper	<0.01 mg/l
13	Zinc	<0.1 mg/l
14	Nickel	<0.05 mg/l
15	Arsenic	<0.05 mg/l
16	Cyanide compound	<0.005 mg/l
17	Sulphur compound	<0.2 mg/l
18	Fluorinated compound	<1 mg/l
19	Unionised ammonia	<0.02 mg/l
20	Kjeldhal nitrogen	<0.05 mg/l
21	Volatized phenol	<0.005 mg/l
22	Yellow phosphorus	<0.001 mg/l
23	Petroleum	<0.05 mg/l
24	Acrylonitrile	<0.05 mg/l
25	Acrylaldehyde	<0.02 mg/l
26	BHC	<0.002 mg/l
27	DDT	<0.001 mg/l
28	Malathion	<.005 mg/l
29	Pentachlorophenol	<0.01 mg.l
30	Rogor	<0.1 mg/l
31	Methamidophos	<1 mg/l
32	Parathion methyl	<0.0005 mg/l
33	Carbofuran	<0.01 mg/l

6.3.2 Discharge

After harvesting, the aquaculture effluent should be sent to a wastewater treatment plant for secondary treatment to comply with some of the elements of Class III of the *National Water Quality Standard*, with the exception of COD that cannot be effectively measured for saline waters. The analysis of the other parameters will also need to take into account that the discharge will be saline. The treated water from the wastewater treatment plant can then be discharged.

Table 6-3 Discharge Limit for Treated Effluent

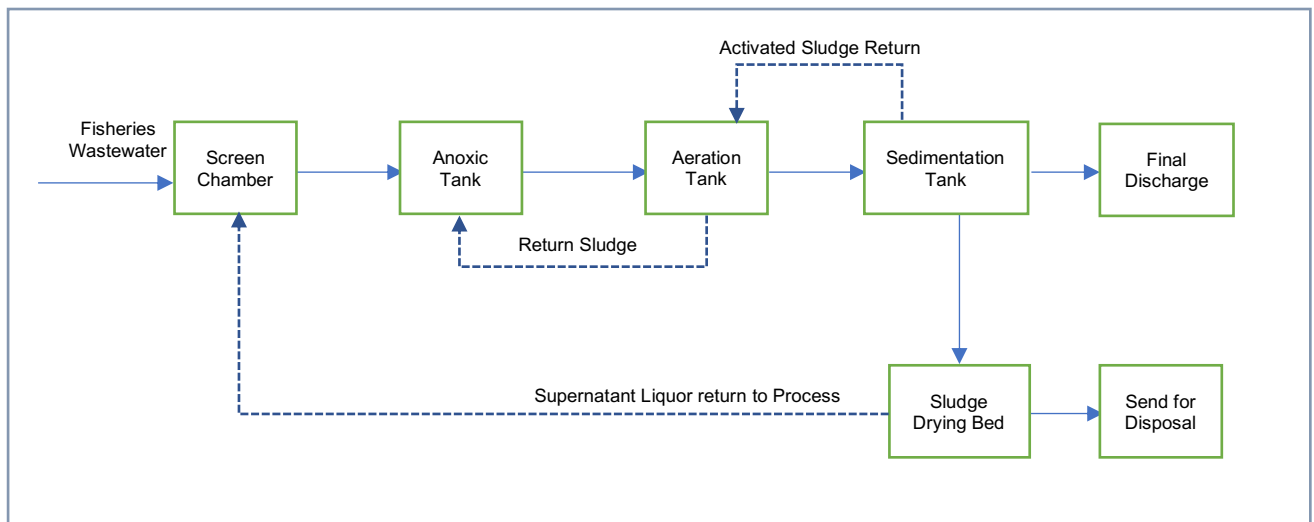
Parameters	Value	Unit
pH	6.5 - 9.0	-
BOD	6.0	mg/L
COD	50.0	mg/L
Total NH ₃ , Nitrogen	-	mg/L
TSS	150	mg/L
Soluble Phosphorus	0.1	mg/L
Dissolved Oxygen	3.0 – 7.0	mg/L

The treatment process for the aquaculture project as below:

Physical Treatment – Screen Chamber	Screening devices are used to remove coarse solids and other large objects that may be contained in the aquaculture wastewater from the farming pond. This is to protect pumps or any other mechanical equipment and to prevent clogging of valves and other appurtenances in the treatment system. The solids retained in the screen will be removed by manual raking or mechanical cleaning. Screening devices should also prevent accidental feral release of farmed stock.
Biological Treatment – Anoxic and Aeration	<p>The objectives of the biological treatment of the fisheries wastewater are to:</p> <ul style="list-style-type: none"> (i) transform or oxidise dissolved and particulate biodegradable constituents into acceptable end products, (ii) capture and incorporate suspended and non-settle-able colloidal solids into a biological floc or biofilm, (iii) transform or remove nutrients, such as nitrogen and phosphorus, and (iv) In some cases, removal of specific trace organic constituents and compounds. The principal processes used for wastewater treatment are classified as suspended growth, attached growth, or combinations thereof. <p>In suspended growth processes, the microorganisms responsible for treatments are maintained in liquid suspension by appropriate mixing</p>

	methods, whereby in attached growth processes, the microorganisms are attached to an inert packing material.
Nitrification & Denitrification	<p>Nitrification and denitrification systems are used to control ammonia levels and convert nitrate to gaseous nitrogen oxides. Denitrification is a biological process that removes nitrogen by converting nitrate to nitrogen gas under anaerobic conditions when sufficient organics or energy are available.</p> <p>Nitrification is the process by which ammonia is converted to nitrites (NO₂) and then to nitrates (NO₃-). This process occurs naturally in the environment, where it is carried out by specialised bacteria. The nitrification process is carried out by two different types of bacteria. Nitrosomonas carry out the first step of the process, producing nitrite, whereby another type of bacteria, Nitrobacters, converts the resulting nitrite to nitrate.</p>
Sedimentation	At the Sedimentation Tank, the biological sludge is allowed to settle at the bottom of the tank. A portion of the settled sludge will be returned to the Aeration Tank to maintain the desired concentration of microorganisms in the reactor. The remaining sludge will be pumped into the Sludge Drying Bed for further free water removal.
Dewatering Process	The sludge from the Sedimentation Tank will be pumped to the Sludge Drying Bed for further removal of water for the reduction sludge weight and lead to savings in disposal cost before sent for disposal.

Figure 6-2 Example of Process Block Flow Diagram for Aquaculture Wastewater Treatment



6.4 BIOSECURITY

6.4.1 Disease Management

The main disease control for the proposed aquaculture farming activities would be by controlling the water quality in the aquaculture pond. The intake water should be allowed for sedimentation before being diverted into the treatment pond. A 15ppm chlorination should be maintained in the treatment pond prior to release of the water into the production ponds. The biosecurity and disease control practices should be implemented in reference to Malaysian Aquaculture Farm Certification Scheme (*Skim Pensijilan Ladang Akuakultur – SPLAM*) and Good Aquaculture Practices Certification Scheme (*Sijil Amalan Akuakultur Baik - SAAB*) administered by the Fishery Department of Malaysia and the Ministry of Agriculture.



Example of Shrimp Pond Layout Plan with myGAP Certification
 Source: Dept. of Fisheries, Malaysia

6.4.2 Feral Release

Feral species pose a potential risk to resident flora and fauna through habitat destruction, interspecific (predation), and intraspecific (competition) interactions. Many species introduced by humans for social and economic benefits have invaded new ranges by escaping from captivity.

Understanding the factors that relate to the establishment of feral populations of introduced species is therefore of great importance for managing introduced species. A screening control can minimise the risk from introduced species.



*Photo Source: Floating Freshwater Farm, Batang Ai, Sarawak
Fanli Marine & Consultancy Sdn Bhd*

DEVELOPING OUTLINE OF ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER 7. DEVELOPING OUTLINE OF ENVIRONMENTAL MANAGEMENT PLAN

7.1 INTRODUCTION

The Environmental Management Plan (EMP) is a legal document prepared by the Project Proponent incorporating pollution prevention and mitigation measures (P2M2s) and best management practices (BMPs) stipulated in the EIA Conditions of Approval (COA).

The key contents of the EMP are formatted as the scope of work in the Bill of Quantities (BQ) for the contractors to bid for the implementation of the project. Other than mitigation measures, the EMP includes the guided self-regulation requirements (GSR), an environmental monitoring plan and an audit programme to assess the effectiveness of the P2M2s implementation.

The EMP is a living document and has to be updated whenever there are major changes to the project design, layout, or construction methods that could result in impacts not originally stated in the EMP.

7.2 EMP FRAMEWORK

In the Environmental Impact Assessment (EIA) phase, the project may not have sufficient information on the project work plan to produce a comprehensive EMP. The EMP chapter in the EIA will only be an EMP framework for eventual morphing into a full EMP after the EIA approval stage.

The Project Proponent can submit the detailed EMP concurrently with the EIA report if there is sufficient information for the EMP. The EMP can later be updated to incorporate the requirements of the COAs.

Standard COAs are:

- (a) Monthly monitoring of the water quality of the receiving water body by an Accredited Laboratory or any other frequency determined by the DOE.
- (b) Monthly monitoring of TSS and turbidity at the inlets and outlets of sediment structures or any other frequency as determined by DOE.
- (c) In situ monitoring of TSS and turbidity after a rain event.
- (d) Monthly or Quarterly monitoring of air, noise, and vibration qualities depending on sensitivity of receptor.
- (e) Planning, construction, and maintenance of LD-P2M2 on site.

- (f) P2M2 notification and implementation.
- (g) Identification for the need of competent people to carry out a specific task on site.
- (h) Description and implementation details of EMT.
- (i) Clear documentation on any transfer of ownership or proponent of approved EIA.
- (j) Allocation and reporting of sufficient resources to carry out project activities on site.
- (k) Details of the temporary/permanent abandonment/project closure plan for all phases.
- (l) Implementation of 5S concept in good housekeeping practices.
- (m) Any other green initiatives undertaken for site development activities

The format of the EMP shall be based on the requirements stated in the EGIM 2016, and shall contain details from the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) document and the proposed monitoring and audit programmes.

7.3 SELF-REGULATION (SR)

Environmental Mainstreaming (EM) is a strategic tool that allows for the cultural evolution of embracing the environmental agenda at all levels of the organisational structure of the Project Proponent. With an understanding of EM, all key personnel in an organisation can play a role in protecting our environment in an effective manner. As such, the elements as espoused in the EMT provide a guide in achieving the ultimate Goal of Environmental Excellence in an Organisation.

Details on the SR for the project shall be incorporated into the EMP framework as required by the Environmental Mainstreaming Directive issued by the DOE. This shall cover the seven environmental mainstreaming tools:

ENVIRONMENTAL POLICY	This refers to the Project Proponent’s Environmental Policy and the conveyance of such policies throughout the organisation.
ENVIRONMENTAL BUDGETING	The Project Proponent has to provide an environmental budget for environmental-related commitments, e.g., personnel, P2M2, monitoring, auditing, training, remedial and rehabilitation works. If budget is not available during the EIA stage, the Project Proponent shall provide a pledge to allocate adequate budget for the project during the post- EIA stage to ensure compliance. The budget requirements shall also form part of the BQ for the contractors at the contractual stage.

ENVIRONMENTAL MONITORING COMMITTEE

The Project Proponent is required to identify and setup an Environmental Regulatory Compliance Monitoring Committee (ERCMC) at the policy level to be headed by the Chief Executive Officer (CEO) or organisation chairman.

At the working level, the Environmental Performance Monitoring Committee (EPMC) is chaired by a senior officer of the organisation.

For projects involving multiple contractual work packages by many contractors, the respective main contractors are required to have their respective Environmental Management Teams (EMTs) comprising at least a minimum number of personnel such as an Environmental Manager (EM) and an Environmental Officer (EO).

The organisation chart along with the roles and responsibilities of all relevant parties in charge of environmental management for the project should be included in the EMP framework.

ENVIRONMENTAL FACILITY

The EMP shall provide the range of environmental facilities in the project, such as wastewater treatment system (WWTS), sewage treatment systems (STS), air pollution control system (APCS), BMPs, P2M2 structures, and associated supporting utilities and facilities that need operational and maintenance support.

ENVIRONMENTAL COMPETENCY

Training requirements are needed to ensure competency for environmental management for all relevant site personnel. The proposed training programme and requirements shall be included in the EMP framework.

ENVIRONMENTAL REPORTING AND COMMUNICATIONS

The EMP framework shall contain a reporting time schedule for various submissions during the post-EIA phase, which shall include:

- Environmental Management Plan.
- Monitoring Reporting.
- Audit Reporting.

The mode of communication between the ERCMC, EPMC, and the respective EMTs must be clearly defined. Lines of communication between the Project Proponent, the EPMC, and the relevant stakeholders must be clearly defined. This is not only limited to project site management, but also in engagements with affected communities and the general public.

(i) Record Keeping

A documented procedure on record keeping for the activities, operations and maintenance of the P2M2 must be established to ensure all aspects of the compliance and performance of the

Organisation in EM is properly and easily referred to. Records must be made available to DOE as the Regulator, whenever requested.

(ii) Data Analysis & Interpretation

The Competent Person has to analyse and interpret the data from the IM, CM and PM in a suitable format for presentation the ERCMC and EPMC for any decision-making purpose. Data from any upset conditions must also be analysed so that records can be kept for continuous improvement purposes.

**ENVIRONMENTAL
TRANSPARENCY**

Company status, environmental policy, compliance, and achievement can be displayed on the company website or billboard located on the project site boundary or the entrance to the company's premises to improve public confidence. An annual environmental sustainability report has to be prepared and submitted to DOE.

7.4 MONITORING AND AUDIT PROGRAMMES

Environmental monitoring and audit programmes are important components of the EMP. Monitoring and audit shall be implemented during the post-EIA stage.

7.4.1 Monitoring Category

Environmental monitoring can be categorised into three main categories:

Performance Monitoring (PM)

- Relates to monitoring of the performance treatment systems such as IETS, STS and APCS.
- This shall be undertaken by a Competent Person with expertise in the related treatment system.

Compliance Monitoring (CM)

- Relates to the monitoring of P2M2s within the site and their performance. Samplings and measurements are usually taken either of the ambient parameters (water, air and noise) or of the discharges (sewage, sediment basin).
- This shall be carried out by a Qualified Person such as the EO and/or the Qualified Person.

Impact Monitoring (IM)

- Impact monitoring may only be required in cases where there is a possibility that the impacts may still affect receptors outside of the project boundary despite implementation of P2M2s on-site.
- This task must be carried out by a Qualified Person (Environmental Consultant)

7.4.2 Monitoring Methodology

The extent of monitoring shall be determined by the scale of the project and of the predicted impacts. Monitoring covers both within the project site and outside its boundary where impacts are perceived to affect sensitive receptors.

Details of the monitoring programme are decided upon by the Qualified Person and Environmental Consultants, and to be approved by DOE before implementation. The monitoring locations, frequencies, parameters to monitor, recommended limits, instrumentation, and personnel requirements have to be identified in the EMP. The monitoring programme shall be tailored for all types of projects involving environmentally sensitive areas, based on site conditions and types of development (**Table 7-1**).

7.4.3 Environmental Audit

Environmental auditing is a post-EIA evaluation process to determine the effectiveness and performance of the mitigation measures put in by the Project Proponent to comply with the COAs. Audit requirements are to be prepared as per the Environmental Audit Guidance Manual issued by the DOE. The audit must be undertaken by an independent third party DOE registered auditor.

The typical audit process involves:

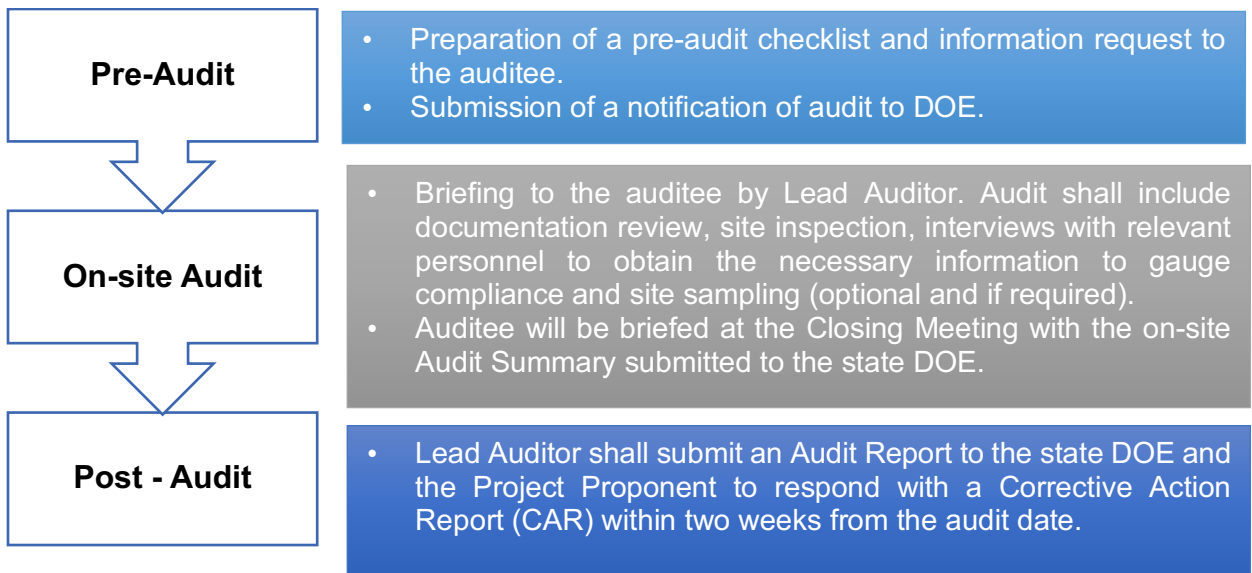


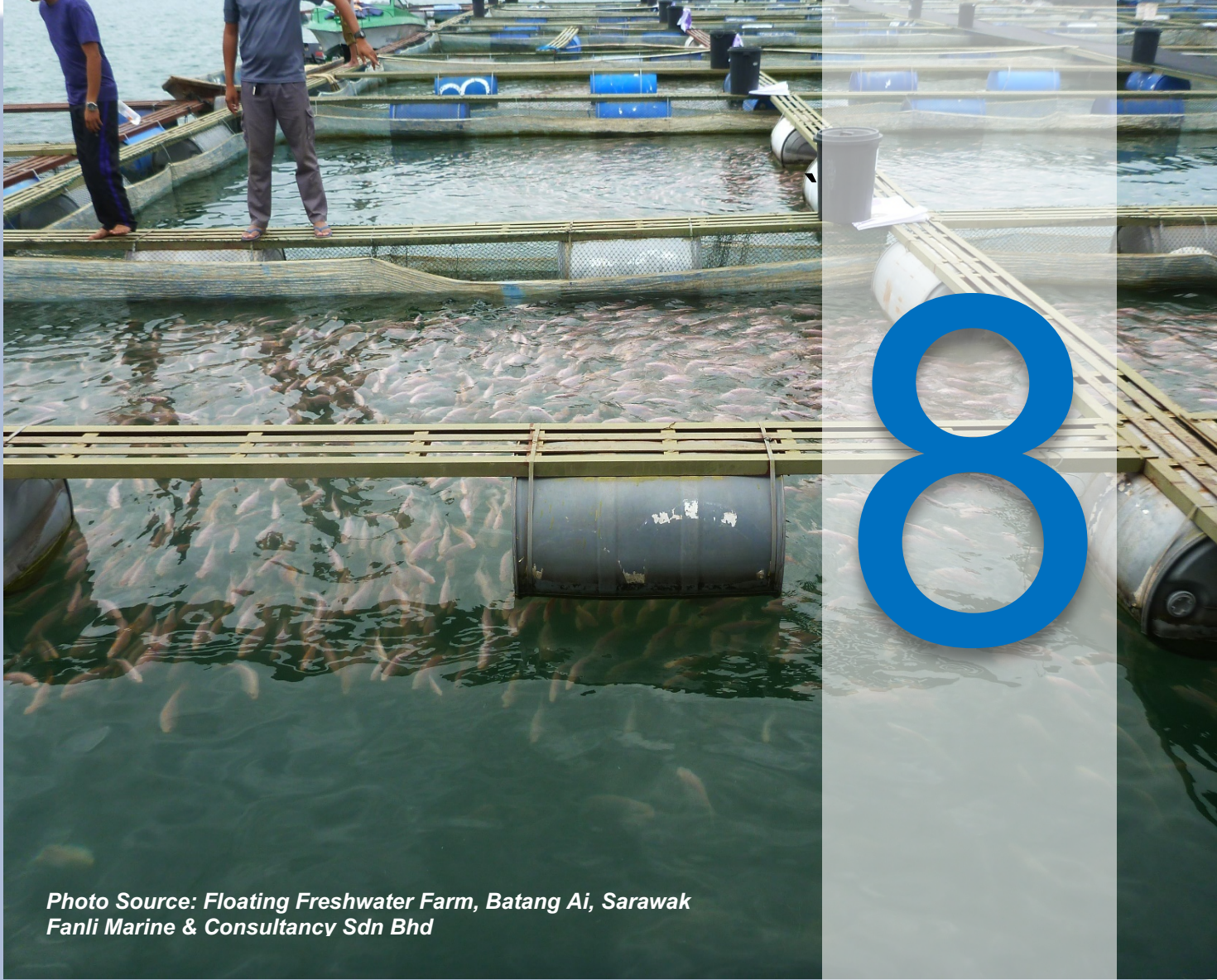
Table 7-1 Proposed Environmental Monitoring Parameters

Aspect	Phase	Methods	Parameters	Frequency
Water Quality	Construction	Grab sampling or other accepted standard methods (upstream and downstream of waterways)	<u>Ambient</u> : Relevant parameters of the National Water Quality Standards (NWQS)	Monthly
		Grab sampling or other accepted standard methods (along coastline at multiple depths during high and low tides)	<u>Ambient</u> : Relevant parameters of Malaysian Marine Water Quality Criteria and Standards (MWQCS)	Monthly
		In situ sampling at the final discharge point	Sediment basin/silt trap discharge: TSS and turbidity	After every heavy rain event (12.5 mm measured by the rain gauge)
		Grab sampling before and after silt curtain	Silt curtain: TSS	Weekly throughout active works in coastal waters.
	Operational	Sampling at the final discharge outlet of the sewage treatment plant (STP).	<u>Sewage</u> : Environmental Quality (Sewage) Regulations 2009	Monthly
Air Quality	Construction	Measurement using an approved air sampler (boundary and nearest receptors)	<u>Ambient</u> : Relevant parameters of Malaysian Ambient Air Quality Standards (MAAQS)	Quarterly
Noise Level	Construction	Measurement using approved noise meter (boundary and nearest receptors)	<u>Ambient</u> : The Planning Guidelines for Environmental Noise Limits and Control, 2nd Edition, DOE, 2007 and The Planning Guidelines for Vibration Limits and Control in the	Quarterly
Vibration	Construction	Measurement by approved vibration measuring meter		During piling and blasting work

Aspect	Phase	Methods	Parameters	Frequency
			Environment, 2nd Edition, DOE, 2007	
Ecological Monitoring¹	Construction and Operational	Site surveys and inventory	Flora and fauna surveys. Phytoplankton & zooplankton assessment. Coral and seagrass surveys.	Half-yearly during construction and two-year post-construction
Shoreline Monitoring²	Operational	Land and bathymetric survey of coastal profile by licensed surveyors	Coastal profile change	Half-yearly during construction and two-year post-construction

Note:

- (i) *The list is not exhaustive and to be suited according to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the monitoring requirements based on the COA or as required by DOE.*
- (ii) ¹ *If required by the relevant GAs: PERHILITAN, Department of Marine Park Malaysia, DOF, etc.*
- (iii) ² *Requirements based on Department of Irrigation and Drainage (DID) Manual Volume 2 – Coastal Management, Chapter 11 (DID, 2009).*



*Photo Source: Floating Freshwater Farm, Batang Ai, Sarawak
Fanli Marine & Consultancy Sdn Bhd*

PREPARING THE EIA REPORT, SUBMISSION & REVIEW PROCESS

CHAPTER 8. PREPARING THE EIA REPORT AND REVIEW PROCESS

8.1 INTRODUCTION

This chapter provides the format and procedures for an Environmental Impact Assessment (EIA) Report to be submitted to the Department of Environment (DOE) for approval, after the completion of all other necessary studies and requirements.

8.2 EIA REPORT

The Environmental Impact Assessment Guideline in Malaysia (EGIM) (DOE, 2016) provides the requirements and the format for EIA reporting under Section 4.6 and Appendix 9.

8.2.1 EIA Report Format

The EIA report shall typically include the following contents:

- (a) Declaration from the Project Proponent and Qualified Person in the format detailed in Appendix 9 of EGIM (DOE, 2016). The declaration must be printed on the respective company letterhead and attached to the EIA.

- ❖ The Project Proponent shall provide a pledge that he has understood the studies and recommendations in the EIA and shall carry out all P2M2 recommended in the EIA.
- ❖ The Qualified Person shall provide a pledge that the EIA Study is carried out professionally and that the recommendations for P2M2 to be implemented will be able to mitigate against the identified environmental impacts to an acceptable level to ensure minimal degradation of the environment.

- (b) Executive Summary of the EIA Report in Bahasa Malaysia and English.
- (c) Brief introduction to the project, Project Proponent (address, key person and contact information), Environmental Firm (address, key person and contact information) and EIA Team Members (name, academic qualifications, areas of study, signature).
- (d) Review of the policy, regulatory, and legal requirements for the project (**Chapter 2**).
- (e) Terms of Reference (TOR) for the EIA Study as endorsed by the DOE (**Chapter 3**). Endorsement letter from DOE to be attached as an appendix to the EIA report.
- (f) Statement of need for the project. Supporting arguments for the project to justify its needs and necessity are included as part of the report (**Box 4**).

- (g) Deliberation on the alternatives and project options (refer to **Section 3**).
- (h) Detailed description of the project that includes site information, concept and breakdown of major components, material and manpower requirements, project activities, and time schedule (**Table 8-1**).
- (i) Description of the baseline conditions (physical, chemical, ecology and socio-economy) within the Zone of Study (ZOS) and/or the ZOI that may be impacted by the project (**Chapter 4**).
- (j) Assessment of the significant impacts (positive and negative), prediction of the extent and effects on nearby sensitive receptors and proposal of pollution prevention and mitigation measures (P2M2s) to minimise or enhance these impacts.
- (k) Details of public consultation and engagement as part of EIA requirements.
- (l) Environmental Management Plan (EMP) incorporating the Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), monitoring and audit programme (see Chapter 7).
- (m) Appendices containing technical studies, supporting documentation, results of analysis, list of references, etc. to be included.

Box 4

Key Points for Statement of Need

Among key supporting arguments for a project can include, but are not limited to the following:

- Fulfilment of or adherence to the goals of national and state policies and plans.
- Provision of essential services to the community or stakeholders, e.g. better housing, improved amenities, etc.
- Improving the existing environmental conditions of an area.
- Social and economic benefits to society.
- Bringing new green and sustainable technology that will benefit the community and country.

Table 8-1 Recommended Project Description in EIA Report

Project Details

- (a) Project title.
- (b) Name and contact details of the Project Proponent (contact person, address, telephone number, e-mail address).
- (c) Name of registered EIA Consulting Firm (EIA Team Leader, address, telephone number, e-mail address).
- (d) Location of the project (coordinates, lot no, district, etc.).
- (e) Relevant map showing project location and accessibility.

Location

- (a) General site plan that includes ZOS (5-km radius from the project boundary and / or 1 km corridor (0.5 km on either side along the ROW for linear projects)).
- (b) Project boundary and layout including boundary coordinates.
- (c) Description of location in relation to identifiable landmarks (e.g., city centres, main roads, towns, etc.).

Project Component and Design Details

- (a) Project details (land area, buffer requirements, lots, and land status).
- (b) Project concept.
- (c) Project components.
- (d) Technology use.
- (e) Examples of similar project type and scale.

Note: The above shall be supported with technical drawings, illustration and diagrams.

Project Activities

- (a) Method statement to be provided for major project activities during preconstruction, construction, and operational stages.
- (b) Manpower requirements.
- (c) Resource requirements (e.g., soil and aggregate sources, spoil disposal area, etc.).

Infrastructure, Utilities and Amenities Requirement

Details of the estimated demand for:

- (a) Water supply.
- (b) Electricity.
- (c) Sewerage.
- (d) Telecommunications.
- (e) Transport system.
- (f) Waste management.

Project abandonment Plan and Rehabilitation

- (a) Wastes.
- (b) Structure.
- (c) Site Stability.
- (d) Closing and Maintenance.

Project Implementation Schedule

- (a) The estimated timeline for various stages of project implementation from planning to construction and operational stages.
- (b) Details of each stage of implementation.

Note: *The list is not exhaustive and to be suited for the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.*

(n) Executive Summary

The Executive Summary provides a concise brief of the findings and recommendations from the EIA study for decision makers to review. The Executive Summary shall be short and written in non-technical language, both in Bahasa Malaysia and English, presenting the following information:

Title of the project.
Name and contact details of the Project Proponent.
Name and contact details of EIA Team members.
Location of the project site.
Relevant maps showing the location of the project and sensitive receptors and the extent of ZOS.
Alternatives considered.
A tabulation of significant impacts and proposed P2M2s (format as detailed in EGIM).
Description of the monitoring and audit programme [Performance Monitoring (PM), Compliance Monitoring (CM), and/or Impact Monitoring (IM)].
Conclusion to the Study.

A soft copy of the Executive Summary (PDF format) will be submitted to DOE along with a soft copy of the full EIA report.

(o) Data Deliverables

- The Project Proponent shall make available all relevant data collected during the EIA study to be submitted (raw and processed format) together with the EIA report.
- Examples of such data include – sampling results (certificates and raw data), modelling databases, baseline data (surveys, hydrographic data, and climate data), metadata files, etc.
- These data shall be provided to relevant government agencies upon request.

(p) Conclusion to the EIA Report

8.2.2 STAKEHOLDER ENGAGEMENT AND PUBLIC DISPLAY

The stakeholder engagement process shall be ongoing since the project planning stage (see **Section 3.3** for details). In the EIA phase, stakeholder engagement is essential for the Project Proponent to brief the stakeholders about the project and the potential impacts, and to obtain their feedback on the suggested mitigation measures.

For a Second Schedule EIA, there are additional mandatory requirements prior to the approval of the EIA report. These include:

Public Briefing	For EIAs under the Second Schedule, public engagement is mandatory. It can take many forms, but the common one is through a public briefing with the stakeholders within the Zone of Impact (ZOI). In the briefing, the Project Proponent and the EIA Team will present the project brief followed by a questions and answers (Q&A) session. All discussions will be recorded and reported in the EIA.
Public Display and Review of EIA Report	Similarly, after the EIA is submitted, there is a public review period of 30 days, by which the public will officially be requested to submit their responses and comments in writing to the DOE. Notification of the public display is published in two local newspapers (consecutively 3 days).
Display Locations	The EIA will be displayed at selected locations (DOE office, public libraries, and local authority offices) where the public can view the documents easily. The Project Proponent and Qualified Person can hold discussions with DOE to propose suitable locations for display.
Online Display	The EIA will be uploaded to the DOE website for the duration of the review period.
Additional Engagements	Although it is only mandatory for the Second Schedule EIA for official public engagement, all comments are useful in the EIA study. The Project Proponent is encouraged to carry out stakeholder engagements voluntarily even for the First Schedule EIA.
Documentation	The public participation process shall be properly documented and reported in the EIA. The report shall contain the following: <ul style="list-style-type: none">• Details of the programme (dates, venue, itinerary).• Attendance list of participants.• Copies of survey forms.• Brief summary of findings from the event, e.g. reports, minutes of meeting, list of questions and responses, photograph of event.• Video or voice recordings (optional and only as reference).

The report shall form part of the Appendix in the EIA, and the issues brought up and responses from the Project Proponent must be clearly stated and discussed in the EIA report.

Box 5 provides some examples of good practices when engaging with the stakeholder.

Box 5

Good Practices in Stakeholder Engagement

- i. **Stakeholder Identification:** Selection of stakeholders should be inclusive, encompassing and without bias. The focus should be those that are directly affected by the project within the zone of impact (ZOI) but may include any other relevant stakeholders.
- ii. **Transparency:** The stakeholder engagement process shall be carried out in a transparent and inclusive manner, with ample opportunities for the relevant stakeholders to obtain information, provide comments and submit feedbacks.
- iii. **Information Disclosure:** Information provided should be adequate and relevant to allow for stakeholders to understand the project and make informed decisions. Sufficient time should be allowed for information assessment and feedback.
- iv. **Communication Tools:** Communication can be in many forms – reports, formal meetings, focal group discussions (FGDs), information sheets, surveys, websites, etc. The method should best be suited to the target audience, with information communicated in simple to understand language and none too technical.
- v. **Notification:** All stakeholders should be informed and notified appropriately of any meetings or discussions to be held and given ample time to make arrangements. All efforts shall be made to ensure representative attendance by the stakeholders.
- vi. **Selection of Venue:** Meeting locations should be in a venue close by, convenient and accessible to the stakeholders. This would ideally be near the project site. For public display of EIA reports, these shall be at locations open and accessible to the public, e.g. public library, police station, local authority office, etc.
- vii. **Documentation:** All engagements shall be properly documented and reported in the EIA. Actions taken to address the issues brought up shall be clearly spelled out and mitigation measures incorporated as part of the project design. It is a good practice to follow up with the stakeholders on actions taken.
- viii. **Accountability and Continuity:** All comments and feedbacks from stakeholders shall be assessed and reviewed objectively. Actions shall be taken by the Project Proponent to address legitimate concerns. Stakeholder management should be throughout the project lifespan. Provision of platforms for stakeholders' engagement post-EIA is a best practice that should be adopted.

8.3 EIA REPORT SUBMISSION AND REVIEW PROCESS

Requirements for submission of EIA Report and the review process for the First and Second Schedule EIA is presented in **Table 8-2**.

Table 8-2 Comparison of the Submission and Review Process for the First and Second Schedule EIA

Components	First-Schedule Activity	Second Schedule Activity
Report Submission	Submission to DOE State Office	Submit to DOE HQ
No. of Reports	Minimum 3 hardcopies + 1 softcopy to State DOE 1 hard copy + 1 soft copy to DOE HQ	Minimum 3 copies + 1 soft copy
No. of corrected EIA (if needed)	3 hard copies + 1 soft copy	3 hardcopies + 1 softcopies
Review Timeline	25 working days (5 weeks)	60 working days (12 weeks)
Public Participation	Required	Required
Public Display	Not required	Required
Web Display	Required Submit a soft copy of the EIA report to the DOE State Office.	Required Submit a soft copy of the EIA report to the DOE State Office.
Advertisement	Not required	Advertise in two major newspapers or main media streams.

Source: Adapted from EGIM, DOE, 2016, and DOE Notice JAS.600-1/1/7 Jilid 2(22) dated 7 December 2020, JAS.100-1/4/1 Jilid 3(22) dated 3 August 2020, Notis Kepada Jururunding EIA 2/2020 dated 25 August 2020.

The submission of the EIA report shall be in accordance with the steps and procedures outlined in the EGIM (DOE, 2016). The EIA Report Quality Self-Assessment Tool (RQSAT) in the EGIM (DOE, 2016) can be used by the Project Proponent and the Qualified Person to assist in conducting self-check of the quality of the EIA report prior to submission to the DOE, to avoid rejection. This EIA Checklist is appended in **Appendix 3**. If the EIA is approved, the DOE will issue the Conditions of Approval (COA) to the Project Proponent. If the EIA is rejected, a new EIA can be submitted. Details in **Box 6**. This marks the end of the EIA process.

Box 6: Outcomes from EIA Review Process

The possible outcomes of the EIATRC meetings are:

- i. Approval of the EIA Report, provided that the report meets with the requirements of Section 34A (2C) of the Environmental Quality Act (EQA) 1974.
- ii. Rejection of the EIA Report, where the report does not meet the requirements of Section 34A (2C) of the EQA 1974.

An aerial photograph of a large-scale aquaculture farm. The facility consists of numerous rectangular ponds arranged in a grid-like pattern, separated by concrete or earthen walkways. The water in the ponds varies in color, from clear blue to a milky white, indicating different stages of the farming process. In the foreground, a long, covered walkway with a black and white striped roof runs parallel to the ponds. A dirt road and some small structures with blue roofs are also visible. The overall scene depicts a well-organized and extensive aquaculture operation.

REFERENCES

References

- DID (2011). *Guideline for Development Related to Rivers and River Reserves*. Department of Irrigation and Drainage (DID), Kuala Lumpur.
- DOE (2012). *Guidance Document on Ecological Assessment in EIA*. Department of Environment, Putrajaya.
- DOE (2017). *Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2)*. Department of Environment, Putrajaya.
- DTCP (2012). National Coastal Zone Physical Plan (NPP-CZ) Vols. 1 & 2. Department of Town and Country Planning, Peninsular Malaysia (DTCP), Ministry of Housing and Local Government, Putrajaya.
- DTCP (2017). National Physical Plan-3 (NPP-3). Department of Town and Country Planning, Ministry of Housing and Local Government, Putrajaya.
- DTCP (2009). *Central Forest Spine 1: Master Plan for ecological linkages*. Department of Town and Country Planning (DTCP), Ministry of Housing and Local Government, Putrajaya.
- DTCP (2009). *Central Forest Spine 2: Master Plan for ecological linkages*. Department of Town and Country Planning, Ministry of Housing and Local Government, Putrajaya.
- FAO (1988). Definition of aquaculture, *Seventh Session of the IPFC Working Party of Experts on Aquaculture*, IPFC/WPA/WPZ, p.1-3, RAPA/FAO, Bangkok.
- HCV Malaysia Toolkit Steering Committee (2018). *Malaysian National Interpretation for the Identification of High Conservation Values*. HCV Malaysia Toolkit Steering Committee, Putrajaya.
- KATS (2019). Master List of Protected Areas in Malaysia – A Tool for National Biodiversity Conservation Management and Planning. Ministry of Water, Land and Natural Resources (KATS), Putrajaya.
- NRE (2008). A Common Vision on Biodiversity: In government and the development process – Reference document for planners, decision-makers & practitioners. Ministry of Natural Resources and Environment (NRE), Putrajaya.
- NRE (2009). Managing Biodiversity in the Landscape. Ministry of Natural Resources and Environment (NRE), Putrajaya.
- NRE (2010). Managing Biodiversity in the Riparian Zone. Second edition. Ministry of Natural Resources and Environment (NRE), Putrajaya.
- NRE (2016). *National Policy on Biological Diversity 2016-2025*. Ministry of Natural Resources and Environment (NRE), Putrajaya.

An aerial photograph of a wastewater treatment plant. The image shows several large, rectangular aeration tanks with water being aerated, creating white foam. A long, covered walkway with a black and white striped roof runs alongside the tanks. The surrounding area is green with trees and grass. The word "GLOSSARY" is written in large, bold, blue letters across the center of the image.

GLOSSARY

Glossary

Acute/Subacute Toxicity	- Immediate or short-term response of an organism to a single dose of a chemical substance through various routes of exposure. Refers to a generalised toxic response with lethality usually being the observed endpoint. Includes LD ₅₀ , LC ₅₀ , LD ₁₀ , and other quantitative endpoints.
Analysis	- An examination in order to understand. See assessment.
Aquatic	- Living, growing, or taking place in or on water.
Assessment	- Examination in order to decide. See analysis.
Assessor	- The assessor is the person who conducts or coordinates an environmental impact assessment. The person may be the leader of a team of experts and is responsible to the Project Initiator.
Bacteria	- A class of microscopic unicellular organisms that cause many diseases.
Baseline data	- Site-specific data pertaining to existing environment (physical, chemical, biological, and human) in the vicinity of the project site; establishes the current ambient status of the environment.
Baseline Studies	- Baseline studies are fundamental surveys of the physico-chemical, biological, and human environment. They may be specific to a particular project or they may be to provide a data-base for future Environmental Assessment or Environmental Impact Assessment at other localities.
Benefit-Cost	- A term that represents the relationship between the benefits accrued for the cost incurred.
Benthic Fauna	- Animal organisms living in bottom muds.
Benthos	- Flora and fauna at the bottom of a water body.
Berm	- An earthen bank raised above the ground.
Berm (beach berm)	- A nearly horizontal portion of the beach formed by the deposition of sediment by the receding waves.
Bilge Water	- Wastes from the bottom of the ship usually contain considerable oils.
Bioconcentration/ Biomagnification	- The uptake and retention of a chemical substance in an organism or in organs or tissues of an organism (bioconcentration). An increase in the tissue concentration of organisms higher in the food chain (biomagnification).
Carcinogen	- A substance that increases the risk of cancer.
Carrying Capacity	- Number of individuals that an environment can support.
Checklist	- A list for verification purposes, a comprehensive list; an inventory.
Chlorination	- A treatment process in which chlorine is used. For example, (1) to sterilize water or (2) to extract gold from the ore.

Chronic Toxicity	- Response of an organism to repeated long-term exposure to a chemical substance.
Chronic	- Of a disease or disorder; developing slowly and persisting for a long time.
Coastline	- The line of topographic contour where the elevation of the ground is 0 m above the mean sea level.
Communicable Diseases	- Diseases that are transmitted from one person or animal to another via a host of agents, such as insects, food, and contaminated materials.
Community	- Any group of naturally occurring organisms sharing a particular habitat.
Cost-Benefit Analysis	- This is a systematic comparison between the cost of carrying out a service or activity and the value of that service or activity. As far as possible, all cost and benefits, whether direct or indirect, financial, social, or environmental, should be quantified. The procedure leads to the calculation of a cost-benefit ratio which is: $\frac{\text{Gross Benefits (discounted from present value)}}{\text{Gross Cost (discounted to present-day value)}}$
Cross-Sectoral Issues	- Issues of concern to more than one sector.
Culvert	- An arched channel beneath a road or a railway to carry water.
Data	- A general term used to denote any or all facts in the form of numbers, letters, text, or symbols. (Raw facts or statistics that alone have little or no meaning, but as a group allow some meaningful relationships to be drawn).
Decision Makers	- Those persons or organisations whose prerogative and responsibility is to make project planning and implementation decisions are the decision-makers. They are the Project Initiator, the Approving Authority for the project and higher authorities.
Decontaminate	- Removal of or cleaning up chemicals or residue to avoid or reduce danger or damage to desirable plants, insects, animals, people, or the natural environment.
Design Solution	- A design solution is any design measure incorporated into a project plan that will avoid a potentially significant environmental impact.
Desludging	- Removal of accumulated solid materials by pumping from a septic tank or leaching pit.
Drawdown	- The magnitude of the change in water level in a well, reservoir, or natural body of water resulting from the withdrawal of water.
Ecology	- The study of the relationship between communities of organisms and their environment.
Ecosystem	- A community and its environment (living and non-living considered collectively) (may range in extent from very small to very large units).
Effluent	- Liquid industrial and agricultural waste; outflowing sewage during purification.

Endemic	- Of a disease or organism; indigenous to a geographic area or population.
Environment	- The surrounding zone (the specific zone to be affected by the project), all natural resources (physical and biological) and human resources (people, economic development, and quality of life values).
Environmental Data Collection	- This is the collection of environmental information from existing sources, e.g. libraries, universities, and environment-related agencies, or through base-line studies.
Environmental Risk Assessment (ERA)	- The description, analysis and communication of information about risks to human health and welfare and to ecosystems; the risks arising from or being transmitted through the natural environment.
Environmental Components	- Environmental components are the detailed environmental categories listed on the Preliminary Assessment Matrix.
Environmental Monitoring	- Observation of the effects of development projects on environmental resources and values, including sampling, analysis, including temporary monitoring during the project construction stage and continuing periodic monitoring following the commencement of project operations. Environmental monitoring allows the actual impact of the project to be measured and improves the database for future impact prediction.
Environmental Impact Assessment (EIA)	- Assessment of the changes in environmental resources or values resulting from a proposed project (called an environmental impact statement (EIS) in the US and in the Philippines).
Environmental Effect or Impact	- An effect on an environmental resource or value resulting from natural or man-made actions, including project development (measured by physical, chemical, biological and social parameters).
Environmental Resource or Value	- An aspect of the environment which is of benefit to man, including all ecological resources and values.
Exposure	- To be accessible to the influence of a chemical or chemical action.
Fault Tree	- A logic diagram beginning with an undesired consequence and systematically deducing all the different plausible chains of events leading to the consequence.
Feasibility	- A measure to prove that the technical options are sustainable and are also the best in that situation.
Feasibility Study	- For the process of the environmental impact assessment procedure and guidelines, a feasibility study is a project planning exercise that results in a final project plan and immediately proceeds the design phase of the project. For most projects, it is followed by a period project (reappraisal) during which the final implementation decision is made.
Flammable Limits	- Flammable limits denote the concentration range at which the flammable or explosive mixture will ignite and continue to burn.
Flash Point	- The flash point is the temperature at which a liquid or volatile solid gives off vapour sufficient to form an ignitable mixture with air.

Flotables (or Floatables)	- Materials that float on the water surface, including oils, greases, rubber bits, etc.
Frequency	- Rate of occurrence per unit of time.
Geographic Information System	- An information system that can input, manipulate, and analyse geographically referenced data in order to support the decision-making processes of any organisation. (The term "GIS" is used not only to describe the concept underlying the system but also the facility based on it).
Groundwater	- Water that occurs naturally beneath the ground surface and may include the fraction of precipitation that infiltrates the land surface.
Habitat	- The normal abode or locality of an animal or plant; the physical environment of a community; the place where a person or thing can usually be found.
Hazard	- Anything that jeopardises safety or health.
Hazardous Wastes	- All wastes which pose significant hazards to people and ecology, including toxics, inflammables, explosives, and incendiary materials.
Hazardous Chemical	- An element or compound that may cause damage to human health and welfare because of its properties, such as toxicity, flammability, explosivity, corrosivity, or extreme reactivity.
HAZOP Studies	- Studies by a multidisciplinary team to identify hazard and operability problems by systematically searching for deviations from design intentions.
Health Hazard	- Potential to cause harm to people.
Health Risk	- The likelihood that a health hazard will cause harm to a human community. Measure of probability that a hazard will cause harm. As there are great uncertainties, only a simple ranking procedure can be used.
Host	- An organism on or in which a parasite lives and feeds.
Infiltration	- Inflow of groundwater into the sewer through leaky joints.
Insecticide	- Any substance or mixture of substances intended to prevent, kill, repel, or control an insect pest.
Integrated Project Planning	- Integrated project planning is a process in which through various procedures available, all technical, economic, and environmental factors in project planning are assessed and evaluated together and through the course of project development.
Integrated Pest Management	- A pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilises all suitable techniques and methods in a manner as compatible as possible to maintain the pest populations at levels below those causing economically unacceptable damage or loss.
Intertidal Zone	- Zone between low tide and high tide levels.

LD ₅₀	- Doses of a chemical that kill half of a population of test animals if taken by mouth or absorbed through the skin. Expressed in milligrams of toxicant per kilogram of body weight of test animal (mg/kg).
Leaching	- The removal of readily soluble components, such as chlorides, sulphates, and carbonates, from soil by percolating water.
Malaria	- A mosquito-borne disease caused by <i>Plasmodium</i> parasites.
Marine Zone	- Seaward zone beyond low tide level; also known as offshore zone.
Matrix	- A matrix is a two-dimensional checklist of environmental components and project activities used to identify and communicate the potential environmental impacts of a proposed project.
Migration	- Permanent movement of a population from one habitat or location to another.
Mitigation and Abatement Measures	- These are measures adopted into the final project plan that either moderate or completely forestall potential environmental impact.
Natural Hazard	- Processes or events that damage human health and welfare, such as storms, volcanic eruptions, tsunamis, lightning, or fires.
Pathogens	- An organism that causes disease. Most pathogens are microscopic in size.
Pest	- Any animal, plant or pathogen that causes damage or annoyance to humans, their animals, crops, or possessions.
Pesticide	- Any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of foods, agricultural commodities, wood and wood products or animal feedstuffs, or substances administered to animals for the control of insects, arachnids or other pests in or on their bodies. The term includes substances intended for use as a plant-growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit, and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.
Pesticide Residue	- Pesticide remaining on or in a plant or treated area following a time lapse after application.
pH	- Value that represents the acidity or alkalinity of a solution. It is defined as the logarithm of the reciprocal of the hydrogen ion concentration.
Plume	- A narrow column of smoke or noxious gases.
Potable Water	- Water that is palatable and safe for human consumption; in which any toxic substances, pathogenic organisms, and factors have been reduced to safe or acceptable levels.
PPM (parts per million)	- A means to express the concentration of chemicals in a solution or in food, plants and animals. One part per million equals 1 milligram in 1 kilogram.

Project Activity	- A project activity is an operation or procedure conducted during the planning, development, or subsequent operation of the project. The various project activities during each phase of the project adequately describe the work carried out.
Public Participation	- Public participation in project planning is a means of: <ol style="list-style-type: none"> 1. Identifying the material or psychological impact of a proposal. 2. Measure and promote the social acceptance of a project. 3. Monitoring community needs and ensuring that development continues to meet those needs. 4. Monitoring changing environmental values in the community.
Remote Sensing	- Collection of information or electromagnetic radiation from an object without being in physical contact with it. Recording images of the Earth's surface from aircraft and satellites and processing and analysing these images to obtain information needed for inventories of natural resources, assessments of natural disasters, preparation of maps, etc.
Residual Environmental Impact	- A residual environmental impact is the potential impact that remains after the mitigation measures have been adopted in a project plan.
Risk	- The likelihood (probability) of an adverse effect, direct or indirect, on human health and welfare.
Runoff	- Precipitation that flows over the surface of the land as opposed to that that penetrates beneath the surface.
Sanitary Landfill	- Method of disposing of municipal refuse by depositing on land with periodic covering of deposited material with layers of earth for prevention of odour nuisances and hazards of vector diseases.
Scenario	- A sequence of actions and events that involve the project technology, facilities, the environment, and affected persons.
Scope	- A field of activity.
Scoping	- Setting the boundaries or scope of works for EIA in terms of issues, time, cost, alternatives, and other variables.
Septic Tank/Leaching System	- Septic tank plus subsurface leaching system for effluent disposal. The term "septic tank" generally means both the tank and the leaching system.
Sewage	- Human excreta and waste water flushed along a sewer pipe.
Significant Environmental Impact	- A significant environmental impact is one that will have an appreciable effect on the quality of life of people in the community or an appreciable effect on the ecosystem on which the community depends.
Species	- A group of plants or animals, with similar characteristics and common name, that reproduce true to type.
Standpipe	- A tap on the end of a free-standing water pipe.
Storm Sewer	- Sewer or conduit for receiving storm surface water runoff (storm water).

Tailings	- Soil and other debris washed out of a mine works.
Terms of Reference	- The terms of reference issued in a detailed assessment brief list the significant environmental impacts and the impacts of unknown significance that must be assessed during detailed assessment.
Topographic Map	- Map that presents the horizontal and vertical positions of the represented features.
Toxicity	- A physiological or biological property which determines the capacity of a chemical to do harm or produce injury to living organism by other than mechanical means.
Weeds	- Unwanted plants.
Wetlands	- Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of marine waters, the depth of which at low tide does not exceed six metres. In addition, the Ramsar Convention (1971) provides that wetlands “may incorporate riparian and coastal zones adjacent to the wetlands and island or bodies of marine water deeper than six metres at low tide lying within the wetlands”.



APPENDICES

Appendix 1: Generalised Pathway for Planning Fisheries Projects

STAGE	ACTION	BY WHOM
Project Identification	Reconnaissance Survey	Project Proponent (PP)
	Consultation with DOE / Forest Dept. (FD) / Land Office (LO)	PP
Pre-Feasibility & Feasibility	Identification of site(s) areas	Project Proponent
	Screening for site selection	PP & EIA Consultant
	Scoping of EIA	PP, EIA Consultant & DOE
	Land Conversion Plan(s)	Project Consultant appointed by PP
	Selection of site / area	PP
	EIA Study	EIA Consultant
	Submission of EIA to DOE for approval	PP
	Application to Approval Authority for project approval (State Forest Dept.)	PP
	DOE, FD / Land Office sends EIA and harvesting plan submission, respectively, to various public sector agencies for comments.	DOE (for EIA) LO(for land conversion)/FD
	Comments compiled, and recommendations made.	DOE & LO
	Decision on EIA	DOE
	PP informed of EIA approval / conditions	DOE
	Key EIA Issues (if necessary)	EIA Consultant
	Recommendation made to Approval Authority	FD
	Decision of project	Approval Authority
PP informed of project approval	Approval Authority	
Detailed design / planning	Detailed layout plan / engineering design	PP
	Submission to LO, FD and various agencies (e.g. JKR, JPS, DOE, Fisheries, Agriculture, etc.) for approval.	PP
	Approval of detailed layout by referred agencies	Individual agencies referred to
Implementation	Land clearing, land preparation / construction	PP
	Operation	PP
	Environmentally Monitoring and Auditing (EM&A) / Reporting	PP/DOE/Consultant
Post-Harvesting	Decommissioning	PP
	Ongoing EM&A (as necessary)	PP/DOE/Consultant
	Post-closure Landuse Plan	PP

APPENDIX 3: SPECIFIC STANDARDS AND LIMITS FOR THE FISHERIES PROJECT

Recommended Water Quality Limits for Fisheries and Aquaculture Purposes

Parameter	Fisheries and Aquaculture Limits		References*
	Freshwater	Marine	
<i>Physico-chemical</i>			
pH	6.5-8.5	6.5-8.5	Department of Fisheries (2014)
Temperature	25 - 32°C	25 - 32°C	Department of Fisheries (2014)
Dissolved Oxygen	>5 mg/L	>5 mg/L	Bhatnagar and Devi (2013); Franklin (2014); Boyd (2003)
Biochemical Oxygen Demand	<6 mg/L	<6 mg/L	Bhatnagar and Dev (2013)
Total Suspended Solids	<50 mg/L	<50 mg/L	Boyd (2003)
Total Dissolved Solids	<750 mg/L	-	Scannell and Jacobs (2001)
Total Organic Carbon	15 mg/L	10 mg/L	EPA (2003)
<i>Inorganics (Heavy Metals and Others)</i>			
Nitrate	<3.0 mg/L	<3.0 mg/L	Department of Fisheries (2014)
Nitrite	<0.2 mg/L	<0.125 mg/L	Bhatnagar and Devi (2013); AOTA (2008)
Ammoniacal Nitrogen, NH ₃ -N	<0.02 mg/L	<0.02 mg/L	Department of Fisheries (2014); Boyd, (2003); Bardon-Albaret and Saillant (2016)
Total Phosphorus	<0.5 mg/L	<0.015 mg/L	EPA (2003); Loka (2015)
Chlorine	<0.003 mg/L	<0.0075 mg/L	ANZECC (2000); EPA (2003)
Hydrogen Sulphide	<0.02 mg/L	<0.02 mg/L	Bhatnagar and Devi (2013)
Fluoride	<0.5 mg/L	-	Camargo (2003)
Chromium	<0.02 mg/L	<0.02 mg/L	ANZECC (2000); EPA (2003)
Arsenic	<0.01 mg/L	<0.04 mg/L	Kumari et al., (2016); Rajkumar (2013)
Mercury	<0.001 mg/L	<0.00085 mg/L	ANZECC (2000); Krishnani et al. (2003)
Lead	<0.007 mg/L	<0.007 mg/L	ANZECC (2000)
Zinc	<0.05 mg/L	<0.05 mg/L	EPA (2003)
Cadmium	<0.0018 mg/L	<0.005 mg/L	ANZECC (2000); EPA (2003)
Boron	1.2 mg/L	1.2 mg/L	Moss and Nagpal (2003)
Manganese	<1 mg/L	<2.2 mg/L	Howe et al. (2004), Krishnani et al. (2003)
Iron	<2.0 mg/L	<2.0 mg/L	Department of Fisheries (2014)

Parameter	Fisheries and Aquaculture Limits		References*
	Freshwater	Marine	
Nickel	<0.15 mg/L	<0.015 mg/L	ANZECC (2000)
Organics (Non-Pesticides)			
Polychlorinated biphenyls (PCBs)	0.001 µg/L	0.004 µg/L	EPA (2003)
Phenols and chlorinated phenols	<0.6 - 1.7 µg/L	-	ANZECC (2000)
Pesticides			
Aldrin	<0.01 µg/L	-	ANZECC (2000)
Azinphos-methyl	<0.1 µg/L	-	ANZECC (2000)
Chlordane	<0.01 µg/L	0.004 µg/L	ANZECC (2000)
Chlorpyrifos	<0.001 µg/L	-	ANZECC (2000)
DDT (including DDD & DDE)	<0.0015 µg/L	-	ANZECC (2000)
Demton	<0.01 µg/L	-	ANZECC (2000)
Dieldrin	<0.005 µg/L	-	ANZECC (2000)
Endosulfan	<0.003 µg/L	0.001 µg/L	ANZECC (2000)
Endrin	<0.002 µg/L	-	ANZECC (2000)
Hexachlorobenzole	<0.00001 µg/L	-	ANZECC (2000)
Heptachlor	<0.005 µg/L	-	ANZECC (2000)
Lindane	<0.01 µg/L	0.004 µg/L	ANZECC (2000)
Malathion	<0.15 µg/L	-	ANZECC (2000)
Methoxychlor	<0.0311 µg/L	-	ANZECC (2000)
Mirex	<0.0012 µg/L	-	ANZECC (2000)
Paraquat	-	<0.01 µg/L	ANZECC (2000)
Parathion	<0.04 µg/L	-	ANZECC (2000)
Toxaphene	<0.002 µg/L	-	ANZECC (2000)
2,4-dichloropheno	<4 µg/L	-	ANZECC (2000)

NOTES:

*** - Reference for**

ANZECC (2000). *Australian and New Zealand guidelines for fresh and marine water quality*. The Guidelines. National Water Quality Management Strategy, Volume 1, Paper No. 4.

AOTA (2008). *Water quality criteria*. Ornamental Aquatic Trade Association, OATA. www.ornamentalfish.org

Bardon-Albaret, A., and Saillant, E.A. (2016). Effects of hypoxia and elevated ammonia concentration on the viability of red snapper embryos and early larvae. *Aquaculture*, 459 (1), 148-155.

- Bhatnagar, A., and P. Devi. (2013). Water quality guidelines for the management of pond fish culture. *International Journal of Environment Sciences*, 3 (6), 1980 - 2009.
- Boyd, C.E. (2003). Guidelines for aquaculture effluent management at the farm-level. *Aquaculture*, 226, 101 – 112.
- Camargo, J.A. (2003). Fluoride toxicity to aquatic organisms: a review. *Chemosphere*, 50(3), 251 – 264.
- Department of Fisheries (2014). Kit amalan akuakultur baik ke arah akuakultur bertanggungjawab. Retrieved January 22, 2021 from https://www.dof.gov.my/dof2/modules_resources/bookshelf/AKuaBaik/mobile/index.html#p=26
- EPA (2003). Aquaculture management and the environment protection (Water Quality) Policy. Environmental Protection Agency, EPA 488/03. http://report.epa.sa.gov.au/files/477399_aquaculture_mgmt.pdf.
- Franklin, P.A. (2014). Dissolved oxygen criteria for freshwater fish in New Zealand: a revised approach. *New Zealand Journal of Marine and Freshwater Research*, 48,1, 112-126. doi: 10.1080/00288330.2013.827123
- Howe, P.D., Malcolm, H.M., and Dobson, S. (2004). *Manganese and its compounds: environmental aspects*. Concise International Chemical Assessment Document 63. World Health Organization (WHO).
- Krishnani, K.K., Azad, I.S., Kailasam, M., Thirunavukkarasu, A.R., Gupta, B P., Joseph, K.O., Muralidhar, M., and Abraham, M. (2003). Acute toxicity of some heavy metals to *Lates calcarifer* fry with a note on its histopathological manifestations. *Journal of Environmental Science and Health, Part A*, 38(4), 645-655.
- Kumari, B., Kumar, V., Sinha, A.K., Ahsan, J., Ghosh, A.K., Wang, H., and DeBoeck, G. (2016). Toxicology of arsenic in fish and aquatic systems. *Environmental Chemistry Letters*, 15(1), 43–64. doi:10.1007/s10311-016-0588-9
- Loka, J. (2015). Importance of water quality in mariculture. Karwar Research Centre of CMFRI, Karwar, 91-94. Retrieved January 22, 2021 from <http://eprints.cmfri.org.in/10674/1/14.%20Jayasree%20Loka.pdf>
- Moss, S.A., and Nagpal, N.K. (2003). *Ambient water quality guidelines for boron*. Water Protection Section, Ministry of Water, Land and Air Protection.
- Rajkumar, K. S., Kanipandian, N., and Thirumurugan, R. (2016). Toxicity assessment on haematology, biochemical and histopathological alterations of silver nanoparticles-exposed freshwater fish *Labeo rohita*. *Applied Nanoscience*, 6(1), 19-29.
- Scannell, P.W., and Jacobs, L.L. (2001). *Effects of total dissolved solids on aquatic organisms*. Alaska: Alaska Department of Fish and Game Restoration.



**Department of Environment
Ministry of Environment and Water**

Aras 1 - 4, Podium 2 & 3,
Wisma Sumber Asli No.25,
Persiaran Perdana, Presint 4,
Pusat Pentadbiran Kerajaan Persekutuan,
62574 Putrajaya, Malaysia.



Tel: 03-8871 2000 / 2200

Faks: 03-8888 9987 / 03-8889 1040



www.doe.gov.my



www.doe.gov.my

e ISBN 978-967-2845-30-0



9 789672 845300