

EIA GUIDELINES



CONSTRUCTION OF DAMS



Department of Environment
Ministry of Environment and Water, Malaysia



EIA GUIDELINES FOR CONSTRUCTION OF DAM

2021

Department of Environment, Malaysia

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The Department of Environment (DOE) would like to express our gratitude to all Government Agencies (GAs), both at the Federal and State level, the Local Authorities, Consultants, stakeholders and Non-Governmental Organisations (NGOs) in providing their inputs and incomparable assistance in developing the content of the Guidelines.

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 reports preparation in the country.

Last but not least, DOE also hopes that the Guidelines will be used in the context of EQA 1974 for the betterment of Environmental Management in the country.

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PREFACE



This document (referred as **the Guideline**) represents the revised version of the *EIA Guidelines for Dams and/or Reservoirs Projects* developed by the Department of Environment (DOE) in 1995. It is prepared following the latest requirements in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, of the Environmental Quality Act (EQA) 1974 (Act 127).

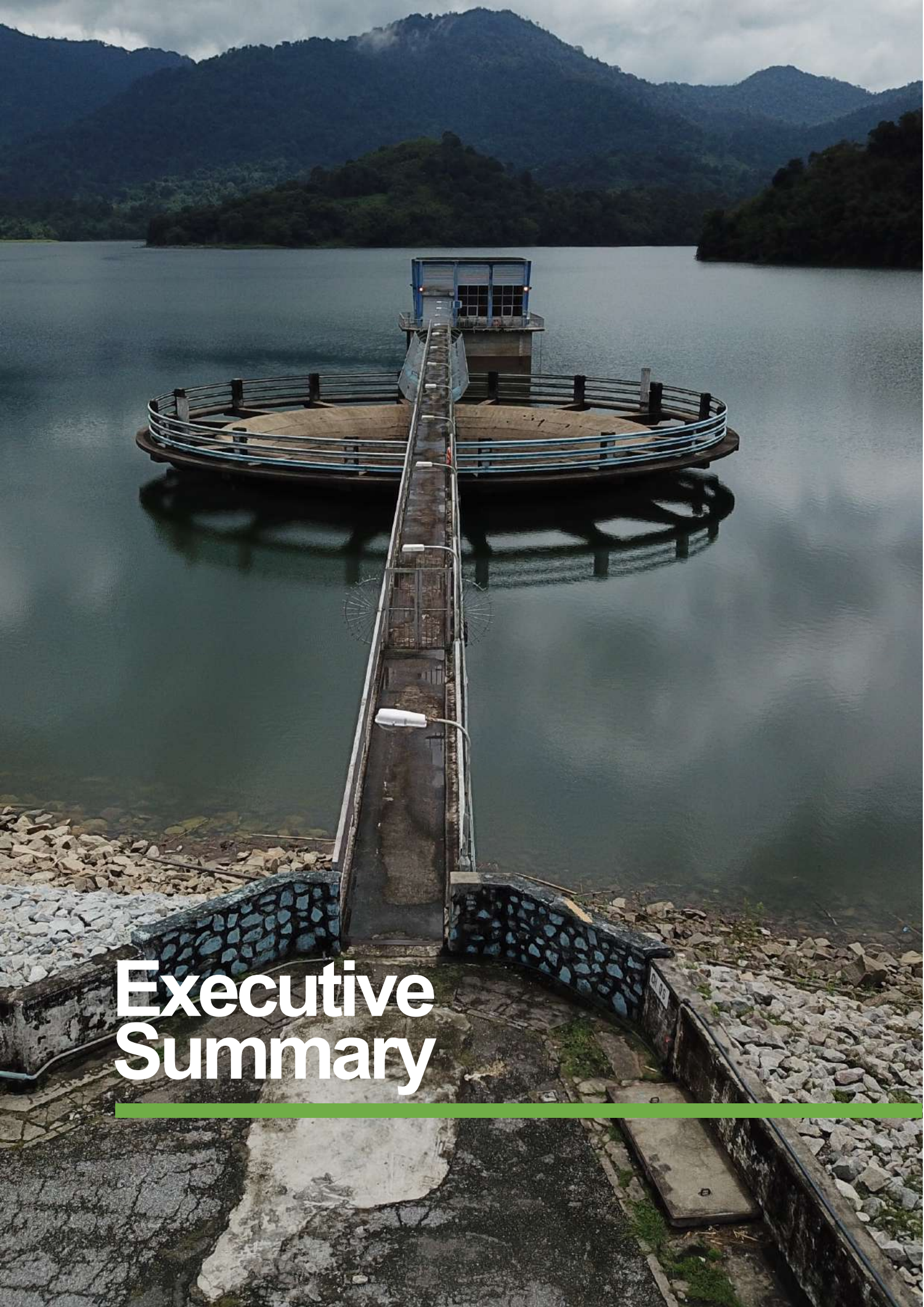
This Guideline is meant to assist various stakeholders that are involved with the construction of a dam. This includes the Project Proponent, project team, environmental consultant, government agencies, and also non-profit organisations (NGOs).

This document provides in depth guidance on the requirements to conduct an Environmental Impact Assessment (EIA) study including step-by-step approaches to ensure it is carried out in accordance to all related guidelines and standards. Apart from that, this Guideline highlights the EIA prerequisites to be considered by the Project Proponent and states the roles and responsibilities of each stakeholders involved. This takes into account the task of each government agencies within the EIA domain.

As the project spans over various aspects and legal jurisdictions, it is recommended that this document is read together with other relevant guidance documents to ensure all environmental issues and requirements are addressed appropriately.

A handwritten signature in black ink, appearing to read 'N. B. Jaafar'.

NORLIN BINTI JAAFAR
Director General,
Department of Environment



Executive Summary

SCOPE OF THE GUIDELINE

Second Schedule EIA

PRESCRIBED ACTIVITY 15 (a)

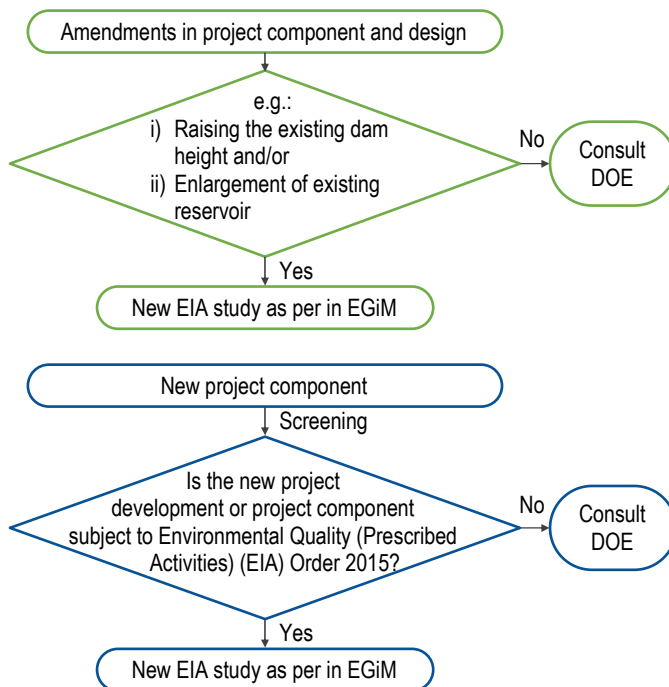
Construction of dam or impounding reservoir for the purpose of irrigation, flood mitigation, control of siltation, recreational, water supply or any other reason with a surface area of 100 hectares or more.

PRESCRIBED ACTIVITY 15 (b)

Dam and hydro-electric power scheme with either or both of the following:

- i) Dam of 15 metres or more in height and ancillary structures covering a total area of 40 hectares or more;
- ii) Reservoir with a surface area of 100 hectares or more.

EIA REPORT REQUIREMENT



TERMS AND DEFINITIONS

DAM – All man-made barriers, together with appurtenant works, constructed for storage, or control of water or other fluids. Dam can be located on the surface or underground.

IMPOUNDING RESERVOIR – A reservoir with outlets controlled by gates that release stored surface or ground water for various purposes. Reservoir can be located on-stream, off-stream, coastal area, in a pond, in a lake or underground.

IRRIGATION – stores and provides water for irrigation for agricultural purposes.

FLOOD MITIGATION – Also known as flow-through dam or perforated dam or detention dam.

CONTROL OF SILTATION – A dam is built to stop the downstream movement of the sediment load.

WATER SUPPLY – impounds and stores river water and rainwater on the upstream side and releases it back into the river at a controlled rate. A water intake point is located downstream which connects with a water treatment plant to treat the river water before distributing it to consumers.

ANY OTHER REASON - Construction of dam or impounding reservoir for the purpose of storage, water quality control, diversion, recreation, navigation and industrial water cooling.

DAM AND HYDRO-ELECTRIC POWER SCHEME – Water is stored at a higher elevation (dam) and led downward through large pipes or tunnels (penstocks) to a lower elevation. Water falling from upstream side to downstream side (head) of dam will generate electricity by rotating turbines.

ANCILLARY STRUCTURES – All ancillary or appurtenant structures, components and equipment functionally pertaining to the dam and hydro-electric power scheme including, spillway, inlet and outlet work, penstock, power house, tail race, diversion, draft tube and switchyard.

OVERVIEW OF EIA PROCESS



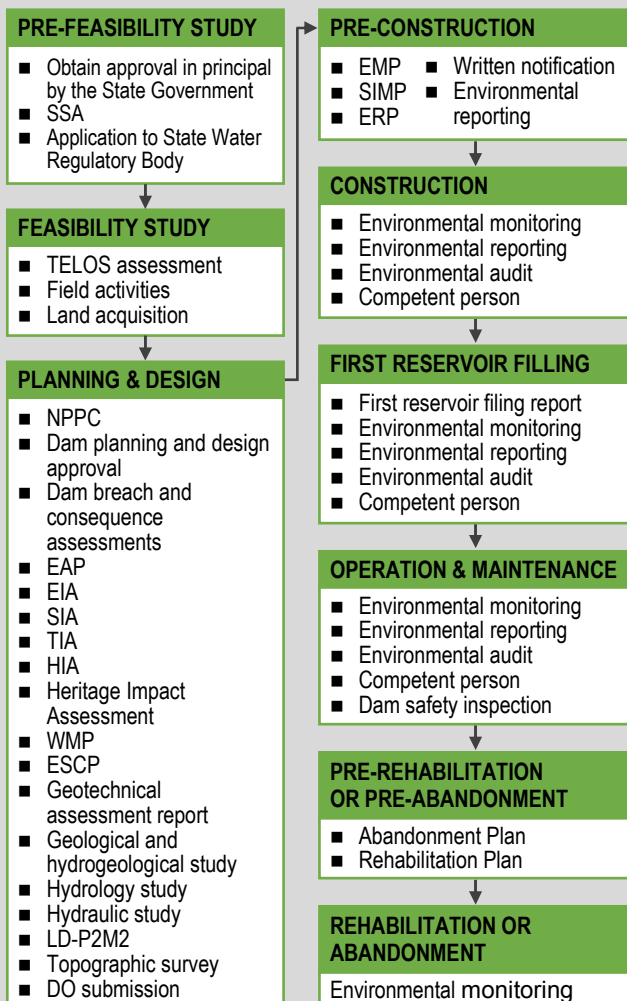
ENVIRONMENTAL PROJECT PLANNING

RELEVANT LEGISLATIONS

Currently, there is no specific legislation that regulates dam management in Malaysia. Since construction of a dam is subjected to the EIA Order 2015 of the EQA 1974, the following provisions are directly applied:

- i) **SECTION 34A (6)** - Any person intending to carry out a prescribed activity shall not carry out such activity until the report required under this section to be submitted to the Director General has been submitted and approved.
- ii) **SECTION 34A (7)** - If the Director General approves the report, the person carrying out the prescribed activity, in the course of carrying out such activity, shall provide sufficient proof that the conditions attached to the report (if any) are being complied with and that the proposed measures to be taken to prevent, reduce or control the adverse impact on the environment are being incorporated into the design, construction and operation of the prescribed activity.

RELEVANT REQUIREMENTS AT VARIOUS PROJECT IMPLEMENTATION STAGE



RELEVANT POLICIES

- Sustainable Development Goals
- Five Year Malaysia Plan
- National Physical Plan (NPP)
- Central Forest Spine Ecological Network Master Plan
- National Policy on Biological Diversity 2016 – 2025
- National Policy on Climate Change
- National Water Resources Policy
- National Policy on the Environment
- Green Technology Master Plan Malaysia 2017 – 2030
- Malaysia National Forestry Policy 1978 (Revised 1993)
- RFZPPN

RELEVANT GUIDELINES

- Malaysia Dam Safety Management Guidelines (MyDAMS)
- GPP Pembangunan dan Pengurusan di Kawasan Berisiko Bencana Gempa Bumi
- GPP Pemuliharaan dan Pembangunan Kawasan Sensitif Alam Sekitar (KSAS)
- GPP Pembangunan di Kawasan Bukit dan Tanah Tinggi
- EGiM (LD-P2M2, EMP)
- Guidelines for Erosion and Sediment Control in Malaysia
- Guidelines for Slope Design
- Urban Stormwater Management Manual for Malaysia (MSMA 2nd Edition)
- Garis Panduan Pembangunan Melibatkan Sungai dan Rizab Sungai
- Garis Panduan Jalan Hutan 2010 (Pindaan 2013)
- Integrated Approaches under the National Water Resources Policy (IWRM,ILM, ICZM, ISMP,IFM)

STAKEHOLDER ENGAGEMENT

Relevant Stakeholders

- DOE
- Project Proponent
- Government Agencies
- Approving Authorities
- Affected Groups
- Interest Groups

Engagement Methods

- Direct interview
- Workshop
- Public Dialogue
- Focus Group Discussion (FGD)
- Exhibitions and road show
- Round table discussion

Documentation and Reporting

- Engagement details (date, venue, itinerary)
- List of attendance
- Copies of survey form
- Report on summary of the engagement (minutes of meeting, photos, analysis)
- Video or voice recordings

TERMS OF REFERENCE

ENVIRONMENTAL SCOPING

- Information gathering and analysis
- Identification of significant environmental issues
- Prioritise significant issues for further studies in EIA
- Determine approach, methodology and tools for assessment
- Identify potential pollution prevention and mitigation measures (P2M2)
- Submission of TOR and ESI for DOE assessment and endorsement

SITE SUITABILITY ASSESSMENT (SSA)

- Consideration of project alternatives and options:
- Project siting
 - Terrain and topography
 - Hydrology
 - Social aspect
 - Accessibility

EIA STUDY BOUNDARY

- Zone of Study (ZOS)
 - 5 km radial zone from project boundary
 - For linear project component (e.g.: water transfer tunnel), 500 m on either side
- Zone of Impact (ZOI): Not limited to a specific distance and will be determined by modeling and impact-causing project activities

DETERMINATION OF KEY PROJECT ACTIVITIES

- Pre-construction
 - Survey
 - Investigation
 - Land acquisition
- Construction
 - Temporary occupation
 - Site preparation
 - Diversion
 - Dam construction
 - Intakes and spillways
 - Reservoir filling
 - Baseline for dam surveillance
 - Demobilisation
- Operation
 - Reservoir presence
 - Reservoir usage
 - Dam presence
 - Weed control
 - Catchment
 - Dam surveillance
- Decommissioning/Abandonment
 - Decommissioning or abandonment

BASELINE DATA REVIEW

- Must be adequate to assess potential impacts on the ESAs which includes:
- Physical: Land use, geology and hydrogeology, soil characteristics, terrain, climate, hydrology, water quality, air quality, noise and vibration level
 - Biological: Ecosystem, terrestrial flora and fauna, aquatic flora and fauna
 - Social: Demography, stakeholders, public health status, heritage, culture and archaeology, ecotourism
 - Land traffic, marine traffic
 - Environmentally sensitive areas (ESA)
 - Existing site constraints

IDENTIFICATION OF SIGNIFICANT IMPACTS AND PRIORITY SETTING

- Various techniques to analyse and prioritise issues and impacts: Network method, comparison with other similar projects, questionnaire and matrix
- Criteria for determining significance of impacts: Magnitude, permanence, reversibility and cumulative effects

RELATED KEY ISSUES

- Risk of structural failure or accidental outflows
- Location of dam
- Regulated flow
- In-stream barrier
- Water-related diseases
- Population influx
- Reservoir protection (during operation)
- Earthworks (construction issue only)

SELECTION OF MITIGATION MEASURES

- To be assessed and identified based on best available techniques (BATs), best management practices (BMPs) and options available
- To be qualitative and descriptive only and to be detailed out in the EIA stage

PREPARATION OF TOR AND ESI REPORT

Preparation of the document to follow as per EGIM and to be submitted to DOE HQ for endorsement

EIA STUDY TEAM MEMBERS

- Study team can be formed once issues and possible impacts are identified
- Qualified Person must be registered with DOE
- All team members are to perform the tasks required for the EIA study (studies, modeling, public engagements)
- Assess the impacts, proposed P2M2, EMP and monitoring framework

ESTABLISHMENT OF STUDY REQUIREMENT

- Scope of EIA study is dependent of the scale and magnitude of the project
- Qualified Person to provide methodologies, assessment/modeling tools, baseline data, potential impact and proposed mitigation measures

BASELINE DATA

BASELINE DATA COLLECTION

Purpose

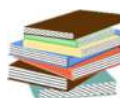
- Identify existing environmental conditions which may influence project design decisions;
- Identify sensitive issues or areas requiring mitigation or compensation;
- Provide input data to numerical models for prediction of impacts; and
- Provide baseline reference for compensation during project implementation stage.

PRIMARY DATA

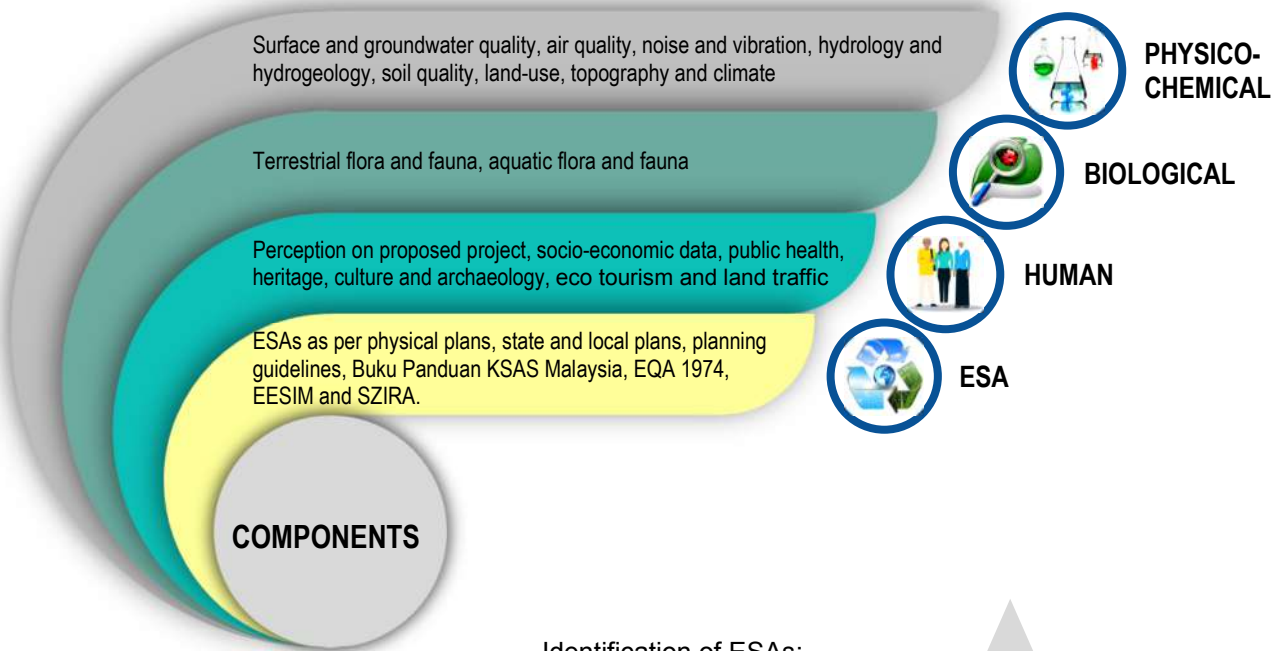


First-hand data collected e.g. site survey, ground-trothing, sampling programme

SECONDARY DATA



Information from various sources e.g. published reports and research papers



Identification of ESAs:

01. ESA rank
02. Category
03. Location
04. The nearest distance from project boundary
05. Source

WASTE MANAGEMENT

- **Assessment requirements**
 - i) Types of waste generated during construction and operations
 - ii) Impacts from these wastes and management measures
- **Prediction method**
 - i) Potential scheduled waste generation based on project activities
 - ii) Waste generation estimation based on population
 - iii) Total biomass based on vegetation types and published studies values
- **Evaluation of impacts**
 - i) Identify and estimate the quantum of all waste sources
 - ii) Severity of impacts from improper management
 - iii) Locations of temporary storage within the site
 - iv) Locations for disposal site
- **Output**
 - i) Proper temporary disposal sites and storage facilities
 - ii) Mitigation measures against spillage and other impacts
 - iii) Mitigation measures to be incorporated into project site management

CLIMATE

- **Assessment requirements**
 - i) Loss of carbon sink due to forest clearance
 - ii) Changes of micro climate due to the presence of reservoir
- **Prediction method**
 - i) The GHG Protocol of the WRI
 - ii) Technical reports and methodology guidelines of the IPCC
- **Evaluation of impacts**
 - i) Determine loss of carbon sink due to vegetation clearance
 - ii) Determine potential carbon sink of aquatic vegetation (microphyte) in the water body
- **Output**

Identify potential environmental measures to offset the loss of carbon sink

HYDROLOGY & HYDRAULIC

- **Assessment requirements**
 - i) Land clearing scale and alterations to hydrological and drainage characteristics of the site
 - ii) Scale of drainage system that may be altered
 - iii) Hydrological condition before and after project implementation
 - iv) Impacts to the downstream and its surrounding area
 - v) Determination of environmental flow setting
- **Prediction method**
 - i) Hydrological procedures (DID)
 - ii) Numerical models for estimating peak flood, runoff, watershed analysis, flood plain hydraulics, etc.
 - iii) Numerical models for dam break modeling
 - iv) Hydrological analysis
- **Evaluation of impacts**
 - i) Delineate river basins are affected
 - ii) Hydrological data and long-term rainfall trends
 - iii) Hydrological condition: Pre- and post-project implementation
 - iv) Ultimate discharge from a hypothetical breach of the dam
- **Output**
 - i) Hydrological and drainage systems of the project and its impact on the surrounding
 - ii) Flood peak or flood wave immediately downstream from the dam
 - iii) Environmental flow analysis

WATER QUALITY

- **Assessment requirements**
 - i) Types & scale of impairment to water quality
 - ii) Potential sources of pollutants
- **Prediction method**
 - i) Mathematical models (1-, 2- or 3D) analysis of pollution loads and dispersion in the waterways
 - ii) Simple mass balance models
- **Evaluation of impacts**
 - i) Pollutant loading (magnitude and extent of impacts further downstream)
 - ii) Potential water polluting sources
 - iii) Users and sensitive habitat located downstream
- **Output**

Identify suitable BMP and treatment system

EROSION AND SEDIMENTATION

- **Assessment requirements**
 - i) Land clearing scale
 - ii) Conditions of the hydrological and drainage system
 - iii) Extent of erosion and sedimentation
 - iv) Suitable BMP
- **Prediction method**
 - i) RUSLE
 - ii) MUSLE
 - iii) Computer models
- **Evaluation of impacts**
 - i) Rate of erosion and sediment yield
 - ii) Erosion scenarios i.e. with and without mitigation measures
 - iii) Simulation to determine the BMPs that shall be adopted
- **Output**
 - i) Adoption of avoidance principles
 - ii) Identify suitable BMP to incorporate in the LD-P2M2

LAND USE AND AESTHETICS

- **Assessment requirements**
 - i) Compatibility of the project towards the surrounding land use
 - ii) Adequacy of buffer as per structure plan, local plan or any other guidelines
- **Prediction method**
 - i) Compatibility based on structure plan, local plan and other guidelines
 - ii) setback based on national and state guidelines
 - iii) 2D and 3D viewshed analysis
- **Evaluation of impacts**
 - i) Designated land use of the project site as per the spatial plan
 - ii) Suitability of the project on the surrounding development
- **Output**
 - i) Suitability of the project on the designated site
 - ii) Land use conflict that may arise

INFRASTRUCTURE AND UTILITIES

- **Assessment requirements**

Existing infrastructure and utilities such as road, power supply, water supply and telecommunication
- **Prediction method**
 - i) Demand estimation methods by regulators
 - ii) Compare existing supply to meet future demand to determine adequacy

ECOLOGY■ **Assessment requirements**

- i) Mapping of important habitats and ESA
- ii) Inventory of existing flora and fauna
- iii) Identification of critical species

■ **Prediction method**

- i) Assessment of conservation status and sensitivity of habitat, flora and fauna
- ii) Ecological models for species diversity and population change
- iii) Limit of Acceptable Change (LAC)

■ **Evaluation of impacts**

- i) Level of encroachment into ESA
- ii) Possible loss of habitat and its flora and fauna
- iii) Project activities that could disturb animal behaviour
- iv) Forest fragmentation and its consequences

■ **Output**

- i) Highlight important area to be protected
- ii) Identification of critical areas for mitigation measures
- iii) Develop WMP

NOISE■ **Assessment requirements**

Ambient noise environment and activities that pose impairment hazards

■ **Prediction method**

- i) Mathematical models
- ii) Noise modeling software
- iii) Traffic noise models

■ **Evaluation of impacts**

Model or calculate the increase in noise level, mapped as noise contours

■ **Output**

- i) Extent of potential impacts to nearby sensitive receptors
- ii) Critical levels for pollutant at sensitive receptors

SAFETY AND HEALTH■ **Assessment requirements**

Assessment of safety and health towards workers and nearby population

■ **Prediction method**

- i) Health—Qualitative/Quantitative Health Risk Assessment (HRA) encompassing hazard identification, exposure assessment and risk characterisation
- ii) Safety (risk and hazard) - Qualitative/Quantitative Risk Assessment (QRA) encompassing hazard identification, exposure assessment and risk characterisation

■ **Evaluation of impacts**

- i) Determine the level of risk to neighbouring receptors
- ii) Identify the existing health conditions of receptors
- iii) Assess the possible impacts on workers' safety and health during construction stage
- iv) If necessary, use risk assessment models to ascertain the level of risk

■ **Output**

- i) Determine the qualitative/quantitative risk to receptors to identify appropriate BMP
- ii) Findings from HIA can also provide possible preventive and mitigation measures

GEOTECHNICAL HAZARDS■ **Assessment requirements**

- i) Areas of the project site and its surroundings for risk
- ii) Adequacy of buffer to avoid or reduce risk of hazards
- iii) Suitable engineering and geotechnical measures

■ **Prediction method**

- i) SI study
- ii) GTM
- iii) Site assessment
- iv) Risk analysis
- v) Engineering design and estimation of FOS

■ **Evaluation of impacts**

- i) Risk map and determine FOS
- ii) Impact and extent of damages/ losses in the event of slope failure and sensitive receptors that may be affected
- iii) Areas in need of mitigation measures

■ **Output**

- i) Hazard areas
- ii) Areas of high
- iii) Monitoring programme for slopes

TRAFFIC■ **Assessment requirements**

- i) Traffic arrangement during construction
- ii) Identification of the need for mitigation measures

■ **Prediction method**

- i) Traffic impact assessment
- ii) Simulation

■ **Evaluation of impacts**

- i) Review and incorporate main findings from TIA into the EIA
- ii) Main impact elements are communities living along the logistic road during construction

■ **Output**

- i) Potential issues during construction and incorporation of structural and non-structural measures
- ii) Identification of risk factors

AIR QUALITY■ **Assessment requirements**

Potential air pollution generating sources

■ **Prediction method**

Gaussian plume dispersion model

■ **Evaluation of impacts**

Level of pollutants; pre- and post-development for major sensitive receptors

■ **Output**

- i) Extent of potential impacts to nearby sensitive receptors
- ii) Critical levels for pollutant at sensitive receptors

SOCIAL■ **Assessment requirements**

- i) Land and property acquisition and relocation of communities
- ii) Extent of impacts, both positive and negative
- iii) Views and perception of the affected stakeholders

■ **Prediction method**

- i) Social and economic surveys on affected population
- ii) Perception survey to ascertain acceptance of project
- iii) SIA

■ **Evaluation of impacts**

- i) Extent of land acquisition and affected stakeholders
- ii) Delineate the survey catchment and determine statistically the number of surveys required
- iii) Focus on communities within the ZOS
- iv) Main findings from SIA shall be incorporated

■ **Output**

Land and property acquisition and relocation of communities must first be settled prior to EIA commissioning and submission

MITIGATION MEASURES

PURPOSE

- Avoidance of negative impacts through selection of alternatives to implement the preventive measures
- Adopt relevant mitigation measures to minimise the impacts
- Enhance and amplify the beneficial impacts
- Ensure that residual impacts are kept within acceptable levels



P2M2

Key P2M2s based on environmental components/aspects:

- Air quality
- Land disturbance
- Slope stabilisation
- Waste management
- Surface water pollution
- Noise and vibration
- Ecological management
- Runoff and stormwater management
- Land traffic

LD-P2M2

- BMPs comprising activities, facilities, measures, planning or procedures used to minimise accelerated erosion and sedimentation
- Site specific
- Must have Work Breakdown Structure (WBS) of project activities
- Main components of LD-P2M2: Project activity and implementation, information and analysis on project site and development, map of site plan with existing condition

GENERAL APPROACHES



Need and extend of P2M2s correspond to significance of impact



Explanation on the design and function of P2M2s shall be supported by diagrams, illustrations, photos and maps



Priority on control at source and rectifying the impacts



P2M2s shall require regular inspection, maintenance and rehabilitation



Project-specific



Enhance and amplify the beneficial impacts



Practical, easy to implement and effective



Effectiveness of the P2M2s shall be documented via monitoring programme



Use of new technology is encouraged

NOTE:

1. The Qualified Person shall identify and propose BMPs based on the findings of the EIA.
2. The submission of the EIA and the pledge by the Project Proponent shall reflect the agreement and commitment towards ensuring implementation of the P2M2s and BMPs on-site during all stages of work.

PROJECT ACTIVITY & IMPLEMENTATION



- Phasing plan
- Project implementation schedule
- Description of construction activities
- Construction timeline, including BMP installation
- Construction method statement

INFORMATION AND ANALYSIS ON PROJECT SITE AND DEVELOPMENT



- Selected weather and rainfall data
- Site runoff velocity and flow rates (pre and post development)
- Description of soil and geological characteristics
- Description of adjacent areas that may be affected by land disturbance
- List of drainage, streams and river onsite, including receiving water bodies
- List of BMP proposed
- Access roads and project components located outside of project boundary
- Earthworks cut and fill volume
- Availability of materials
- Biomass management
- Construction and domestic waste management
- Spill prevention and control plan
- Soil loss prediction (pre, during and post development as well as with and without BMP scenarios)
- Projected runoff flows
- Calculation for BMP (sediment traps/basins, check dams, etc.)

MAP OF SITE PLAN WITH EXISTING CONDITION



- Topographic survey map
- Geological terrain map
- Erosion risk map
- Land use map
- Site development plan

ENVIRONMENTAL MAINSTREAMING AGENDA AND SELF-REGULATION CULTURE

- Full responsibility and accountability of the Project Proponent
- Regulatory compliance to the COA and other environmental requirements
- Embracing the environmental mainstreaming and self-regulation aspirations
- Portray positive image of good governance and corporate social responsibility to the public

ROLES AND RESPONSIBILITIES DURING POST-EIA STAGE

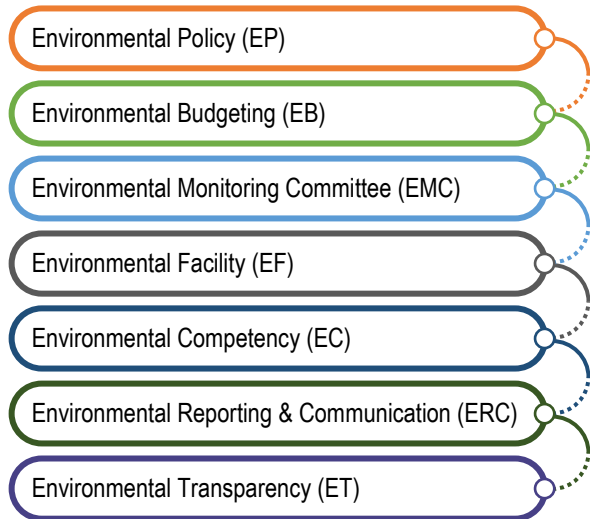
Implementation of EIA Conditions of Approval (COA) and P2M2 requires the involvement of several parties:

- DOE
- Project Proponent
- Environmental Officer
- Environmental Consultant
- Environmental Auditor

ENVIRONMENTAL MANAGEMENT PLAN

- A living document that states explicitly on:
 - actions to be taken;
 - measures to be instituted; and
 - structures to be built
- Needs to be revised and updated
- Includes LD-P2M2 document

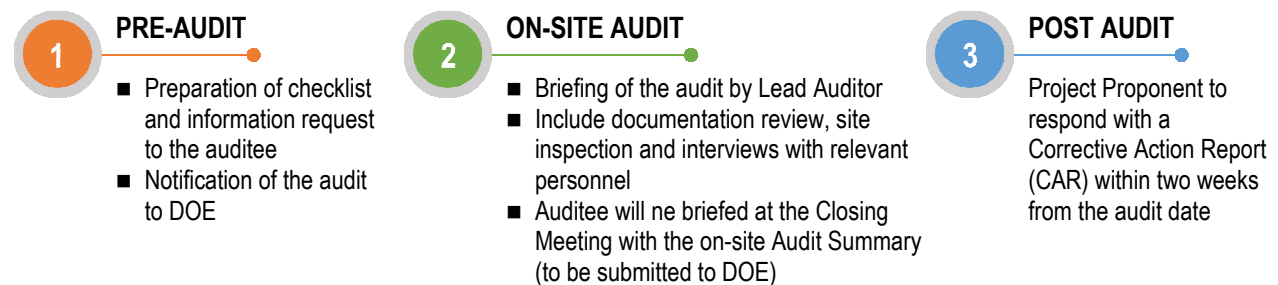
ENVIRONMENTAL MAINSTREAMING TOOLS



ENVIRONMENTAL MONITORING DATABASE

- Conducted after the EMP document has been approved and the physical work of the project is about to commence
- Can be grouped into three different aspects; Impact Monitoring (IM), Performance Monitoring (PM) and Compliance Monitoring (CM)
- Monitoring programme: Physical environment, biological environment

ENVIRONMENTAL AUDIT (TYPICAL AUDIT PROCESS)



ENVIRONMENTAL SUSTAINABILITY REPORT

- An organisational report that gives information about environmental performance, compliance and monitoring
- Can be made up of several reports, e.g. environmental reports (Compliance Report and Monitoring Report)

ENVIRONMENTAL DATABASE

- Recommended to be established to assist the Project Proponent in managing issues in an effective way
- Benefits: Environmental scanning, A Fact Library, financial viability

TOR AND EIA CHECKLIST

- Checklists to assist the Qualified Person in preparing:
 - TOR/ESI; and
 - EIA.
- Both checklists must be filled in and incorporated at the front of the respective reports.
- Can also be used by the EIATRC as a reference.

- Specific format for the EIA report, as detailed in Appendix 9 of EGIM.
- Consist of cover page, preliminary pages, chapters arrangement and appendices

<p>FIRST / SECOND SCHEDULE</p> <p>ENVIRONMENTAL IMPACT ASSESSMENT REPORT</p> <p>NAME OF PROJECT PROPONENT</p> <p>PROJECT TITLE VOLUME X/Y</p> <div style="border: 1px solid black; height: 40px; margin: 5px 0;"> <p style="text-align: center; font-size: 8px;">PROPOSED PROJECT GRAPHIC (ILLUSTRATION)</p> </div> <p>MONTH/YEAR</p>

EIA report cover

<p>PROJECT PROPONENT'S LETTERHEAD</p> <p>ENVIRONMENTAL PLEDGE FROM PROJECT PROPONENT</p> <p>Environmental Impact Assessment (First Schedule) for</p> <p>.....</p> <p>I hereby declare that the entire EIA Report is the product of the EIA Consultant engaged by my company and all the facts stated in the Report and the accompanying information are to the best of my knowledge and belief true and correct, and that I have not withheld or distorted any material facts. I agree and I undertake the responsibility to implement all the pollution prevention and mitigating measures (P2M2) described in the EIA Report, in the Environmental Management Plan (EMP) and in the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) as proposed by the EIA Consultant. I have allocated sufficient funds for the above purpose.</p> <p>Name : NRIC Number : Designation : Signature : Date : Company's Stamp :</p>

Environmental Pledge by the Project Proponent

<p>EIA STUDY TEAM LEADER'S LETTERHEAD</p> <p>DECLARATION FROM EIA STUDY TEAM LEADER</p> <p>Environmental Impact Assessment (First Schedule) for</p> <p>.....</p> <p>I declare that the entire EIA Report is the product of my own and the work of my team members (i.e. other consultants who are also Qualified Persons) who worked under my supervision and all the facts stated in the Report and the accompanying information are to the best of my knowledge and belief true and correct, and that I have not withheld or distorted any material facts. I have briefed the Project Proponent on the content of the Report and highlighted to him all the pollution prevention and mitigating measures (P2M2) described in it, and in the Environmental Management Plan (EMP), and in the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), and the Project Proponent has agreed to implement them (i.e. P2M2).</p> <p>Name of EIA Consultant Team Leader : NRIC Number : Designation : Signature : Date : Company's Stamp :</p>
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Declaration by the Qualified Person

EIA REPORT FORMAT

MAIN TEXT OF THE EIA REPORT

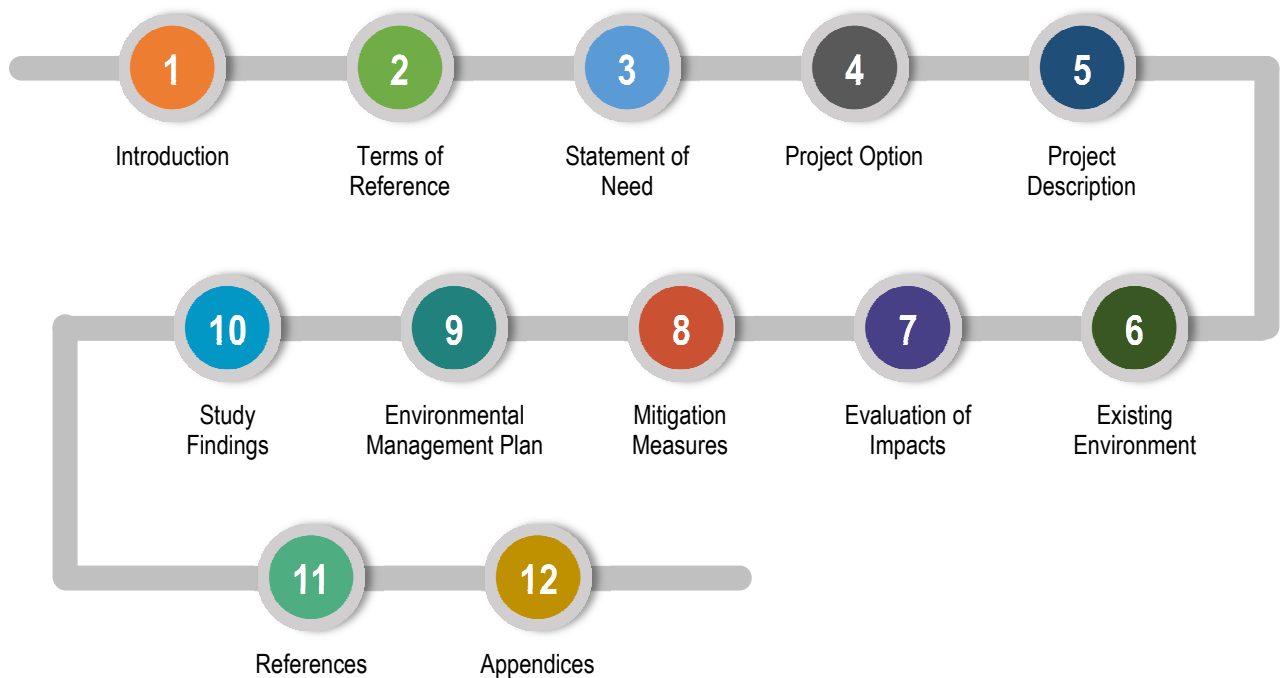


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ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	micrograms per cubic metre	EQA	Environmental Quality Act
$\mu\text{S}/\text{cm}$	microsiemens per centimetre	ERC	Environmental Reporting and Communication
AGC	Attorney General Chambers	ERCMC	Environmental Regulatory Compliance Monitoring Committee
AI	Appointed Individual	ERP	Emergency Response Plan
ASEAN	Association of Southeast Asian Nations	ESA	Environmentally Sensitive Area
BAT	Best Available Technology	ESC	Erosion and Sediment Control
BBA	Water Supply Department	ESI	Environmental Scoping Information
BKSA	Water Regulatory Body	ESCP	Erosion and Sediment Control Plan
BMP	Best Management Practice	ESR	Environmental Sustainability Report
BOD	Biochemical oxygen demand	ET	Environmental Transparency
CePEOEIA	Certified Professional Environmental Officer in EIA Project Development and Operation	EVEI	Economic Valuation of Environmental Impacts
CESSWI	Certified Erosion, Sediment and Storm Water Inspector	FDPM	Forestry Department of Peninsular Malaysia
CFRD	concrete face rockfill dam	FGD	Focus Group Discussion
CFS	Central Forest Spine	FIA	Fisheries Impact Assessment
cfu	colony-forming unit	FOS	Factor of Safety
CH ₄	Methane	FRIM	Forest Research Institute of Malaysia
CIDB	Construction Industry Development Board	GA	Government Agencies
CISEC	Certified Inspection of Sediment and Erosion Control	GCD	gabion check dams
CITES	Convention on International Trade in Endangered Species	GHG	Greenhouse Gas Protocol
CM	compliance monitoring	GIS	Geographic Information System
CO	Carbon monoxide	GPP	Garis Panduan Perancangan
COA	Conditions of Approval	GPS	Global Positioning System
dB	decibels	GTM	Geological Terrain Mapping
dba	A-weighted decibels	H ₂ S	Hydrogen sulphide
DID	Department of Irrigation and Drainage	HIA	Health Impact Assessment
DO	Dissolved oxygen	HQ	headquarters
DOE	Department of Environment	HRA	Health Risk Assessment
DOF	Department of Fisheries	HSE	Health, Safety and Environment
DOSH	Department of Occupations Safety and Health	HWC	Human-Wildlife Conflict
DWNP	Department of Wildlife and National Parks	Hz	hertz
EAP	Emergency Action Plan	IACRR	International Association for Coastal Reservoir Research
EB	Environmental Budget	ICZM	Integrated Coastal Zone Management
EC	Environmental Competency	IFM	Integrated Flood Management
EERE	Office of Energy Efficiency and Renewable Energy	IKRAM	Malaysian Institute of Labour
EESIM	Environmental Essentials for Siting of Industries in Malaysia	ILM	Integrated Lake Management
EF	Environmental Facility	IM	impact monitoring
EGiM	Environmental Impact Assessment Guidelines in Malaysia	IPCC	Intergovernmental Panel on Climate Change
EIA	Environmental Impact Assessment	IRBM	Integrated River Basin Management
EIATRC	EIA Technical Review Committee	IRDA	Iskandar Regional Development Authority
EMC	Environmental Monitoring Committee	ISMP	Integrated Shoreline Management Plan
EMP	Environmental Management Plan	IUCN	International Union for Conservation of Nature
EMR	Environmental Monitoring Report	IWK	Indah Water Konsortium
EMT	Environmental Mainstreaming Tools	IWRM	Integrated Water Resources Management
EO	Environmental Officer	JAKOA	Department of Orang Asli Development
EP	Environmental Policy	JKPTG	Department of Director General of Lands and Mines Federal
EPMC	Environmental Performance Monitoring Committee	JMG	Department of Mineral and Geoscience Malaysia
EPMD	Environmental Performance Monitoring Document	JUPEM	Department of Survey and Mapping Malaysia

ABBREVIATIONS

KASA	Ministry of Environment and Water	PTG	State Land and Mines Office
km	kilometre	PM	performance monitoring
KM	Planning Permission	PMR	Performance Monitoring Report
LAC	Limit of Acceptable Change	PPE	personal protection equipment
LCP	Development Proposal Report	PWD	Public Works Department
LD-P2M2	land disturbing pollution prevention and mitigation measures	QRA	Qualitative/Quantitative risk assessment
LLM	Malaysian Highway Authority	RCC	roller compacted concrete
LoS	Level of Safety	RFZPPN	National Physical Plan for Coastal Zone
m	metres	RKK	Special Area Plans
MAAQS	Malaysian Ambient Air Quality Standards	RoR	run-of-the-river
MarDep	Marine Department	RUSLE	Revised Universal Soil Loss Equation
MARPOL	The International Convention for the Prevention of Pollution from Ships 1973/1978	SAINS	Syarikat Air Negeri Sembilan
MESTECC	Ministry of Energy, Science, Technology, Environment and Climate Change	SAMM	Laboratory Accreditation Scheme of Malaysia
METMalaysia	Malaysian Meteorological Department	SATU	Syarikat Air Terengganu
mg/l	milligrams per litre	SDG	Sustainable Development Goals
ml	millilitre	SI	Soil Investigation
mm/s	millimetre per second	SIA	Social Impact Assessment
MMWQS	Malaysian Marine Water Quality Standards	SIMP	Social Impact Management Plan
MOH	Ministry of Health	SO ₂	Sulphur dioxide
MOTAC	Ministry of Tourism, Arts and Culture Malaysia	SPAN	National Water Resources Commission
MRA	Marine Risk Assessment	SSA	Site Suitability Assessment
MSIA	Malaysian Association of Social Impact Assessment	STP	sewage treatment plant
MSMA	Urban Stormwater Management Manual	SZIRA	Guidelines for Siting and Zoning of Industry and Residential Areas
MUSLE	Modified Universal Soil Loss Equation	TBT	tributyltin
MyDAMS	Malaysia Dam Safety Management Guidelines	TCU	true colour units
NAHRIM	National Hydraulic Research Institute of Malaysia	TIA	Traffic Impact Assessment
NCIA	Northern Corridor Implementation Authority	TNB	Tenaga Nasional Berhad
NGO	non-governmental organization	TOR	Terms of Reference
NLWQS	National Lake Water Quality Criteria and Standards	TORAC	TOR Adequacy Check
NO ₂	Nitrogen dioxide	UNDP	United Nations Development Programme
NPP	National Physical Plan	UPEN	State Economic Planning Unit
NPPC	National Physical Plan Council	US	United States
NRE	Ministry of Natural Resources and Environment	USM	unsuitable material
NTU	Nephelometric turbidity unit	WBS	work breakdown structure
NWRP	National Water Resources Plan	WMP	Wildlife Management Plan
NWQS	National Water Quality Standards for Malaysia	WQI	Water Quality Index
O ₃	ozone	WRI	World Resources Institute
ORS	off-river storage	ZOI	Zone of Impact
P2M2	pollution prevention and mitigation measures	ZOS	Zone of Study
PAH	polycyclic aromatic hydrocarbons		
PE	Professional Engineer		
PLANMalaysia	Federal Department of Town and Country Planning		
PTD	Land Registry Offices		

GLOSSARY

Active Treatment System (ATS) Treatment of runoffs using a mechanical system with the application of coagulants and flocculants to promote the settling of suspended solids out of the aqueous phase. Only coagulants and flocculants which have been approved for use by environmental agencies such as USEPA or similar authorities are allowed to be used.

Appointed Individuals (AIs) Persons appointed to be part of the TRC with expertise and specialist knowledge on specific fields/subjects to contribute to the technical review of a report.

Approving Authority/Agencies Any government ministry, agencies or department with the authority to approve a project and/or activity under their jurisdiction by law.

Auditing Evaluation process carried out by an independent auditor to determine effectiveness and performance of P2M2 and to ensure compliance of a project with the COA from DOE and other agencies.

Baseline Data Site specific data pertaining to the existing environment (physical, chemical, biological and human). It establishes the ambient situation, usually before some drastic change occurs, e.g. a major project.

Best Available Technology (BAT) The most current and advanced technologies and methods available for pollution prevention and management.

Best Management Practices (BMPs) Using the best controlling measures to prevent or mitigate pollution of other sources of environmental impact.

Biological Diversity/ Biodiversity The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Buffer Zone An area designated around the boundary of a project and/or adjacent to environmentally sensitive areas where no or limited development is allowed for the purpose of mitigating against any environmental impact from the site to the surrounding areas or vice versa.

Catchment The area determined by landform within which falling rain will contribute to runoff at a particular point such as a stream or river. Often, it is used synonymously with basin or watershed.

Central Forest Spine (CFS) The backbone of Peninsular Malaysia's ESA network which comprises of four major forest complexes [i] Banjaran Titiwangsa-Banjaran Bintang- Banjaran Nakawan, [ii] Taman Negara-Banjaran Timur, [iii] South East Pahang, Chini and Bera Wetlands, and [iv] Endau Rompin Park-Kluang Wildlife Reserves.

Competent Person A person with the necessary skills and knowledge to carry out the specific technical task, usually gained through certification, work experience or training.

Compliance Monitoring (CM) Monitoring of P2M2 installed within the project site to ensure they are functional and effective in treating pollutants.

Conditions of Approval (COA) A set of legally binding instructions and requirements prepared by DOE after the end of EIA process for the Project Proponent to abide by for all phases of the development.

Cumulative Impact The total sum from combination of various activities or sources resulting in accumulation and aggregation of multiple impacts which would be significantly expanded as compared to a single event.

Cut and Fill Procedure in which the elevation of a landform surface is modified by the removal or addition of surface material.

Development Order (DO) A legal approval for a Project Proponent to proceed with the construction of a project once they have satisfied the requirements of the approving authority, i.e. One Stop Centre (OSC).

Disposal Area A designated or gazetted area specifically for the storage of wastes or excess materials generated from construction and during operation.

Drainage Natural or artificial removal of surface and sub-surface water from an area.

Earthworks Excavation and relocation of large quantities of soil and earth to form slopes, platforms, embankments, etc.

Ecology The study of the habits and modes of life-living organisms (such as plants and animals), and their relationships to each other and their environment.

Ecosystem A dynamic complex of plant, animal and microorganism communities and their non-living environment that interact as a functional unit.

GLOSSARY

EIA Adequacy Check Initial review of the EIA by a technical committee comprising of DOE HQ/state officers to determine compliance with the TOR.

Emergency Action Plan (EAP) A document prepared by Dam Owner which contains predetermined plan of action to be taken to reduce the potential for loss of life, environmental damages and economic losses affect by dam breach. It is a continually updated set of instructions and maps, with reference to the dam break study, that deal with possible emergency situations or unusual occurrences at or related to a dam or reservoir.

Emergency Response Plan (ERP) A manual incorporating all measures, actions, roles and responsibilities for the project team to take action during emergencies and crisis, covers various scenarios that may occur during construction and operations.

Endemic Species Native to, and restricted to, a particular geographical region. Highly endemic species, those with very restricted natural ranges, are especially vulnerable to extinction if their natural habitat is eliminated or significantly disturbed.

Environment The area (specific zone to be affected by the project), and all natural resources (physical, biological and human resources), people, economic development and quality-of-life values.

Environmental Flow The timing and amount of water to be retained in lakes, rivers, streams and estuaries to sustain seasonal patterns of high and low water levels needed for natural functions, processes and resilience to persist.

Environmental Flow Setting A specific method which covers both ecological quality and quantity must be adopted, by considering habitat simulation and hydrologic-hydraulic method for the environmental flow setting. Wherever possible, the requirement of habitat maintenance for specific riverine species of interest, must be considered.

Environmental Impact Assessment (EIA) A study to identify, predict, evaluate and communicate information about the impacts (both beneficial and adverse) on the environment of a proposed development activity and to detail out the mitigating measures prior to project approval and implementation.

Environmental Management Plan (EMP) A legally binding document which spells out in concise details the environmental requirements and P2M2 as detailed in the EIA and LD-P2M2 as well at other information, e.g. environmental budget, monitoring and audit programmes and roles and responsibilities of the EMT.

Environmental Management Team (EMT) Specialist team comprising of relevant personnel of a project with specific roles and responsibilities in the management of environmental matters at site.

Environmental Manager (EM) A person mandated to oversee all aspects of managing environmental compliance for a project, usually heads the EMT.

Environmental Officer (EO) The site personnel directly in charge of supervising a site to ensure that all P2M2 are in place, maintained and repaired and that all requirements within the COA and Contract are adhered by the contractors. Other tasks include training of staff, taking samples for reporting and attending site walkabouts and meetings. EO is normally appointed by Contractor.

Environmental Performance Monitoring Committee (EPMC) Organisational setup within the Project Proponent which shall management environmental compliance at the working level during construction and operational phases of a project.

Environmental Pledge/Declaration Statement by the Project Proponent and/or Qualified Person preparing the EIA that they have carried out the study in the proper manner and all facts and figures are to their knowledge true and correct and that they will carry out the recommendations and P2M2 for the project as described in the EIA.

Environmental Regulatory Compliance Monitoring Committee (ERCMC) Organisational setup within the Project Proponent which shall management environmental compliance at the policy level during construction and operational phases of a project.

Environmental Quality Act 1974 (EQA) The main legislation governing environmental management in Malaysia, contains provisions on setting up of an environmental management body; rules and regulations for specific activities within its jurisdiction; powers for enforcement and licensing; etc.

Environmental Scoping Information (ESI) A report detailing the findings of the environmental scoping carried out for a site to allow for decision making through identification of significant impacts, proposals for mitigation measures and required studies. Forms and important part of the EIA process.

Environmental Scoping Matrix Technique to integrated large amounts of information for a rapid assessment in identifying significant impacts based on project activities and their impacts on different aspects of the environment.

Environmentally Sensitive Areas (ESAs) A special area that is very sensitive to any changes in the ecosystem as a result of natural processes or activities in or around the area, either directly or indirectly.

Erosion The detachment or wearing away of the earth's surface, particularly soil or loose materials, by flowing water, wind or other geological agents.

Erosion and Sediment Control Plan (ESCP) Document incorporating all erosion and sediment control measures as required by the Department of Irrigation and Drainage (DID) for a site. Usually prepared by a professional engineer (PE) to be endorsed by DID.

Gazette The official publication of a government organisation institution, or protected area.

Geological Terrain Mapping (GTM) Report prepared by a licensed Geologist required by the Minerals and Geoscience Department (JMG) to be submitted for DO approval, contains information on the terrain, geological makeup, soils and slope classification to allow for assessment of site suitability for construction.

Geology The science which has for its object the investigation of the earth's crust, of the strata which enter into its composition with their mutual relations, and of the successive changes to which their present condition and position are due.

Government Agencies (GAs) Personnel from government ministries, agencies and/or department with a role in specific committees, approving authorities or decision making bodies.

Guided Self-Regulation (GSR) An initiative by DOE to cultivate environmental ownership and excellence in environmental commitment from the sectors regulated by DOE especially in regards to performance monitoring of pollution control measures, scheduled reporting, record keeping, competent persons and involvement of environmental professionals with specific roles.

Health Impact Assessment (HIA) A report which assesses the health impacts of policies, plans and projects using quantitative, qualitative and participatory techniques for decision making. Usually required by the Ministry of Health (MOH) or Department of Health (DOH) for projects with health implications to nearby populations.

Hydrology The study of the rainfall and runoff process and relates to the derivation of hydrographs for given floods, droughts and seasonal pattern of inundation.

Impact Monitoring (IM) Monitoring of impacts outside of the project site to ascertain its origin and magnitude.

Land Acquisition/Alienation The act of obtaining, either voluntarily or by law, the necessary land from existing landowners. May involve relocation of existing population on the said piece of land.

Land-Disturbing Activities Activities such as clearing of trees or vegetation, excavating, raising or sloping of ground, trenching, grading and blasting.

Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) A legal pledge document by the Project Proponent to prevent, mitigate and control the discharge from the development area containing the major pollutant (suspended solids) resulting from land disturbing activities through the protection of natural resources by preservation and conservation, reduction of waste generation and releases or discharges of pollutants to land, air and water and incorporation of BMPs and techniques to attain compliance with the EIA COA.

L₁₀ Level exceeded for 10% of the time and takes account of any annoying peaks in noise.

L₅₀ Level exceeded for 50% of the time and takes account of any annoying peaks in noise.

L₉₀ Level exceeded for 90% of the time and takes account of any annoying peaks in noise.

L_{Aeq} A-weighted, equivalent continuous sound level in decibels measured over a stated period of time.

L_{max} Highest sound level measured during a single noise event.

L_{min} Lowest sound level measured during a single noise event.

Marine Risk Assessment (MRA) Technical document which studies the existing marine traffic of the project area, identifying constraints for navigation and risk of potential collision or mishaps during vessel operations.

Method Statement A detailed scope and account of proposed construction techniques, equipment and machinery usage and structural and non-structural measures applied in carrying out construction, usually prepared by the contractors.

Modeling To simulate a particular feature of the world using mathematical and computer aids to better understand, define, quantify and visualise the process.

Monitoring To measure, systematically and repeatedly, the continuing conditions to track change (s).

Noise A sound, especially one that is loud or unpleasant or that causes disturbance.

Orang Asli Collective term for ethnic groups who are widely regarded as comprising Peninsular Malaysia's original inhabitants as defined under Aboriginal Peoples Act 1954 (Act 134).

GLOSSARY

Performance Monitoring (PM) Monitoring of performance systems

Permanent Reserved Forest (PRF) The total area of forest land that has been legally designated for retention for forestry as defined under the Forestry Act 1985.

Personal Protective Equipment (PPE) Equipment designed to safeguard a user against harm when working in risk and hazard areas.

PM_{2.5} Atmospheric particulate matter (PM) that have a diameter of less than 2.5 micrometers.

PM₁₀ Atmospheric particulate matter (PM) that have a diameter of less than 10 micrometers.

Pollution Prevention and Mitigation Measures (P2M2) The various methods (structural and non-structural) required to ensure that pollution does not occur or at least minimised as a result of a project.

Prescribed Activity Any activity specified by the Director General of Environment under the Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015, as requiring to prepare an EIA.

Project Activities Specific tasks undertaken throughout the course of a project (earthworks, construction or operational) which serves to meet certain objectives.

Project Brief Information pertaining to a project or development, including the details of the project, layout, method statement, location, etc. which can assist in assessment of the project.

Project Proponent The main person, organisation or body which is proposing to undertake a project or activity. He/she shall bear responsibility to ensure that the project meets all environmental requirements mandated by DOE and other GAs or is liable to be held accountable under the law.

Public Display Mandatory viewing of a Second Schedule EIA for a fixed period of time whereby the public can forward recommendations and objections to the report for consideration by DOE in the EIA approval process.

Public Participation/Engagement The process whereby the public and related stakeholders are allowed the opportunity to participate in the planning, decision making, objection, idea sharing and/or approval of a project which may affect them. Can be mandated or voluntary.

Qualified Person A person appointed by the Director General of Environment or is certified by/registered with DOE under Section 34A (2B) under EQA 1974 to carry out an EIA study, e.g. Environmental Consultant.

Revised TOR Final version of the TOR after incorporation of comments from the TRC and additional information.

Risk A combination of the likelihood of an occurrence of a hazardous event with specified period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event.

River Corridor The area extending 50 m beyond the river reserve on both sides where planning is required based on the Riverfront Development Guidelines.

River Reserve The land strips that are located either side of the river channels and this particular land has been gazetted under Section 62 of the National Land Code.

Runoff The portion of precipitation that runs off the surface as opposed to soaking in.

Sampling Station Locations identified and designated for collection of environmental data (air, water, noise, vibration, ecology, etc.).

Schedule Categorisation of Prescribed Activities divided into the First Schedule (EIA without need for public display and public comments and will be processed by DOE State) and Second Schedule (EIA requiring public display and public comments and will be processed by DOE HQ).

Scheduled Wastes Any form of toxic and hazardous wastes listed under the First Schedule of the Environmental Quality (Scheduled Wastes) Regulations 2005 (Amendment 2007).

Scoping Initial phase in an EIA to identify the key environmental issues and the study spatial and temporal boundaries. The scoping will identify the required investigations and assessment of significant impacts during the subsequent phases of the EIA process.

Screening Process by which a proposed development project is identified as being subjected to a regulatory provision requiring an EIA.

Sedimentation The deposition of sediment from suspension in water.

Seismicity The occurrence or frequency of ground vibrations or earthquakes in a region.

Self-regulation The adoption and implementation of measures and practices by a Project Proponent on their own initiative without requiring intervention of the authorities to safeguard the environment and meet all regulatory requirements of the country.

Setback Distance which a building or other structure is set back from a street or road, a river, a shore or any other place which is deemed to need protection.

Siltation The deposition or accumulation of silt that is suspended in a body of water.

Site Suitability Assessment (SSA) A study on the suitability of various sites and the determination based on specific criteria on the best possible site for a project.

Social Impact Assessment (SIA) A process to identify, predict, evaluate and communicate information about the social impacts of a proposed project, policy, programme or plan on a community and their activities, and to choose the best development option and subsequently propose mitigation measures.

Soil Investigation (SI) Technical study on the soil and sub-surface strata of a project site to determine the sub-surface conditions and engineering requirements needed prior to a development.

Spoil Rock and debris produced by tunneling, dredging and other excavations.

Statement of Need A brief on the justifications for a project, including supporting arguments and evidence on the necessity of the project and benefits that will be generated.

Stormwater Water that originates during precipitation events, e.g. rainfall.

Suspended Sediment Sediment suspended in a fluid by its (fluid) turbulent flow.

Technical Review Committee (TRC) A panel of decision makers comprising DOE officers, IAs and GAs that are selected to review the TOR and/or EIA to provide approval based on the reports submitted by the Project Proponent and Qualified Person(s).

Terms of Reference (TOR) Product of the scoping process which sets the objectives, defines the scope, and establishes the strategy and schedule for EIA process to address identified significant issues. Typically, the TOR is complemented by an ESI.

Topography The configuration of the surface of the earth, including its relief, the position of its streams, roads, cities, etc. The earth's natural and physical features collectively.

TOR Adequacy Check (TORAC) A review by a selected panel of DOE officers, IAs and/or GAs on whether a TOR has been prepared in accordance with DOE requirements and contains all necessary information for decision making to be made.

Traffic Impact Assessment (TIA) A study on the condition of the roads and traffic (level of service) in an area and if there is adequate capacity to meet the increasing demand from a project or to identify measures required to ensure that traffic will be smooth and uninterrupted.

Visual/Aesthetics Pleasing scenery, vistas and view to an audience.

Wastes Any substance which is discarded after primary use. Comprises of various types of wastes, such as municipal wastes, scheduled wastes, biomass wastes, etc.

Water Quality A term to describe the chemical, physical and biological characteristics of water, usually with respect to its suitability for a particular purpose.

Water Quality Index (WQI) An index integrating six water quality parameters to provide a general categorisation to determine the condition of the water source.

Wildlife Management Plan (WMP) A technical report that outlines implementation steps to increase, preserve and manage wildlife impacted from a project, both during construction and operation project. The management plan usually contains maps, descriptive documents, and records of progress and change.

Zone of Impact (ZOI) The maximum area which will receive the impacts from the project. For upstream ZOI, it depends on the inundation area whereas for the downstream ZOI, it can be as far as river mouth and coastal area. The ZOI depends on the size of the dam project and river geomorphology.

Zone of Study (ZOS) Boundary identified for the EIA Study which would be the main spatial area to carry out baseline data gathering, determine extent of modelling and assessment and other supporting studies.



CHAPTER 1

Introduction

Klang Gate Dam, Selangor
Photo by DNASB



1.1 INTRODUCTION

This document is entitled:

‘Environmental Impact Assessment (EIA) Guidelines for Construction of Dam’

This document shall be referred as “**the Guideline**” hereinafter. It supersedes the ‘*EIA Guidelines for Dams and/or Reservoirs Projects*’ published in 1995.

The Guideline adopts the latest amendments in the Environmental Quality Act 1974 (EQA 1974) (Act 127), mainly the Environmental Quality (Prescribed Activities) (EIA) Order 2015 (hereinafter to be referred to as “the EIA Order 2015”). The EIA Order 2015 replaced EIA Order 1987 that had been referred to in the previous guideline.



EIA Order 2015

1 INTRODUCTION

The Guideline also incorporates all new elements that have been introduced by the Department of Environment (DOE) with regards to EIA through its other recent guidelines, directives and notifications such as:

- i) Environmental Impact Assessment Guidelines in Malaysia (EGiM);
- ii) Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), 2017; and
- iii) Environmental Mainstreaming Directive, 2017

Additionally, this document also considers current practises in terms of policy, technology, design, mitigating measures and environmental management.

This includes relevant information and description that enable the stakeholders to understand the overall concept of EIA and the possible environmental issues that may arise from the proposed project.

This Guideline complements EGiM and thus should be read together with other guidelines relevant to the prescribed activity. Compliance with the requirements as set out in this Guideline and EGiM will thereby fulfil the obligations of the Project Proponent as specified in the Section 34A (2C) of the EQA 1974, and/or any amendments thereafter.

1.2 OBJECTIVES OF THE GUIDELINE

The Guideline is structured to supplement the general guidelines specified in the EGiM. It is also intended to improve the effectiveness of the current EIA procedures by:

- i) providing a clear and concise guidance document on EIA preparation to the Project Proponent, DOE officers, qualified person(s), stakeholders, government agencies (GAs), appointed individuals (AIs), non-governmental organisations (NGOs) and other EIA-related practitioners;
- ii) facilitating integration of the EIA into the overall project planning and development cycle;
- iii) ensuring compliance with and adherence to the legal requirements;
- iv) providing a detailed step-by-step guidance with explanations of the EIA procedures and submissions, comprising Environmental Scoping Information (ESI), Terms of Reference (TOR), EIA reporting and post-EIA;
- v) defining 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 other applicable requirements by other authorities or agencies, to facilitate overall decision-making and EIA approval; and
- vi) providing an integrated framework for decision making for the DOE in assessing the EIA report.

1.3 SCOPE OF THE GUIDELINE

Figure 1.1 itemised the nine implicit prescribed activities that are under the Prescribed Activity 15 of the Second Schedule EIA of the EIA Order 2015. There are six prescribed activities from Activity 15 (a) and three from Activity 15 (b).

PRESCRIBED ACTIVITY 15 (a)	PRESCRIBED ACTIVITY 15 (b)
<ul style="list-style-type: none"> ■ Construction of dam or impounding reservoir for the purpose of irrigation with a surface area of 100 hectares or more. ■ Construction of dam or impounding reservoir for the purpose of flood mitigation with a surface area of 100 hectares or more. ■ Construction of dam or impounding reservoir for the purpose of control of siltation with a surface area of 100 hectares or more. ■ Construction of dam or impounding reservoir for the purpose of recreational with a surface area of 100 hectares or more. ■ Construction of dam or impounding reservoir for the purpose of water supply with a surface area of 100 hectares or more. ■ Construction of dam or impounding reservoir for the purpose of any other reason with a surface area of 100 hectares or more. 	<p>(i) Dam and hydro-electric power scheme with dam of 15 metres or more in height and ancillary structures covering a total area of 40 hectares or more.</p> <p>(ii) Dam and hydro-electric power scheme with reservoir with a surface area of 100 hectares or more.</p> <p>(i) and (ii) Dam and hydro-electric power scheme dam of 15 metres or more in height and ancillary structures covering a total area of 40 hectares or more and with reservoir with a surface area of 100 hectares or more.</p>

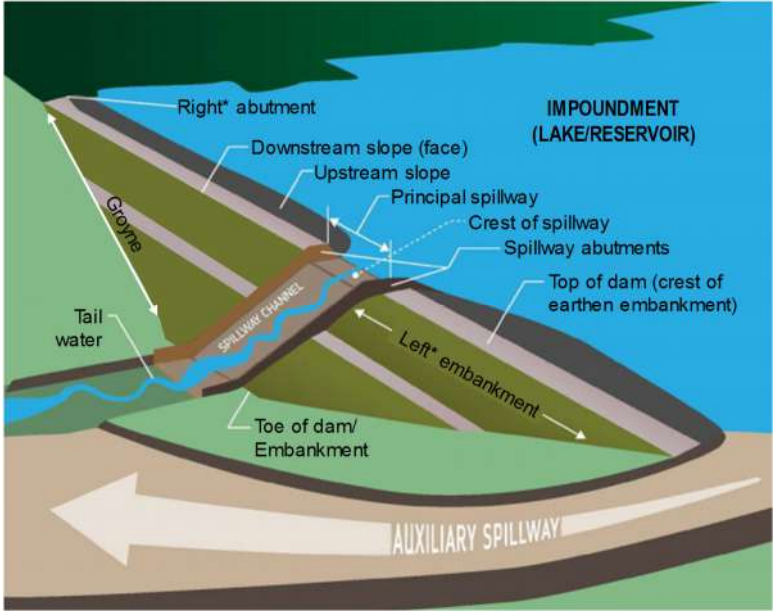
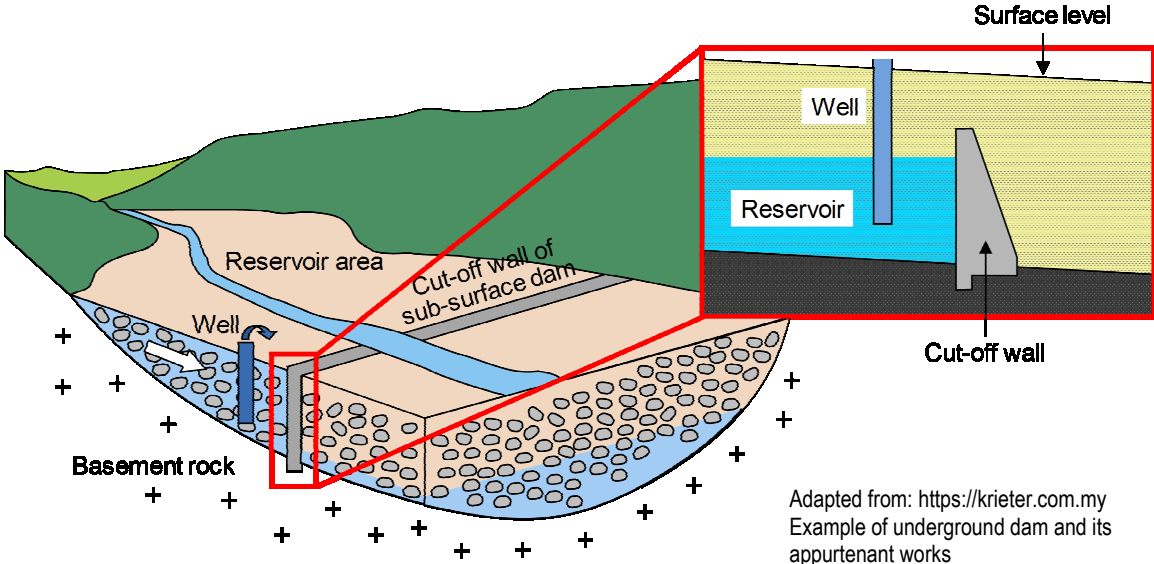
FIGURE 1.1 Prescribed activities under Prescribed Activity 15 of the Second Schedule EIA

1.4 TERMS AND DEFINITIONS

As specified in the EIA Order 2015, the construction of dam falls under Prescribed Activity 15 of the Second Schedule EIA. *Table 1.1* and *Table 1.2* describe the relevant terms and definitions for each activity.

1 INTRODUCTION

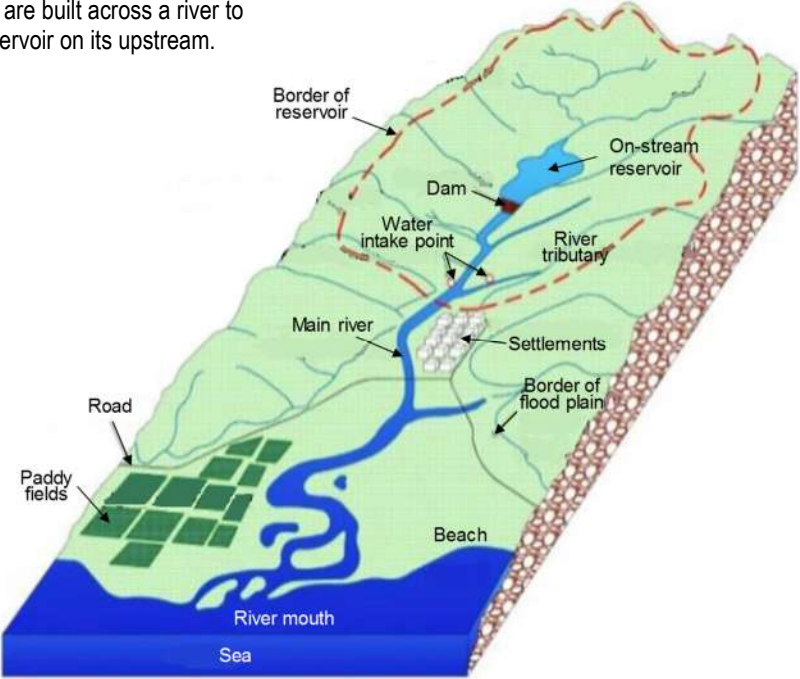
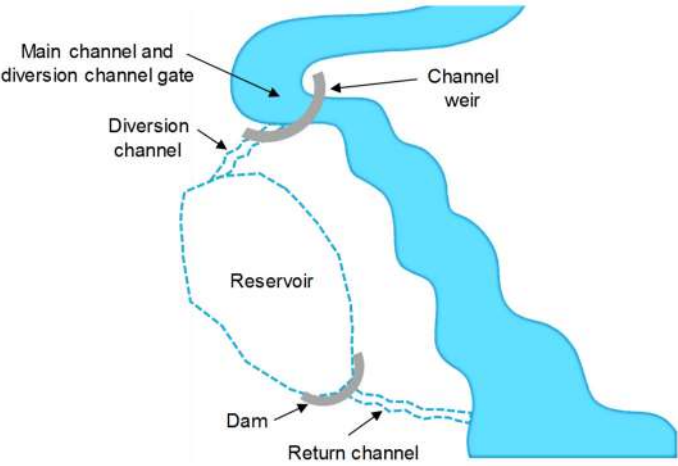
TABLE 1.1 Terms and definition for Activity 15 (a) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (a)	
Construction of dam or impounding reservoir for the purpose of irrigation, flood mitigation, control of siltation, recreational, water supply or any other reason with a surface area of 100 hectares or more.	
<p>DAM</p> <p>All man-made barriers, together with appurtenant works, constructed for storage, or control of water or other fluids. Dam can be located on the surface or underground.</p>	 <p>Note: * Left and Right are reinforced while looking downstream Source: https://dnr.wisconsin.gov/ Example of surface dam and its appurtenant works</p>
 <p>Adapted from: https://krieter.com.my Example of underground dam and its appurtenant works</p>	

Sources:

- ¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- ² Impounding reservoir. (n.d.) McGraw-Hill Dictionary of Scientific & Technical Terms, 6E. (2003). Retrieved March 2 2020 from <https://encyclopedia2.thefreedictionary.com/impounding+reservoir>
- ³ IACRR. (2018). What is a Coastal Reservoir? Retrieved from International Association for Coastal Reservoir Research: <https://iacrr.org/about>

TABLE 1.1 (cont'd) Terms and definition for Activity 15 (a) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (a)	
<p>IMPOUNDING RESERVOIR</p> <p>A reservoir with outlets controlled by gates that release stored surface or ground water for various purposes. Reservoir can be located on-stream, off-stream, coastal area, in a pond, in a lake or underground.</p> <ul style="list-style-type: none"> ■ On-stream reservoir – Structures are built across a river to block water flow and create a reservoir on its upstream. 	 <p>Source: GPPPP KSAS (PLANMalaysia, 2017)</p>
<ul style="list-style-type: none"> ■ Off-stream reservoir – Part of a river water is pump or divert into a reservoir located off-river via conveyance method. Examples of conveyance methods are pipeline, aqueducts or any other artificial methods. The off-stream reservoir can be operated singly or in series. Examples of off-stream reservoirs are off-river storage (ORS) or bunded storage. 	

Sources:

- ¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- ² Impounding reservoir. (n.d.) McGraw-Hill Dictionary of Scientific & Technical Terms, 6E. (2003). Retrieved March 2 2020 from <https://encyclopedia2.thefreedictionary.com/impounding+reservoir>
- ³ IACRR. (2018). What is a Coastal Reservoir? Retrieved from International Association for Coastal Reservoir Research: <https://iacrr.org/about>

TABLE 1.1 (cont'd) Terms and definition for Activity 15 (a) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (a)	
<ul style="list-style-type: none"> Coastal reservoir – A freshwater reservoir located within the ocean, with an impermeable barrier separating the two water bodies. The reservoir may be located close to or within a river mouth, and may be constructed as a solid dam, a soft dam or any combination thereof. 	
<ul style="list-style-type: none"> Pond reservoir* – Temporary storage of storm runoff which is used to control peak discharged rates by controlled release rate(s). An example of pond reservoir is detention pond. 	

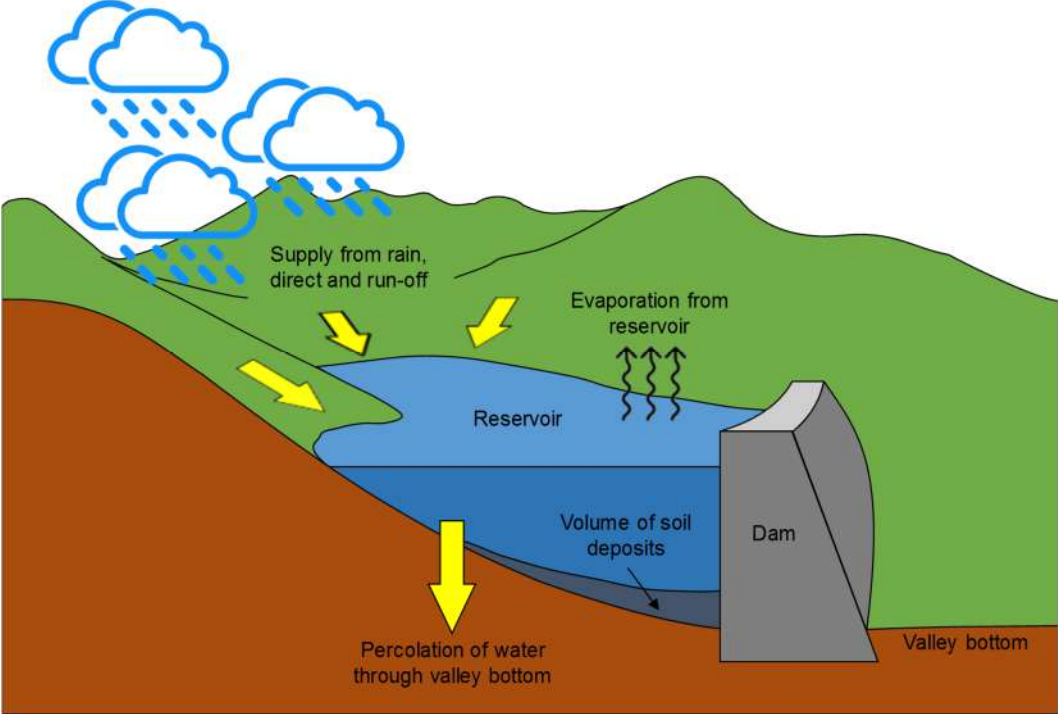
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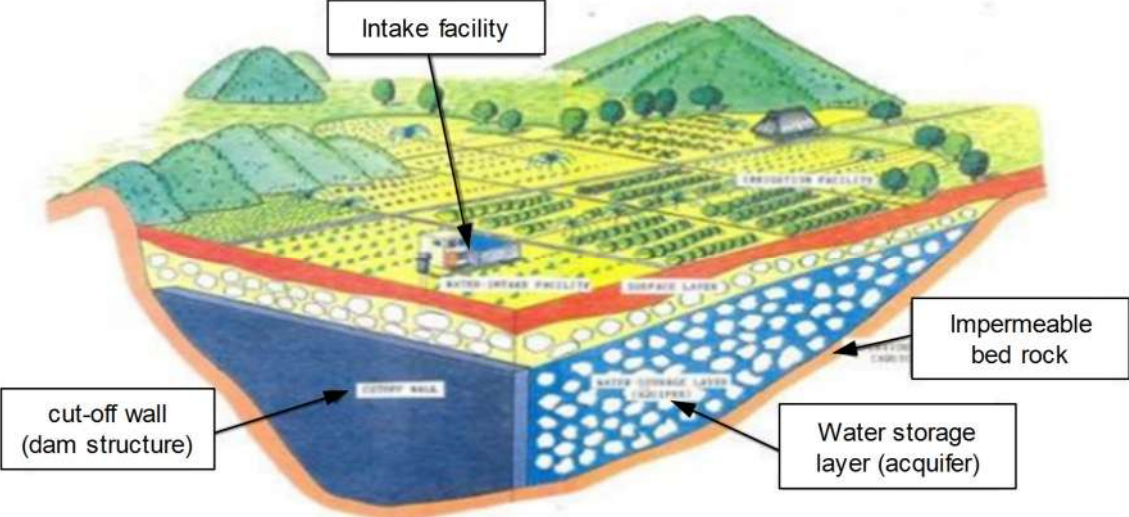
- DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- Impounding reservoir. (n.d.) McGraw-Hill Dictionary of Scientific & Technical Terms, 6E. (2003). Retrieved March 2 2020 from <https://encyclopedia2.thefreedictionary.com/impounding+reservoir>
- IACRR. (2018). What is a Coastal Reservoir? Retrieved from International Association for Coastal Reservoir Research: <https://iacrr.org/about>

TABLE 1.1 (cont'd) Terms and definition for Activity 15 (a) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (a)

- Lake reservoir – A lake with outlets controlled by gates to release stored surface water for various purposes.

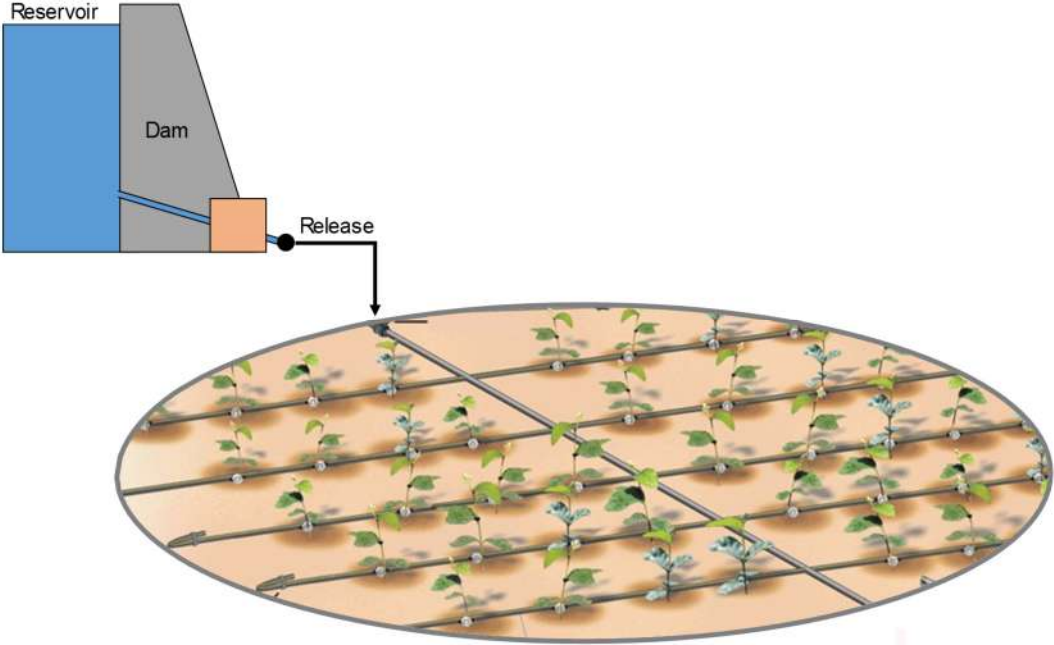
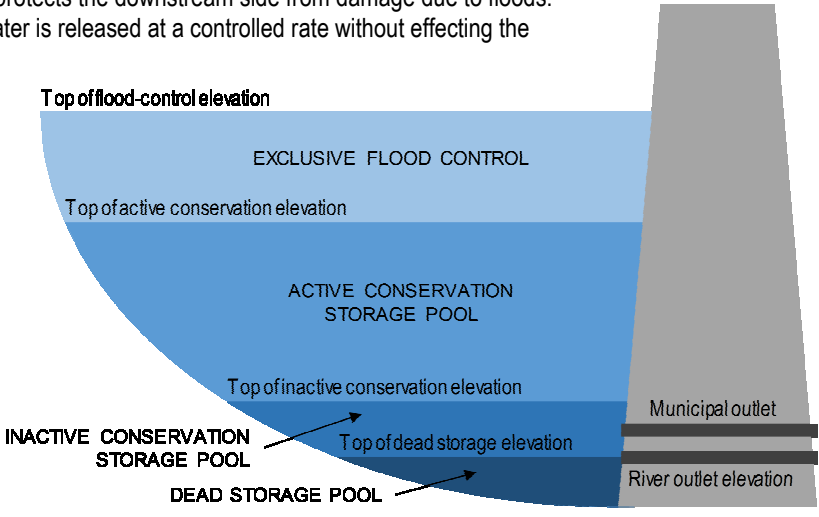

- Underground reservoir – Intercepts the groundwater flow and stores water underground.



Sources:

- ¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- ² Impounding reservoir. (n.d.) McGraw-Hill Dictionary of Scientific & Technical Terms, 6E. (2003). Retrieved March 2 2020 from <https://encyclopedia2.thefreedictionary.com/impounding+reservoir>
- ³ IACRR. (2018). What is a Coastal Reservoir? Retrieved from International Association for Coastal Reservoir Research: <https://iacrr.org/about>

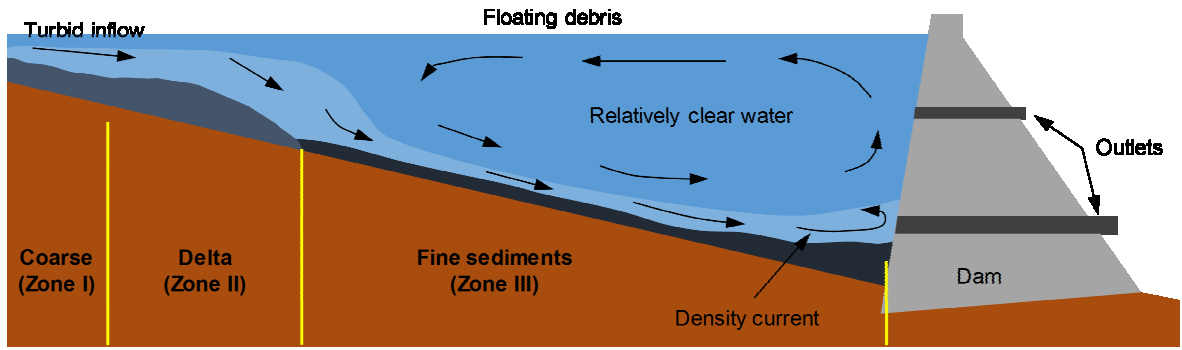
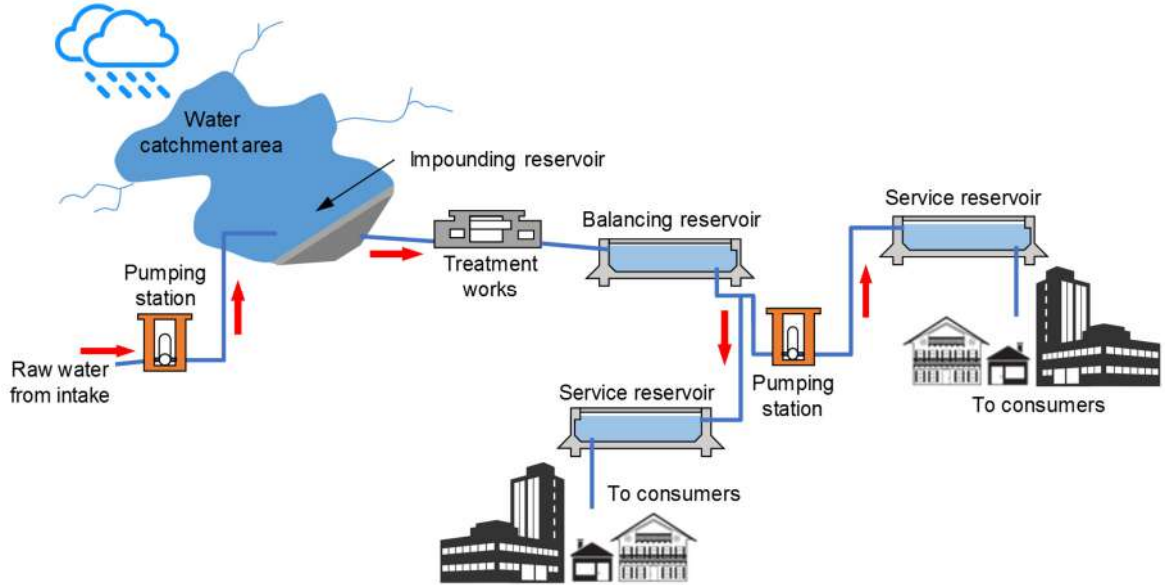
TABLE 1.1 (cont'd) Terms and definition for Activity 15 (a) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (a)	
<p>IRRIGATION Stores and provides water for irrigation for agricultural purposes.</p> 	
<p>FLOOD MITIGATION Also known as flow-through dam or perforated dam or detention dam. During flood period, it stores the water in a reservoir and protects the downstream side from damage due to floods. After the flood period, the stored water is released at a controlled rate without effecting the downstream side.</p> 	
<p>Source: Adapted from Bureau of Reclamation, 2000</p>	

Sources:

- ¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- ² Impounding reservoir. (n.d.) McGraw-Hill Dictionary of Scientific & Technical Terms, 6E. (2003). Retrieved March 2 2020 from <https://encyclopedia2.thefreedictionary.com/impounding+reservoir>
- ³ IACRR. (2018). What is a Coastal Reservoir? Retrieved from International Association for Coastal Reservoir Research: <https://iacrr.org/about>

TABLE 1.1 (cont'd) Terms and definition for Activity 15 (a) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (a)	
<p>CONTROL OF SILTATION</p> <p>A dam is built to stop the downstream movement of the sediment load. Regular maintenance dredging must be conducted in the reservoir to ensure it is operate at full capacity.</p>	 <p>Source: Reservoir sedimentation zones (Palmieri, et al., 2003)</p>
<p>WATER SUPPLY</p> <p>Impounds and stores river water and rainwater on the upstream side and releases it back into the river at a controlled rate. A water intake point is located downstream which connects with a water treatment plant to treat the river water before distributing it to consumers.</p>	 <p>Notes: Any pond such as abandoned mining pond that is converted to an impounding reservoir (without any major activities e.g. excavation or earthwork) is not covered under this activity. Nonetheless, the Project Proponent needs to consult DOE.</p>

Sources:
¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
² Impounding reservoir. (n.d.) McGraw-Hill Dictionary of Scientific & Technical Terms, 6E. (2003). Retrieved March 2 2020 from <https://encyclopedia2.thefreedictionary.com/impounding+reservoir>
³ IACRR. (2018). What is a Coastal Reservoir? Retrieved from International Association for Coastal Reservoir Research: <https://iacrr.org/about>

1 INTRODUCTION

TABLE 1.1 (cont'd) Terms and definition for Activity 15 (a) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (a)
<p>ANY OTHER REASON Construction of dam or impounding reservoir for the purpose of storage, water quality control, diversion, recreation, navigation and industrial water cooling.</p> <ul style="list-style-type: none">■ Storage dam is built to control water flow by retarding flow downstream, helping reduce flash floods, flow rate restriction, subsurface water replenishment and sediment trapping. The water is retained in a reservoir to be later gradually released.■ Water quality control dam is to impound water in a reservoir and to be gradually released during low flow. This is to maintain downstream water quality of a river.■ Diversion dam is to divert river water into an off-taking canal (or a conduit) or to a designated location. It provides pressure to push water into ditches, canals, or other areas used for conveyance. It is also use to fill irrigation channels or reservoirs (ORS).■ Recreation dam generally emerges with a hydroelectric dam. Among the recreational activities include fishing, boating, swimming, bird watching, camping, etc.■ Navigation dam is to increase the river depth level for navigation purposes.■ Industrial cooling water dam is built to contain high-temperature water discharges from the outfall. The water is retained in a reservoir to be later gradually released. <p>SURFACE AREA OF 100 HECTARES OR MORE The area of outer part or uppermost of a reservoir must be 100 hectares or more.</p>

Sources:

- ¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- ² Impounding reservoir. (n.d.) McGraw-Hill Dictionary of Scientific & Technical Terms, 6E. (2003). Retrieved March 2 2020 from <https://encyclopedia2.thefreedictionary.com/impounding+reservoir>
- ³ IACRR. (2018). What is a Coastal Reservoir? Retrieved from International Association for Coastal Reservoir Research: <https://iacrr.org/about>

TABLE 1.2 Terms and definition for Activity 15 (b) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (b)
<p>Dam and hydro-electric power scheme with either or both of the following:</p> <ol style="list-style-type: none">i. Dam of 15 metres or more in height and ancillary structures covering a total area of 40 hectares or more;ii. Reservoir with a surface area of 100 hectares or more.
<p>DAM AND HYDRO-ELECTRIC POWER SCHEME Water is stored at a higher elevation (dam) and led downward through large pipes or tunnels (penstocks) to a lower elevation. Water falling from upstream side to downstream side (head) of dam will generate electricity by rotating turbines.</p>

Sources:

- ¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- ² EERE. (2020). Glossary of Hydropower Terms. Retrieved from Energy Efficient & Renewable Energy: <https://www.energy.gov/eere/water/glossary-hydropower-terms>

TABLE 1.2 (cont'd) Terms and definition for Activity 15 (b) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (b) (i)

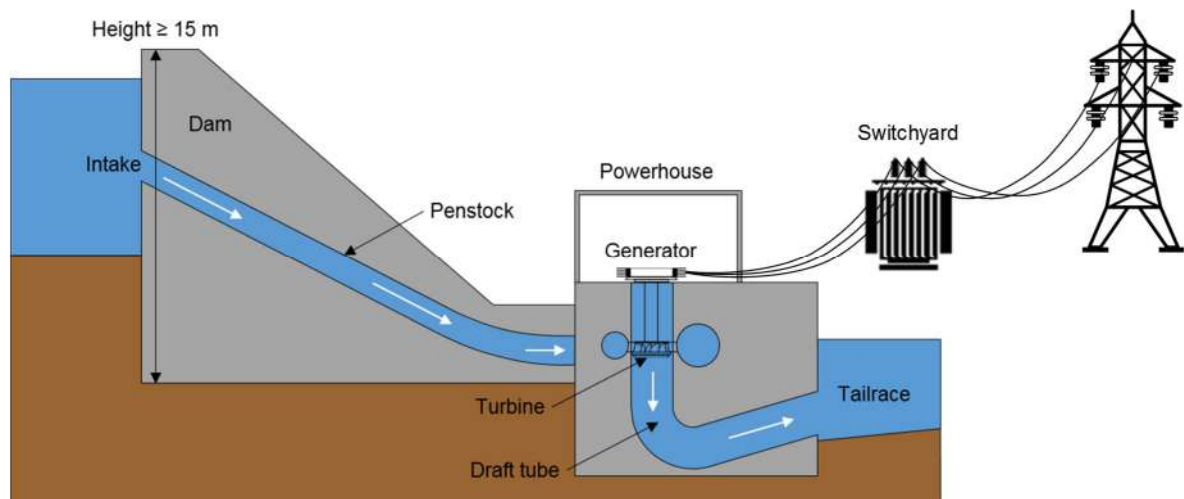
DAM OF 15 METRES OR MORE IN HEIGHT

The maximum height of a dam is from the lowest point of the general foundation area to the top of the dam.

ANCILLARY STRUCTURES

All ancillary or appurtenant structures, components and equipment functionally pertaining to the dam and hydro-electric power scheme including, spillway, inlet and outlet work, penstock, power house, tail race, diversion, draft tube and switchyard.

- Spillway – A weir, channel, conduit, tunnel, gate or other structure designed to permit discharges from the reservoir normally under flood conditions or in anticipation of floods.
- Inlet and outlet works – The combination of intake structure, conduits, tunnels, flow controls and dissipation devices to allow the controlled release of water from a dam.
- Penstock – A closed conduit or pipe for conducting water to the powerhouse.
- Power house – The structure that houses generators and turbines.
- Tailrace – the channel that carries water away from a dam.
- Diversion – a facility that channels a portion of a river through a canal or penstock.
- Draft tube - A water conduit, which can be straight or curved depending upon the turbine installation, which maintains a column of water from the turbine outlet and the downstream water level.
- Switchyard (*pencawang masuk utama*) - the interconnection point of 132 kV or 275 kV to the National Grid



Typical cross section of dam and hydro-electric power scheme

TOTAL AREA OF 40 HECTARES OR MORE

All temporary or permanent areas that are involved with the project development including construction working areas must be 40 hectares or more.

Sources:

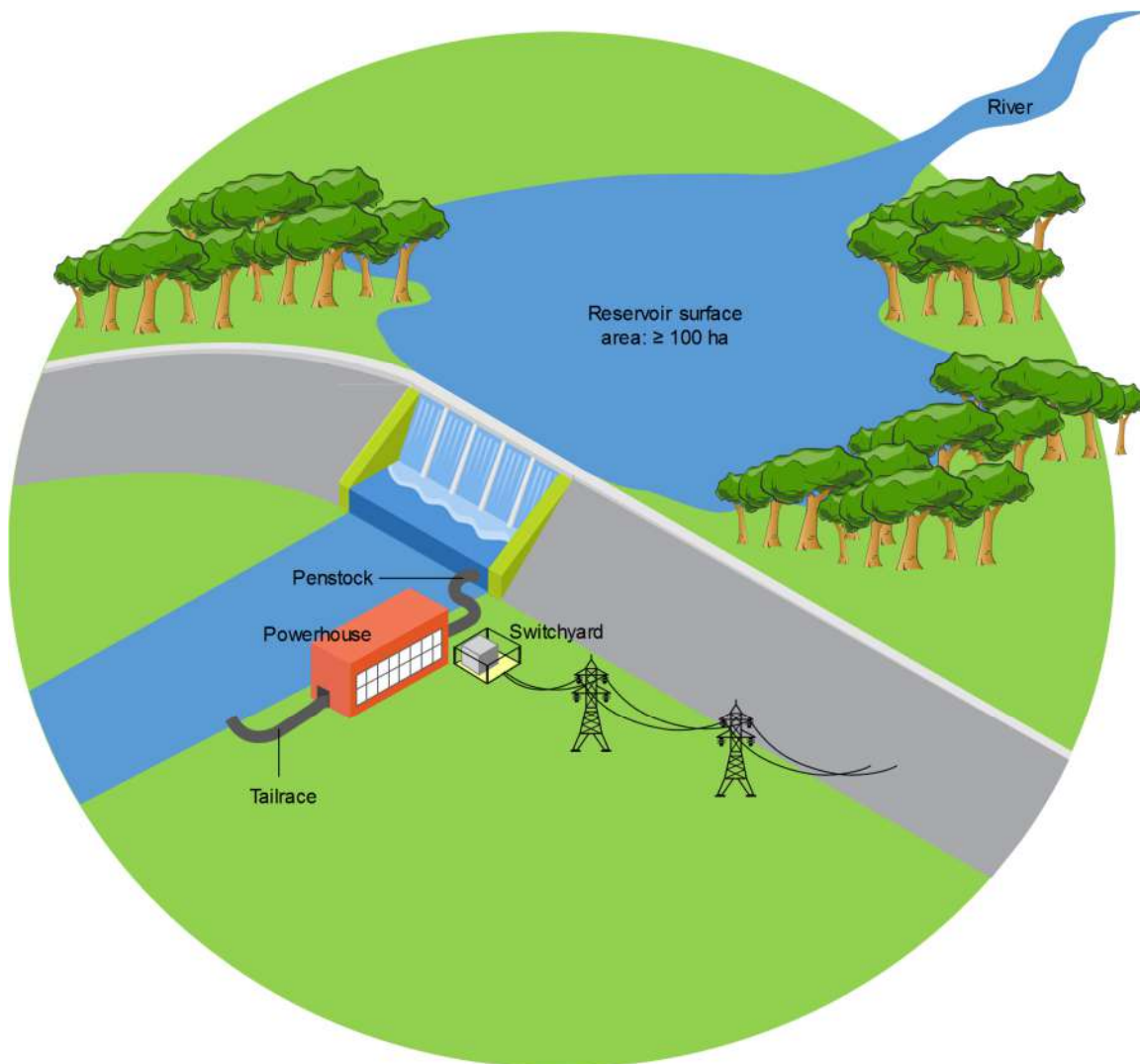
- ¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- ² EERE. (2020). Glossary of Hydropower Terms. Retrieved from Energy Efficient & Renewable Energy: <https://www.energy.gov/eere/water/glossary-hydropower-terms>

1 INTRODUCTION

TABLE 1.2 (cont'd) Terms and definition for Activity 15 (b) of the Second Schedule EIA

DEFINITION FOR ACTIVITY 15 (b) (ii)

RESERVOIR WITH A SURFACE AREA OF 100 HECTARES OR MORE - The area of outer part or uppermost of a reservoir of the dam and hydro-electric power scheme must be 100 hectares or more.



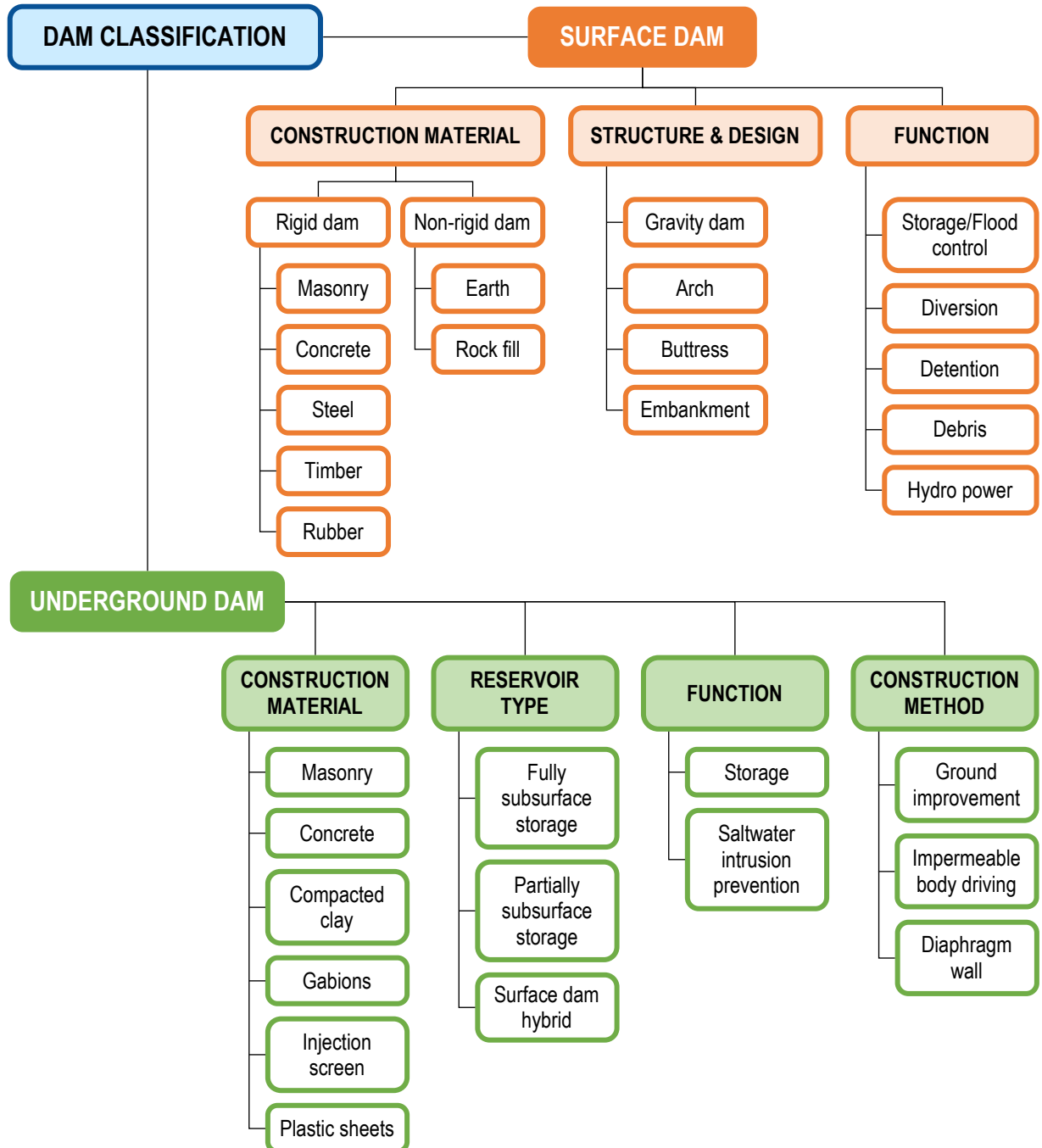
Typical top view of dam and hydro-electric power scheme

Sources:

- ¹ DID. (2017). *Malaysia Dam Safety Management Guidelines (MyDAMS)*. Kuala Lumpur: Department of Irrigation and Drainage Malaysia.
- ² EERE. (2020). Glossary of Hydropower Terms. Retrieved from Energy Efficient & Renewable Energy: <https://www.energy.gov/eere/water/glossary-hydropower-terms>

1.5 SCOPE OF THE PRESCRIBED ACTIVITIES

The scope of the prescribed activities under Activity 15 of the Second Schedule EIA covers both surface dam and underground dam. Technically, dams are classified based on construction material used, structure and design as well as functions as summarised in *Figure 1.2* and brief description of each is listed in *Table 1.3* and *Table 1.4* respectively.



Adapted from <https://theconstructor.org/>
FIGURE 1.2 Classification of dams

1 INTRODUCTION

TABLE 1.3 Brief description of each classification for surface dam







TYPE	BRIEF DESCRIPTION
A. SURFACE DAM CLASSIFICATION BASED ON CONSTRUCTION MATERIAL	
<p>1. RIGID DAM Basic shape: Triangular</p> <ul style="list-style-type: none"> ■ MASONRY  <p>Source: DNASB Database, 2019 Gunung Pulai Masonry Dam, Johor</p>	<ul style="list-style-type: none"> ■ Masonry is a dam using stone masonry or brick masonry on the upstream and downstream faces. ■ Large stone blocks were shaped and fitted into the structure, and the joints filled with cement and sand mortar. ■ Some of these masonry dams still remain in excellent conditions.
<ul style="list-style-type: none"> ■ CONCRETE <ul style="list-style-type: none"> a) Conventional concrete gravity  <p>Source: wikimapia.org Klang Gates Dam, Selangor</p>	<ul style="list-style-type: none"> ■ Concrete gravity dams are dams that by their own weight resist the forces imposed on them with a desired factor of safety. ■ Concrete gravity dams rely on the shearing resistance developed at dam base. The weight constitutes to less uplift forces under the dam. ■ The integrity of the foundation to resist the imposed load from the reservoir.
<ul style="list-style-type: none"> <ul style="list-style-type: none"> b) Roller compacted concrete (RCC)  <p>Source: tnb.com.my Ulu Jelai Hydroelectric Dam, Pahang</p>	<ul style="list-style-type: none"> ■ RCC is a term for a new construction method evolved for concrete gravity dams, which placed and compacted concrete materials using earthfill construction techniques. ■ The composition of the RCC will give less thermal heat compared to the conventional concrete which reduces chances of thermal crack to occur. ■ RCC basic components: concrete, production of concrete, transportation and placement of the concrete. ■ RCC dams behave similarly to gravity dams during earthquakes. High seismic stresses occur in the central upper portion of the dam. The main difference between RCC and conventional gravity dams is the dynamic behaviour of mass concrete. In RCC dams, the tensile strength at a lift joint may be a fraction of that of the mass concrete. This means that, in a strong earthquake, horizontal cracks are likely to form along these interfaces, as well as the opening of contraction joints.

TABLE 1.3 (cont'd) Brief description of each classification for surface dam

TYPE	BRIEF DESCRIPTION	
A. SURFACE DAM CLASSIFICATION BASED ON CONSTRUCTION MATERIAL		
<p>1. RIGID DAM Basic shape: Triangular (cont'd)</p>	<ul style="list-style-type: none"> ■ STEEL  <p>Source: wikimedia.org Redridge Steel Dam, USA</p>	<ul style="list-style-type: none"> ■ A steel dam is made of steel, rather than the more common masonry, earthworks, concrete or timber construction materials. ■ Steel dams use a series of footings anchored in the earth. These footings hold struts which in turn hold up a series of deck girders which in turn hold steel plates. It is these plates that the water comes in contact with. ■ The suitable height is up to 18 m.
	<ul style="list-style-type: none"> ■ TIMBER  <p>Source: https://theconstructor.org/ Green River Crib Dam, USA</p>	<ul style="list-style-type: none"> ■ Timber uses for a dam, generally for temporary purposes. ■ The purposes is to divert water for the main dam construction and to control flood water flow, etc. ■ The suitable height is up to 9 m.
	<ul style="list-style-type: none"> ■ RUBBER  <p>Rubber Dam in Kermanshah, Iran</p>	<ul style="list-style-type: none"> ■ Rubber dam consists of fabric reinforced rubber bags, and can be inflated or deflated by water or air. ■ The purposes of this dam are for irrigation, water storage, navigation, power generation, flood prevention and control, tidal barriers, sewage treatment, groundwater recharge, erosion control.

1 INTRODUCTION

TABLE 1.3 (cont'd) Brief description of each classification for surface dam




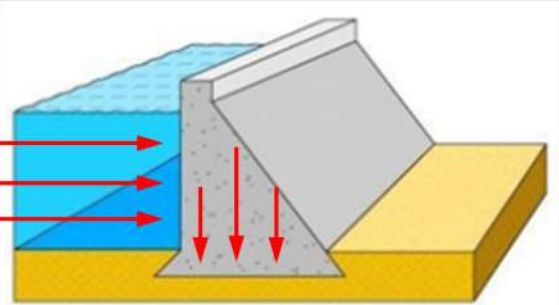
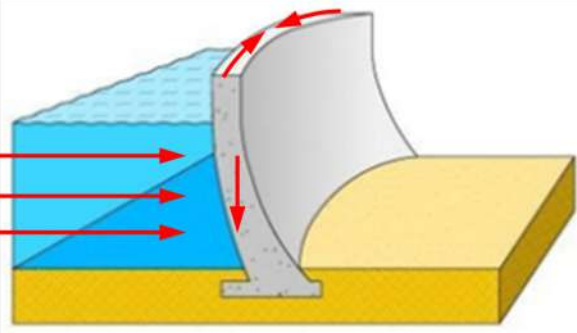
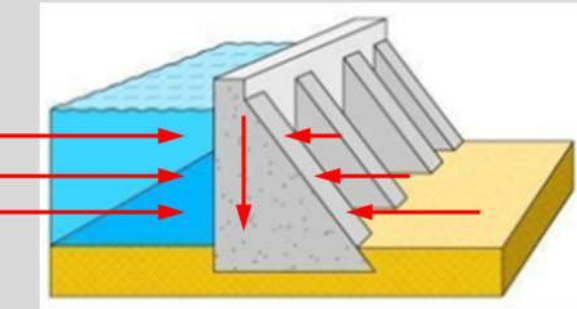
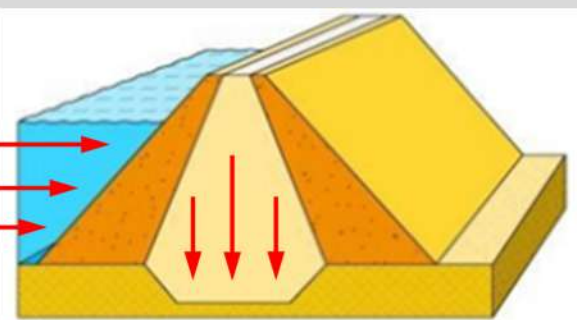
TYPE	BRIEF DESCRIPTION
A. SURFACE DAM CLASSIFICATION BASED ON CONSTRUCTION MATERIAL	
<p>2. NON-RIGID DAM Basic shape: Trapezoidal</p> <p>■ EARTHFILL</p>  <p>Source: water.gov.my Labong Dam, Johor</p>	<ul style="list-style-type: none"> ■ Earthfill dams can be constructed on an earth, as well as on a rock foundation. ■ Earthfill dams can be constructed out of a great variety of locally available materials. ■ Suitable where the foundation soil is very weak and not strong enough to carry the weight of masonry dam. ■ It is competitive in cost with concrete and rockfill dams. The cost of construction is very less compared to rigid type dam.
<p>■ ROCKFILL</p>  <p>Source: mada.gov.my Concrete Face Rockfill Dam (CFRD) – Ahning Dam, Kedah</p>  <p>Source: smhb.com Clay Core Rockfill Dam – Sungai Selangor Dam, Selangor</p>	<ul style="list-style-type: none"> ■ Rockfill dam is defined as an embankment dam that relies on rockfill as the major structural element. ■ The principal types of rockfill dams are the earth core rockfill and the concrete face rockfill. Other types of rockfill dams that can be an appropriate selection for certain sites are asphaltic concrete faced, or are built with asphaltic cores. ■ The principal body is composed entirely of rockfill, and the waterproof membrane is placed on the sloping upstream face. ■ More stable than earthen dams and its flexible nature helps it better against earthquake forces.
B. SURFACE DAM CLASSIFICATION BASED ON STRUCTURE AND DESIGN	
<p>1. GRAVITY DAM</p>  <p>Example: Kinta dam, Perak</p>	<ul style="list-style-type: none"> ■ Resists the external forces by its own weight or self-weight. ■ Generally constructed by using masonry or concrete. ■ Various external forces like water pressure, uplift pressure, wave pressure, ice pressure, earthquake pressure, etc., are resisted by its self-weight only which acts vertically downwards. ■ Good foundation is required to construct gravity dam preferably rocky strata under the dam. ■ Cross section shape is approximately triangular. ■ Infiltration gallery can be provided within the dam to resist uplift pressure.

TABLE 1.3 (cont'd) Brief description of each classification for surface dam

TYPE	BRIEF DESCRIPTION
B. SURFACE DAM CLASSIFICATION BASED ON STRUCTURE AND DESIGN	
<p>2. ARCH DAM</p>  <p>Example: Klang Gates Dam, Selangor</p>	<ul style="list-style-type: none"> ■ An arch dam is curved in plan with its convex upstream. ■ Various forces coming onto the dam are resisted by its arch action. ■ It is constructed using masonry or concrete but requires less material compared to gravity dam. ■ The loads coming onto the dam are transferred to the abutments of dam. ■ Abutments must be stronger and generally natural formations like hills are used as abutments. ■ Arch dams are generally preferred for narrow valleys. ■ Arch dam is economical when the length of dam is less than its height. So, this type of dams can be build up to greater heights.
<p>3. BUTTRESS DAM</p>  <p>Example: Muda Dam, Kedah</p>	<ul style="list-style-type: none"> ■ Contains face slab, buttresses and base slab. ■ Face slab is provided on the upstream side with some inclination and this slab is supported by series of buttresses which are nothing but supports. ■ Base slab acts as foundation for the whole dam which receives the load from buttresses and face slab. ■ It is either straight or curved in plan. ■ Greater the height of dam higher the number of buttresses. ■ This type of dams are preferred where the foundation soil is very weak. ■ The space available between the buttresses can be used for several purposes like water treatment plant installation, power plant installation, etc.
<p>EMBANKMENT DAM</p>  <p>Examples:</p> <ul style="list-style-type: none"> ■ Homogeneous earthfill embankment - Bukit Merah Dam, Perak ■ Zoned earthfill embankment - Batu Dam 	<ul style="list-style-type: none"> ■ Massive dams made of earth and rock. ■ Rely on their weight to resist the flow of water. ■ Armed with a dense core, it has more resistant to prevent water from seeping through the structure. ■ Three types i.e.: homogeneous embankment, zoned embankment, diaphragm embankment.

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TABLE 1.3 (cont'd) Brief description of each classification for surface dam





TYPE	BRIEF DESCRIPTION
C. SURFACE DAM CLASSIFICATION BASED ON FUNCTIONS	
<p>1. STORAGE DAM</p>  <p>Source: bharian.com.my Timah Tasoh Dam, Perlis</p>	<ul style="list-style-type: none"> ■ Storage dam is built to store water on the upstream side especially during rainy seasons and is released during dry weather season or when there is higher demand of water. ■ Storage dams may also provide a supply water to the local wildlife, and store water for hydroelectric power generation, and irrigation. ■ Storage dams are the most common types of dams.
<p>2. DIVERSION DAM</p>  <p>Source: ainselangor.com Sungai Labu Off-River Storage Reservoir, Selangor</p>	<ul style="list-style-type: none"> ■ A diversion dam is constructed for the purpose of diverting water of the river into an off-taking canal (or a conduit) or to a designated location. ■ It provides pressure to push water into ditches, canals, or other areas used for conveyance. ■ Diversion dams are typically lower in height and have a small water storage area in it is upstream. ■ To divert the flow of water from its natural course. ■ It is used to fill irrigation channels or reservoirs (Off-River Storage).
<p>3. DETENTION DAM</p>  <p>Source: water.gov.my Macap Dam, Johor</p>	<ul style="list-style-type: none"> ■ Detention dam is built to control flood by retarding flow downstream, helping reduce flash floods (to some extent). ■ The water is retained in a reservoir to be later gradually released. ■ The functions are to control floods, flow rate restriction, subsurface water replenishment and sediment trapping. ■ During flood period, it stores the water and protects the downstream side from damage due to floods. ■ After the flood period, the stored water is released at a controlled rate without effecting the downstream side.
<p>4. DEBRIS DAM</p>  <p>Source: https://theconstructor.org/ Mono Debris Dan, Santa Barbara USA</p>	<ul style="list-style-type: none"> ■ To retain the debris of the river water such as sand, gravel, and driftwood flowing in the river with water. ■ The water after passing over a debris dam is relatively clear.

TABLE 1.3 (cont'd) Brief description of each classification for surface dam


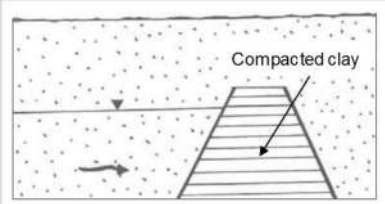
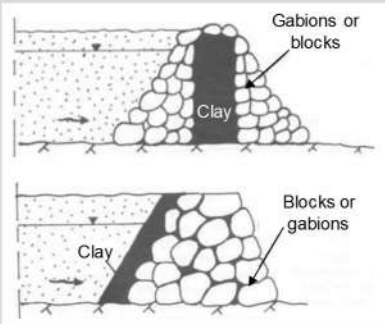
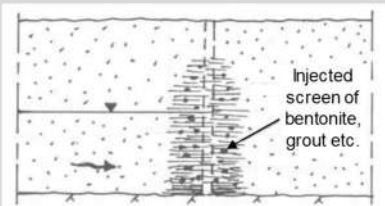
TYPE	BRIEF DESCRIPTION
C. SURFACE DAM CLASSIFICATION BASED ON FUNCTIONS	
<p>5. HYDRO-POWER DAM</p>  <p>Source: samadikaca.blogspot.com Temenggor Dam, Perak</p>	<ul style="list-style-type: none"> ■ To contain water and generate electricity by rotating turbines with the help of water falling from upstream side to downstream side of dam. ■ In the generation of hydroelectric power, water is collected or stored at a higher elevation and led downward through large pipes or tunnels (penstocks) to a lower elevation as the difference in these two elevations is known as the head.

TABLE 1.4 Brief description of each classification for underground dam

TYPE	BRIEF DESCRIPTION
A. UNDERGROUND DAM CLASSIFICATION BASED ON CONSTRUCTION MATERIAL	
<p>1. COMPACTED CLAY</p> 	<ul style="list-style-type: none"> ■ The clay should be deposited in the trench in uniform, thick layers, moistened, and compressed to about half that thickness. ■ Multiple layers are placed and compressed, until the clay layers reach the surface of the soil. ■ Clay fill is used frequently in earth dams, commonly in road embankments and sometimes as backfill below or within structures.
<p>2. GABIONS</p> 	<ul style="list-style-type: none"> ■ Gabion check dams (GCDs) are among the most diffused soil and water conservation practices used to cope with soil loss and reservoir siltation. ■ GCDs are flexible, permeable structures built in gullies to create a sedimentation bench that decreases the average upstream slope. ■ The consequent slowing-down of the flowing water limits flood-wave sediment transport capacity reducing soil loss upstream, reduces the amount of trapped sediment in reservoirs and promotes water infiltration into the soil.
<p>3. INJECTION SCREENS</p> 	<ul style="list-style-type: none"> ■ Injection screens of bentonite are used to arrest and tap flow in large or deep-seated aquifers and to protect groundwater from sea water intrusion. ■ The use of these materials requires highly skilled personnel and is used for the construction of large sub-surface dams. ■ The height of underground dams is typically 10 m for injection screen dams.

1 INTRODUCTION

TABLE 1.4 (cont'd) Brief description of each classification for underground dam

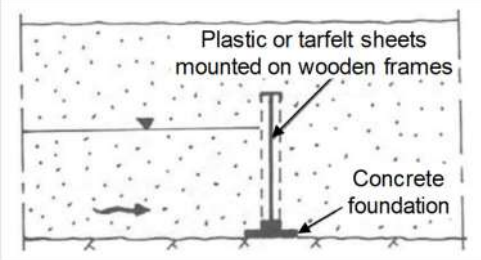
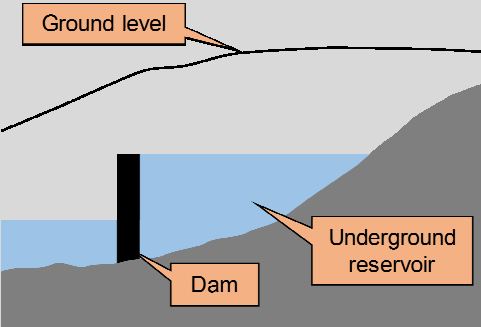
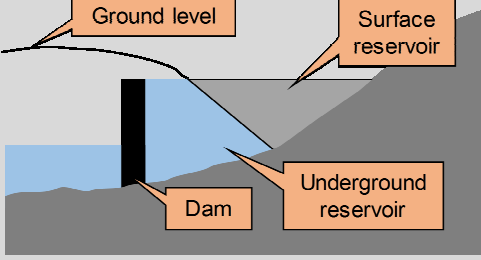
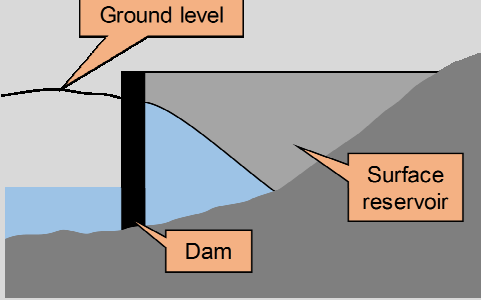
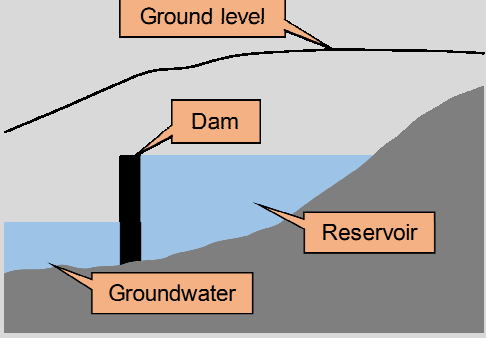
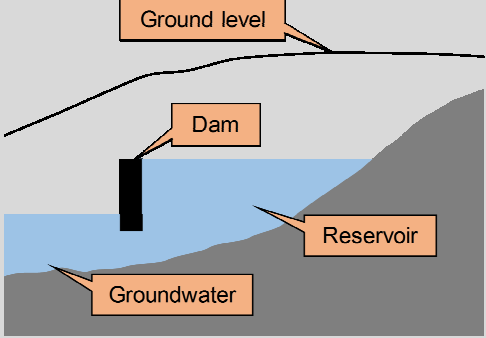
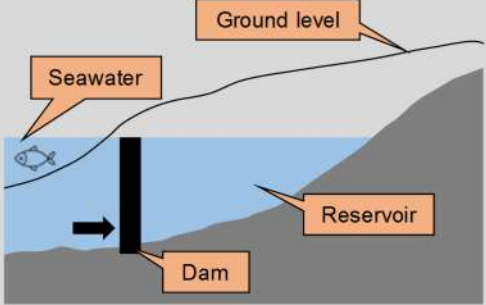
TYPE	BRIEF DESCRIPTION
A. UNDERGROUND DAM CLASSIFICATION BASED ON CONSTRUCTION MATERIAL	
<p>4. PLASTIC SHEETS</p> 	<ul style="list-style-type: none"> ■ The height of underground dams is typically 2 m. ■ The use of plastic-tarred-felt sheets requires skilled personnel. ■ It is possible to use an artificial fabric core in this technology. ■ At the bottom of the trench, on the upstream side, a small gutter should be dug in the impermeable layer, and a similar gutter dug in the soil surface at the top of the trench, on the downstream side. ■ These gutters are used to secure and seal the ends of the plastic sheets, using the same mud mortar as in the plaster.
B. UNDERGROUND DAM CLASSIFICATION BASED ON RESERVOIR TYPE	
<p>1. FULLY SUBSURFACE STORAGE</p> 	<ul style="list-style-type: none"> ■ A sub-surface dam is constructed to the underlying impervious material, with its crest at a desired depth below the ground level. ■ Excess groundwater flows above the dam crest to recharge downstream aquifers.
<p>2. PARTIALLY SUBSURFACE STORAGE</p> 	<ul style="list-style-type: none"> ■ A sand-storage dam is constructed across riverbeds, with the dam crest at a desired height above ground level. ■ The dam impounds water in sediments, especially sand, caused to accumulate by the dam itself.
<p>3. SURFACE DAM HYBRID</p> 	<p>At the surface dam, reservoir water is stored in the ground in addition to on the ground by the effectiveness of the water-tightness barrier, which is created by the foundation treatment such as grouting works.</p>

TABLE 1.4 (cont'd) Brief description of each classification for underground dam

TYPE	BRIEF DESCRIPTION
C. UNDERGROUND DAM CLASSIFICATION BASED ON DAMS FUNCTIONS	
<p>1. DAM UP</p> <p>a) Storage dam</p>  <p>b) Run-off control</p> 	<ul style="list-style-type: none"> ■ To store water on the upstream side especially during rainy seasons and is released during dry weather season or when there is higher demand of water. ■ Can also be used to generate power, irrigation, water supply, etc. ■ Storage dam is not mean to divert or keep water out, but to keep water in. ■ Storage dams are constructed to store water during the rainy seasons, supply water to the local wildlife, and store water for hydroelectric power generation, and irrigation. ■ Storage dams are the most common types of dams. ■ It is constructed to store water during the rainy session when there is a large flow in the river. ■ Many small dams impound the spring runoff for later use in dry summers. ■ Storage dams may also provide a water supply or improved habitat for fish and wildlife. ■ It may store water for hydroelectric power generation, irrigation or for a flood control project. ■ Storage dam is the most common type of dams and in general the means a storage dam unless qualified otherwise.
<p>2. SALTWATER INTRUSION PREVENTION</p> 	<ul style="list-style-type: none"> ■ It is mainly constructed to prevent saltwater intrusion to the inland of coastal area. ■ It is beneficial to improve water quality and prevent seawater intrusion for groundwater utilisation as raw water for potable or irrigation purposes.

1 INTRODUCTION

TABLE 1.4 (cont'd) Brief description of each classification for underground dam


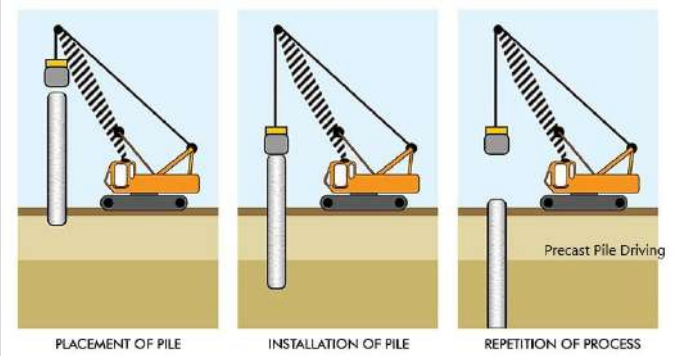
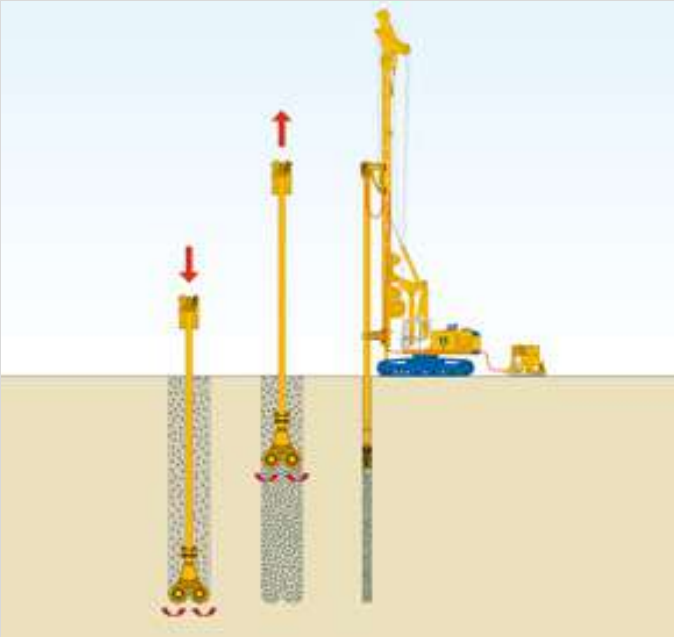
TYPE	BRIEF DESCRIPTION
D. UNDERGROUND DAM CLASSIFICATION BASED ON CONSTRUCTION METHOD	
<p>1. GROUND IMPROVEMENT (GROUTING METHOD)</p>  <p>Source: http://www.pcacontracting.com.au/</p>	<ul style="list-style-type: none"> ■ In general, it is applied by foundation improvement of surface dam, using injection of cement milk under the ground and hardening the milk, and so constructing the impermeable barrier (grout curtain). ■ This method is applied to underground dam in small scale.
<p>2. IMPERMEABLE BODY DRIVING METHOD</p>  <p>Source: https://www.structuralguide.com/</p>	<ul style="list-style-type: none"> ■ This method is to construct a dam body by driving steel sheet pile (or concrete sheet pile). ■ This method is used for shallow unconsolidated layer.
<p>3. DIAPHRAGM WALL METHOD</p>  <p>Source: https://bauerdamcontractors.com/</p>	<ul style="list-style-type: none"> ■ It is applied to underground dam in large scale. ■ Among of the several types of diaphragm method are used for underground dam construction (soil mixing wall method).

Table 1.5 lists the functions of a dam and its typical components. However, it should be noted that the list provided is only indicative as site conditions and available technologies can vary between projects.

TABLE 1.5 Functions of dam and its typical components

FUNCTION OF DAM / RESERVOIRS	TYPICAL PROJECT COMPONENTS	FUNCTION OF DAM / RESERVOIRS	TYPICAL PROJECT COMPONENTS
Water supply	<ul style="list-style-type: none"> ■ Water transfer tunnel ■ Water intake ■ Disposal area ■ Water treatment plant ■ Pipeline 	Control of siltation	<ul style="list-style-type: none"> ■ Flushing gate ■ Disposal area
Flood mitigation	<ul style="list-style-type: none"> ■ Re-regulating pond ■ Disposal area 	Water quality control	Disposal area
Irrigation	<ul style="list-style-type: none"> ■ Disposal area ■ Pipeline ■ Canal 	Sediment retention	<ul style="list-style-type: none"> ■ Water intake ■ Disposal area
Hydro power	<ul style="list-style-type: none"> ■ Tunnel ■ Water intake ■ Disposal area ■ Pipeline ■ Penstock ■ Power station ■ Transmission lines ■ Tailrace outlet ■ Diversion tunnel ■ Inlet and outlet ■ Water conduit ■ Switchyard ■ Control Room (Operation Office) ■ Access road 	Recreation	Disposal area
		Fishing	Disposal area
		Navigation	Disposal area
		Industrial cooling water	<ul style="list-style-type: none"> ■ Water intake ■ Flushing gate ■ Disposal area ■ Pipeline



1.6 EIA REPORT REQUIREMENT

Section 34A of the EQA 1974 provides powers to the Minister to prescribe, by order, any activity which may have significant environmental impacts as a prescribed activity, for which a report on an assessment of the impact(s) such an activity will have on the environment, be submitted to the Director General of Environmental Quality for approval. The submission of an EIA report for approval by the Director General is a requirement prior to the approval by the relevant project’s approving authorities.

Enforcement of the provisions of Section 34A of the EQA 1974 was made possible from 1st April, 1988.

In the **EIA Order 2015**, the construction of dams falls under Prescribed Activity 15 of the Second Schedule EIA:

- a) Construction of dam or impounding reservoir for the purpose of irrigation, flood mitigation, control of siltation, recreational, water supply or any other reason with a surface area of 100 hectares or more;
- b) Dam and hydro-electric power scheme with either or both of the following:
 - i. Dam of 15 metres or more in height and ancillary structures covering a total area of 40 hectares or more; and
 - ii. Reservoir with a surface area of 100 hectares or more.

Since the construction of dam falls under the Second Schedule, the EIA report requires the following steps:

- i) Public display; and
- ii) Public comments.

The EIA approval process will be carried out by DOE HQ. The respective State DOE will provide local input in order to facilitate DOE HQ’s roles.

The prescribed activities mentioned shall not apply to Sabah and Sarawak where these are subjected to separate state legislations and authorities as listed in *Table 1.6*.

TABLE 1.6 Environmental legislation for Sabah and Sarawak

STATE	LEGISLATIONS	AUTHORITY
Sabah	Environment Protection Enactment (Prescribed Activities) (Environmental Impact Assessment) Order 2005	Environment Protection Department (EPD)
Sarawak	Natural Resources and Environment (Prescribed Activities) Order 1994	Natural Resources and Environment Board (NREB) Sarawak

1.6.1 Scenarios that Require EIA

There are several scenarios where a dam related project do not fall directly under the Activity 15 of the Second Schedule EIA. However, these scenarios may require an EIA study to be carried out for approval. Brief descriptions of these scenarios are detailed in the following subsections.

1.6.1.1 Amendments in Project Component and Design

Any amendment in the component and design which has been detailed in the approved EIA is not permitted without having obtained approval from the DOE. Among the amendment includes, but not limited to the followings:

- i) Raising the existing dam height:
A most effective and economic way of expanding the reservoir capacity is by raising the existing dam height. The dam raising works should be carried out similar to a new dam development which involve investigation, design, construction and commissioning.

- ii) **Enlargement of existing reservoir:**
To cope up with the increasing demands of water, existing reservoir capacity is required to secure water supplies in the long term. These works should be carried out similar to a new dam development which involve investigation, design, construction and commissioning.

1.6.1.2 New Project Component

The Project Proponent may need to incorporate new project component for mitigation purposes or to manage with the current demand. The new project components includes, but not limited to the followings:

- i) **Construction of re-regulating weir**
Re-regulating weir structure is build at the downstream of the tailrace tunnel to prevent local flooding and rapid fluctuation in river water levels. This structure will lessen the impact of the hydro power operation on the river.
- ii) **Integration any renewable energy sources at existing dam or reservoir**
Integrating hydro facilities or other renewable energy sources such as floating solar farm at existing dam or reservoir are one of the green energy initiatives to offset climate change issue. Electricity generated from these sources can be a means to reach emission reduction goals.

1.6.1.3 New Project Development

■ Mini Hydro Through Riparian Flow

The small hydropower system is one of the most effective renewable sources of energy for sustainable development. Typically, mini hydro comprises diversion weir, intake, headrace channel, forebay, penstocks, powerhouse, tailrace and switchyard. The intake structure is at the riverbank and water is taken through penstocks to the powerhouse.

Since mini hydro project is run-of-the-river (RoR) type, no need of storing of water is required at the weir. The water leaves the generating station and is returned to the river without altering the existing flow or water levels.

1.6.1.4 Associated Facilities and Infrastructures

The following facilities and infrastructures are usually built as part of the dam related project:

- i) **Access road** - To allow for the transportation of construction materials and equipment from outside to support the dam construction and later will be used by the workers during dam operation.
- ii) **Project Proponent camp** - office for engineers and administration
- iii) **Contractor camp** - office, store, workshop
- iv) **Spoil areas** - Areas to temporarily or permanently dispose excavated soil during dam construction and operation stages.

Following to that, the dam related project may be subjected to any of the prescribed activities of the EIA Order 2015 as listed in *Figure 1.3*.

FIRST SCHEDULE
<ul style="list-style-type: none"> ■ Activity 3: Drainage and Irrigation ■ Activity 5: Forestry ■ Activity 7: Land Reclamation ■ Activity 11: Power Generation and Transmission ■ Activity 13: Development in Slope Area ■ Activity 19: Quarry ■ Activity 20: Road ■ Activity 21: Water supply
SECOND SCHEDULE
<ul style="list-style-type: none"> ■ Activity 3: Drainage and Irrigation ■ Activity 5: Forestry ■ Activity 7: Land Reclamation ■ Activity 13: Development in Slope Area

FIGURE 1.3 Prescribed activities related to dam projects

1.7 OVERVIEW OF THE EIA PROCESS

This section provides an overview of the step-by-step guide to the preparation of an EIA study for the construction of dam. Each step is briefly described and reference made to each chapter is listed in *Table 1.7*.

TABLE 1.7 Step-by-step guide for the EIA process

STEP	DESCRIPTION	REFERENCE IN THE GUIDELINE
1. Project Proponent to provide project brief and technical studies	<ul style="list-style-type: none"> ■ The Project Proponent must provide basic information about the proposed project in order for the Qualified Person to understand the intent, objectives and scope of the proposed project. ■ The basic information includes: <ol style="list-style-type: none"> i) project location with coordinates; ii) project boundary; iii) project acreage; and iv) project layout plan and components. ■ This is to assist the Qualified Person to determine whether the proposed project falls under the Prescribed Activity 15 of the Second Schedule EIA of the EIA Order 2015. 	Chapter 1
2. Identify applicable policies, laws and guidelines	The Project Proponent is required to identify and comply with the relevant legal requirements before submitting the EIA report to the DOE HQ for approval.	Chapter 2
3. Carry out preliminary stakeholders engagement	<ul style="list-style-type: none"> ■ It is important for the Project Proponent to carry out stakeholders engagement prior to preparing the Terms of Reference (TOR) and Environmental Scoping Information (ESI) reports. ■ Constant engagement with DOE is advisable (via the designated officer in charge), as well as with the relevant government agencies (GAs). This is to ensure the scoping is comprehensively covered in the EIA report. 	Chapter 2
4. Prepare TOR and ESI report	<ul style="list-style-type: none"> ■ TOR and ESI must be submitted for endorsement before submission of EIA report. ■ Qualitative data will suffice. However, quantitative data can also be included if available. ■ These reports must cover the followings: <ol style="list-style-type: none"> i) Site Suitability Assessment (SSA); ii) determine project and study boundaries iii) overview baseline data iv) identify current issues and constraints within the project site; v) identify existing site conditions and environmentally sensitive areas (ESA); vi) predict potential impacts; and 1) propose appropriate mitigation measures. 	Chapter 3

TABLE 1.7 (cont'd) Step-by-step guide for the EIA process

STEP	DESCRIPTION	REFERENCE IN THE GUIDELINE
5. Submit TOR and ESI	<ul style="list-style-type: none"> ■ The TOR and ESI prepared by the Qualified Person must follow the format as documented in the EGIM and this Guideline. ■ The TOR and ESI must be submitted to DOE HQ for review and endorsement. 	Chapter 3
6. Collect baseline data	<ul style="list-style-type: none"> ■ After the TOR endorsement, data collection must be carried out to obtain information of the existing environment and surroundings of the project site. ■ Two approaches will be used for the data collection which are primary data and secondary data. <ul style="list-style-type: none"> i) Primary data: <ul style="list-style-type: none"> - Site survey, ground-truthing and sampling programmes. i) Secondary data: <ul style="list-style-type: none"> - Relevant reports and literatures from various government departments and agencies; and - Studies performed for other projects within the project's vicinity. 	Chapter 4
7. Prepare EIA report	<ul style="list-style-type: none"> ■ The EIA study must covers the following main components: <ul style="list-style-type: none"> i) assess impacts of the project against baseline by comparing scenarios 'before project' and 'after project'; ii) predict impacts qualitatively and measure quantitatively; iii) identify and predict the environmental issues during pre-construction, during construction and operation stages of the project; iv) propose applicable pollution prevention and mitigation measures (P2M2s) during pre-construction, during construction and operation stages of the project; and v) provide post-EIA framework including Environmental Management Plan (EMP) and Environment Mainstreaming Tools (EMTs) programmes. ■ Project description must cover the following (refer <i>Attachment 1</i> for more detail): <ul style="list-style-type: none"> i) project location; ii) project components; iii) project activities; iv) project detailed design; v) infrastructure, utilities and amenities requirement; and vi) project implementation schedule. 	Chapters 5, 6 and 7

1 INTRODUCTION

TABLE 1.7 (cont'd) Step-by-step guide for the EIA process

STEP	DESCRIPTION	REFERENCE IN THE GUIDELINE
8. Carry out stakeholders engagement	<ul style="list-style-type: none"> ■ Upon completion of the draft EIA report, a stakeholder engagement must be carried out by the Project Proponent and assisted by the Qualified Person. ■ The potential stakeholders are local communities, business operators etc., who are likely to be directly or indirectly affected by the project. ■ The main objectives of these engagements are: <ul style="list-style-type: none"> i) to brief the stakeholders about the project, the potential environmental impacts and the proposed P2M2s; and ii) to seek stakeholders concern and feedback regarding the project. ■ All findings from the public engagements shall be incorporated into the final EIA report. 	Chapter 2
9. Completion of EIA report	<ul style="list-style-type: none"> ■ Key findings from all the relevant technical studies must be incorporated into the EIA report. ■ The EIA report prepared by the Qualified Person must follow the format as documented in the EGIM and this Guideline. 	Chapter 8
10. Submit EIA report and carry out Public Display	<ul style="list-style-type: none"> ■ Hard copy and soft copy (in PDF format) of the EIA report must be submitted to DOE HQ for approval. ■ Concurrently, the Project Proponent must engage major newspaper companies to advertise and announce the availability of the EIA report for public review. ■ The proposed locations for the EIA report to be displayed must obtain prior approval from the DOE HQ. ■ The public can vet through the EIA report and give their comments to the DOE HQ throughout the public display period. 	Chapter 8
11. Post-EIA	<ul style="list-style-type: none"> ■ Once the EIA is approved, the Project Proponent must appoint a Qualified Person to prepare an EMP report for submission and approval from the relevant State DOE. ■ The Project Proponent must also implement the EMTs to ensure the project is regulatory-compliant and the environmental agendas are achieved. 	Chapter 9

1.8 STRUCTURE OF THE GUIDELINE

The structure of the Guideline is as following:

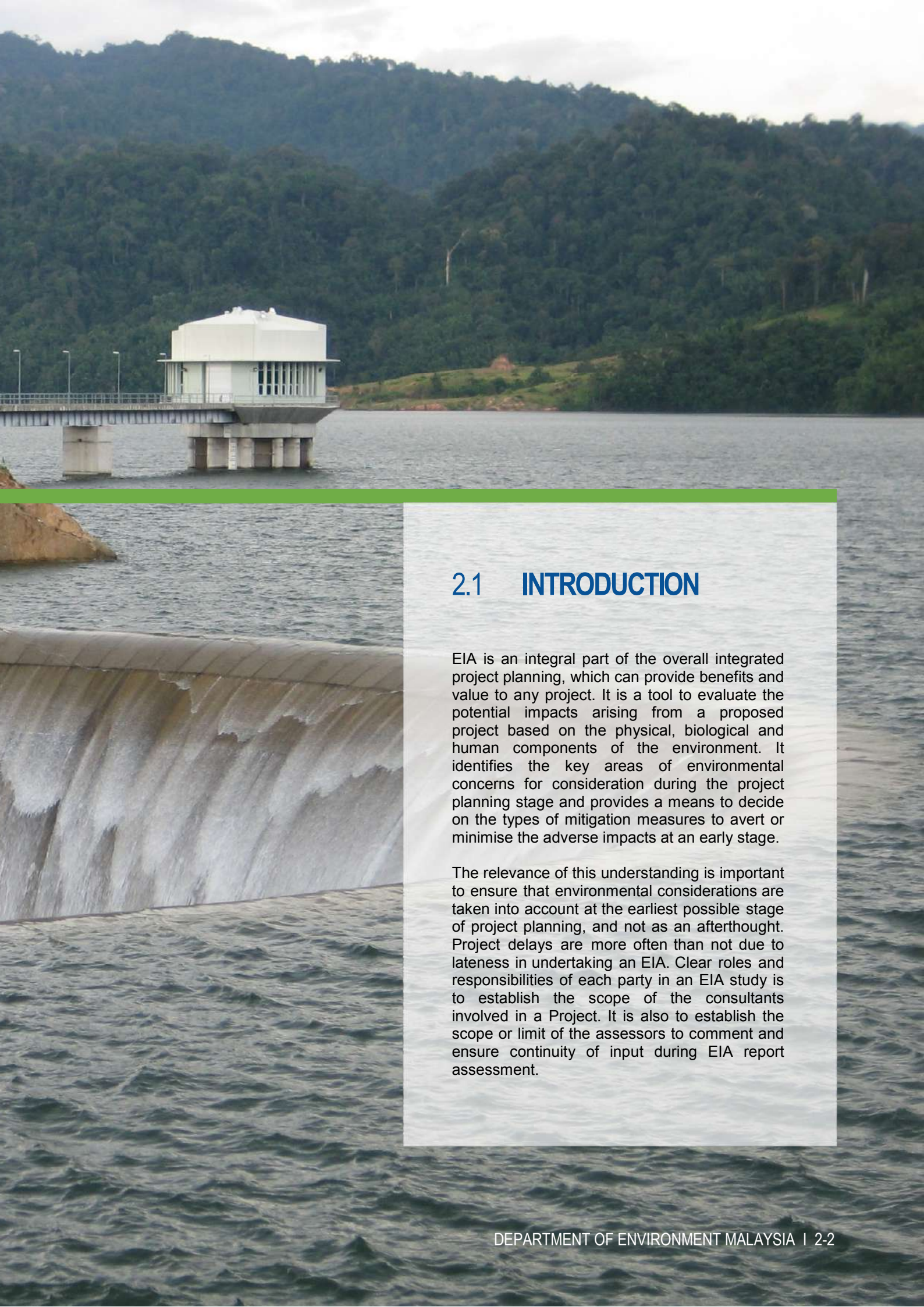
Chapter 1 INTRODUCTION	Provides the terms and definition of the prescribed activities, scope, overview of EIA study and structure of the Guideline
Chapter 2 ENVIRONMENTAL PROJECT PLANNING	Outlines relevant legal requirements and policies throughout the life cycle of a dam project
Chapter 3 TERMS OF REFERENCE (TOR)	<ul style="list-style-type: none"> ■ Provides the procedures to conduct environmental scoping in order to prepare TOR and ESI documents. ■ Presents the structure and content of TOR document, including an overview of the TOR review and endorsement process.
Chapter 4 ENVIRONMENTAL BASELINE DATA	Outlines the relevant baseline data information to be incorporated in the EIA report.
Chapter 5 EVALUATION OF IMPACTS	<ul style="list-style-type: none"> ■ Provides the methodology and tools to identify, predict, evaluate and assess the potential significant environmental impacts. ■ Details the requirement of LD-P2M2 and its procedure.
Chapter 6 MITIGATION MEASURES	Identifies applicable P2M2s to minimise negative impacts from the project.
Chapter 7 POST-EIA	<ul style="list-style-type: none"> ■ Outlines the EMP and EMT frameworks. ■ Provides roles and responsibilities during post-EIA stage. ■ Details out the environmental monitoring, audit, sustainability report and database.
Chapter 8 TOR AND EIA CHECKLIST	Provides the checklist for environmental review criteria for TOR and EIA approval. The checklist is prepared to assist projects proponents, consultant, and DOE.
Chapter 9 EIA REPORT FORMAT	Outline the format of an EIA Report.

A photograph of the Sungai Selangor Dam, showing water cascading over a concrete spillway. In the background, there are lush green mountains and a road with streetlights. The sky is overcast.

CHAPTER 2

Environmental Project Planning

*Sungai Selangor Dam
Photo by Norbert Nyulin on Flickr.com*



2.1 INTRODUCTION

EIA is an integral part of the overall integrated project planning, which can provide benefits and value to any project. It is a tool to evaluate the potential impacts arising from a proposed project based on the physical, biological and human components of the environment. It identifies the key areas of environmental concerns for consideration during the project planning stage and provides a means to decide on the types of mitigation measures to avert or minimise the adverse impacts at an early stage.

The relevance of this understanding is important to ensure that environmental considerations are taken into account at the earliest possible stage of project planning, and not as an afterthought. Project delays are more often than not due to lateness in undertaking an EIA. Clear roles and responsibilities of each party in an EIA study is to establish the scope of the consultants involved in a Project. It is also to establish the scope or limit of the assessors to comment and ensure continuity of input during EIA report assessment.

2.2 OVERVIEW OF DAM MANAGEMENT

Dam management plays a vital role in ensuring equitable water supplies. The management of dams in Malaysia is divided into four major groups namely flood mitigation, hydroelectric, water supply and agriculture. Water supply dams in Malaysia are managed and operated by private and water board of respective states. Meanwhile, DID is responsible for flood mitigation dam and silt retention dam and Tenaga Nasional Berhad (TNB) is managing hydroelectric scheme in Peninsular Malaysia.

Currently, there is no specific Act that is enacted in Malaysia for dam development and management. The only relevant legal requirement is the Environmental Quality (Prescribed Activities) (EIA) Order 2015 where the construction of dam required the following approvals from the Director-General of DOE prior to project commencement:

- i) Environmental Impact Assessment for prescribed activities;
- ii) Site Suitability Assessment (SSA);
- iii) written notification before construction; and
- iv) written approval for installation of equipment.

2.3 GOVERNANCE STRUCTURE OF DAM MANAGEMENT

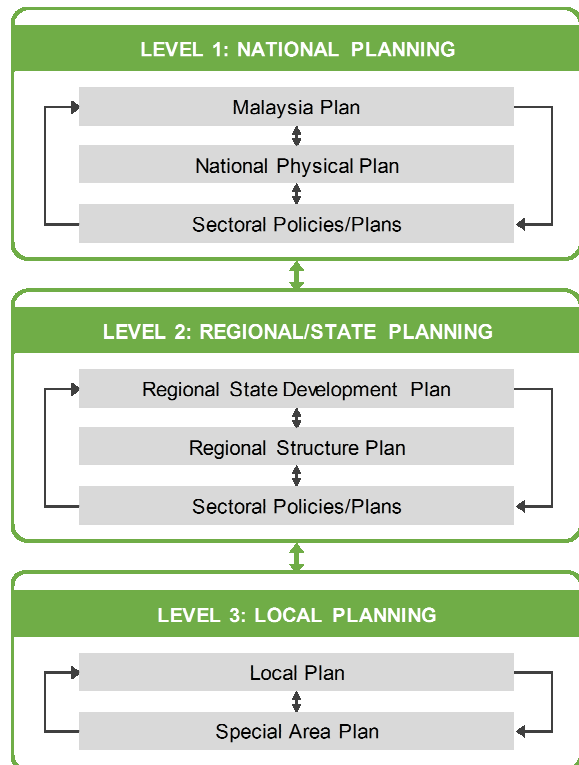
In Malaysia, the authority to make decision on planning development is a shared responsibility of the Federal and State Government. According to the Town and Country Planning Act 1976 (Act 172):

“Section 20B. (1) Without prejudice to section 20A, it shall be the duty of every Federal Government and State Government department or agency to seek advice from the Council on a development proposal relating to-

b) any construction of a major national infrastructure including –

*(i) airports, seaports, inland ports, railway transportation networks, highways, power stations, **dams** and toxic waste disposal sites;*

Thus, any dam projects must seek advice from the National Physical Planning Council (NPPC) prior to its implementation. The development process in Malaysia is governed through a 3-tiered process, known as the National Development Planning Framework. The essence of this framework is embodied through the enactment of the Town and Country Planning Act 1976 (Act 172). This Act provides the legal framework of which the functions of the federal, state and local governments are stipulated, as illustrated in *Figure 2.1*.



Source: National Physical Plan-2, Federal Department of Town and Country Planning, Ministry of Housing and Local Government, Malaysia

FIGURE 2.1 National Development Planning Framework

2.4 RELEVANT LEGISLATIONS

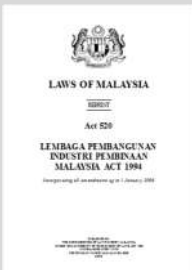
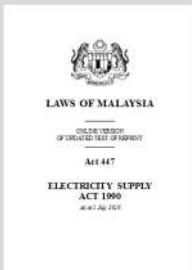
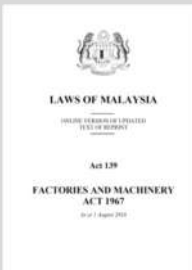
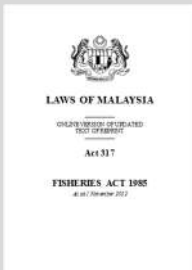
Currently, there is no specific legislation that regulates dam management in Malaysia. Since construction of a dam is subjected to the EIA Order 2015 of the EQA 1974, the following provisions are directly applied:

- i) Section 34A (6) - Any person intending to carry out a prescribed activity shall not carry out such activity until the report required under this section to be submitted to the Director General has been submitted and approved.
- ii) Section 34A (7) - If the Director General approves the report, the person carrying out the prescribed activity, in the course of carrying out such activity, shall provide sufficient proof that the conditions attached to the report (if any) are being complied with and that the proposed measures to be taken to prevent, reduce or control the adverse impact on the environment are being incorporated into the design, construction and operation of the prescribed activity.

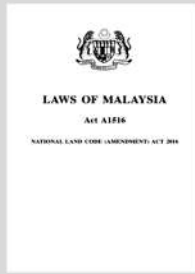
As such, the Project Proponent is legally responsible to manage the dam starting from the project planning stage up until rehabilitation or abandonment stages.

2.4.1 Relevant Federal Laws

Other than the EQA 1974, other relevant federal laws shall also be referred to prior to any commencement of dam projects. The federal laws are including but not limited to the following:

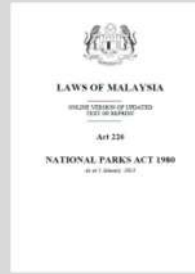
 <p>CONSTRUCTION INDUSTRY DEVELOPMENT BOARD (CIDB) ACT 1994 This Act defines the construction of dam including on site clearance, soil investigation and improvement, earth-moving, excavation, laying of foundation, site restoration and landscaping; and procurement of construction materials, equipment or workers.</p>	 <p>ELECTRICITY SUPPLY ACT 1990 This Act provides the regulation of the electricity supply industry and the licensing of any electrical installation.</p>
 <p>FACTORIES AND MACHINERY ACT 1967 This Act concerns matters relating to the safety, health and welfare of person therein, the registration and inspection of machinery and on matters connected therewith during construction, structural alteration, repair or maintenance of a dam.</p>	 <p>FISHERIES ACT 1985 This Act concerns the conserving, managing and developing any maritime and estuarine fishing and fisheries matters.</p>

2 ENVIRONMENTAL PROJECT PLANNING



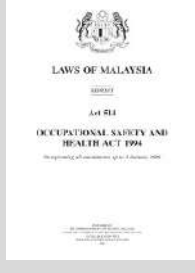
NATIONAL LAND CODE 1965

This Act is to consolidate the laws relating to land and land tenure, the registration of title to land and of dealings therewith.



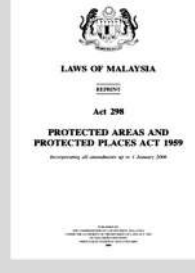
NATIONAL PARKS ACT 1980

This Act preserves and protects flora and fauna within the National Park boundary.



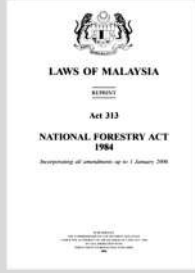
OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) 1994

This Act secures the safety, health and welfare of persons at work, and for protecting others against risks to safety or health in connection with the activities of persons at work.



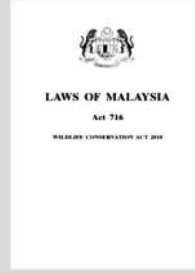
PROTECTED AREAS AND PROTECTED PLACES ACT 1959

This Act is to provide for protected areas and places.



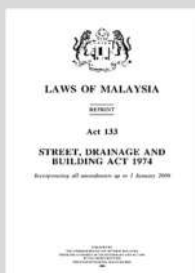
NATIONAL FORESTRY ACT 1984

This Act is to provide the administration, management and conservation of forests and forestry development within the States of Malaysia and for connected purposes.



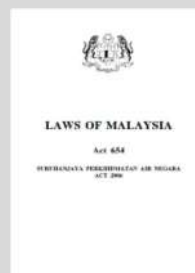
WILDLIFE CONSERVATION ACT 2010

This Act is to provide for the protection and conservation of wildlife and for matters connected therewith.



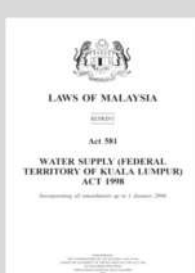
STREET, DRAINAGE AND BUILDING ACT 1974

This Act is to consolidate the laws relating to street, drainage and building in local authority areas in Peninsular Malaysia, and for purposes connected therewith.



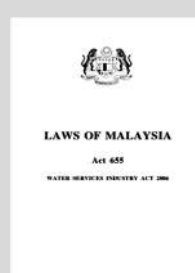
SURUHANJAYA PERKHIDMATAN AIR NEGARA (SPAN) ACT 2006

This Act provides the establishment of SPAN with powers to supervise, regulate and enforce water supply and sewerage services laws.



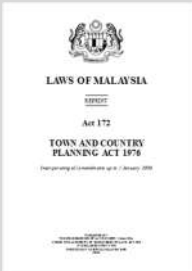
WATERS ACT 1920

This Act controls and licenses any disruption or diversion of water from rivers and streams.

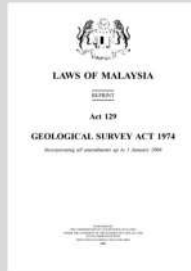


WATER SERVICES INDUSTRY ACT 2006

This Act is to provide for and regulate water supply services and sewerage services and for matters incidental thereto.



TOWN AND COUNTRY PLANNING (AMENDMENT) ACT 2017
 This Act controls and regulates town and country planning in Malaysia and for purposes connected therewith or ancillary thereto. As specified in this Act, all applications for planning permission for any coastal reclamation projects and construction of a major national infrastructure including dams must seek advice from the National Physical Planning Council (NPPC). Prior to that, a Social Impact Assessment (SIA) must be submitted to PLANMalaysia for approval.



GEOLOGICAL SURVEY ACT 1974
 This Act regulates and controls geological surveys, to establish geological archives and to provide for matters incidental thereto.

2.4.2 Relevant State Laws

The relevant water acts in each state that are relevant to dam project are including but not limited to the following:



JOHOR

- Water Supply Enactment (No. 119)
- Water Supply Rules 1986




SELANGOR

- Waters Act 1920
- Selangor Waters Management Authority Enactment 1999




KELANTAN

Kelantan Water Resources Enactment 2019



NEGERI SEMBILAN

Waters Act 1920



PAHANG

- Waters Act 1920
- Pahang Water Resources Enactment 2007




PERLIS

Water Supply Enactment 2006



PULAU PINANG

- Waters Act 1920
- Water Supply Enactment 2004
- Water Supply (Catchment Area) Order 2004



PUTRAJAYA

- Waters Act 1920
- Control of Activities on the Lake (Putrajaya) By Laws 2004

2 ENVIRONMENTAL PROJECT PLANNING



KUALA LUMPUR
Water Supply (Federal Territory of Kuala Lumpur) Act 1998



TERENGGANU

- Terengganu Water Resources Enactment 2020
- Water Supply Enactment 1998



PERAK

- Waters Act 1920
- Perak Water Board Enactment 1988



MELAKA

- Waters Act 1920
- Malacca River and Coastal Development Corporation Enactment 2005
- Melaka Water Resources Enactment 2014



KEDAH

- Muda Agricultural Development Authority Act, 1972
- Kedah Water Resources Enactment 2008

2.5 RELEVANT POLICIES

National planning policies facilitate decision-making for development planning so as to control the type, location and quantum of the proposed development. Taking into account the sensitivity of an area, the planning policies also identify the locations of Environmentally Sensitive Areas (ESAs) and the type of developments that are permitted in these areas. The national planning policies will be the guidance to formulate and prepare the local and regional planning policies. List of the policies that are relevant to dam



SUSTAINABLE DEVELOPMENT GOALS (SDG) (UNDP, 2015)

A blueprint under the United Nations to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. Goals 6 and 7 of the SDG are relevant with dam projects.

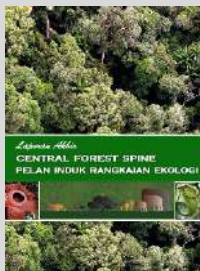
Balok, Pahang
Photo by Eutah Mizushima on Unsplash.com



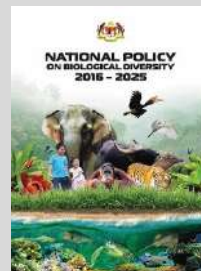
FIVE YEAR MALAYSIA PLAN
 Outlines the Malaysia's five-year development policies and strategies plan.



THIRD NATIONAL PHYSICAL PLAN (NPP) (PLANMalaysia)
 Provides the national physical planning framework for the implementation of sustainable development strategies for the whole nation



CENTRAL FOREST SPINE (CFS) ECOLOGICAL NETWORK MASTER PLAN (PLANMALAYSIA)
 Provides a general framework for development planning within and near to any identified ecological networks.



NATIONAL POLICY ON BIOLOGICAL DIVERSITY 2016 – 2025 (NRE, 2016)
 Provides direction and framework to conserve biodiversity.



NATIONAL POLICY ON CLIMATE CHANGE (NRE, 2010)
 Provides framework to mitigate climate change in an integrated and balance manner.



NATIONAL WATER RESOURCES POLICY (NRE, 2012)
 Sets out strategies that will guide water resources stakeholders to structure actions for effective conservation and management of water resources.



NATIONAL POLICY ON THE ENVIRONMENT (MINISTRY OF SCIENCE, TECHNOLOGY AND THE ENVIRONMENT, 2002)
 Provides principles and strategies to ensure the environment remains productive, both ecologically and economically.



GREEN TECHNOLOGY MASTER PLAN MALAYSIA 2017 – 2030 (MESTECC, 2017)
 The master plan includes planning in the adoption and use of green technology in harnessing energy, water resources and managing wastes.



MALAYSIA NATIONAL FORESTRY POLICY 1978 (REVISED 1993) (FORESTRY, 1993)
 Conserve and manage the forest through sustainable management and maintain its important roles in the national economy and preservation of environmental stability.

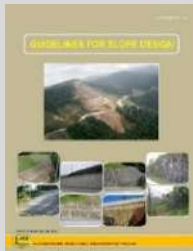


RANCANGAN FIZIKAL ZON PERSIRAN PANTAI NEGARA (RFZPPN) (PLANMALAYSIA)
 Provide the framework for spatial planning in the costal zone

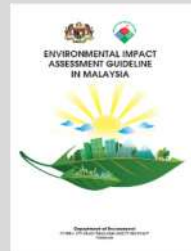
2.6 RELEVANT GUIDELINES AND GUIDANCE DOCUMENTS

Guidelines pertaining to environment-related system, management and safety of dam must be cross-referenced and incorporated in the EIA report. Any other relevant guidance documents such as notices or circulars issued by DOE or any other Government Agencies must also be incorporated in the EIA report. The guidelines and guidance documents relevant to dam projects are including but not limited to the following:

	<p>MALAYSIA DAM SAFETY MANAGEMENT GUIDELINES (MYDAMS) (DID, 2017) Outlines appropriate practices that should be considered during investigation, design, construction, commissioning, maintenance, operation, safety surveillance, safety review, emergency preparedness, rehabilitation and the life cycle management of dams.</p>
	<p>GARIS PANDUAN PERANCANGAN (GPP) PEMBANGUNAN DAN PENGURUSAN DI KAWASAN BERISIKO BENCANA GEMPA BUMI (PLANMALAYSIA, 2018) Provides the requirements for development in areas susceptible to earthquake.</p>
	<p>GARIS PANDUAN PERANCANGAN (GPP) PEMULIHARAAN DAN PEMBANGUNAN KAWASAN SENSITIF ALAM SEKITAR (KSAS) (PLANMALAYSIA, 2017) Provides the requirements for development in ESAs.</p>
	<p>GARIS PANDUAN PERANCANGAN (GPP) PEMBANGUNAN DI KAWASAN BUKIT DAN TANAH TINGGI (PLANMALAYSIA, 2009) Provides the requirements for development in hilly areas, upland, hillsides and hilltops</p>
	<p>GUIDANCE DOCUMENT ADDRESSING SOIL EROSION AND SEDIMENT CONTROL (ESC): ASPECTS IN THE EIA REPORT AS PER APPENDIX 3 OF THE EGIM (DOE, 2016) Guidance to address aspects of soil erosion and sediment control (ESC).</p>
	<p>GUIDELINES FOR EROSION AND SEDIMENT CONTROL IN MALAYSIA (DID, 2010) Guidelines for prevention and control of soil erosion and siltation for specific projects including examples of control measures and best management practices.</p>



GUIDELINES FOR SLOPE DESIGN (PWD, 2010)
Provides geotechnical design criteria for slopes.



GUIDANCE DOCUMENT FOR THE PREPARATION AND SUBMISSION OF EMP AS PER CHAPTER 6 OF THE EGIM (DOE, 2016)
Guidance for the preparation of the EMP.



URBAN STORMWATER MANAGEMENT MANUAL FOR MALAYSIA (MSMA 2ND EDITION) (DID, 2012)
Provides planning and design guidance to manage stormwater.



GARIS PANDUAN PEMBANGUNAN MELIBATKAN SUNGAI DAN RIZAB SUNGAI (DID, 2000)
Provides proper planning and sustainable development involve the river and its reserve area.



GARIS PANDUAN JALAN HUTAN 2010 (PINDAAN 2013) (FDPM, 2014)
Guidance for forest road management includes phases of planning, construction, maintenance and closure of forest roads.



GUIDANCE DOCUMENT FOR THE PREPARATION OF THE DOCUMENT ON LAND-DISTURBING POLLUTION PREVENTION AND MITIGATION MEASURES (LD-P2M2) AS PER APPENDIX 4 OF THE EGIM (DOE, 2016)
Guidance for the preparation of the LD-P2M2 document which is to be included as part of the EMP document for approval from DOE State.



INTEGRATED APPROACHES UNDER THE NATIONAL WATER RESOURCES POLICY:

- INTEGRATED WATER RESOURCES MANAGEMENT (IWRM)
- INTEGRATED RIVER BASIN MANAGEMENT (IRBM)
- INTEGRATED LAKE MANAGEMENT (ILM)
- INTEGRATED COASTAL ZONE MANAGEMENT (ICZM)
- INTEGRATED SHORELINE MANAGEMENT PLAN (ISMP)
- INTEGRATED FLOOD MANAGEMENT (IFM)

Assist in structuring current practices towards better water resources governance, taking into consideration their unique application ranging from facilitating allocation to addressing hazards.

2.7 INTEGRATION OF ENVIRONMENTAL COMPLIANCE INTO PROJECT PLANNING

The Project Proponent is responsible of all legal requirements on environment begins from the planning stage up until the rehabilitation or abandonment stage. As such, an effective project planning requires involvement from many parties or stakeholders to ensure that it covers all relevant sectors. This includes a technical Project Team from the Project Proponent side in providing input and from various technical government agencies (GA).

A transparent and smooth integration between sectors must be established first in a Project Team in order to fulfill DOE's and GA's requirements. The EIA Consultant must be able to cross-refer various sectors in order to come up with a good environment findings that not only focusing during the EIA study but also during the post-EIA stage. A typical life cycle of a dam project and relevant requirements in each stage is shown in *Figure 2.2* and the details are listed in *Table 2.1*.

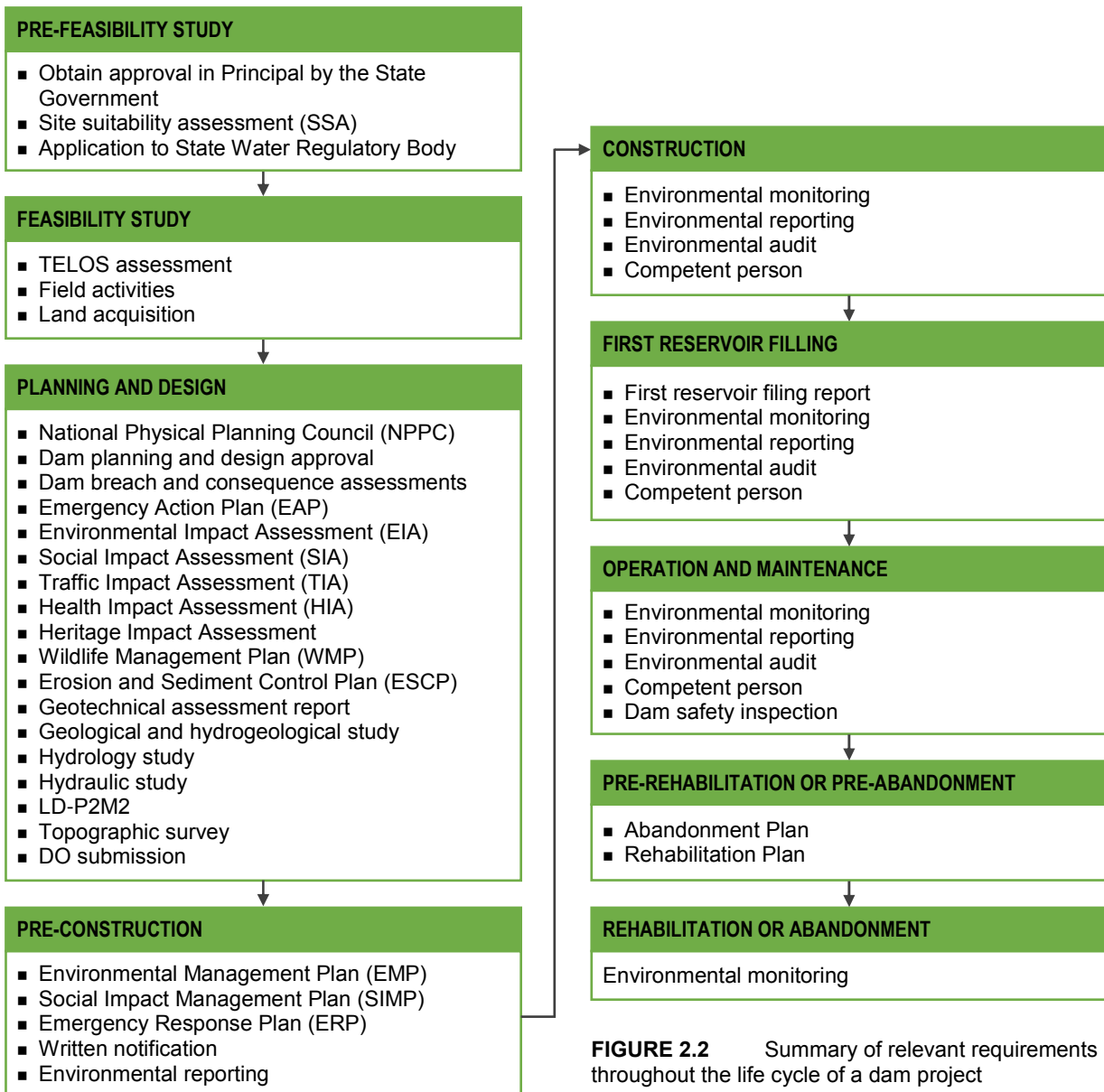


FIGURE 2.2 Summary of relevant requirements throughout the life cycle of a dam project

TABLE 2.1 List of relevant requirement at various project implementation stage

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PRE-FEASIBILITY STUDY			
Obtain approval in Principle by State Government	Permission to develop the project	State government	Town and Country Planning Act 1976 (Act 172)
Site Suitability Assessment (SSA)	Identify a preferred dam site for development are detailed in <i>Section 3.4 of the Chapter 3</i>	<ul style="list-style-type: none"> ■ Department of Director -General of Lands and Mines (JKPTG) ■ State Land and Mines Office (PTG) ■ DID ■ DOE 	NA
Application to abstract water	Application to obtain license for water abstraction for water supply	State Water Regulatory Body	State Water Enactment
FEASIBILITY STUDY			
TELOS assessment at the opted site	TELOS framework to assess five key areas: Technical, Economic, Legal, Organisational and Scheduling	NA	NA
Field activities	<ul style="list-style-type: none"> ■ Geological mapping ■ Drilling ■ Geophysical investigation 	JMG	Geological Survey Act 1974 (Act 129)
Land acquisition	<ul style="list-style-type: none"> ■ No. of lots involved ■ Land boundary ■ Compensation plan 	<ul style="list-style-type: none"> ■ Department of Director -General of Lands and Mines (JKPTG) ■ State Land and Mines Office (PTG) 	National Land Code 1965 (Act 56)
PLANNING AND DESIGN			
National Physical Planning Council (NPPC)	<ul style="list-style-type: none"> ■ All applications for planning permission for any construction of a major national infrastructure including dams must seek advice from the National Physical Planning Council (NPPC) ■ Technical studies 	PLANMalaysia	Town and Country Planning Act 1976 (Act 127)
Dam planning and design approval	Detailed design of each structure for the proposed dam	<ul style="list-style-type: none"> ■ Local Council ■ DID 	NA
Dam breach and consequence assessments	<ul style="list-style-type: none"> ■ Dam break analysis <ul style="list-style-type: none"> i) Initial conditions (sunny-day failures, flood-induced failures) ii) Breach location and parameters iii) Discharge hydrograph ■ Flood wave routing ■ Inundation mapping 	<ul style="list-style-type: none"> ■ PWD ■ DID 	NA

Note: The list is not exhaustive and not all the listed requirements are relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant requirements required for environmental assessment and compliance.

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.1 (cont'd) List of relevant requirement at various project implementation

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PLANNING AND DESIGN (cont'd)			
Emergency Action Plan (EAP)	<ul style="list-style-type: none"> ■ Emergency contact lists ■ Identification, assessment and classification procedures ■ Notification procedures ■ Preventive and emergency actions ■ Emergency termination actions ■ Access to site ■ Response procedures ■ EAP maintenance and training ■ Any additional information to ensure appropriate response to an emergency 	NA	NA
Environmental Impact Assessment (EIA)	<ul style="list-style-type: none"> ■ TOR and ESI ■ Statement of need ■ Project options ■ Project description ■ Existing environment ■ Evaluation of impacts ■ Mitigation measures ■ Post-EIA 	DOE	Environmental Quality Act (EQA) 1974 (Act 127)
Social Impact Assessment (SIA)	<ul style="list-style-type: none"> ■ Project description ■ Existing human environment ■ Evaluation of social impacts ■ Mitigation measures ■ Post-SIA 	<ul style="list-style-type: none"> ■ PLANMalaysia ■ PLANMalaysia@Negeri 	Town and Country Planning Act 1976 (Act 127)
Traffic Impact Assessment (TIA)	<ul style="list-style-type: none"> ■ Project description ■ Road and junction characteristics ■ Traffic count survey ■ Existing traffic condition evaluation ■ Traffic forecast ■ Evaluation of traffic impacts ■ Mitigation measures ■ Post-TIA 	<ul style="list-style-type: none"> ■ PWD ■ Local Council 	<ul style="list-style-type: none"> ■ Road Transport Act 1987 (Act 333) ■ Town and Country Planning Act 1976 (Act 127)
Health Impact Assessment (HIA)	<ul style="list-style-type: none"> ■ Project description ■ Existing public health status ■ Evaluation of health impacts ■ Mitigation measures ■ Post-HIA 	Ministry of Health (MOH)	EQA 1974 (Act 127)
Heritage Impact Assessment	<ul style="list-style-type: none"> ■ Project description ■ Land use assessment ■ Existing heritage component ■ Evaluation of heritage impacts ■ Mitigation measures 	Department of National Heritage	National Heritage Act 2005 (Act 645)

Note: The list is not exhaustive and not all the listed requirements are relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant requirements required for environmental assessment and compliance.

TABLE 2.1 (cont'd) List of relevant requirement at various project implementation

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PLANNING AND DESIGN (cont'd)			
Wildlife Management Plan (WMP)	<ul style="list-style-type: none"> ■ Project description ■ Existing wildlife status ■ Evaluation of wildlife impacts ■ Mitigation measures ■ Post-WMP 	DWNP	Wildlife Conservation Act 2010
Erosion and Sediment Control Plan (ESCP)	<ul style="list-style-type: none"> ■ Annual soil erosion rate ■ Sediment yield ■ Mitigation measures (erosion and sedimentation control measures) ■ Inspection and maintenance 	DID	NA
Geotechnical assessment report	<ul style="list-style-type: none"> ■ Project description ■ Geology and terrain classification ■ Site investigation ■ Geotechnical design considerations ■ Method statement ■ Post-project slope and site maintenance ■ Recommendations 	<ul style="list-style-type: none"> ■ JMG ■ PWD Geotechnical Branch ■ IKRAM 	Geological Survey Act 1974, No. 129
Geological and hydrogeological study	<ul style="list-style-type: none"> ■ Project description ■ Geological profile ■ Permeability test ■ Construction materials ■ Groundwater regime ■ Evaluation of impact ■ Mitigation measures 	JMG	Geological Survey Act 1974, No. 129
Hydrology study	<ul style="list-style-type: none"> ■ Project description ■ Existing hydrology conditions ■ Evaluation of impact (including potential coastal erosion) ■ Mitigation measures 	DID	NA
Hydraulic study	<ul style="list-style-type: none"> ■ Project description ■ Site and meteo-marine conditions ■ Existing condition hydrodynamic, waves, water quality, littoral transport) ■ Evaluation of impact including potential coastal erosion (hydrodynamic, waves, water quality, sediment transport, littoral transport, sediment spill dispersion) ■ Assessment on river geomorphology ■ Mitigation measures 	DID	NA

Note: The list is not exhaustive and not all the listed requirements are relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant requirements required for environmental assessment and compliance.

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.1 (cont'd) List of relevant requirement at various project implementation

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PLANNING AND DESIGN (cont'd)			
LD-P2M2	<ul style="list-style-type: none"> ■ Description of adjacent areas that may be affected by land disturbance ■ List of BMP proposed ■ Earthworks cut and fill volume ■ Availability of materials ■ Biomass management ■ Spill prevention and control plan ■ Soil loss prediction (pre, during and post development as well as with and without BMP scenarios) ■ Projected runoff flows ■ Calculation for BMP (sediment traps/ basins, check dams, etc.) 	DOE	EQA 1974 (Act 127)
Topographic survey	Topographical map of the project area	NA	Geological Survey Act 1974, No. 129
Development Order	Approval of various submission to the technical agencies: <ul style="list-style-type: none"> ■ EIA report – DOE ■ SIA report – PLANMalaysia ■ TIA report – PWD ■ HIA report – MOH ■ Heritage Impact Assessment report – Department of National Heritage ■ ESCP report – DID ■ Geotechnical report—JMG ■ Other relevant technical studies 	Local Authority	Town and Country Planning Act 1976 (Act 172)
PRE-CONSTRUCTION			
Environmental Management Plan (EMP)	<ul style="list-style-type: none"> ■ Project Proponent/Contractor's Environmental Policy ■ Organisational chart (EPMC and ERCMC) ■ Training requirements ■ Environmental requirements (COAs, LD-P2M2 document) ■ Environmental Mainstreaming Tools (EMTs) ■ To provide at least the followings: <ul style="list-style-type: none"> ■ name of Environmental Officer (EO) ■ detailed design drawings ■ name of contractors ■ name of Resident Engineer ■ name of consultants 	DOE	EQA 1974 (Act 127)
Social Impact Management Plan (SIMP)	<ul style="list-style-type: none"> ■ Project description ■ Existing human environment ■ Social impact ■ Enhancement/Mitigation measures ■ Monitoring programme 	<ul style="list-style-type: none"> ■ PLANMalaysia ■ PLANMalaysia@Negeri 	Town and Country Planning Act 1976 (Act 172)

Note: The list is not exhaustive and not all the listed requirements are relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant requirements required for environmental assessment and compliance.

TABLE 2.1 (cont'd) List of relevant requirement at various project implementation

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PRE-CONSTRUCTION (cont'd)			
Emergency Response Plan (ERP)	<ul style="list-style-type: none"> ■ Vulnerability assessments ■ Chain of command ■ Emergency response team ■ Alarms and communication systems ■ Suppression systems ■ Evacuation planning ■ Rescue and emergency medical facility 	<ul style="list-style-type: none"> ■ DOSH ■ DOE 	<ul style="list-style-type: none"> ■ Occupational Safety and Health Act (OSHA) 1994 ■ EQA 1974 (Act 127)
Written notification	<ul style="list-style-type: none"> ■ Written notification to DOE prior starts of work ■ Installation of equipment at site such as power generator 	DOE	EQA 1974 (Act 127)
Environmental reporting	<ul style="list-style-type: none"> ■ Form EIA 1-18 – EIA (EIA Project Information Status) ■ Form EIA 2-18 – EIA Approval Conditions Compliance Report 	DOE	EQA 1974 (Act 127)
CONSTRUCTION			
Environmental monitoring	Performance, compliance and impact monitoring: <ul style="list-style-type: none"> ■ water quality monitoring ■ noise monitoring ■ air quality monitoring ■ silt trap discharge monitoring ■ LD-P2M2 structure 	DOE	EQA 1974 (Act 127)
Environmental reporting	<ul style="list-style-type: none"> ■ Form EIA 1-18 – EIA (EIA Project Information Status) ■ Form EIA 2-18 – EIA Approval Conditions Compliance Report 	DOE	EQA 1974 (Act 127)
Environmental audit	<ul style="list-style-type: none"> ■ Audit site administrative details ■ Regulatory compliance summary ■ Audit findings ■ Recommendations 	DOE	EQA 1974 (Act 127)
Competent person	Environmental Officer (EO) <ul style="list-style-type: none"> ■ Certified Erosion, Sediment and Storm Water Inspector (CESSWI) ■ Certified Inspection of Sediment and Erosion Control (CISEC) ■ Certified Professional Environmental Officer in EIA Project Development and Operation (CePEOEIA) 	DOE	EQA 1974 (Act 127)
FIRST RESERVOIR FILLING			
First reservoir filling report	Inspection and monitoring of dam performance: <ul style="list-style-type: none"> ■ seepage ■ pore pressure ■ dam movement ■ seismic activity 	DID	NA

Note: The list is not exhaustive and not all the listed requirements are relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant requirements required for environmental assessment and compliance.

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.1 (cont'd) List of relevant requirement at various project implementation

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
FIRST RESERVOIR FILING (cont'd)			
Environmental monitoring	Performance, compliance and impact monitoring: <ul style="list-style-type: none"> ■ water quality monitoring (reservoir and downstream) 	DOE	EQA 1974 (Act 127)
Environmental audit	<ul style="list-style-type: none"> ■ Audit site administrative details ■ Regulatory compliance summary ■ Audit findings ■ Recommendations 	DOE	EQA 1974 (Act 127)
Competent person	Environmental Officer (EO): <ul style="list-style-type: none"> ■ Certified Erosion, Sediment and Storm Water Inspector (CESSWI) ■ Certified Inspection of Sediment and Erosion Control (CISEC) ■ Certified Professional Environmental Officer in EIA Project Development and Operation (CePEOEIA) 	DOE	EQA 1974 (Act 127)
OPERATION AND MAINTENANCE			
Environmental monitoring	Performance, compliance and impact monitoring: <ul style="list-style-type: none"> ■ water quality monitoring ■ noise monitoring ■ air quality monitoring 	DOE	EQA 1974 (Act 127)
Environmental reporting	<ul style="list-style-type: none"> ■ Form EIA 1-18 – EIA (EIA Project Information status) ■ Form EIA 2-18 – EIA Approval Conditions Compliance Report 	DOE	EQA 1974 (Act 127)
Environmental audit	<ul style="list-style-type: none"> ■ Audit site administrative details ■ Regulatory compliance summary ■ Audit findings ■ Recommendations 	DOE	EQA 1974 (Act 127)
Competent person	Environmental Officer (EO) <ul style="list-style-type: none"> ■ Certified Erosion, Sediment and Storm Water Inspector (CESSWI) ■ Certified Inspection of Sediment and Erosion Control (CISEC) ■ Certified Professional Environmental Officer in EIA Project Development and Operation (CePEOEIA) 	DOE	EQA 1974 (Act 127)
Dam safety inspection	<ul style="list-style-type: none"> ■ Visual recognition of the onset of potential failure modes and dam safety deficiencies ■ Potential failure modes ■ Emergency response procedures including escalation process for alerting others ■ Safe operation of gates and valves (if appropriate) 	DID	EQA 1974 (Act 127)

Note: The list is not exhaustive and not all the listed requirements are relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant requirements required for environmental assessment and compliance.

TABLE 2.1 (cont'd) List of relevant requirement at various project implementation

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PRE-REHABILITATION OR PRE-ABANDONMENT			
Abandonment plan	Overall abandonment strategy	DOE	EQA 1974 (Act 127)
Rehabilitation plan	Remedial action study (interim and long-term measures): <ul style="list-style-type: none"> ■ alternative risk reduction options ■ cost of each alternative ■ level of risk reduction ■ environmental and social impacts ■ mitigation measures 	<ul style="list-style-type: none"> ■ DOE ■ DID 	EQA 1974 (Act 127)
REHABILITATION OR ABANDONMENT			
Environmental monitoring	Performance, compliance and impact monitoring: <ul style="list-style-type: none"> ■ water quality monitoring ■ noise monitoring ■ air quality monitoring 	DOE	EQA 1974 (Act 127)

Note: The list is not exhaustive and not all the listed requirements are relevant to the project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant requirements required for environmental assessment and compliance.

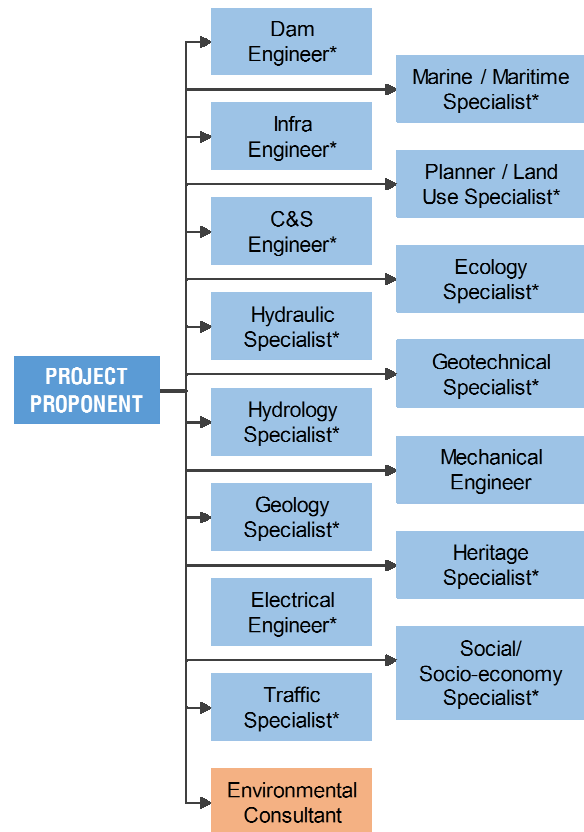
2.7.1 Project Team

In order to ensure that all relevant requirements listed in *Table 2.1* are fulfilled, the Project Proponent is advised to form a Project Team. The Project Team members comprise the EIA Study Team and other technical or engineering consultants responsible for other components of the project. This can be illustrated as per *Figure 2.3*.

The **Project Team** members must:

- i) provide sufficient input in ensuring that a comprehensive of the relevant technical studies are prepared; and
- ii) advise the Project Proponent with accurate information so that the Project Proponent can make informed holistic decisions.

Table 2.2 shows the studies typically required in a project and each Project Team member's roles.



* May prepare other studies required by the Authority as tabulated in *Table 2.2*.

FIGURE 2.3 Organisation chart of project team

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.2 Typical project team members' roles and relevant studies

PROJECT TEAM MEMBER	STUDY / SECTOR	ROLE	ASSESSMENT AUTHORITY
Project Proponent		<ul style="list-style-type: none"> ■ Fully responsible for the project starting from planning stage until rehabilitation or abandonment stages ■ Provide project information: <ul style="list-style-type: none"> i) project title ii) project location iii) land title iv) statement of need v) project options vi) project concept and description vii) project layout plan and components viii) method statement ix) sources of construction materials x) spoil disposal areas xi) biomass disposal areas xii) transport route and temporary access xiii) project implementation schedule and phasing 	NA
Environmental Consultant (Registered with DOE Malaysia)	Environmental Impact Assessment	<ul style="list-style-type: none"> ■ Identify ESAs ■ Assess impacts on the environment ■ Propose P2M2 ■ Propose EMP framework 	DOE
Planner/Land Use Specialist	Land use study	<ul style="list-style-type: none"> ■ Identify ESAs/buffer zone ■ Prepare Development Proposal Report (LCP) ■ Conduct viewscape assessment ■ Prepare Planning Permission (KM) submission 	Local authority
Geology Specialist	Geological/ Hydrogeological study	<ul style="list-style-type: none"> ■ Determine geological characteristics of the project area ■ Identify potential groundwater locations present within or near the project area ■ Assess impact to the geology/hydrogeology of the surrounding area 	JMG
Dam Engineer	Dam design study	Design dam structure and its auxiliary components	<ul style="list-style-type: none"> ■ BBA ■ DID ■ KASA
Geotechnical Specialist	Geotechnical/ Foundation study	<ul style="list-style-type: none"> ■ Conduct geotechnical assessment ■ Design structure's foundation and treatment ■ Design construction materials in dam 	<ul style="list-style-type: none"> ■ JMG ■ PWD Geotechnical Branch ■ IKRAM
Hydrology/ Hydraulic Specialist	River hydraulics and hydrology study	<ul style="list-style-type: none"> ■ Assess the river's hydraulics and hydrology ■ Design drainage masterplan ■ Flood analysis 	<ul style="list-style-type: none"> ■ DID ■ NAHRIM
Coastal Engineer	Coastal hydraulics	<ul style="list-style-type: none"> ■ Assess the coastal hydraulics ■ Design coastal structures ■ Design hydraulic structures (spillway, intake structure) 	DID
Ecology Specialist	Ecology Impact Assessment	<ul style="list-style-type: none"> ■ Conduct impact assessment on ecology ■ Propose mitigating measures 	<ul style="list-style-type: none"> ■ DOF ■ DWNP

TABLE 2.2 (cont'd) Typical project team members' roles and relevant studies

PROJECT TEAM MEMBER	STUDY / SECTOR	ROLE	ASSESSMENT AUTHORITY
Social Impact Assessment (SIA) Specialist (registered with MSIA)	Social Impact Assessment (SIA)	<ul style="list-style-type: none"> ■ Conduct impact assessment on social ■ Conduct Social Impact Assessment (SIA) ■ Propose Social Impact Management Plan (SIMP) 	<ul style="list-style-type: none"> ■ PLANMalaysia ■ PLANMalaysia@Negeri
Traffic Specialist	Traffic Impact Assessment (TIA)	<ul style="list-style-type: none"> ■ Conduct impact assessment on present traffic conditions ■ Predict traffic conditions in the future ■ Propose upgrading or new roads if necessary 	<ul style="list-style-type: none"> ■ PWD ■ Local council
Marine / Maritime Specialist	Marine Risk Assessment (MRA)	<ul style="list-style-type: none"> ■ Conduct risk assessment from marine navigation ■ Propose marine Emergency Response Plan (ERP) 	MarDep
Civil and Structure/ Infrastructure Engineer	Earthwork plan	<ul style="list-style-type: none"> ■ Design the platform level ■ Calculate cut and fill volume ■ Design of infrastructure, road and drainage ■ Determine project phasing 	<ul style="list-style-type: none"> ■ DID ■ PWD ■ Local council
Civil and Structure Engineer	Erosion and Sediment Control Plan (ESCP)	<ul style="list-style-type: none"> ■ Prepare ESCP layout ■ Design BMPs 	<ul style="list-style-type: none"> ■ DID ■ Local council
Mechanical Engineer	Mechanical works	<ul style="list-style-type: none"> ■ Design gates, penstocks, lifting equipment, mechanical ventilation, fire protection system, etc. 	Local council
Electrical Engineer	Electrical works	<ul style="list-style-type: none"> ■ Design power supply, instrumentation and control system, general lightings, lightning protection system, etc. 	Local council
Environmental Consultant	Environmental Management Plan (EMP)	<ul style="list-style-type: none"> ■ Prepare EMP based on EIA COAs ■ Prepare LD-P2M2 document ■ Propose monitoring programme and audit framework 	DOE
Environmental Consultant	Environmental monitoring report	<ul style="list-style-type: none"> ■ Conduct environmental monitoring as required in the approved EMP ■ Prepare monitoring report 	DOE
Dam Engineer (Dam Safety Field Surveillance Inspector)	Dam Safety (during dam operation)	<ul style="list-style-type: none"> ■ Visual recognition of the onset of potential failure modes and dam safety deficiencies ■ Potential failure modes ■ Emergency response procedures including escalation process for alerting others ■ Safe operation of gates and valves (if appropriate) 	DID

2.8 STAKEHOLDERS ENGAGEMENT

Stakeholders engagement is an important factor in an EIA study. The stakeholders engagement must be conducted under the socio-economic study in the EIA. The stakeholders engagement is also another platform for the general public to voice their concerns on top of being able to review and comment the EIA report.

For EIA purposes, there will be at least three stages of stakeholder engagements:

STAGE 1: Preliminary stakeholders engagement
<p>It is important for the Project Proponent to carry out stakeholders engagement prior to preparing the TOR and ESI reports. Constant engagement with DOE is advisable (via the designated officer in charge), including relevant government agencies (GAs). This is to ensure that the scoping is comprehensively covered in the EIA report.</p>
STAGE 2: Engagement during the preparation of EIA
<p>Stakeholders' input is also an important factor in an EIA study. The stakeholders' engagements in the form of Focus Group Discussions (FGDs) or public dialogues must be conducted under the socio-economic study in the EIA. All comments both positive and negative and the responses must be compiled in the EIA report and submitted to DOE for department's record.</p>
STAGE 3: Engagement after the final EIA report is complete
<p>During the EIA review process by the EIATRC, public display of the EIA report at public areas approved by DOE must be carried out. At this stage, the public is able voice their concerns via written comments to the DOE. Separate engagement with the Project Proponent and stakeholders can be also be done at this stage.</p>

2.8.1 Identification of Stakeholders

The potential stakeholders engagement for dam projects can be categorised into six main categories as shown in *Figure 2.4*. Each category plays an important roles and shoulder different responsibilities in the EIA process. It is imperative that the stakeholders engagement must cover the extent of the Zone of Impact (ZOI). If the forecasted ZOI spreads into a neighbouring state, the engagement shall also include stakeholders from the affected area.

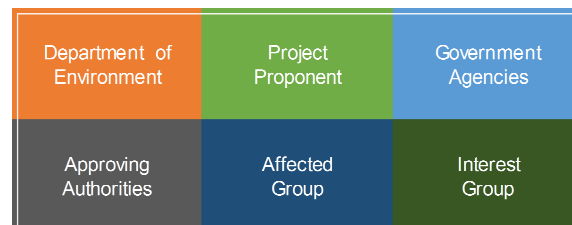


FIGURE 2.4 Relevant stakeholders to be engaged during the EIA process

2.8.2 Roles and Responsibilities

Table 2.3 lists the potential stakeholders to be considered for the stakeholders engagement. Representatives from government agencies (GAs) and Non-Governmental Organisations (NGOs) will also be engaged to seek for their opinion or feedback on the dam project. It is important for these representatives to highlight the relevant issues and give feedback of the project to be incorporated in the TOR and EIA. The representatives sent for these engagements should be the same representatives to attend the TORAC and EIATRC meetings (if not, handed over to the replacement) to guarantee continuity of the input provided.

TABLE 2.3 Roles and responsibilities of stakeholders

POTENTIAL STAKEHOLDER	ISSUE/IMPACT OF INTEREST	ROLES AND RESPONSIBILITIES
Department of Environment (DOE)	<ul style="list-style-type: none"> ■ Water quality degradation ■ Air quality degradation ■ Waste management 	Assess and approve the EIA report based on the EIA guideline
Local Council	<ul style="list-style-type: none"> ■ Area management ■ Development order 	<ul style="list-style-type: none"> ■ Approve Planning Permission (KM) as per Town and Country Planning Act 1976 (Act 172) ■ Ensure local plan and special management area are considered ■ Ensure EIA has addressed all relevant sectors adeptly ■ Highlight any licensing issues related to the development
JKPTG / PTG / PTD	<ul style="list-style-type: none"> ■ Land status compliance ■ Land acquisition ■ Minerals release 	<ul style="list-style-type: none"> ■ Ensure that the Project Proponent owns the land and the status is correct with its intended development type ■ Ensure there are no constraints on the land that may prohibit it from being developed
Economic Planning Unit	Economic benefits	Ensure alignment with relevant national economic policies
Department of Irrigation and Drainage (DID)	<ul style="list-style-type: none"> ■ Flooding ■ Coastal/River bank erosion and sedimentation ■ River diversion ■ River reserves 	<ul style="list-style-type: none"> ■ Ensure DID Guidelines are adhered to (e.g.: MyDAMS, MSMA, ISMP, ICZM, IWRM, ILM, IFM, IRBM) ■ Ensure any flow regimes are not affected ■ Ensure no major erosion and sedimentation ■ Review and approve Erosion and Sediment Control Plan (ESCP) ■ Review and endorse hydrology and hydraulic report
Fisheries Development Authority of Malaysia (LKIM)	Fishermen livelihood	Adhere to Fisheries Development Authority of Malaysia Act 1971 (Act 49)
Malaysian Public Works Department (PWD) / Malaysian Highway Authority (LLM)	<ul style="list-style-type: none"> ■ Level of Service (LoS) of nearby PWD road ■ Building code and standard ■ Road design specification 	Ensure compliance to all PWD / LLM Guidelines and Manuals
PWD	Slope design specification	Ensure compliance to all PWD Guidelines and Manuals
Department of Mineral and Geoscience Malaysia (JMG)	<ul style="list-style-type: none"> ■ Slope stability and protection requirements ■ Geological conditions ■ Soil conditions and suitability ■ Geological Terrain Mapping (GTM) requirements 	<ul style="list-style-type: none"> ■ Ensure topography, terrain and geological features within the site is suitable for development ■ Ensure compliance to Mineral Development Act 1994 (Act 525) and Geological Survey Act 1974 (Act 129) ■ Ensure adherence to all JMG Guidelines

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

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.3 (cont'd) Roles and responsibilities of stakeholders

POTENTIAL STAKEHOLDER	ISSUE/IMPACT OF INTEREST	ROLES AND RESPONSIBILITIES
Department of Wildlife and National Parks Peninsular Malaysia (DWNP)	<ul style="list-style-type: none"> ■ Wildlife ■ Terrestrial fauna ■ Wildlife Management Plan (WMP) 	<ul style="list-style-type: none"> ■ Ensure adherence to the Wildlife Conservation Act 2010 (Act 716) ■ To determine the sensitivity of site in terms of flora and fauna species and constraints for development
Marine Department (MarDep)	<ul style="list-style-type: none"> ■ Marine risk ■ Marine traffic and navigation 	Ensure compliance to all acts and laws under the control of Marine Department such as State Ports Rules, Boat Rules 1953, and Merchant Shipping Act (Oil Pollution) 1994 (Act 515)
Forestry Department of Peninsular Malaysia	<ul style="list-style-type: none"> ■ Logging/Forest clearing ■ Logging Management Plan 	<ul style="list-style-type: none"> ■ Ensure adherence to the National Forestry Act 1984 (Act 313) and CFS ■ To determine the status of the forest, ensuring it can be developed with state approval ■ Facilitate and coordinate with DOE on LD-P2M2 implementation particularly on management of <i>matau</i>, skid trails and access roads (<i>jalan hutan</i>)
State water operators (Air Selangor, SATU, SAINS, etc.)	Water supply service	<ul style="list-style-type: none"> ■ Ensure no impact on water supply ■ Work together with Water Regulatory Body
Water Regulatory Body	Water resources	<ul style="list-style-type: none"> ■ Ensure conservation of water resources, river basin, coastal waters and the surrounding environment ■ Ensure compliance to State's laws ■ Work together with water operators ■ Issue license (water resource abstraction) ■ Enforcement and prosecution under the State's laws
Department of Fisheries (DOF)	<ul style="list-style-type: none"> ■ Loss of marine/aquatic habitat ■ Encroachment of marine parks ■ Aquaculture production ■ Fishermen livelihood ■ Fisheries Management Plan 	<ul style="list-style-type: none"> ■ Ensure compliance to Fisheries Act 1985 (Act 317) and its regulations ■ Assess impacts on fisheries are minimised or none ■ Ensure offset programmes or fisheries plan are undertaken and monitored to mitigate any loss of habitat
Federal Department of Town and Country Planning (PLANMalaysia)	<ul style="list-style-type: none"> ■ ESAs within the project area ■ Land use conflict ■ Planning guidelines ■ Buffer zone ■ Social Impact Assessment (SIA) requirements 	<ul style="list-style-type: none"> ■ Ensure that the National Physical Plan (NPP), State Structure Plan and Local Plan are complied ■ Ensure other planning policies are adhered to (e.g.: CFS, NWRP, National Forestry Policy, National Policy on the Environment, National Action Plan for Peatland) ■ Ensure ESAs are not significantly impacted ■ To determine the need of SIA

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

TABLE 2.3 (cont'd) Roles and responsibilities of stakeholders

POTENTIAL STAKEHOLDER	ISSUE/IMPACT OF INTEREST	ROLES AND RESPONSIBILITIES
Department of Orang Asli Development (JAKOA)	Development requirements within Orang Asli settlements and their roaming areas, agriculture plots, cultural, heritage, religious and archaeological sites	<ul style="list-style-type: none"> ■ Ensure adherence to the Aboriginal Peoples Act 1954 (Revision 1974 (Act 134) ■ Ensure that the area is not occupied by Orang Asli community and if so, how to manage impacts
National Water Services Commission (SPAN)	<ul style="list-style-type: none"> ■ Water supply system ■ Sewerage system 	Ensure compliance to National Water Services Commission Act 2006 (Act 654), Water Service Industry Act 2006 (Act 655) and their regulations
Department of Survey and Mapping Malaysia (JUPEM)	<ul style="list-style-type: none"> ■ Topography ■ Bathymetry 	<ul style="list-style-type: none"> ■ Confirm the Project boundary ■ Ensure that the latest reference map from JUPEM is referred to
Ministry of Health (MOH)	<ul style="list-style-type: none"> ■ Health impact ■ Type of diseases 	Ensure adherence to all MOH Guidelines in establishing workers' camp/quarters.
Regional development authorities (IRDA, NCIA, etc.)	Regional matters	Ensure the EIA has addressed all relevant sectors adeptly
Attorney General Chambers (AGC)	<ul style="list-style-type: none"> ■ National and international laws ■ Legal compliance 	Check that all relevant laws and legislations are complied
Affected groups: <ul style="list-style-type: none"> ■ Local community including Orang Asli ■ Business owner ■ Land owner 	<ul style="list-style-type: none"> ■ Give relevant inputs for protection of local interest ■ Give feedback to the impact findings 	
Port authorities (Penang Port Commission, Johor Port Authority, etc.)	<ul style="list-style-type: none"> ■ Port limit ■ Port requirements 	Ensure compliance to State Port Rules
Interest groups: <ul style="list-style-type: none"> ■ NGOs relevant to the environment sector ■ Specialists ■ Environmental practitioners 	<ul style="list-style-type: none"> ■ Provide inputs based on their technical knowledge and expertise 	

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

2.8.3 Method of Engagement

The stakeholders engagements can be focused by having direct interview, focus group discussion (FGD), public dialogue, workshop, exhibition and road show, and round table discussion. Details of these methods are as follows:



Direct interview

- Useful in obtaining specific information and attitudes from wider range of stakeholders in the early stages. Also useful in exploring more complex issues among key stakeholders later during the project design stage.
- Typical questionnaire method to gather socio-economic data, with questions typically covering:
 - i) information on head of the household;
 - ii) information on household numbers;
 - iii) education of household;
 - iv) house and housing condition;
 - v) transport and vehicle ownership;
 - vi) land ownership (or occupation);
 - vii) livestock;
 - viii) income and expenditure;
 - ix) perceptions regarding the project;
 - x) perceptions regarding constraints to agricultural development;
 - xi) attitude to resettlement (readiness to move); and
 - xii) preferred areas for resettlement and income-producing activities.



Focus group discussion (FGD)

- Involves specific groups that may be affected such as fishermen, hoteliers, etc. (small groups: recommended 6 to 12 people).
- Allows facilitator to probe emerging issues.
- It is resource intensive and may be more appropriately used later in the process.



Public dialogue

- Enables presentation of project information to the general public.
- Allows large numbers of people to be involved in some limited discussion.
- Need to be carefully managed to ensure all views are heard.



Workshop

- Structured group discussions designed to solve problems and identify the ways forward.
- Useful in bringing different groups of experts together. Requires experienced facilitators as well as in providing careful explanation to the attendees.



Roundtable discussion

- Facilitated debates between groups with different views with the aim of reaching consensus.
- Useful for engaging specialist interest and single-issue groups.



Exhibitions and roadshow

- Useful way of presenting project information and options to the public, especially local communities.
- Able to reach large numbers of people if well-advertised.
- Allows face-to-face feedback of information.

2.8.4 Documentation and Reporting

The overall process of the stakeholder engagement must be adequately documented and reported in the EIA report. The report must include, but not limited to the followings:

- i) engagement details (date, venue, itinerary);
- ii) list of attendance;
- iii) copies of survey form;
- iv) report on summary of the engagement (minutes of meeting, photos, analysis); and
- v) video or voice recordings.

All comments both positive and negative and its responses must be compiled in the EIA and submitted to DOE for their record.

CHAPTER 3

Terms of Reference

*Kenyir Dam, Terengganu
Photo by Mior Zulkarnain Mohd Zamhuri on Flickr*



3.1 INTRODUCTION

The Terms of Reference (TOR) is the first major milestone in the overall EIA process. The key objectives in preparing TOR document are:

- i) to assess suitability of the project site;
- ii) to refine the project boundary according to the environmental sensitivity of the surrounding area;
- iii) to determine the zone of study (ZOS) and zone of impact (ZOI);
- iv) to identify baseline data required to be assessed for the project;
- v) to outline the key project activities during the various stages of the project implementation namely pre-construction, construction and post construction;
- vi) to identify existing environmental issues within the EIA study boundary which cover physical, biological and social components;
- vii) to identify significant impacts and non-significant impacts of the project which are also to be categorised accordingly. All impacts during the various stages of the project implementation namely pre-construction, construction and post construction must be identified;
- viii) to identify and detail out the methodologies and assessment tools to be used in the EIA for the identified significant impacts; and
- ix) to propose applicable P2M2 to reduce the significant impacts.

As such, the Qualified Person must carry out environmental scoping to produce a comprehensive TOR document for submission to DOE.

3 TERMS OF REFERENCE

The TOR document will be complemented by an ESI which provides further elaboration and serves as evidence on how the TOR of an EIA project is formulated. An ESI must focus mainly on the important issues and significant impacts to be addressed or covered by the Project Proponent in the EIA. Resources must not be expended on matters that are trivial. Fundamentally, a TOR document can be considered as the “executive summary” of an ESI.

3.2 ENVIRONMENTAL SCREENING

A preamble of the TOR preparation is conducting environmental screening whereby it determines whether a proposed project is subject to a regulatory provision requiring an EIA as defined in *Section 1.4* in **Chapter 1**.

3.3 ENVIRONMENTAL SCOPING

Environmental scoping is essential to identify the environmental attributes and issues associated with the project. This is to determine the focus, depth, spatial and temporal boundaries of the EIA study that are significant and require assessment. The scoping must cover all aspects of physical, biological and socio-economic.

In overall, *Figure 3.1* illustrates the flow path for environmental scoping

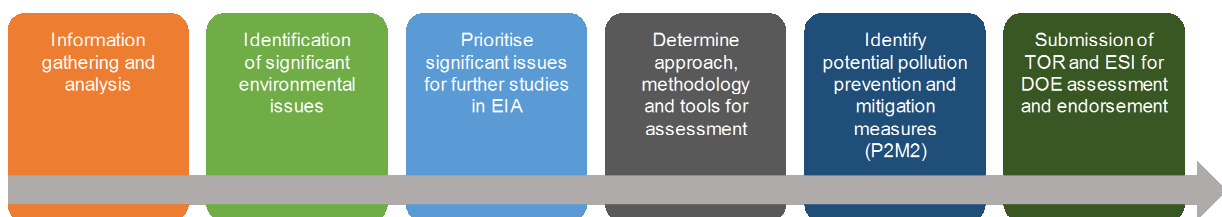


FIGURE 3.1 Environmental scoping flow path

3.4 SITE SUITABILITY ASSESSMENT (SSA)

The identification of a suitable site is normally undertaken during pre-feasibility stage and based on general criteria such as technical constraints, availability of land, and costs in respect of land, utilities and infrastructure facilities required. Environmental issues and impacts form additional matters which need to be taken into account in site selection. In order to achieve this, SSA is introduced as a method for site selection.

It is imperative that the nature of the proposed project must be in line with what was gazetted in the planning policies in order to avoid land use incompatibility issues. The project must conform to all hierarchy levels of the planning policies namely:

- i) National: NPP-3, RFZPPN, CFS, ESAs, etc.;
- ii) State: State Structure Plan;
- iii) Regional: Regional Development Planning Policy; and
- iv) Local: Local Plan.

Comments on SSA shall be incorporated in the EIA report. There may be a situation where the proposed project site or location may not contradict with the approved development plans or any other guidelines but the site exhibits certain critical characteristics (e.g. geomorphological features) that may present a particularly formidable constraint to the project. In such situation, the Consultant shall thoroughly examine the suitability of the site and state its conditions in the EIA report.

Table 3.1 shows some of the considerations that shall be made in assessing the suitability of the project site while site selection criteria for dam projects are listed in Table 3.2.

A 'No Project' option shall also be assessed and its implications discussed comparatively with the 'With Project' option.

TABLE 3.1 Considerations for SSA

PROJECT ASPECT	CONSIDERATION
Project siting	<ul style="list-style-type: none"> ■ Adherence to national, state and local policies and plans such as National Physical Plan (NPP) ■ Site constraints to the project and vice versa ■ Location and proximity to sensitive receptors ■ Buffer/setback availability and requirements (project buffer zone)
Terrain and topography	<ul style="list-style-type: none"> ■ Availability of land for buffers ■ Slope classification and degree ■ Conditions of the site (hilly, steep slopes, flood risk, geohazards, etc.) ■ Soil conditions ■ Visual/aesthetic impacts
Geology	<ul style="list-style-type: none"> ■ Seismicity (liquefaction, cracking, potential fault offsets, deformations, and settlement) ■ Fault zones
Hydrology	<ul style="list-style-type: none"> ■ Site hydrology and drainage patterns ■ Water-holding capability ■ Evaporation rates ■ Storage zones
Accessibility	<ul style="list-style-type: none"> ■ Availability of access ■ Proximity to construction/source materials ■ Strategic locational advantages ■ Traffic conditions
Pollution prevention and mitigation measures (P2M2) technology options	<ul style="list-style-type: none"> ■ Availability of technology to minimise impacts ■ Best available control technology (BACT) options ■ Benchmarking with alternative technology ■ Green technology adoption
Project component and design	<ul style="list-style-type: none"> ■ Layout consideration ■ Choice of method statement
Social	<ul style="list-style-type: none"> ■ Need for land acquisition or relocation ■ Location for workers camp ■ Location within or close to sensitive area and historical sites, cemeteries, places of worship, Orang Asli settlements and their roaming areas ■ Location within or close to populated areas and scenic areas

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 Qualified Person to determine the relevant information required for environmental assessment and compliance and to engage with relevant agencies.

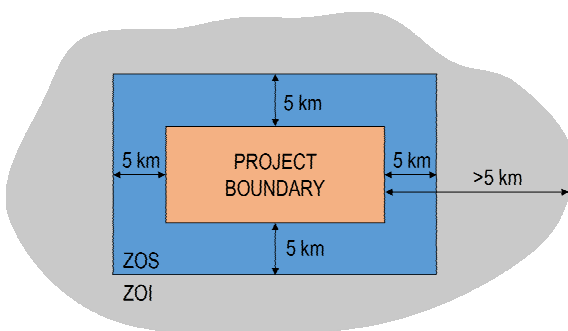
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TABLE 3.2 General site selection criteria

CRITERIA	DESCRIPTION
Land use	<ul style="list-style-type: none"> Must be far from valuable land such as agriculture, settlement, important wildlife habitat Reservoir should not submerge valuable land or property
Terrain and topography	<ul style="list-style-type: none"> Location of the reservoir should consider narrow opening in the valley (near dam structure) Surrounding hills and surrounding basin must be water tight Open out at upstream to provide large basin for reservoir storage Deep reservoir to avoid evaporation loss and weed growth Location of the dam must be higher compared to the reservoir
Hydrology	<ul style="list-style-type: none"> Good hydrological conditions Low percolation losses in reservoir For larger storage in reservoir, dam site should be located at the confluence of two rivers Avoid sites with mineral deposits in and around reservoir area
Geology	<ul style="list-style-type: none"> Prefer less infiltration and maximum runoff Water tight rock base, percolation below the dam should be minimum Avoid fault zones. However, small scale fault zones can be treated effectively by grouting
Accessibility	<ul style="list-style-type: none"> Easily accessible, economically connected to towns and cities Construction materials should be available either locally or near vicinity of the site (to reduce transportation cost)
Water pollution	<ul style="list-style-type: none"> Avoid or exclude water from tributaries carrying high percentage of silt in water (except for sediment retention dam)

3.5 EIA STUDY BOUNDARY

It is essential to determine the coverage and boundary of the EIA study to ensure that significant environmental issues are comprehensively assessed and reported in the EIA report. There are two types of study boundaries as illustrated in *Figure 3.2* and *Figure 3.3*.



■ Zone of Study (ZOS) – Encompass a 5 km radial zone from the project boundary
■ Zone of Impact (ZOI) – Not limited to a specific distance and will be determined by modeling and impact-causing project activities

FIGURE 3.2 Types of study boundaries

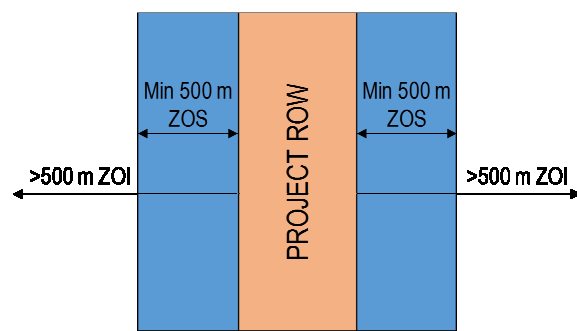


FIGURE 3.3 ZOS and ZOI for linear project components

3.6 BASELINE DATA REVIEW

The baseline information must be sufficiently adequate to assess the potential impacts on the ESAs. Quantitative data and findings wherever available, must be provided to support the assessment. *Table 3.3* provides the indicative requirements for baseline description in the environmental scoping exercise.

If any of the baseline data is unavailable at the time of scoping, the Qualified Person must state in the TOR that the data will be made available in the EIA report. Irrelevant and insignificant baseline data requirements can be omitted and reasons are addressed in the TOR.

TABLE 3.3 Baseline data requirements for environmental scoping

ENVIRONMENTAL COMPONENT		TYPE OF DATA	DATA SOURCE
Physical	Land use	<ul style="list-style-type: none"> ■ Land use maps and its surrounding area ■ Photos ■ Description of existing and future land use (5 km ZOS) 	<ul style="list-style-type: none"> ■ Topography maps (JUPEM) ■ Aerial or satellite imagery ■ Structure and local plans (PLANMalaysia) ■ Ground truthing
	Geology/Hydrogeology	Description of local and regional geology	<ul style="list-style-type: none"> ■ Geological and hydrogeological maps (JMG) ■ Geological Terrain Mapping (GTM) report
	Soil characteristics	<ul style="list-style-type: none"> ■ Soil profile ■ Particle size distribution ■ Construction suitability map 	<ul style="list-style-type: none"> ■ Soil investigation (SI) report ■ Soil map (Department of Agriculture – DOA)
	Terrain	Topography and slopes	<ul style="list-style-type: none"> ■ Topography map ■ Site survey
	Climate	Climate data (min 5 years)	Malaysian Meteorological Department (METMalaysia)
	Hydrology	<ul style="list-style-type: none"> ■ River systems ■ Catchment areas ■ Flood prone areas ■ Downstream receptors 	<ul style="list-style-type: none"> ■ Hydraulic and hydrology report ■ Topography map ■ Flood map (DID)
	Water quality	<ul style="list-style-type: none"> ■ Historical water quality data ■ Water intake points ■ Water treatment plants 	<ul style="list-style-type: none"> ■ Published reports by water agencies and DOE ■ State water resources departments ■ Field data collection
	Air quality	Historical air quality data	<ul style="list-style-type: none"> ■ Published reports by DOE ■ Field data collection
	Noise and vibration level	Location of noise polluting sources	Field data collection
Biological	Ecosystem (terrestrial, flora and fauna, fisheries, marine flora and fauna)	<ul style="list-style-type: none"> ■ Existing ecology and habitats ■ Presence of endemic, rare, threatened, endangered and near extinct flora and fauna 	<ul style="list-style-type: none"> ■ Published reports by DWNP and FDPM ■ Ground truthing and field data collection

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TABLE 3.3 (cont'd) Baseline data requirements for environmental scoping

ENVIRONMENTAL COMPONENT		TYPE OF DATA	DATA SOURCE
Social	Demography	<ul style="list-style-type: none"> ■ Demographics data ■ Stakeholders 	<ul style="list-style-type: none"> ■ Population census (Department of Statistics) ■ Local Plans (PLANMalaysia)
	Public health	Public health status	Morbidity statistics and public health data (MOH)
	Heritage, culture and archaeology	<ul style="list-style-type: none"> ■ Locations of historical and cultural sites ■ Location and numbers of Orang Asli areas and settlements 	Data from JAKOA
	Ecotourism	Locations of ecotourism sites	Data from Ministry of Tourism, Arts and Culture Malaysia (MOTAC)
Others	Land traffic	Road network	<ul style="list-style-type: none"> ■ Aerial or satellite imagery ■ Ground truthing
Environmentally sensitive areas (ESAs)		<ul style="list-style-type: none"> ■ Central Forest Spine (CFS) ■ Water intakes (downstream of project area) ■ Aquaculture ■ River 	<ul style="list-style-type: none"> ■ NPP ■ GPPPP ■ Aerial or satellite imagery ■ Structure and local plans (PLANMalaysia) ■ Ground truthing

*Other baseline data e.g. contour areas, biological ecosystems, heritage areas etc. are also considered as ESAs. This section highlights specific ESAs that may need to be considered for the project.

3.6.1 Identification of Existing Environmental Site Constraints

Subsequent to the reviewing of available baseline data, a list of existing site constraints can be generated based on the data in hand. Examples of environmental site constraints are:

- i) flood-prone areas;
- ii) slope areas;
- iii) central forest spine; and
- iv) Orang Asli settlement or roaming area.

The identification of these constraints must be done as early as possible to ensure that the proposed project can be designed and implemented smoothly. This includes any mitigation to alleviate the anticipated impacts.

3.7 DETERMINATION OF KEY PROJECT ACTIVITIES

In order to successfully undertake an EIA, it is necessary to conduct the following:

- i) describe the project activities which could potentially adversely affect the environment.
- ii) clearly identify just what the issues are.
- iii) predict who or what could be affected and how.
- iv) evaluate the significance of the effects.

The identification of key project activities should be done as early as the scoping stage. Although the activities may be different, in many instances their impacts on the environment are similar.

When evaluating and describing the existing environment and the impact on this environment from the project, it is **the issues** which need to be highlighted with the focus on the components of the environment.

When it comes to determining practical mitigating measures, however, such as specifying clauses within contract documentation, the focus changes back to **the activities** (including siting), for it is by controlling activities that environmental effects can be most cost-effectively mitigated.

The Project Proponent must provide key project activities to the Qualified Person during the scoping stage. The project activities are the basis for assessing the potential impacts. A summary of the typical dam project activities at each project stage is presented in *Figure 3.4*.

The key activities in each stage can be expanded further as shown in *Table 3.4*. It should be noted that the lists provided in *Figure 3.3* and *Table 3.4* are not exhaustive and may not be relevant with a particular project. It is the responsibility of the Project Proponent and the Qualified Person to determine the relevant information required for environmental assessment and compliance.

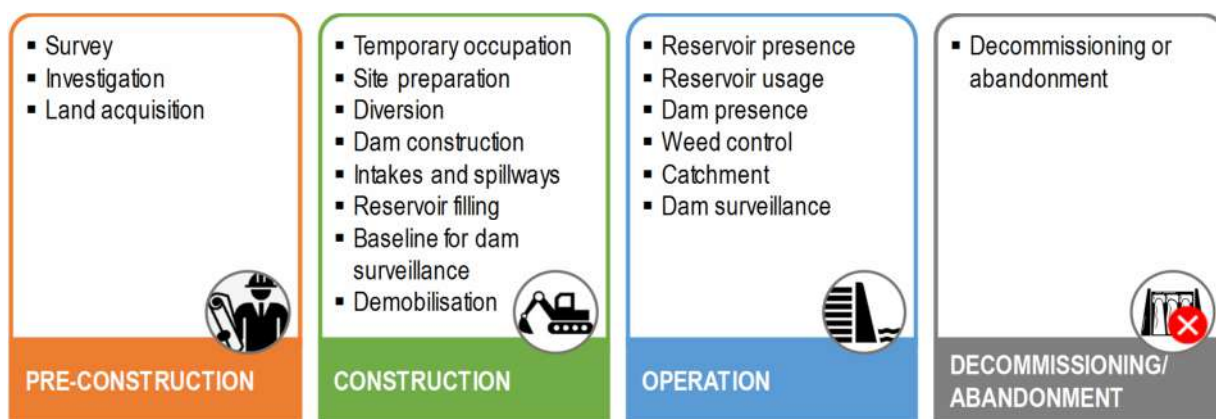


FIGURE 3.4 Typical dam project key activities

TABLE 3.4 Details of the key activities

PROJECT STAGE	KEY ACTIVITIES	DETAILS OF KEY ACTIVITIES
Pre-construction	Survey	<ul style="list-style-type: none"> ■ Sending surveyors into new areas ■ Cutting sights lines through vegetation ■ Establishing base camps
	Investigation	<ul style="list-style-type: none"> ■ Introduction of workforce in new areas ■ Establishing base camps ■ Putting in access tracks ■ Drilling holes and/or digging pits
	Land acquisition	<ul style="list-style-type: none"> ■ Acquire land ■ Resettlement of affected occupants
Construction	Temporary occupation	<ul style="list-style-type: none"> ■ Construction of temporary buildings, storage facilities and working areas ■ Water supply ■ Solid waste disposal ■ Sewage disposal ■ Workforce ■ Pest control ■ Machine servicing and maintenance ■ Resources abstraction – logging, mining

3 TERMS OF REFERENCE

TABLE 3.4 (cont'd) Details of the key activities

PROJECT STAGE	KEY ACTIVITIES	DETAILS OF KEY ACTIVITIES	
Construction (cont'd)	Site preparation	<ul style="list-style-type: none"> ■ Demolition and removal of structures ■ Land clearing (removal) and disposal of vegetation ■ Tree felling ■ Constructing access roads 	<ul style="list-style-type: none"> ■ Constructing temporary drainage ■ Operating equipment (chainsaw, bulldozers) ■ Disposal of unsuitable material (USM)
	Diversion works	<ul style="list-style-type: none"> ■ Operation of equipment 	<ul style="list-style-type: none"> ■ Diversion of surface water
	Dam construction	<ul style="list-style-type: none"> ■ Operation of equipment (bulldozers, roller compactors, diggers, trucks, scrapers) ■ Construction of haul roads ■ Cutting quarrying/ blasting, borrow areas 	<ul style="list-style-type: none"> ■ Transportation of construction materials ■ Filling/pouring/grouting ■ Building structures (concrete or rollcrete)
	Reservoir fillings/impounding	<ul style="list-style-type: none"> ■ Raising groundwater levels ■ Inundation of land ■ Vegetation decomposition 	<ul style="list-style-type: none"> ■ Alteration of surface water hydrology ■ Wildlife rescue
	Baseline for dam surveillance	Inspection of dam performance including seepage, pore pressure, dam movement, seismic activity	
	Intakes and spillways	<ul style="list-style-type: none"> ■ Operation of equipment ■ Alteration of surface water hydrology 	
	Demobilisation	<ul style="list-style-type: none"> ■ Demobilisation and removal of temporary buildings ■ Waste removal/ disposal (including rubbish, equipment and liquid wastes) ■ Rehabilitation of occupied site 	
Operation	Reservoir presence	<ul style="list-style-type: none"> ■ Wetland ■ Evaporation ■ Micro-seismicity 	<ul style="list-style-type: none"> ■ Community severance ■ Provision of habitat for disease vectors
	Reservoir usage	<ul style="list-style-type: none"> ■ Aquaculture ■ Fishing ■ Boating 	<ul style="list-style-type: none"> ■ Water discharge ■ Drawdown ■ Water supply
	Dam presence	<ul style="list-style-type: none"> ■ Dam safety 	<ul style="list-style-type: none"> ■ Barrier presence
	Weed control	<ul style="list-style-type: none"> ■ Manual and mechanical cutting 	<ul style="list-style-type: none"> ■ Use of herbicides
	Catchment	<ul style="list-style-type: none"> ■ Repair of slope failures and erosion ■ General maintenance ■ Resettlement of catchment occupants 	
	Dam surveillance	Inspection of dam performance including seepage, pore pressure, dam movement, seismic activity	
Decommissioning/abandonment	Decommissioning/abandonment	<ul style="list-style-type: none"> ■ Dewatering of reservoir ■ Decommissioning of dam ■ Removal of sediment 	<ul style="list-style-type: none"> ■ Demolition of dam ■ Restoration of reservoir area

3.8 IDENTIFICATION OF SIGNIFICANT IMPACTS AND PRIORITY SETTING

3.8.1 Technique to Prioritise Environmental Impacts

There are various techniques that can be used to conduct environmental scoping, such as network method, comparison with other similar projects, questionnaire checklists, matrix table, etc.

The recommended technique to analyse and prioritise important issues in an EIA study is by using a matrix table as in *Table 3.5*. The contents of the matrix table are not fixed and may vary based on the project activities and location. The matrix table provides the means to assess the cause-effect relationship between the project activities and their impacts on the environment. The Qualified Person is required to determine the significance of an impact. It is recommended that the matrix table is incorporated in the ESI document.

In addition to the impact matrix established, there are also several criteria that need to be considered in prioritizing significant impacts to be studied in the EIA which are as follows:

- i) **Magnitude**
The degree and scale of an impact (positive/negative) towards sensitive receptors due to the proposed activity.
- ii) **Permanence**
Nature of the effects whether they are temporary or permanent.
- iii) **Reversibility**
A measure of whether mitigation measures can be implemented in rehabilitating the site back to its original state or better.
- iv) **Cumulative impacts**
A measure of whether the effects will be accumulative singly or in combination with other effects from nearby sites/activities (positive/negative) over a period of time.



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TABLE 3.5 Specific EIA matrix for dam projects

PROJECT ACTIVITIES	PHYSICO-CHEMICAL																		
	LAND COMPATIBILITY							SURFACE WATER											
	Coastal Erosion	Landforms	Soil Profile	Soil Composition	Slope Stability	Subsidence and Compaction	Seismicity	Flood Plains / Swamps	Land Use	Engineering and Mineral Resources	Buffer Zones	Shore Line	Bottom Interface	Flow Variation	Water Quality	Drainage Pattern	Water Balance	Flooding	Existing use
PRE-CONSTRUCTION																			
■ Survey																			
■ Investigation																			
■ Land acquisition																			
CONSTRUCTION																			
■ Temporary occupation																			
■ Site preparation																			
■ Diversion works																			
■ Dam construction																			
■ Intakes and spillways																			
■ Reservoir filling																			
■ Baseline for dam surveillance																			
■ Demobilisation																			
OPERATION																			
■ Reservoir presence																			
■ Reservoir usage																			
■ Dam presence																			
■ Weed control																			
■ Catchment management																			
■ Dam surveillance																			
DECOMMISSIONING/ABANDONMENT																			

- X Insignificant and excluded from EIA study.
- T Environmental impact that is potentially significant but on a temporary basis and will assume equilibrium after certain period of time.
- I Environmental impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- S Potentially significant adverse environmental impact for which a design solution has been identified.
- R Residual and significant adverse environmental impact.
- P Significant positive environmental impact.

TABLE 3.5 (cont'd) Specific EIA matrix for dam projects

PROJECT ACTIVITIES	PHYSICO-CHEMICAL												
	GROUND WATER					ATMOSPHERE				NOISE			
	Water Table	Flow Regime	Water Quality	Recharge	Aquifer Characteristics	Existing Use	Air Quality	Air Flow	Climate Change	Visibility	Intensity	Duration	Frequency
PRE-CONSTRUCTION													
■ Survey													
■ Investigation													
■ Land acquisition													
CONSTRUCTION													
■ Temporary occupation													
■ Site preparation													
■ Diversion works													
■ Dam construction													
■ Intakes and spillways													
■ Reservoir filling													
■ Baseline for dam surveillance													
■ Demobilisation													
OPERATION													
■ Reservoir presence													
■ Reservoir usage													
■ Dam presence													
■ Weed control													
■ Catchment management													
■ Dam surveillance													
DECOMMISSIONING/ABANDONMENT													

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- R Residual and significant adverse environmental impact.
- P Significant positive environmental impact.

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TABLE 3.5 (cont'd) Specific EIA matrix for dam projects

PROJECT ACTIVITIES	BIOLOGICAL													
	SPECIES AND POPULATIONS						HABITATS AND COMMUNITIES							
	Terrestrial Vegetation	Terrestrial Wildlife	Other Terrestrial Fauna	Aquatic / Marine Flora	Fish	Other Aquatic / Marine Fauna	Terrestrial Habitat	Terrestrial Communities	Aquatic Habitats	Aquatic Communities	Estuarine Habitats	Estuarine Communities	Marine Habitats	Marine Communities
PRE-CONSTRUCTION														
■ Survey														
■ Investigation														
■ Land acquisition														
CONSTRUCTION														
■ Temporary occupation														
■ Site preparation														
■ Diversion works														
■ Dam construction														
■ Intakes and spillways														
■ Reservoir filling														
■ Baseline for dam surveillance														
■ Demobilisation														
OPERATION														
■ Reservoir presence														
■ Reservoir usage														
■ Dam presence														
■ Weed control														
■ Catchment management														
■ Dam surveillance														
DECOMMISSIONING/ABANDONMENT														

- X Insignificant and excluded from EIA study.
- T Environmental impact that is potentially significant but on a temporary basis and will assume equilibrium after certain period of time.
- I Environmental impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- S Potentially significant adverse environmental impact for which a design solution has been identified.
- R Residual and significant adverse environmental impact.
- P Significant positive environmental impact.

TABLE 3.5 (cont'd) Specific EIA matrix for dam projects

PROJECT ACTIVITIES	HUMAN																								
	HEALTH AND SAFETY				SOCIAL				AESTHETIC AND CULTURAL																
	Physical Safety	Physiological Well-being	Parasitic Safety	Communicate Disease	Physiological Disease	Employment	Housing	Education	Utilities	Amenities	Property and Settlement	Landforms	Biota	Wilderness	Water Quality	Atmospheric Quality	Climate	Tranquility	Sense of Community	Community Structure	Man-made Object	Historic Places or Structure	Religious Places or Structure	Landscape	
PRE-CONSTRUCTION																									
■ Survey																									
■ Investigation																									
■ Land acquisition																									
CONSTRUCTION																									
■ Temporary occupation																									
■ Site preparation																									
■ Diversion works																									
■ Dam construction																									
■ Intakes and spillways																									
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- S Potentially significant adverse environmental impact for which a design solution has been identified.
- R Residual and significant adverse environmental impact.
- P Significant positive environmental impact.

3.8.2 Linkage between Activities, Issues and Impacts

Environmental impacts result from actions, or activities, associated with planning, constructing, operating and closing of groundwater projects.

Activities which result in environmental changes that are potentially significant are issues. The amount and degree of environmental change is the impact. Impacts can be grouped under issues and can be broken down into primary and secondary impacts. Impacts can also be grouped under broad environmental components which are subject to change.

Environmental issues basically arise when the project activities:

1. Have the potential to cause pollution or other physical effects.
2. Result in resource depletion (i.e. not sustainable).
3. Threaten biodiversity.
4. Are not acceptable to the host community or wider public (possibly as a result of all points above among other matters).

3.8.3 Issues and Impacts

Issues and impacts can be formulated from the project activities mentioned in *Section 3.7*. A brief discussion on the environmental issues throughout the project period i.e. post-construction, construction and operation are itemised in *Table 3.6*.

TABLE 3.6 Key issues and impacts

ENVIRONMENTAL ISSUES		IMPACTS
Risk of structural failure or accidental outflows		<ul style="list-style-type: none"> ■ Threat to human settlements ■ Flash floods downstream ■ Threat to wildlife ■ Induce tremor/small-scale earthquake due to water impounding
Location of dam	Loss of habitat, flora, fauna and biodiversity	<ul style="list-style-type: none"> ■ Migratory patterns of wildlife may be disrupted by development ■ Poaching and eradication of species considered to be agricultural pests ■ Aquatic fauna, including waterfowl, reptiles, and amphibian populations are expected to increase with the dam ■ Character of the aquatic ecosystem will change from a riverine to a lacustrine environment with major changes in species and community composition ■ Tracts of intact pristine lowland dipterocarp forest are particularly at risk from dam projects
	Resettlement	<ul style="list-style-type: none"> ■ Forced relocation of those living within the proposed inundation area ■ Provision of funds for rehabilitation (as well as for property compensation) should be an integral part of the project's core budget ■ Rehabilitation requires training for the re-settler in how to manage his new situation. For example, a lowlands paddy farmer who is moved uphill to grow upland crops, or is moved to an urban centre for employment ■ Rehabilitation costs usually include some subsidy to compensate the re-settler over at period before he can be expected to achieve earnings equal to that of his original lifestyle
	Encroachment via access route	New access routes will be built for farmers, hunters, timber, exploiters, etc.

TABLE 3.6 (cont'd) Key issues and impacts

ENVIRONMENTAL ISSUES		IMPACTS
Location of dam (cont'd)	Fishing area	Reservoir may be exploited as fishing area
	Water-based recreation	Dams appear attractive for eco-tourism development of water-based recreation
	Transboundary issue	Applicable for river that flows through two or more states
Regulated flow	Deterioration of water quality	<ul style="list-style-type: none"> ■ If the inundated land is heavily wooded and not sufficiently cleared prior to flooding, decomposition will deplete oxygen levels in the water ■ This affects aquatic life and may result in large fish kills
	Impaired navigation at low water	<ul style="list-style-type: none"> ■ Dam presence can impair downstream navigation, particularly during the dry season with low flows ■ In contrast, upstream navigation may be considerably improved
	Changes in hydraulic and morphology of the river	<ul style="list-style-type: none"> ■ Effects of changes in the hydraulic of the river basin include altered levels of the water table both above and below the reservoir and salinisation problems which have direct ecological impacts and affect downstream water users ■ Dam presence will decrease volume of sediment carried to the sea and cause intensification of the coastal erosion
In-stream barrier	Reduction in stream fishing (fish barrier)	<ul style="list-style-type: none"> ■ Riverine fisheries usually decline due to change in river flow, deterioration of water quality, water temperature changes, loss of spawning ground and barriers to fish migration ■ In rivers with biologically productive estuaries, estuarine fish and shellfish suffer from changes in water flow and quality ■ Changes in freshwater flows in an estuary will alter species distribution and breeding patterns of fish and shellfish ■ Changes in nutrient levels and decrease in the quality of the river water can also have profound impacts on the productivity of an estuary
	Impaired navigation	As with flow regulation, the presence of a stream barrier impairs navigation on the river
	Depletion of sediment/aggregate/nutrients downstream (sediment trap)	<ul style="list-style-type: none"> ■ Suspended particles carried by the river will be settled in the reservoir, limiting its storage capacity and lifetime and depleting the downstream ■ The decomposition of existing or trapped organic matter (e.g. trees) on the flooded lands enriches the nutrients in the reservoir ■ Fertilizer used upstream add to nutrients accumulating and recycling in the reservoir ■ This not only supports reservoir fisheries, it also stimulates the growth of aquatic weeds, such as water lettuce and water hyacinth ■ Weeds and algal mats can be an expensive nuisance when they clog dam intakes and substantially increase water loss through transpiration
	Reduced flooding downstream	The control river flow fluctuation by a dam/reservoir can control/prevent flash floods occurring at downstream
Water-related diseases	Health issues	Water-borne diseases may increase with the creation of a reservoir, associated water management strategies and sanitary conditions of new settlements
	Odour (H ₂ S)	Inundation issue: H ₂ S (odour) due to leftover biomass degradation
Population influx	Health issues	Construction workers, operation employees and seasonal labourers for other dam-induced activities, may overburden existing public services and resources, create social conflicts, and bring about negative environmental impacts on the reservoir and downstream river basin

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TABLE 3.6 (cont'd) Key issues and impacts

ENVIRONMENTAL ISSUES		IMPACTS
Reservoir protection (during operation)	Erosion of access roads and borrow areas	<ul style="list-style-type: none"> ■ Exposed or incompletely turfed access road cuts and embankments, spoil areas and borrow areas are subject to erosion and the silt/runoff may pollute the reservoir and/or waters downstream ■ Inadequately designed cut slopes may increase the risk of landslides along the routes to/or within the reservoir
	Conservation of habitat, flora, fauna and biodiversity	<ul style="list-style-type: none"> ■ The reservoir area can serve as a wildlife refuge and a representative habitat which could conserve flora, fauna and maintain the biodiversity of the remaining habitat ■ Conservation of the reservoir area habitat could, to considerable extent, compensate for the loss of catchments habitat by inundation
Earthworks (construction issue only)	Deterioration of water quality	<ul style="list-style-type: none"> ■ The construction of dams normally involves substantial cutting and filling which inevitably produce high sediment yields which in turn adversely affect surface water quality by increasing turbidity and nutrient levels ■ The increased sediment (both suspended and bedload) may result in aquatic fauna (e.g. fish) mortality, increased aquatic flora (algae and weeds), and reduced navigability due to aggradation ■ Discoloration of water will also adversely affect aesthetics

3.9 SELECTION OF MITIGATION MEASURES

The Qualified Person with assistance from the technical consultants and specialists must assess the BATs, BMPs and options for P2M2. The proposed P2M2 must be able to address and mitigate the identified key environmental issues.

At the point of the TOR and ESI stages, the proposed P2M2 are qualitative and descriptive only and shall be detailed out later in the EIA report. *Table 3.7* lists the example of brief descriptions of potential mitigation measures to be implemented.

TABLE 3.7 Brief description for mitigation measures

ENVIRONMENTAL IMPACT	BRIEF DESCRIPTION FOR MITIGATION MEASURES
Ecological	Confine land clearing and construction activities within the designated working area only
Erosion	Incorporate the slope designs into the measures in the LD-P2M2 to ensure slope stability
Solid waste and scheduled waste	Implement best management practices to handle wastes comprise biomass, municipal, construction and demolition and scheduled wastes
Water quality	Install sediment control structure to trap physical constituents such as silt and sediments except for dissolved materials and oil and grease before final discharge
Air quality	Minimise and control fine dust dispersion and emissions
Noise and vibration	Minimise and control noise and vibration disturbance
Safety and health	Ensure workers and public's safety and health are not compromised with on-going construction activities
Land traffic	Identify and manage traffic along logistic roads during construction stage

3.10 ESTABLISHMENT OF EIA STUDY REQUIREMENT

The scope of an EIA study is dependent on the scale and magnitude of a proposed dam development. This includes compatibility with adjacent land uses and ESAs and the type of planning and study approvals as required by other relevant GAs.

The Qualified Person must extract and incorporate the methodologies, assessment/modeling tools, baseline data, potential impacts and proposed mitigation measures from these studies as part of the TOR. The relevant studies

are listed in *Table 3.8*. However, it should be noted that the list provided is only indicative as site conditions and locations can vary between projects. As such, it is the responsibility of the Qualified Person to assess and verify the applicability and extent of these studies to be conducted for a specific project.

The EIATRC later will assess the suitability of the required studies and may recommend these studies to be incorporated in the TOR during the TORAC meeting.

TABLE 3.8 List of relevant studies to be incorporated in EIA

STUDY REFERENCE	GOVERNMENT AGENCY	
Social Impact Assessment (SIA)	<ul style="list-style-type: none"> ■ PLANMalaysia ■ PLANMalaysia@Negeri 	
Slope Analysis <ul style="list-style-type: none"> ■ Terrain and slope classification 	<ul style="list-style-type: none"> ■ JMG ■ PWD 	
Geological Assessment <ul style="list-style-type: none"> ■ Geology and Geotechnics <ul style="list-style-type: none"> - Rocks - Mineral potential ■ Geological Terrain Mapping (GTM) <ul style="list-style-type: none"> - Erosion - Terrain classification - Terrain component - Construction suitability 	JMG	
Geotechnical Report	PWD Geotechnical Branch	
Erosion and Sediment Control Plan (ESCP)	DID	
Hydrology and Hydraulic Study <ul style="list-style-type: none"> ■ Basin/River systems ■ Runoff ■ Flood risk ■ Sediment transport modelling ■ Coastal erosion risk 	<ul style="list-style-type: none"> ■ DID ■ NAHRIM 	
Traffic Impact Assessment (TIA)	PWD	
Health Impact Assessment (HIA)	MOH	
Heritage Impact Assessment <ul style="list-style-type: none"> ■ Archaeological ■ Heritage 	Department of National Heritage	
Wildlife Management Plan (WMP) <ul style="list-style-type: none"> ■ Wildlife Evacuation Plan ■ Wildlife Monitoring Plan 	DWNP	
To be incorporated in the EIA Study:		
<ul style="list-style-type: none"> ■ Topographic survey ■ Soil Investigation (SI) Study ■ Hydrogeological Assessment ■ Emergency Action Plan (EAP) 	<ul style="list-style-type: none"> ■ Dam Breach and Consequence Assessments <ul style="list-style-type: none"> - Dam break analysis - Flood wave routing - Inundation mapping 	<ul style="list-style-type: none"> ■ Risk and Hazard Assessment <ul style="list-style-type: none"> - Individual risk - Societal risk

3.11 EIA STUDY TEAM MEMBERS

The EIA study team can be formed upon identifying the environmental issues and impacts of a dam project.

The Qualified Person who is part of an EIA study team must be registered with the DOE either as an EIA Consultant, Subject Consultant or Assistant Consultant. He/She has to ensure that his/her EIA registration is valid throughout the EIA study period.

Subsequently, in order to ensure that all environmental issues and impacts are captured comprehensively in the EIA study, the EIA team members are encouraged to further refine the environmental issues and impacts outlined in Section 3.8.3.

The organisation chart of the EIA study team is shown in Figure 3.5.

Roles and responsibilities of an EIA study team member:

1. Identify and map Environmentally Sensitive Areas (ESA);
2. Identify all important tasks to be performed in the EIA study (e.g.: studies, modelling, public engagements, etc.);
3. Ensure all TOR components are covered;
4. Ensure data and information are factually correct, can be verified and technically defensible;
5. Assess impacts holistically and comprehensively;
6. Propose P2M2 with consideration of Best Available Technology (BAT) or Best Management Practices (BMPs) using suitable modeling tools; and
7. Propose EMP and monitoring framework.

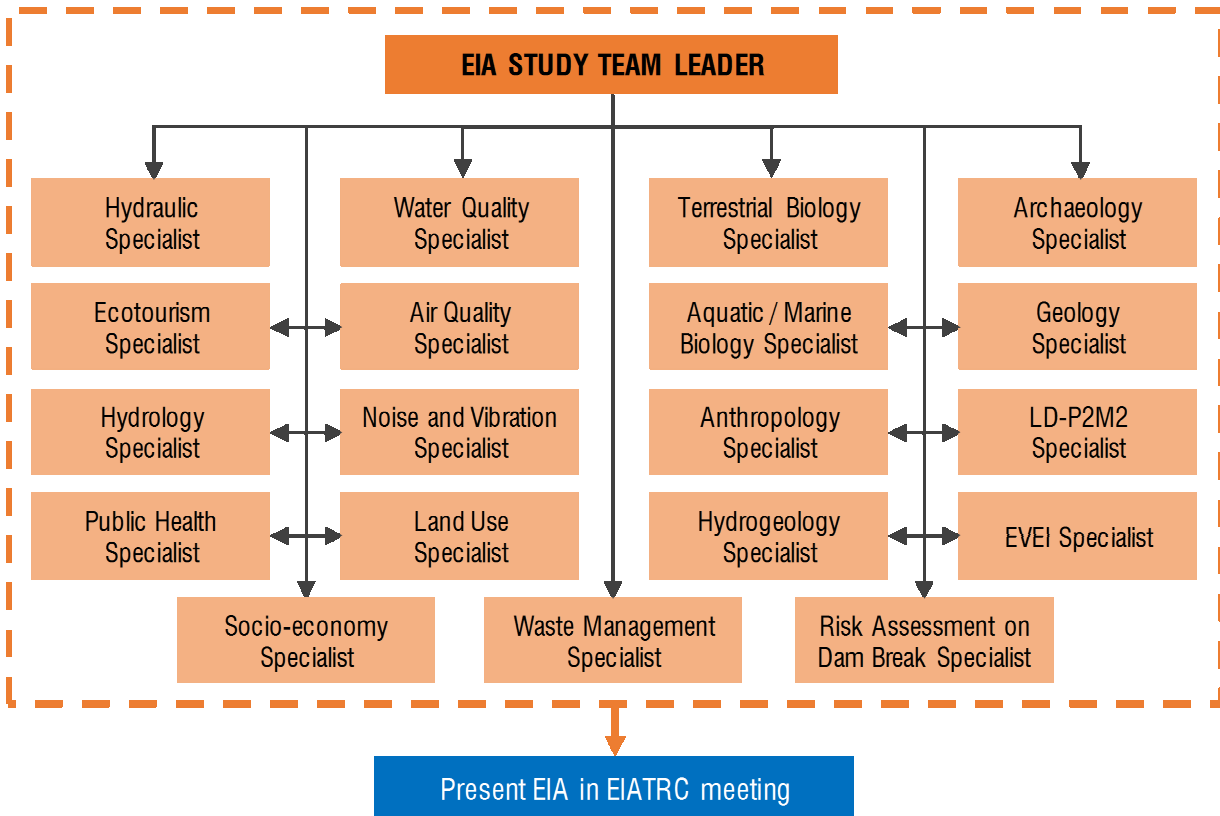


FIGURE 3.5 Organisation chart of EIA study team

3.12 PREPARATION OF TOR AND ESI REPORTS

The outcomes of the environmental scoping are termed as ESI which will form the basis to develop the TOR for DOE endorsement. The TOR must be submitted to DOE HQ for review and endorsement before proceeding to the EIA stage.

3.12.1 TOR Table of Content

The TOR shall contain but not limited to the following:

<p>Chapter 1 INTRODUCTION</p>	<p>This TOR is for the preparation of an Environmental Impact Assessment (EIA) Study for “Project Title”.</p>
<p>Chapter 2 LIST OF CONSULTANTS/ STUDY TEAM</p>	<p>Details of each individuals (must be registered with DOE) who will carry out the EIA study, which include:</p> <ul style="list-style-type: none"> ■ DOE registration number; ■ academic background; ■ experience; ■ area of study; and ■ declaration (signatures). <p>The EIA consultant team is to be led by a Team/Project Leader/Manager who is responsible for the EIA report. Include contact details (complete address, phone and fax numbers) of the appropriate and responsible person(s) to whom enquiries regarding the EIA should be directed to.</p>
<p>Chapter 3 SCOPE OF PROJECT</p>	<p>List out those components of the Project which fall under the Prescribed Activities under the EIA Order, and describe with enough details for the reader to understand the scope of the significant project work components, without the technical details, including a well described engineering implementation programme of the project.</p>
<p>Chapter 4 ALTERNATIVES CONSIDERATION</p>	<p>Outline alternative solutions (project site, technologies, etc.) that will be studied or described to justify that the Project will result in the least environmental impacts.</p>
<p>Chapter 5 SIGNIFICANT ENVIRONMENTAL IMPACTS TO BE STUDIED</p>	<p>List and describe those significant environmental impacts which will potentially be affected by the project works or components which will need to be covered in detail in the EIA.</p>
<p>Chapter 6 STUDY BOUNDARIES</p>	<p>Delineate study boundaries for each of the above significant environmental elements to be investigated and identifying the critical groups of sensitive receptors and how the impacts on the sensitive receptors will be studied.</p>
<p>Chapter 7 ASSESSMENT STANDARDS</p>	<p>List out standards, criteria, acceptable limits, etc. that will be used to assess the environmental impacts to be investigated.</p>

Source: Adapted from EGIM (DOE)

3 TERMS OF REFERENCE

Chapter 9 CONSIDERATION OF CONCURRENT PROJECTS	List out potential concurrent or planned project that may result in cumulative impacts.
Chapter 10 DESCRIPTION OF MODELING TOOLS AND ASSESSMENT METHODOLOGIES	List out modelling tools, methodologies etc. for undertaking impact assessment and evaluation of significance. The extent of accuracy of these tools will also need to be provided, including name of models, applicability of models and tools, verifiability of results, how results are verified, grid size (for water modelling).
Chapter 11 POSSIBLE MITIGATION MEASURES	Outline possible mitigation measures or best management practices from similar projects that may be used to address the environmental impacts on this project.

Source: Adapted from EGIM (DOE)

3.12.2 ESI Table of Content

The ESI must be included with the TOR submission as an annex or appendix. The following is an indicative list of information which must be included in the ESI:

Chapter 1 INTRODUCTION TO ESI	<ul style="list-style-type: none"> ■ Introduction: Provide a short introduction to the ESI. ■ Preparer: Provide the name, designation, contact number and affiliation company of the ESI preparer. ■ The need for EIA: Describe the need for an EIA for the project.
Chapter 2 BASIC INFORMATION OF PROJECT	<ul style="list-style-type: none"> ■ Project Title: Provide name of project. ■ Purpose and Nature of Project: Provide brief description on the project's background, previous studies, statement of need, and project concept, size, components and outline of process technologies, and project development phases including future phases. ■ Identification of Project Proponent: Provide Project Proponent's name and address. If the Proponent is a Joint Venture partnership, the Joint Venture partners shall be identified, together with the Project Manager for the Joint Venture. ■ Location and Scale of Project: Provide coordinates of project, extent of project coverage and maps at appropriate scales. ■ History of Site: Describe brief history of the site where project is to be sited. ■ History of Site: Describe brief history of the site where project is to be sited. ■ Project Justification: Describe any alternatives evaluated during early proposal (e.g. location, siting, technology, process) and summarise the criteria used to compare options and select the preferred project proposal.

Note: The items listed above are not exhaustive. Other items shall be included whenever relevant. The ESI shall be included with the TOR submission as an annex or appendix.

Source: Adapted from EGIM (DOE)

<p>Chapter 2 (cont'd) BASIC INFORMATION OF PROJECT</p>	<ul style="list-style-type: none"> ■ Number and Types of Prescribed Projects: Describe which category the project falls under the EQA, and state the criteria that made the activity fall under the Prescribed Activity. ■ Previously Approved EIA Reports or Studies: List out any previous EIAs or studies that were conducted for other projects around the proposed project site. ■ Regional Setting of Project: Describe how the project is placed in the regional biophysical and social context. ■ Name and Telephone Number of Contact Person: Provide contacts of key personnel of Project Proponent. Normally no more than two persons.
<p>Chapter 3 ALTERNATIVE CONSIDERATION</p>	<p>Outline alternative solutions (project option, project site, technologies, etc.) that will be studied or described to justify that the project will result in the least environmental impacts.</p>
<p>Chapter 4 MAJOR ELEMENTS OF THE ENVIRONMENT IN VICINITY OF PROJECT SITE AND STUDY BOUNDARIES</p>	<p>A relatively comprehensive list of elements of the environment is mentioned in this paragraph. Attention shall be given only to the more significant elements associated with the proposed project.</p> <ul style="list-style-type: none"> ■ Air Quality: Briefly describe the prevailing air streams and wind directions at the project site and identify the list of air sensitive receivers within a study boundary of 500 metres. ■ Noise and Vibration: Briefly describe the existing noise contributors at and around the project site and identify the list of sensitive noise receptors within a study boundary of 500 metres. ■ Water Quality: Briefly describe the existing waterbodies and rivers at and around the project site and identify the list of water sensitive receivers within a study boundary of 500 metres. ■ Hydrology and Hydrogeology: Briefly describe the hydrology and hydrogeology at and around the project site within a study boundary of 1,000 metres. ■ Flood Risk: Briefly describe the existing risk of flooding and flood defense infrastructure at and around the project site within a study boundary of 500 metres. ■ Erosion Risk: Briefly describe the existing risk of erosion and erosion mitigation infrastructure at and around the project site within a study boundary of 500 metres. ■ Waste Management: Briefly describe the existing sources of solid and hazardous waste arising at and around the project site. ■ Ecology: Briefly describe the existing habitats (land and marine including bathymetric characteristics for marine projects) at and around the project site within a study boundary of 500 metres. ■ Cultural Heritage: Briefly describe any historical evidence of cultural importance at and around the Project site within a study boundary of 500 metres. ■ Land Contamination: Briefly describe the existing and previous land uses at and around the project site that may have caused any land contamination within a study boundary of 500 metres. ■ Groundwater: Briefly describe the existing uses of groundwater at and around the project site and the existing and previous land uses that may have caused any groundwater contamination within a study boundary of 1,000 metres.

Note: The items listed above are not exhaustive. Other items shall be included whenever relevant. The ESI shall be included with the TOR submission as an annex or appendix.
Source: Adapted from EGIM (DOE)

<p>Chapter 4 (cont'd) MAJOR ELEMENTS OF THE ENVIRONMENT IN VICINITY OF PROJECT SITE AND STUDY BPUNDARIES</p>	<ul style="list-style-type: none"> ■ Land Use, Landscape and Visual: Briefly describe the existing land use and landscape at and around the project site within a study boundary of 500 m and identify a list of visually sensitive receptors. ■ Traffic: Briefly describe the existing traffic conditions at and around the project site within a study boundary of 3,000 metres. ■ Hazards and Risk Assessment: Briefly describe any existing hazardous installations at and around the project site or risks associated with the project itself within a study boundary of 500 metres (including possibilities such as seismic and geological events). ■ Socio-economy: Briefly describe the socio-economic conditions at and around the project site within a study boundary of 500 metres. ■ Geology: Briefly describe the topographical and geological features at and around the project site within a study boundary of 500 metres and may include information on mineral deposits and soil characteristic. 																
<p>Chapter 5 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME</p>	<ul style="list-style-type: none"> ■ Relevant Policies: Briefly describe government policies (federal, state or local) which are relevant to the project. ■ Project Implementation: Briefly describe who will implement and construct the project works, and who will undertake the detailed EIA studies. ■ Project Timetable: Provide indicative dates when the project will commence and end. ■ Interactions with other Projects: List out all concurrent or planned projects in the vicinity of this project. The purpose of this list is to enable DOE to assess the significance of cumulative impacts from all the projects. ■ Project Assessment Timeline: Provide a proposed target timeline for the whole assessment process. The time table for proposed studies and investigations shall be included, and as a minimum, shall include:- TOR submission; TOR public review (if relevant); environmental studies; consultation programme; EIA report submission; EIA report public display; Project Proponent's response to public comments. ■ Proposed Studies: Describe scope of works of studies/investigations/ surveys that will be undertaken to obtain the baseline information on the major elements of the environment. 																
<p>Chapter 6 POSSIBLE IMPACTS ON THE ENVIRONMENT</p>	<p>Outline the methodologies used in the impact analysis/assessment and provide a brief qualitative description of the potential impacts during construction and operational phases of project implementation on the following:</p> <table border="0"> <tr> <td>■ air quality;</td> <td>■ cultural heritage;</td> </tr> <tr> <td>■ noise and vibration;</td> <td>■ land contamination;</td> </tr> <tr> <td>■ water quality;</td> <td>■ groundwater,</td> </tr> <tr> <td>■ hydrology and hydrogeology;</td> <td>■ land use, landscape and visual,</td> </tr> <tr> <td>■ flood risk;</td> <td>■ traffic,</td> </tr> <tr> <td>■ erosion risk;</td> <td>■ hazards/Risk assessment,</td> </tr> <tr> <td>■ waste management;</td> <td>■ socio-economy, and</td> </tr> <tr> <td>■ ecology;</td> <td>■ Geology.</td> </tr> </table> <p>Note: A relatively comprehensive list of impacts is mentioned in this paragraph. Attention shall be given only to the more significant impacts associated with the proposed project.</p>	■ air quality;	■ cultural heritage;	■ noise and vibration;	■ land contamination;	■ water quality;	■ groundwater,	■ hydrology and hydrogeology;	■ land use, landscape and visual,	■ flood risk;	■ traffic,	■ erosion risk;	■ hazards/Risk assessment,	■ waste management;	■ socio-economy, and	■ ecology;	■ Geology.
■ air quality;	■ cultural heritage;																
■ noise and vibration;	■ land contamination;																
■ water quality;	■ groundwater,																
■ hydrology and hydrogeology;	■ land use, landscape and visual,																
■ flood risk;	■ traffic,																
■ erosion risk;	■ hazards/Risk assessment,																
■ waste management;	■ socio-economy, and																
■ ecology;	■ Geology.																

Note: The items listed above are not exhaustive. Other items shall be included whenever relevant. The ESI shall be included with the TOR submission as an annex or appendix.

Source: Adapted from EGIM (DOE)

<p>Chapter 7 MITIGATION MEASURES TO BE INCORPORATED IN THE DESIGN</p>	<p>Qualitatively describe the proposed pollution prevention and mitigation measures (P2M2) or generally referred to as best management practices that will be implemented to address the impacts from pre-construction (including feasibility studies and design), construction and operational phases of the project implementation as described in “Possible Impacts on the Environment” section of the ESI.</p>
<p>Chapter 8 USE OF PREVIOUSLY APPROVED EIA REPORTS OR STUDIES</p>	<p>Outline and describe any relevant information that is referenced from the previous EIAs or studies that were identified in Section 3(ii) above and briefly discuss how this information is suitable to be used for this project.</p>
<p>Chapter 9 LIST OF DRAWINGS, FLOWCHARTS, DIAGRAMS AND PHOTOGRAPHS</p>	<p>Provide the following:</p> <ul style="list-style-type: none"> ■ Clear, coloured and readable maps, diagrams and photographs to illustrate the nature of the project and its general layouts indicating the location of the project and all its components and project boundaries. ■ Macro scale maps (1:50,000 and 1:25,000), plans, photographs or satellite images, clearly identifying the location of the proposed project location. ■ An updated satellite image to indicate the recent existing environment may be used. The coverage of the land use map must be at least within 5 km radius (intervals of 250 metres). For large scale projects such as the construction of dams or impounding reservoirs, the coverage of the land use map may be beyond 5 km radius depending on the catchment area. ■ Clear, coloured and readable maps, diagrams and photographs to illustrate the nature of the project and its general layouts indicating the location of the project and all its components and project boundaries. ■ Macro scale maps (1:50,000 and 1:25,000), plans, photographs or satellite images, clearly identifying the location of the proposed project location. ■ An updated satellite image to indicate the recent existing environment may be used. The coverage of the land use map must be at least within 5 km radius (intervals of 250 metres). For large scale projects such as the construction of dams or impounding reservoirs, the coverage of the land use map may be beyond 5 km radius depending on the catchment area. ■ Other types of map that may be relevant to the key and critical issues of the proposed project. They may include cadastral map, topography and geological map, bathymetry map, hydrological map, coral population map etc. ■ For industrial-based projects, clear and readable flowchart of the production processes and explanation on the processes and the project's maximum capacity.
<p>REFERENCES</p>	<p>Provide a list of documents and studies used to prepare the Environmental Scoping Information (ESI).</p>

Note: The items listed above are not exhaustive. Other items shall be included whenever relevant. The ESI shall be included with the TOR submission as an annex or appendix.

Source: Adapted from EGIM (DOE)

CHAPTER 4

Baseline Data

Batang Ai Dam, Sarawak
Photo by Ryan O Neil on Unsplash.com

4.1 INTRODUCTION

An EIA shall contain a description of the existing environment before the project commences (termed as 'baseline condition') that may or may not be affected directly or indirectly from the project. Objectives for the description on baseline conditions include:

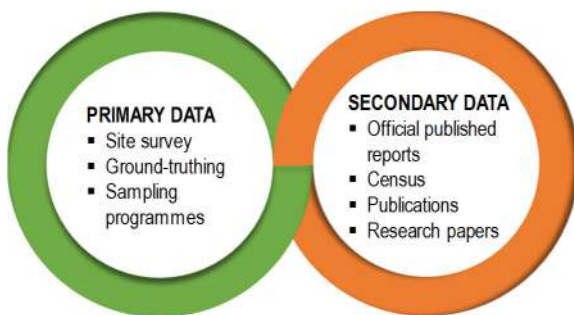
- i) identify existing environmental conditions which may influence project design decisions (project layout, project components)
- ii) identify sensitive issues or areas requiring mitigation or compensation
- iii) provide input data to numerical models for prediction of impacts
- iv) provide baseline reference for compensation during project implementation stage

The approach and methodology in obtaining detailed baseline data and technical studies will be identified in the TOR and ESI documents. The detailed baseline data sampling will be carried out once the DOE endorsed the TOR. However, in some cases, the Qualified Person can do a pre-consultation with the DOE, to obtain a consensus to carry out the baseline sampling, while waiting for the TOR and ESI endorsement.



4.2 BASELINE DATA COLLECTION

There are two types of baseline data namely primary and secondary data which comprise of physico-chemical, biological and human environment. Identifications of ESAs are also defined in this chapter.



PRIMARY DATA is collected to obtain first-hand data for detailed assessment. Primary data can also be collected to fill in the gaps in information gathered through secondary data collection. Typically, the sampling and assessment area shall be bounded by the zone of study (ZOS). However, if assessment shows that the impact may extend much farther away, the zone of impact (ZOI) shall be included as part of the sampling and assessment area. The Qualified Person has to clearly define this in the EIA study.

SECONDARY DATA includes information and statistical data from various sources which are collected to form the basic information brief for the Project. All sources of information and statistics must be clearly referenced and acknowledged alongside the date of publications. References for all maps, photos and diagrams will also need to be included in the EIA.

4.3 COMPONENTS OF ENVIRONMENTAL BASELINE DATA

Environmental baseline data collection covers three major environmental components namely **physico-chemical, biological** and **human** environment.

4.3.1 Physico-chemical Environment

The physico-chemical baseline data collection must focus on the core aspects of pollution which are water, air and wastes.

Baseline data on these three core aspects are needed to determine the status of the environment. The status of the environment which includes before, during and after the project's implementation must be benchmarked against the DOE standards.

A baseline sampling plan, which includes coordinates of sampling stations, methodology, frequency and parameters to be sampled must be determined based on the project location and the project activities. Details of the baseline sampling plan must be clearly stated in the EIA report by the Qualified Person.

Table 4.1 lists a range of baseline data requirements which include water, air, noise and vibration. Other baseline data requirement are listed in *Table 3.3* in **Chapter 3**.

TABLE 4.1 Recommended baseline data requirements for physico-chemical environment

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
River water quality	<ul style="list-style-type: none"> ■ As stated in National Water Quality Standards for Malaysia (NWQS) ■ Selected parameters must be based on site location 	NWQS	<ul style="list-style-type: none"> ■ One time sampling ■ Upstream and downstream of major rivers and streams within the ZOI ■ Multi-depth sampling for deep rivers (>1 m deep) ■ Pesticides testing required for project located near agriculture sites
Estuarine and marine water quality	<ul style="list-style-type: none"> ■ As stated in Malaysian Marine Water Quality Standards (MMWQS) ■ Selected parameters must be based on project location 	MMWQS	<ul style="list-style-type: none"> ■ Sampling once during tide range (spring and neap tides) and tide stage (flooding and ebbing tides) conditions ■ Multi-depth sampling (top, middle and bottom)
Lake water quality	<ul style="list-style-type: none"> ■ As stated in National Lake Water Quality Criteria and Standards (NLWQS) ■ Selected parameters must be based on project location 	NLWQS	<ul style="list-style-type: none"> ■ One time sampling ■ Inlet, middle and outlet of lake ■ Multi-depth sampling for deep lakes (>1 m deep) ■ Pesticides testing required for project located near agriculture sites
Groundwater Quality	<ul style="list-style-type: none"> ■ As stated in National Groundwater Quality Standards ■ Selected parameters must be based on project location 	National Groundwater Quality Standards	Groundwater sampling procedure to follow Standard Operating Procedure practiced by DOE i.e. <i>Prosedur Operasi Tetap (SOP) Program Pengawasan Kualiti Air Tanah</i>
Air quality	<ul style="list-style-type: none"> ■ PM_{2.5} ■ PM₁₀ ■ Carbon monoxide (CO) ■ Sulphur dioxide (SO₂) ■ Nitrogen dioxide (NO₂) ■ Ozone (O₃) 	Malaysian Ambient Air Quality Standards (MAAQS)	<ul style="list-style-type: none"> ■ One time sampling ■ Parameters to be sampled are dependent on project location ■ Minimum two sampling locations (upwind and downwind) ■ Sampling at project boundary and nearest receptors
Noise	<ul style="list-style-type: none"> <li style="width: 50%;">■ L_{Aeq} <li style="width: 50%;">■ L₁₀ <li style="width: 50%;">■ L_{max} <li style="width: 50%;">■ L₅₀ <li style="width: 50%;">■ L_{min} <li style="width: 50%;">■ L₉₀ 	Guidelines for Environmental Noise Limits and Control	<ul style="list-style-type: none"> ■ One time sampling ■ Parameters to be sampled are dependent on project location ■ Sampling at project boundary and nearest receptors
Vibration	Requirements as per Schedule 1-6 of the Planning Guidelines for Vibration Limits and Control	The Planning Guidelines for Vibration Limits and Control	<ul style="list-style-type: none"> ■ One time sampling ■ Parameters to be sampled are dependent on project location ■ Sampling at project boundary and nearest receptors

All samples must be analysed by a laboratory accredited under the Laboratory Accreditation Scheme of Malaysia (SAMM) or equivalent. All test certificates and data shall be included in the appendix of the EIA report as supporting evidence.

The proposed procedures for sampling practices for water, air, noise and vibration are appended in *Attachment 2*.

4.3.2 Biological Environment

Secondary data regarding the location of permanent reserved forests, wildlife sanctuaries and protected areas from various agencies and published journals can be used to strengthen the baseline data information in the EIA study. Similarly, other agencies such as the Forest Research Institute of Malaysia (FRIM) have published research and inventories of flora and fauna in selected forest areas and conservation zones.

The biological environment is divided into two, namely terrestrial and aquatic. Each of these consist of flora and fauna. The scope and requirement for terrestrial and aquatic samplings are determined by the magnitude of the potential impacts. *Table 4.2* lists the recommended baseline sampling requirements for biological environment.

The relevant agencies such as the FDPM and the DWNP must be consulted prior to carrying out data collection, surveys and assessment of the results.



Little Egret
Photo by SK Yeong on Unsplash.com

TABLE 4.2 Recommended baseline data requirements for biological environment

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
Terrestrial flora	<ul style="list-style-type: none"> ■ Tree species inventory (photograph) – family, species, local name ■ Species distribution ■ Conservation status ■ Legal status ■ Diameter (for saplings and trees) ■ Tree quality ■ Non-timber species, climbers, ferns and orchids ■ Rattan, bamboo and palms 	International Union for Conservation of Nature (IUCN) Red List of Threatened Species	<ul style="list-style-type: none"> ■ Surveys within project site and adjacent ■ Approaches: <ul style="list-style-type: none"> i) Stratification ii) Ground samples ■ Survey methods: <ul style="list-style-type: none"> i) Transect line or transect survey ii) Interviews and local knowledge iii) Other relevant methods
Terrestrial fauna	<ul style="list-style-type: none"> ■ Groups: <ul style="list-style-type: none"> i) Avifauna ii) Volant mammals iii) Non-volant mammals iv) Insects v) Herpetofauna ■ Fauna species inventory (photograph) - local name, scientific name, English name ■ Habitat preference ■ Species distribution ■ Conservation status ■ Legal status 	<ul style="list-style-type: none"> ■ IUCN Red List of Threatened Species ■ Wildlife Conservation Act 2010 (Act 716) 	<ul style="list-style-type: none"> ■ Surveys within project site and adjacent ■ Approaches: <ul style="list-style-type: none"> i) Habitat mapping ii) Fauna diversity surveys ■ Survey methods: <ul style="list-style-type: none"> i) Transect line or transect survey ii) Live-trapping iii) Mist netting iv) Camera trapping v) Harp trap vi) Night-spotting vii) Sweeping net viii) Interviews and local knowledge ix) Other relevant methods
Aquatic (flora and fauna)	<ul style="list-style-type: none"> ■ Groups <ul style="list-style-type: none"> i) Fish survey ii) Plankton (zooplankton and phytoplankton) iii) Macro invertebrates iv) Aquatic plants v) Periphyton ■ Species inventory (photograph) - local name, scientific name, English name ■ Species distribution ■ Conservation status ■ Legal status 	<ul style="list-style-type: none"> ■ IUCN Red List of Threatened Species ■ Fisheries Act 1985 (Act 317) 	<ul style="list-style-type: none"> ■ Surveys within project site and adjacent ■ Approaches: <ul style="list-style-type: none"> i) Aquatic sampling ii) Ground truthing (aquaculture operators) ■ Survey methods: <ul style="list-style-type: none"> i) Dip nets ii) Surber samplers iii) Grab samplers iv) Suction samplers v) Colonisation samplers vi) Interviews and local knowledge vii) Other relevant methods

4.3.3 Human Environment

Relevant data collection will be required for the section on socio-economic assessment in the EIA. For primary data, a series of engagement with stakeholders can be arranged to convey information about the proposed project in order to receive perception and feedback from the stakeholders.

The stakeholders engagements can be further focused by having direct interview, focus group discussion (FGD), public dialogue, workshop, exhibition and road show, and round table discussion. Details of these methods are listed in *Section 2.8.3 in Chapter 2*.

For secondary data, it includes the population census. However, for accurate population statistics, the data is best collected from the local authorities and district offices.

If SIA is required, the study shall follow the requirements, guidelines and procedures of PLANMalaysia. This department must review, endorse and enforce the requirements of the SIA. For the purpose of the EIA, only the main findings from the SIA are to be incorporated.

Other components that may affect communities within the vicinity of the project site must be considered if they are deemed as significant issues. These include, but are not limited to:

- i) public health;
- ii) heritage, culture and archaeology;
- iii) ecotourism; and
- iv) land traffic.

Similar with SIA, only the main findings from these studies are to be incorporated in the EIA.

TABLE 4.3 Recommended baseline data requirements for human environment

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
Socio-economic	<ul style="list-style-type: none"> ■ Settlement pattern ■ Population distribution ■ Demography and population dynamics ■ Population socio-economic profile ■ Existing infrastructure, utilities and amenities 	SIA Manual (PLANMalaysia)	<ul style="list-style-type: none"> ■ Surveys on targeted stakeholders potentially affected by the project ■ Surveys must represent the stakeholders in the ZOI ■ Conduct stakeholder engagement
Public health	<ul style="list-style-type: none"> ■ Population profile ■ Public health status 	Guidance Document on HIA in EIA (DOE Malaysia)	<ul style="list-style-type: none"> ■ Surveys on targeted stakeholders potentially affected by the project ■ Surveys must represent the stakeholders in the ZOI ■ Conduct stakeholder engagement
Heritage, culture and archaeology	Identify and determine significance of value of such sites within or near to project site	Department of National Heritage	<ul style="list-style-type: none"> ■ Site surveys and interviews with authorities and locals ■ As specified in local plan, special area plan
Ecotourism	Identify and determine significance of value of such sites within or near to project site	-	<ul style="list-style-type: none"> ■ Surveys on targeted stakeholders potentially affected by the project ■ Conduct stakeholder engagement ■ As specified in local plan, special area plan

4.3.4 Other Relevant Baseline Studies

There may be other relevant baseline studies required that are specific to the project nature which are listed in *Table 4.4*.

TABLE 4.4 Other recommended baseline studies

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
Land traffic	Traffic count during peak periods	PWD/Local council requirements	<ul style="list-style-type: none"> ■ Carried out as part of the TIA ■ Traffic surveys at major junctions near to project site
Marine traffic and navigation	<ul style="list-style-type: none"> ■ Marine features, characteristics and conditions e.g. port and harbour limits, marine operations, anchorage areas, etc. ■ Regulatory setting of the project area concerning marine traffic 	MarDep requirements	<ul style="list-style-type: none"> ■ Data is obtained from (but not limited to) LKIM, DOF and MarDep ■ Can be carried out as part of the MRA

4.4 IDENTIFICATION OF ENVIRONMENTALLY SENSITIVE AREAS (ESAs)

Identification of ESA is central in carrying out the EIA study. The ESA identification shall be based on eight main documents namely:

- i) Physical plans/policies (NPP/RFZPPN);
- ii) State plans;
- iii) Local plans (RTD);
- iv) Planning guidelines e.g. GPP;
- v) *Buku Panduan Kawasan Sensitif Alam Sekitar Malaysia* (DOE, 1993);
- vi) EQA 1974 (water intake points);
- vii) EESIM (water intake points); and
- viii) SZIRA (natural system, human system); and
- ix) Ground truthing.

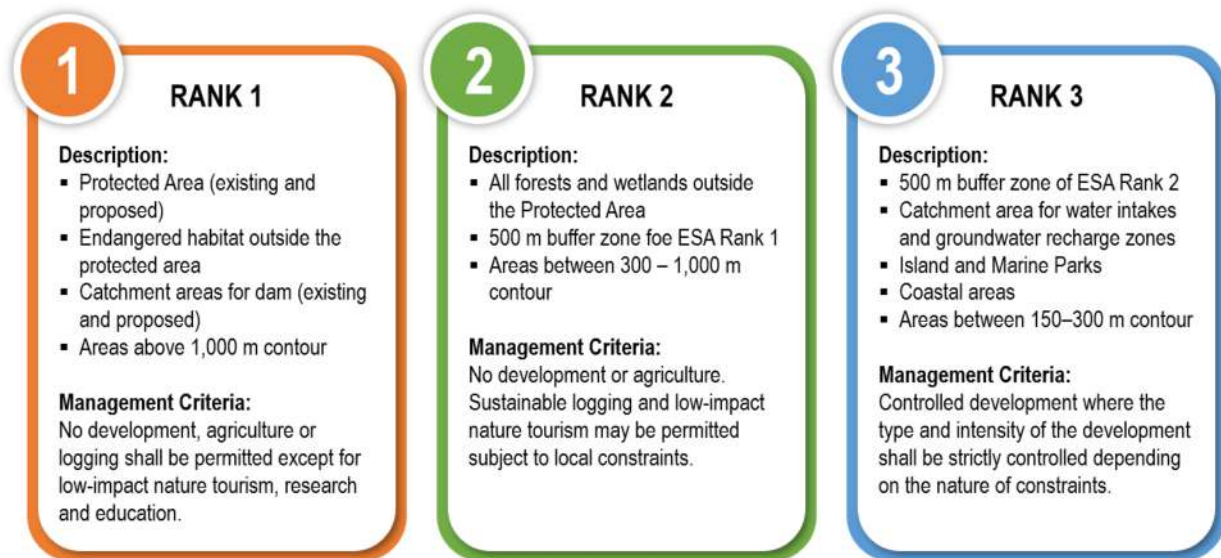
It is recommended that ESAs are to be integrated into the planning and management of land use and natural resources. The rank of ESAs and their respective management criteria are as listed in *Figure 4.1*.

In the GPP Pemuliharaan dan Pembangunan KSAS, the specific guidelines for planning and conservation of water reservoir are further elaborated as shown in *Table 4.5*.

As specified in the NPP-3, an ESA is defined as:

“a special area that is very sensitive to any changes in the ecosystem as a result of natural processes or activities in or around the area, either directly or indirectly”

4 BASELINE DATA



Source: NPP-3 (2016)

FIGURE 4.1 ESA rank and management criteria

TABLE 4.5 Specific guidelines for planning and conservation for water reservoir

WATER RESERVOIR CATEGORY	PERMITTED ACTIVITY WITH CONDITION		NOT PERMITTED ACTIVITY	REMARKS / GUIDELINES
	ACTIVITY	CONDITION		
Gazetted for dam Rank sensitivity: 1	Research	NA	All activities are not permitted	<ul style="list-style-type: none"> Subject to current laws and regulations Catchment buffer zone should be 100 m from the reservoir Logging activities should be carried out 1.5 km away from the border Water quality is maintained between Class I and II of the National Water Quality Index (WQI)
Water intake (forest) Rank sensitivity: 2	<ul style="list-style-type: none"> Recreational area Communication system 	Prepare Environmental Management Plan (EMP)	All activities are not permitted except those listed	<ul style="list-style-type: none"> Adhere to the rules of the Rizab Sungai as stipulated in the '<i>Pembangunan yang Melibatkan Sungai dan Rizab Sungai</i>' DID (2001) Water quality is maintained between Class II and III of the National WQI
Water intake (development) Rank sensitivity: 3	Small industry	Implement effluent recycle program and zero discharge concept	Large industry	<ul style="list-style-type: none"> No direct waste water to be discharged into the river Adhere to the rules of the Rizab Sungai as stipulated in the '<i>Pembangunan yang Melibatkan Sungai dan Rizab Sungai</i>' DID (2001) Water quality is maintained between Class II and III of the National Water Quality Index (WQI) Fuel storage tank (diesel) should have a buffer zone of at least 500 m from the main river in the upstream water intake.

All identified ESAs within the ZOS and ZOI must be presented in a satellite image and each of the ESAs must be listed in a table which consist of ESA rank, category, location, the nearest distance from project boundary; and source.

However, important and sensitive ESAs outside of the ZOS and ZOI must still be identified and shown in the satellite image. An example is shown in *Figure 4.2* and *Table 4.6*. In addition, a brief description of each of the categories must be provided to determine their existing condition.

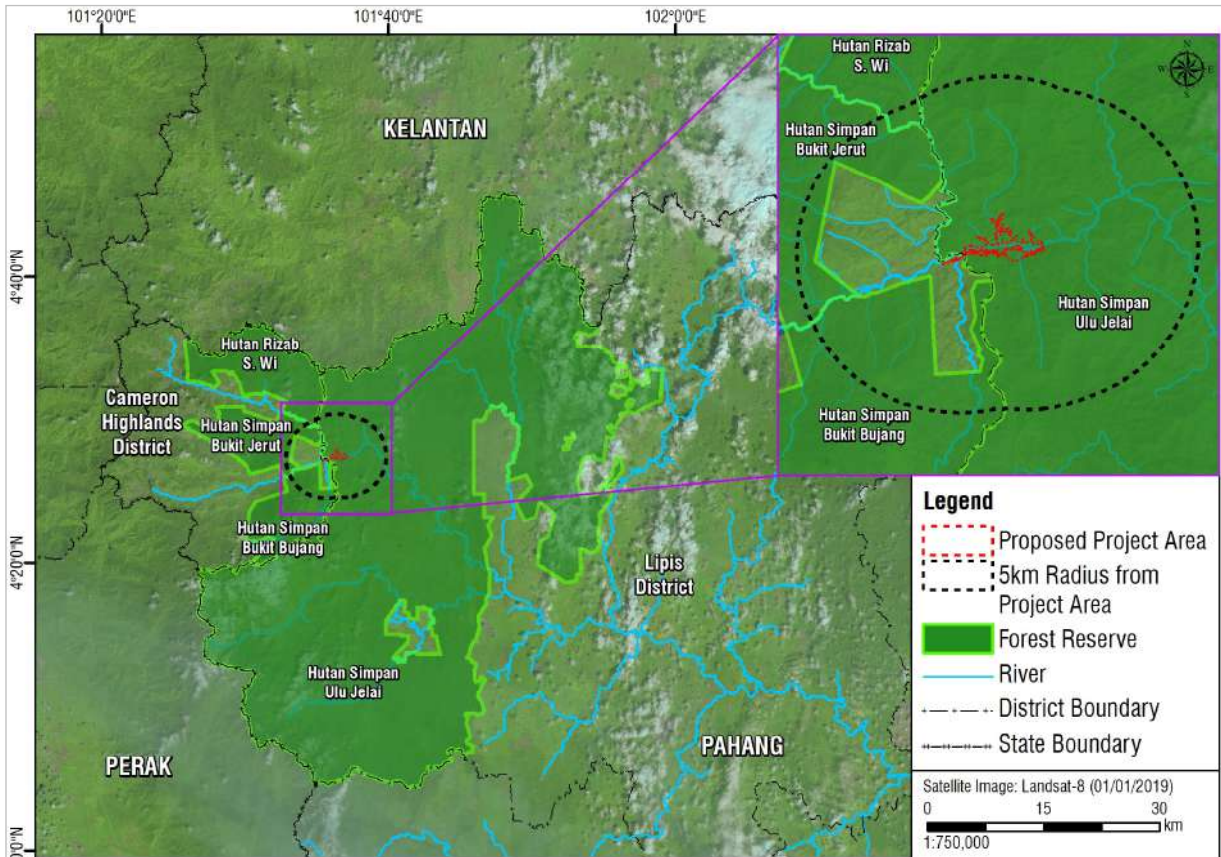
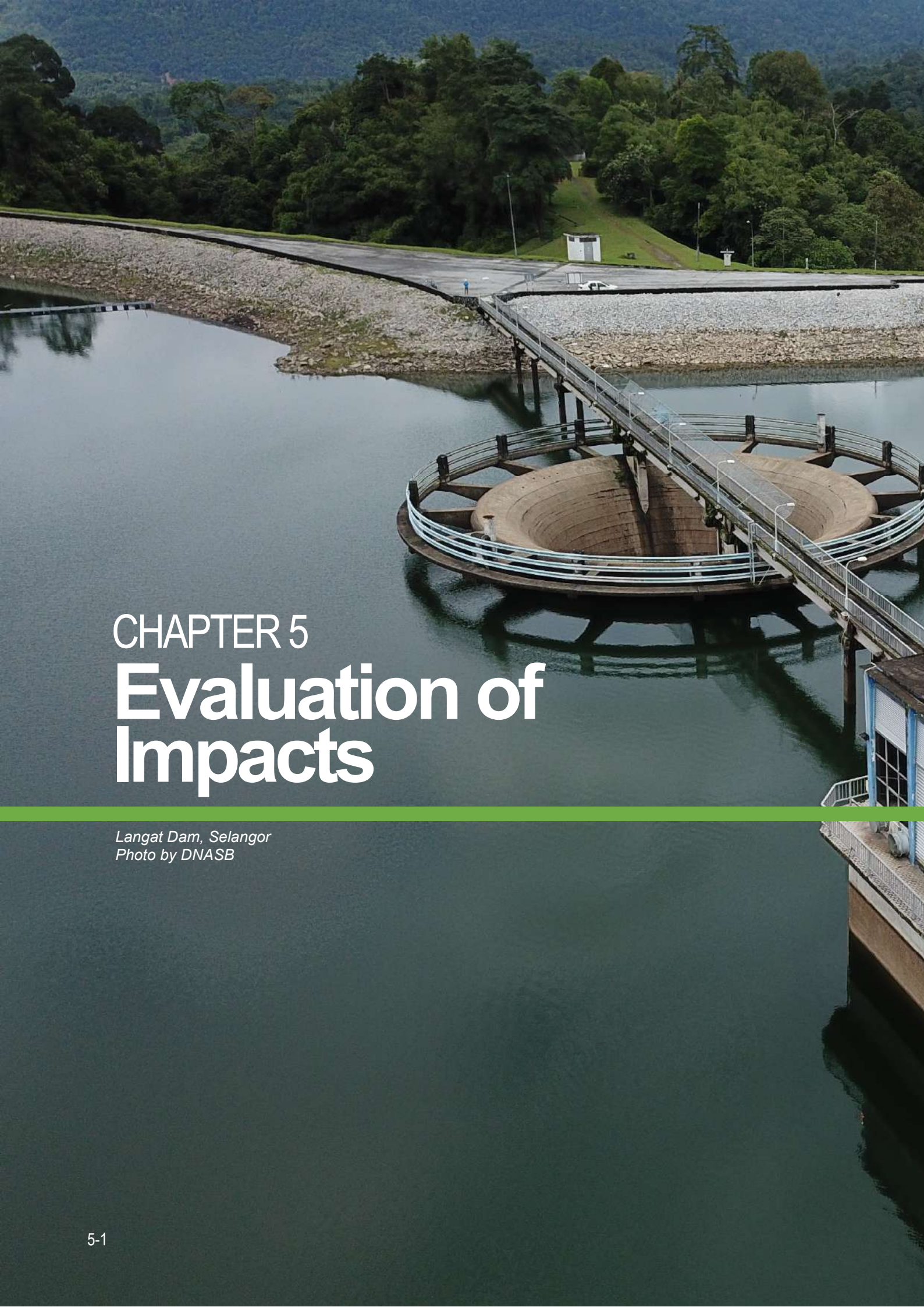


FIGURE 4.2 Example of ESAs identified at a project site

TABLE 4.6 Example of ESAs and its details

ESA RANK	CATEGORY	LOCATION	NEAREST DISTANCE FROM PROJECT BOUNDARY (KM)	SOURCE
1	Forest Reserve	<i>Hutan Simpan Kekal Ulu Jelai, Pahang</i>	Within the Forest Reserve	<ul style="list-style-type: none"> ■ Department of Mapping and Survey (JUPEM), Topographic Map No. 3762 (1993) ■ NPP-3 (PLANMalaysia, 2016) ■ <i>Katalog Metadata Geospasial</i> (FDPM, 2011)
		<i>Hutan Rizab/Hutan Simpan Kekal Bukit Jerut</i>	2.0	<ul style="list-style-type: none"> ■ NPP-3 (PLANMalaysia, 2016) ■ <i>Katalog Metadata Geospasial</i> (FDPM, 2011)
		<i>Hutan Simpan Kekal Bukit Bujang</i>	1.0	<ul style="list-style-type: none"> ■ NPP-2 (PLANMalaysia, 2010) ■ <i>Katalog Metadata Geospasial</i> (FDPM, 2011)



CHAPTER 5 Evaluation of Impacts

*Langat Dam, Selangor
Photo by DNASB*



5.1 INTRODUCTION

There are many methods to predict and evaluate environmental impacts. Generally, all of these methods will assess the impacts of the project against the existing environment (status quo). These impacts are predicted to be caused by project activities during different stages of the project's implementation.

The predictions and evaluations are made through quantitative or qualitative or even both methods.

QUANTITATIVE METHOD is based on the measurement of quantity or amount via numerical tools such as modelling. The result of this method is usually a number or a set of numbers.

QUALITATIVE METHOD involves quality where the results are expressed in words; for example, significant, insignificant, temporary, permanent, high, medium or low. Hence, qualitative methods can be used to understand the meaning of the numbers obtained from quantitative methods.

5 EVALUATION OF IMPACTS

While there is no specific method that fits all requirements, the predictive and assessment method chosen must have at least the following attributes:

- i) established and proven methods and models;
- ii) adequate, accurate and up-to-date data for assessment;
- iii) results can be replicated and are reproducible by independent evaluators; and
- iv) cost-effective and, for any software, can be easily purchased (propriety software and tools can also be used). Widely accepted freeware is acceptable.

It is up to the Qualified Person 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 addressed in detail in the EIA study. Issues that are not significant shall only be addressed qualitatively.

5.2 PREDICTION OF ENVIRONMENTAL IMPACTS

There are various methodologies that can be used for prediction, evaluation and assessment of impacts. Simple methodology is preferred, though this depends on the complexity of the impacts. Whichever method is chosen, it must be appropriate to address the problem, taking into consideration the local conditions of the site.

The EIA report must be scientifically and technically sound and, whenever necessary, quantitative impact prediction on the more significant impacts should be carried out. If computer modeling is carried out (water quality, flooding, etc.), the following information is required:

- i) name and description of method/model;
- ii) model set-up;
- iii) data collection and analysis;
- iv) calibration and validation;
- v) details of scenarios for modelling;
- vi) presentation of results (raw data, table form, graphs); and
- vii) limitations in data collection or method chosen.

All modeling exercises carried out shall capture the impacts under various scenarios, either for short or long-term or for the worst-case scenario. The outputs of the modelling studies shall be presented in a concise manner and all uncertainties shall be discussed.

Methods and tools that can be employed:

1. Expert opinion
2. Consultation and questionnaires
3. Checklists
4. Spatial analysis
5. Network and system analysis
6. Matrices
7. Carrying capacity analysis
8. Mathematical and computer modeling
9. Case studies

Necessary technical report, data analysis, tables and raw data shall be included as 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 studies, which have to be written in a manner that is easily understood by decision makers and the public.

5.3 EVALUATION OF ENVIRONMENTAL IMPACTS

Evaluation is the stage of an EIA where predicted adverse impacts are judged as to their significance. The latter determines the level of mitigation necessary to bring the impacts to acceptable levels.

The judgement of significance can be based on one or more factors, depending on the environmental component being evaluated (Figure 5.1).

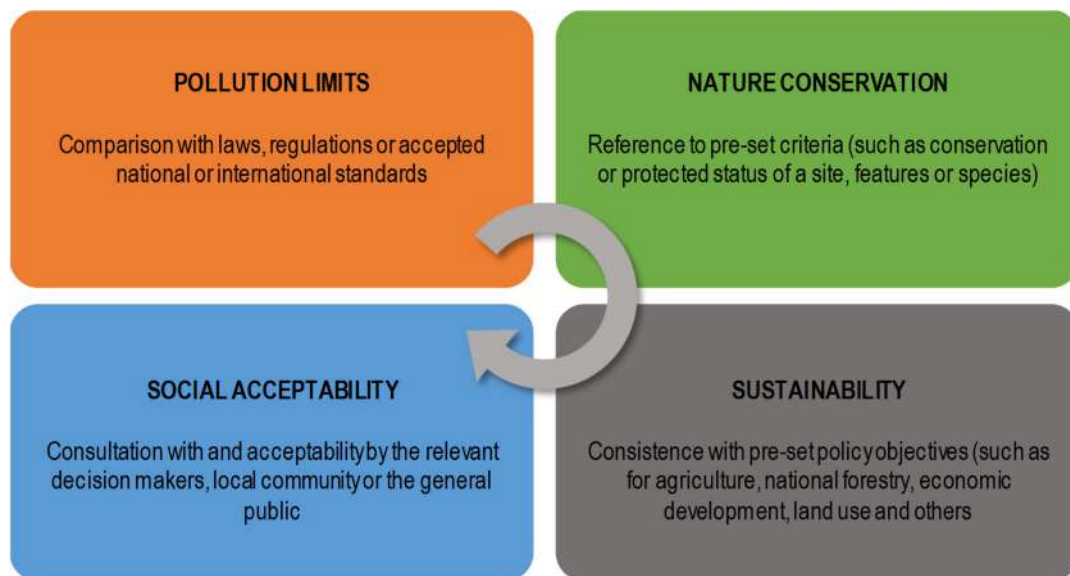


FIGURE 5.1 Components to be considered in impacts evaluation

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

- i) scale of the project (land area, total disturbed areas, etc.);
- ii) intensity of development (total land clearing, phasing of land clearing);
- iii) potential pollution sources from the project;
- iv) magnitude and complexity of impacts (quantitative or qualitative assessment and longevity of the impact (residual impact));
- v) area of impacts (localised, transboundary, upstream, downstream);
- vi) probability of cumulative impacts (effects of project on adjacent land areas and *vice versa*); and
- vii) sensitivity of nearby receptors e.g. ESA.

Table 5.1 summarises the major evaluation of impacts and the expected output based on the typical significant components of a dam project.

5 EVALUATION OF IMPACTS

TABLE 5.1 Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Erosion and sedimentation	<p>Construction Stage</p> <ul style="list-style-type: none"> ■ Land disturbing activities ■ Pollutants of concern: TSS and turbidity 	<ul style="list-style-type: none"> ■ Assessment of land clearing scale to determine rate of erosion ■ Assessment of the conditions of the hydrological and drainage system ■ Assessment of the extent of erosion and sedimentation ■ Determination of suitable BMP
Hydrology and Hydraulic	<p>Construction Stage</p> <p>Land disturbing activities e.g. site clearing, cut and fill</p>	<ul style="list-style-type: none"> ■ Assessment of land clearing scale and alterations to hydrological and drainage characteristics of the site ■ Determine the scale of drainage system that may be altered ■ Evaluation of hydrological condition before and after project implementation ■ Determination of impacts to the downstream ■ Determination of environmental flow setting
	<p>Operation Stage</p> <p>Potential dam break flood to downstream people, property and environment</p>	<p>Determination of impacts to the downstream and its surrounding area (people, property and environment)</p>
Climate	<p>Operation Stage</p> <ul style="list-style-type: none"> ■ Site clearing, removing vegetation in impounded areas, access road, etc. ■ Presence of water body. 	<ul style="list-style-type: none"> ■ Loss of carbon sink due to forest clearance ■ Changes of micro climate due to the presence of reservoir.

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

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
<ul style="list-style-type: none"> ■ Revised Universal Soil Loss Equation (RUSLE) ■ Modified Universal Soil Loss Equation (MUSLE) ■ Computer models <p>Output</p> <ul style="list-style-type: none"> ■ Soil loss rates and sediment yields ■ Erosion risk and potential soil loss maps 	<ul style="list-style-type: none"> ■ Calculate the rate of erosion and sediment yield using standard formulae and site-specific information ■ Provide erosion scenarios i.e. with and without mitigation measures ■ Run simulation to determine the BMPs that shall be adopted to minimise negative impacts 	<ul style="list-style-type: none"> ■ Adoption of avoidance principles ■ Identify suitable BMP to be incorporated in the land-disturbing pollution prevention and mitigation measures (LD-P2M2)
<ul style="list-style-type: none"> ■ Hydrological Procedures (DID) ■ Numerical models for estimating peak flood, runoff, watershed analysis, flood plain hydraulics, etc. Examples include free domain software e.g. HEC-HMS, HEC-RAS and commercial software e.g. MIKE-SHE, MIKE11, InfoWorks ICM and Storm Water Management Model (SWMM) ■ Hydrological analysis in accordance with Hydrological Procedures and approved by DID ■ Hydrological analysis taking into account weather extremity due to climate change (rainfall pattern) <p>Output</p> <ul style="list-style-type: none"> ■ Estimation of pre-construction and post-construction runoff ■ Flood map (flood risk map, flood hazard map, flood evacuation map) ■ Environmental flow analysis (upstream and downstream) 	<ul style="list-style-type: none"> ■ Delineate the river basins or systems that are affected ■ Collect hydrological data and assess long-term rainfall trends ■ Use mathematical or simulation models to ascertain the different hydrological condition pre and post project implementation 	<p>Hydrological and drainage systems of the project and the impact on the surrounding as input to the technical and engineering works</p>
<p>Numerical models for dam break modeling such as MIKE FLOOD, InfoWorks ICM, HEC-RAS, TREX model</p> <p>Output</p> <ul style="list-style-type: none"> ■ Dam breach hydrograph ■ Dam break modeling ■ Flood inundation map ■ Estimate dam break parameters and formulate failure mechanism. Examples include rainy day failure, clear day failure, and earthquake failure 	<p>Determine the ultimate discharge from a hypothetical breach of the dam</p>	<p>Flood peak or flood wave immediately downstream from the dam</p>
<ul style="list-style-type: none"> ■ The Greenhouse Gas Protocol (GHG Protocol) of the World Resources Institute (WRI) ■ The technical reports and methodology guidelines of the Intergovernmental Panel on Climate Change (IPCC) <p>Output</p> <p>Estimation of pre-construction and post-construction carbon sink</p>	<ul style="list-style-type: none"> ■ Determine loss of carbon sink due to vegetation clearance ■ Determine potential carbon sink of aquatic vegetation (microphyte) in the water body 	<p>Identify potential environmental measures to offset the loss of carbon sink</p>

5 EVALUATION OF IMPACTS

TABLE 5.1 (cont'd) Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Ecology	<p>Construction Stage Land disturbing activities e.g. site clearing, construction of access road</p>	<ul style="list-style-type: none"> ■ Mapping of important habitats and ESA ■ Inventory of existing flora and fauna ■ Identification of critical species ■ Recommendation of mitigation measures for flora and fauna that need relocation or protection
Water quality	<p>Construction Stage</p> <ul style="list-style-type: none"> ■ Land disturbing activities (parameters of concern; TSS and turbidity) ■ Sewage discharge from on-site workers quarters (parameters of concern; DO, BOD, ammoniacal nitrogen) 	<ul style="list-style-type: none"> ■ Assessment of types and scale of impairment to water quality ■ Determination of potential sources of pollutants e.g. land clearing, biomass degradation, etc.
Air quality	<p>Construction Stage Vehicles movement and machineries operation</p>	Identify potential air pollution generating sources
Noise	<p>Construction Stage</p> <ul style="list-style-type: none"> ■ Piling activities ■ Vehicles movement and machineries operation 	Assessment of ambient noise environment and activities that pose impairment hazards to the workers and nearby sensitive receptors

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

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
<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 <p>Output</p> <ul style="list-style-type: none"> ■ Habitat map ■ Species inventory, especially of rare, endangered, threatened and near extinct species that may require protection 	<ul style="list-style-type: none"> ■ Determine the level of encroachment into ESA ■ Indication of possible loss of habitat and its flora and fauna ■ Identify project activities that could disturb animal behaviour ■ Forest fragmentation and its consequences ■ Increase in poaching and roadkill ■ Impacts from increased human-wildlife conflict (HWC) 	<ul style="list-style-type: none"> ■ Highlight important area to be protected ■ Identification of critical areas for mitigation measures ■ Develop wildlife management plan
<ul style="list-style-type: none"> ■ Mathematical models (one, two or three-dimensional) analysis of pollution loads and dispersion in the waterways e.g. QUAL2K, MIKE11, PLOAD, TSI, etc. ■ Simple mass balance models e.g. Streeter-Phelps Model <p>Output</p> <ul style="list-style-type: none"> ■ Estimation of pollutant concentration affecting a stretch of river and downstream sensitive areas ■ Estimation of pollutant load and extent of effect on sensitive receptors 	<ul style="list-style-type: none"> ■ Determine pollutant loading via variety of models and determine the magnitude and extent of impacts further downstream ■ Identify potential water polluting sources ■ Identify and determine users and sensitive habitat located downstream 	<p>Identify suitable BMP and treatment system</p>
<p>Gaussian plume dispersion model to assess dust generation over an area under the worst-case scenario</p> <p>Output</p> <ul style="list-style-type: none"> ■ Dispersion contour map indicating levels at sensitive receptors ■ Comparison of computed values with the New Malaysia Ambient Air Quality Standard ■ Determination of location of maximum air pollution concentration 	<p>Assess the level of pollutants pre and post development for major sensitive receptors. If necessary, air quality models shall be used</p>	<ul style="list-style-type: none"> ■ Identify the extent of potential impacts to nearby sensitive receptors ■ Critical levels for pollutant at sensitive receptors shall be identified and mitigated
<ul style="list-style-type: none"> ■ Mathematical models to assess noise levels for point source or linear sources ■ Noise modeling software, e.g. SoundPlan, CadNa or Geographic Information System (GIS) acoustic models ■ Traffic noise models <p>Output</p> <ul style="list-style-type: none"> ■ Quantitative values for noise level at sensitive receptors ■ Noise contour map indicating levels at sensitive areas ■ Comparison of computed values to DOE's permissible noise limits 	<p>Model or calculate the increase in noise level, mapped as noise contours</p>	<ul style="list-style-type: none"> ■ Identify the extent of potential impacts to nearby sensitive receptors ■ Critical levels for pollutant at sensitive receptors shall be identified and mitigated

5 EVALUATION OF IMPACTS

TABLE 5.1 (cont'd) Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Land use and aesthetic	<p><u>Construction Stage</u></p> <ul style="list-style-type: none"> ■ Land disturbing activities e.g. site clearing ■ Construction of buildings 	<ul style="list-style-type: none"> ■ Assessment of the compatibility of the project towards the surrounding land use ■ Determination of the adequacy of buffer as per structure plan, local plan or any other guidelines
Geotechnical hazards	<p><u>Construction Stage</u></p> <ul style="list-style-type: none"> ■ Slope cutting ■ Piling activities 	<ul style="list-style-type: none"> ■ Assessment of areas of the project site and its surroundings for risk. For example, slope failure, erosion, landslides, seismic activities, etc. ■ Determination of the adequacy of buffer to avoid or reduce risk of hazards to the project area ■ Identification of suitable engineering and geotechnical measures required to ensure that hazards are fully addressed
Social	<p><u>Planning Stage</u></p> <ul style="list-style-type: none"> ■ Relocation of settlements <p><u>Construction Stage</u></p> <ul style="list-style-type: none"> ■ Employment opportunities ■ Social conflict between foreigners and locals ■ Nuisance from construction activities; noise and dust 	<ul style="list-style-type: none"> ■ Determine whether there is land and property acquisition and relocation of communities ■ Assessment of extent of impacts, both negative (dust, noise, pollution, hazards, etc.) and positive (job and business opportunities) ■ Assessment of the views and perception of the affected stakeholders
Traffic	<p><u>Construction Stage</u></p> <p>Movement of trucks carrying construction materials</p>	<ul style="list-style-type: none"> ■ Description on traffic arrangement during construction ■ Identification of the need for mitigation measures

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

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
<p>1. Land use</p> <ul style="list-style-type: none"> ■ Compatibility assessment based on structure plan, local plan and other guidelines ■ Adherence to required setback based on national and state guidelines <p>Output Land use compatibility and buffer requirements</p> <p>2. Aesthetic</p> <ul style="list-style-type: none"> ■ Visual assessment on scenic and aesthetic value of the area ■ 2-D and 3-D viewshed analysis <p>Output Before and after project</p>	<ul style="list-style-type: none"> ■ Identify the designated land use of the project site as per the spatial plan ■ Evaluate the suitability of the project on the surrounding development 	<ul style="list-style-type: none"> ■ Determine the suitability of the project on the designated site ■ Highlight possible land use conflict that may arise
<ul style="list-style-type: none"> ■ Soil investigations (SI) ■ Geological Terrain Mapping (GTM) ■ Site assessment by qualified geotechnical engineer and/or geologist ■ Risk analysis ■ Engineering design and estimation of Factor of Safety (FOS) <p>Output Identification and mapping of high risk areas to avoid or to apply mitigation measures</p>	<ul style="list-style-type: none"> ■ Develop risk map and determine FOS for all engineered slopes and hazard areas ■ Assess the impact and extent of damages/losses in the event of slope failure and sensitive receptors that may be affected. ■ Determine areas in need of mitigation measures or engineering solutions to reduce risk 	<ul style="list-style-type: none"> ■ Hazard areas shall be clearly mapped out as part of the GTM to determine construction suitability ■ Areas of high risks shall be avoided being built upon or with adequate geotechnical and engineering measures being proposed ■ Monitoring programme for slopes
<ul style="list-style-type: none"> ■ Social and economic surveys on affected population ■ Perception survey to ascertain acceptance of project ■ SIA <p>Output</p> <ul style="list-style-type: none"> ■ Socio-economic profiling ■ Public opinion survey results ■ Stakeholder feedback for EIA including possible mitigation measures 	<ul style="list-style-type: none"> ■ Identify the extent of land acquisition and affected stakeholders ■ Delineate the survey catchment and determine statistically the number of surveys required ■ Evaluation to focus on communities within the ZOS. If there is a need, those in ZOI shall also be assessed ■ Main findings from SIA shall be incorporated 	<p>Land and property acquisition and relocation of communities must first be settled prior to EIA commissioning and submission</p>
<ul style="list-style-type: none"> ■ Traffic impact assessment, e.g. peak traffic flow, junction analysis ■ Simulation using SIDRA <p>Output Comparison of traffic scenarios pre, during and post project and need for road improvement</p>	<ul style="list-style-type: none"> ■ Review and incorporate main findings from TIA into the EIA ■ Main impact elements are communities living along the logistic road during construction 	<ul style="list-style-type: none"> ■ Identification of potential issues during construction and incorporation of structural and non-structural measures ■ Identification of risk factors

5 EVALUATION OF IMPACTS

TABLE 5.1 (cont'd) Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Waste management	<p><u>Construction Stage</u></p> <ul style="list-style-type: none"> ■ Land disturbing activities e.g. site clearing ■ Construction activities <p><u>Operation Stage</u> Domestic waste from workers</p>	<ul style="list-style-type: none"> ■ Identify types of waste generated during construction and operations and the impacts ■ Assessment of the impacts from these wastes and the required management measures
Safety and health	<p><u>Construction Stage</u> Hazard from construction activities</p>	Assessment of safety and health towards workers and nearby population
Infrastructure and utilities	NA	Description of existing infrastructure and utilities such as road, power supply, water supply and telecommunication

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

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
<p>1. Scheduled Waste Identification of potential scheduled waste generation during construction and operations based on project activities</p> <p>Output Predicted scheduled waste generation</p> <p>2. Domestic Waste Waste generation estimation based on population</p> <p>Output Predicted waste generation</p> <p>3. Biomass Estimation on total biomass based on vegetation types and published studies values</p> <p>Output Predicted biomass waste generation</p>	<ul style="list-style-type: none"> ■ Identify and estimate the quantum of all waste sources ■ Assess the severity of impacts from improper management ■ Identify locations of temporary storage within the site ■ Identify locations for disposal site 	<ul style="list-style-type: none"> ■ Identification of proper temporary disposal sites and storage facilities ■ Develop mitigation measures against spillage and other impacts ■ Mitigation measures to be incorporated into project site management
<p>1. Health Qualitative/Quantitative Health Risk Assessment (HRA) encompassing hazard identification, exposure assessment and risk characterisation</p> <p>Output Potential health impacts to nearby population</p> <p>2. Safety (Risk and Hazard) Qualitative/Quantitative risk assessment (QRA) encompassing hazard identification, exposure assessment and risk characterisation</p> <p>Output Potential risk and hazard during construction and operation stages to construction workers and nearby population</p>	<ul style="list-style-type: none"> ■ Determine the level of risk to neighbouring receptors ■ Identify the existing health conditions of receptors ■ Assess the possible impacts on workers' safety and health during construction stage ■ If necessary, use risk assessment models to ascertain the level of risk 	<ul style="list-style-type: none"> ■ Determine the qualitative/quantitative risk to receptors to identify appropriate BMP ■ Findings from HIA can also provide possible preventive and mitigation measures
<ul style="list-style-type: none"> ■ Existing demand estimation methods by regulators e.g. population equivalent calculations ■ Comparison of existing supply to meet future demand to determine adequacy <p>Output Estimates of demand</p>	NA	NA

5.4 ENVIRONMENTAL CRITERIA AND STANDARDS

The method to determine the level of significant impact is to compare the results against the stipulated current criteria and standard limits imposed by the DOE and/or various GAs. The environmental criteria and standards are provided in *Attachment 3 to Attachment 8*.

In cases where there are no local standards or limits, regional and international limits and adherence levels can be adopted based on expert opinion of the Qualified Person. However, the chosen criteria and standards must be relevant and applicable to local conditions.

Table 5.2 lists the evaluation of criteria and standards for environmental parameters.

TABLE 5.2 Examples of criteria and standards for environmental parameters

IMPACTS	EVALUATION CRITERIA
Erosion and sedimentation	<p>Guidance documents</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 LD-P2M2 (DOE, 2016) ■ Guidelines for Erosion and Sediment Control in Malaysia (DID,2010) ■ Manual Saliran Mesra Alam Edisi-2 (MSMA-2) (DID,2012) <p>Sediment basin/silt trap discharge</p> <ul style="list-style-type: none"> ■ TSS: 50 mg/L or depending on locality ■ Turbidity: 250 NTU or depending on locality <p>Silt curtain</p> <ul style="list-style-type: none"> ■ TSS: Shall be based on limit stated in MMWQS or depending on locality ■ Turbidity: 250 NTU or depending on locality
Air quality	<ul style="list-style-type: none"> ■ Environmental Quality (Clean Air) Regulations 2014 ■ New Malaysia Ambient Air Quality Standard (DOE, 2013)
Water quality and pollution control	<ul style="list-style-type: none"> ■ Ambient water quality: NWQS ■ Ambient marine/brackish water quality: MMWQS ■ Lake water quality: NLWQS ■ Groundwater quality: National Groundwater Quality Standards ■ Sewage discharge: Environmental Quality (Sewage) Regulations 2009 ■ Toilet and septic tanks: Design and requirements approved by SPAN ■ Vessels: The International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78) and MarDep requirements

Note: The list is not exhaustive and not all of the above may be relevant to the project. The Project Proponent and Qualified Person shall make reference to the latest standards and requirements by the authorities.

TABLE 5.2 (cont'd) Examples of criteria and standards for environmental

IMPACTS	EVALUATION CRITERIA
Noise level	<ul style="list-style-type: none"> ■ The Planning Guidelines for Environmental Noise Limit and Control (DOE, 2019) ■ Factories and Machinery (Noise Exposure) Regulations 1989
Vibration	<ul style="list-style-type: none"> ■ The Planning Guidelines for Vibration Limits and Control in the Environment (DOE, 2007) ■ JMG requirements for blasting operations
Flood/run-off management	MSMA-2 requirements
Ecology	<ul style="list-style-type: none"> ■ IUCN and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) listing ■ Wildlife Conservation Act 2010 ■ Feedback from DOF, DWNP and FDP
Land use	<ul style="list-style-type: none"> ■ Structure Plans, Local Plans, Special Area Plans (RKK) ■ ESAs ■ Environmental Essentials for Siting of Industries in Malaysia (EESIM) (DOE, 2017) ■ Guidelines for Siting and Zoning of Industry and Residential Areas (SZIRA) (DOE, 2012) ■ Local authority requirements
Land traffic	<ul style="list-style-type: none"> ■ Acceptable level of service (LOS) for traffic flows ■ Local authority/PWD requirements
Safety health	<ul style="list-style-type: none"> ■ MyDAMS (DID, 2017) ■ Occupational Safety and Health Act 1994 ■ Factory and Machinery Act 1967 ■ Department of Occupational Safety and Health (DOSH) ■ Guidance Document on HIA in EIA (DOE, 2009) ■ EIA Guidelines for Risk Assessment (DOE, 2009)
Socio-economic	<ul style="list-style-type: none"> ■ Public perception on acceptability ■ National Heritage Register (National Heritage Department) ■ Preservation of cultural, heritage, historical and archaeological items and sites of significance ■ SIA requirements in the context of the Town and Country Planning Act (Amendment) 2017 (Act A1522)
Waste management	<p>Scheduled wastes</p> <ul style="list-style-type: none"> ■ Environmental Quality (Scheduled Wastes) Regulations 2005 <p>Other wastes</p> <ul style="list-style-type: none"> ■ Solid Waste and Public Cleansing Management Act 2007 ■ Local authority requirements <p>Solid and Scheduled Wastes from vessels</p> <ul style="list-style-type: none"> ■ The International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78) ■ MarDep requirements
Visual aesthetics	Public perception on acceptability

Note: The list is not exhaustive and not all of the above may be relevant to the project. The Project Proponent and Qualified Person shall make reference to the latest standards and requirements by the authorities.

5.5 ECONOMIC VALUATION OF ENVIRONMENTAL IMPACTS (EVEI)

Due to the substantial capital investment, the proposed project is expected to provide substantial economic and business opportunities to market participants. However, the construction and operation of the proposed project are also likely to cause some negative environmental impacts that must be mitigated as required by law, besides going through the EIA approval process.

The objective of the EVEI is to quantify and monetize the impacts of the proposed project on the flow of environmental services. This requires valuation in monetary terms of the changes (both negative and positive if any) in environmental services arising from project implementation over an assessment period of 50 years.

A critical step in the valuation process revolves around the need to ensure valid attribution of impacts on environmental services to the proposed project. In order to satisfy this requirement, physical environmental impacts that can reasonably be attributable to the proposed project must first be demonstrated. In other words, the approach requires the establishment of a clear link between project impacts on the physical functions of the environment and the alteration of the quality and quantity of streams of environmental goods and services. The Guidelines on the Economic Valuation of the Environmental Impacts for EIA Projects (DOE,2008) is very clear in this regards where it specifies that:

“... a key issue is to identify and quantify the changes in the flow of goods and services produced by the environment which are impacted by a development project, and then to monetize these changes into costs or benefits”

The valuation process can be divided into nine distinct steps, as follows:

- **Step 1: Identify the project stakeholders**
The stakeholders are determined by establishing clear links between the degradation in environmental services to the impacted parties.
- **Step 2: Define the “with project” and “without project” scenario**
A contrast is considered under the “with” and “without” project scenarios, as opposed to “before” and “after” scenarios. It involves the conceptualization of the “with” and “without” project scenarios. For the current project under evaluation, the “with Project” scenario is defined as the situation where the project is implemented. The “without Project” scenario is depicted as the situation in which the proposed project is not implemented i.e. maintenance of the status quo.
- **Step 3: Describe the physical impacts**
A listing of potential physical impacts of the project that can be reliably attributed to the project is prepared and described by focusing on the physical extent of the impact and the link between the project and its impact on the flow of environmental services.
- **Step 4: Quantify the impacts on the environment over the duration of the project**
The physical impacts of the project on the environment is explained and quantified via scientific assessments of the study team that include among others marine biologists, air and water quality specialists, hydraulic specialist, etc.
- **Step 5: Monetize the impacts**
The quantified impacts produced in Step 4 are monetized using market and non-market valuation techniques. Value parameters of similar environmental services obtained in other studies are used as reference points for evaluation.
- **Step 6: Discounting**
Costs and benefits over time (25 years) are discounted to present values using several discount rates (4, 6 and 8%). 25 years is typically used as the standard period of evaluation since the present value of future benefits/costs beyond 50 years tend to become quantitatively insignificant.

- **Step 7: Determine the Net Present Value**
The net present value is computed in this step by adding up the discounted values of the losses and gains in environmental services.
- **Step 8: Perform sensitivity analysis**
Sensitivity test is conducted for different discount rates to demonstrate the impact of variation in rates on the net present value of the environmental costs and benefits.
- **Step 9: Make a recommendation**
An overall assessment is made based on the magnitude of Net Present Values at different levels of discount rates.

5.6 ENVIRONMENTAL TRADE-OFFS

Trade-off can be defined when components of a system are competing with or exclusive of each other. In short, trade-offs can be said as a win-lose situation. It implies a decision to be made with full comprehension of both the upside and downside of a particular choice.

In environmental terms, trade-offs occur when the provision of services from a particular ecosystem or environmental component is reduced as a consequence of development. In short, any environmental impacts that cannot be sufficiently mitigated are considered as trade-offs.

Managing environmental trade-offs is important in achieving the goal of sustainable development. Sustainability can only be attained by providing equal emphasis on the relation between three major components as illustrated in *Figure 5.2*.

New developments are normally related to the:

- i) advancement of economic components; and
- ii) customarily thought to impede on the environmental components.

The outcome from this reaction will have both positive and negative impacts on the social components.

It is imperative for the Project Proponent to carefully deliberate the interweaving of these components so that:

- i) the environmental trade-off can be strongly justified and appropriately managed; and
- ii) the proposed new development will be beneficial in terms of socio-economy as well as spurring the progress of the county.

Acknowledging that most EIA projects will cause some sort of environmental trade-off does not mean there are no alternative ways in mitigating the impacts. One of the tangible ways in addressing environmental trade-offs is by conducting environmental offset, which shall be discussed in **Chapter 6**.

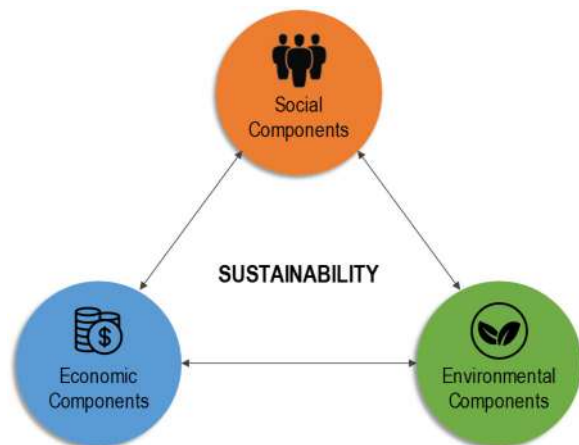



FIGURE 5.2 Major sustainability components

An aerial photograph of the Sungai Labu Dam in Negeri Sembilan, Malaysia. The dam is a long, low concrete structure across a wide river. In the foreground, a large array of solar panels is mounted on a floating platform in the water, connected to a small building on the shore by a concrete walkway. The background shows a lush green landscape with hills and some buildings under a cloudy sky.

CHAPTER 6 Mitigation Measures

*Sungai Labu Dam, Negeri Sembilan
Photo by DNASB*

An aerial photograph of a large reservoir or dam. The water is a calm, light greenish-grey color. In the foreground, there's a concrete dam structure with a road on top. To the left, there's a small white building with a dark roof. The background shows a lush green landscape with hills and some residential buildings under a cloudy sky.

6.1 INTRODUCTION

Pollution prevention and mitigation measure (P2M2) is the stage to determine applicable preventive, remedial or compensatory measures for each of the adverse impacts that have been evaluated as being significant. The mitigation measures provided in this chapter shall serve as a guide only.

The objectives of P2M2:

1. Avoidance of negative impacts through selection of alternatives to implement the preventive measures.
2. When an impact cannot be avoided to adopt relevant mitigation measures to minimise the impacts.
3. Enhance and amplify the beneficial impacts.
4. Ensure that residual impact are kept within acceptable levels.

6.1.1 General Approaches

The key objectives of implementing P2M2s are to reduce environmental degradation and pollution through management measures that best suited to the site conditions. The P2M2s implementation include:

- i) The need and extend of P2M2s required shall correspond to the significance of the predicted impact:
 - a) for significant issue, P2M2s must be identified and elaborated in the EIA. Example: for and from engineering design and calculations for slope reinforcement works on cut slopes; and
 - b) for minor issue, management actions and simple measures need only be highlighted. Example: need for water browsing for dust control at site during construction.
- ii) Priority shall be on control at source and rectifying the impacts;
- iii) Solutions shall be project-specific and designed for the site conditions;
- iv) The P2M2s shall not be complex and costly, but instead be practical, easy to implement and effective;
- v) The explanation on the design and function of P2M2s shall be supported by diagrams, illustrations, photos and maps. The technical reports and specifications shall be attached in the EIA as appendix;
- vi) The use of new technology is encouraged if it can be proved to be effective. The Project Proponent or the Qualified Person is responsible to provide supporting document that the proposed technology is tried and tested and able to mitigate the impacts;

- vii) The proposed P2M2s require regular inspection, maintenance and rehabilitation and shall be incorporated as part of the management requirements of the project as addressed in *Section 7.5.2* of **Chapter 7**; and
- viii) Effectiveness of the P2M2s shall be documented and this is through implementation of a monitoring programme.

The Qualified Person shall also identify and propose Best Management Practices (BMPs) based on the findings of the EIA. The P2M2s and BMPs shall be incorporated into the overall design of the project. It is recommended that alternative measures and/or introduce newer technology which have been proven effective.

The submission of the EIA and the pledge agreed by the Project Proponent shall reflect the agreement and commitment towards ensuring implementation of the P2M2s and BMPs on-site during all stages of work.

6.2 POLLUTION PREVENTION AND MITIGATION MEASURES

The applicable P2M2s for construction of dam projects are listed in *Table 6.1*.

TABLE 6.1 P2M2 for construction of a dam project

ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACT	POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)
PRE-CONSTRUCTION STAGE		
Socio economic	Relocation of those living within the proposed inundation area	Project Proponent must continuously engage with local leaders and government agencies such as JAKOA and local authority.
Noise and vibration	Noise disturbance due to seismic study during field investigation	<ul style="list-style-type: none"> ■ The field investigation must be done during normal working hours only ■ Early notification must be made to the locals prior to field investigation
Geology and geotechnics	Potential of slope erosion due to drilling activity during field investigation	Good practise during field investigation must be applied at all times
Anthropology	Anxiety among the villagers and Orang Asli	Project Proponent must continuously engage with local leaders and government agencies such as JAKOA and local authority
LAND CLEARING/LOGGING STAGE		
Air quality	<ul style="list-style-type: none"> ■ Suspension of dust and particulate matter ■ Exhaust emission 	<ul style="list-style-type: none"> ■ Water spraying must be carried out periodically for suppressing dust during dry period ■ Wash through must be provided at each entrance of the site construction
Noise and vibration	Noise disturbance due to frequent movement of large vehicles	<ul style="list-style-type: none"> ■ Perimeter hoarding to reduce noise propagation ■ Regular maintenance for vehicle and machinery ■ PPE for workers ■ Establish grievance mechanisms for disturbance complaints
Water quality	<ul style="list-style-type: none"> ■ Increase in turbidity and suspended solids levels in river water ■ River water contamination ■ Sedimentation due to soil erosion ■ Increase in organic pollution ■ Sewage from workers camp 	<p>Prepare and implement LD-P2M2. Further details are provided in <i>Section 6.3</i> of the Chapter 6.</p> <p>Wastewater Discharge</p> <ul style="list-style-type: none"> ■ Septic tank and toilet facility at base camp as per National Water Services Commission (SPAN) requirements ■ Sewage discharge to meets the limit of Environmental Quality (Sewage) Regulations 2009 ■ Proper desludging and other maintenance works on the sewage treatment system ■ Installation of oil and grease traps
Hydrology	<ul style="list-style-type: none"> ■ Runoff and flash flood ■ Degradation of river capacity 	Prepare and implement LD-P2M2. Further details are provided in <i>Section 6.3</i> of the Chapter 6

6 MITIGATION MEASURES

TABLE 6.1 (cont'd) P2M2 for construction of a dam project

ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACT	POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)
LAND CLEARING/LOGGING STAGE (cont'd)		
Soil erosion	Slope erosion	<ul style="list-style-type: none"> ■ Adequate buffer zone/setback ■ Slope benching with appropriate protection measures (runoff and erosion control) ■ Geotechnical measures for identified hazard areas ■ Periodical monitoring and maintenance of the slopes
Geology and geotechnics	Slope failures	Construction should follow the design specifications to minimise the impact on soil and rock stability
Waste management	Biomass management	Biomass not taken out and left on site must be piled as rip-rap across slopes, erosion control barrier
Archaeology	Damage the archaeology sites	<ul style="list-style-type: none"> ■ Survey and excavation must be arranged and carried out before logging or land clearing works start ■ Project Proponent must work closely with Jabatan Warisan Negara and any other relevant agencies
Terrestrial flora	Loss of habitat and biodiversity	Reforestation plan
Terrestrial fauna	<ul style="list-style-type: none"> ■ Loss of habitat and biodiversity ■ Illegal poaching ■ Wildlife-human conflicts 	<ul style="list-style-type: none"> ■ Ban on poaching and illegal hunting ■ Delineate work area to ensure no accidental encroachment ■ Wildlife Management Plan ■ Reforestation plan ■ Monitor displaced and stranded wildlife ■ Notify the relevant authorities (e.g. DWNP) of any sighting of rare, endangered, threatened and near extinct wildlife for further actions
Freshwater ecology	<ul style="list-style-type: none"> ■ Loss of habitat and biodiversity ■ Oil and grease enter river system 	<ul style="list-style-type: none"> ■ Provide sufficient environmental flow to maintain biological function of water bodies ■ All temporary silt trap and sedimentation pond must be properly designed and installed to avoid direct sedimentation enters the river
Anthropology	<ul style="list-style-type: none"> ■ Loss/reduce roaming area ■ Affect the tranquillity of the Orang Asli communities 	<ul style="list-style-type: none"> ■ <i>Matau</i> must be located away from Orang Asli roaming area or settlements ■ Warning signage must be installed to inform locals from getting close to the working area
Ecotourism	Loss of ecotourism attraction places	<ul style="list-style-type: none"> ■ Project Proponent must work closely with relevant agencies on how to conserve the affected ecotourism attraction places ■ Continuous monitoring of the ecotourism sites must be done to observe and mitigate impact

TABLE 6.1 (cont'd) P2M2 for construction of a dam project

ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACT	POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)
LAND CLEARING/LOGGING STAGE (cont'd)		
Socio-economic	<ul style="list-style-type: none"> ■ Employment and business opportunities ■ Human-wildlife conflict 	Sub-contracting works and supply of essential materials can be provided by the locals. This will improve their income
Public health	<ul style="list-style-type: none"> ■ Communicable disease outbreak ■ Accident 	<ul style="list-style-type: none"> ■ Practice good housekeeping at all sites ■ All workers must equipped with knowledge particularly on vector-borne disease
QUARRYING STAGE		
Air quality	<ul style="list-style-type: none"> ■ Suspension of dust and particulate matter ■ Exhaust emission 	<ul style="list-style-type: none"> ■ Water spraying must be carried out periodically for suppressing dust during dry period ■ Wash through must be provided at each entrance of the site construction
Noise vibration	<ul style="list-style-type: none"> ■ Noise from drilling and blasting activities ■ Noise disturbance due to frequent movement of large vehicles 	<ul style="list-style-type: none"> ■ Perimeter hoarding to reduce noise propagation ■ Regular maintenance for vehicle and machinery ■ PPE for workers ■ Scheduling of certain activities outside to be within working hour only ■ Establish grievance mechanisms for disturbance complaints
Water quality	<ul style="list-style-type: none"> ■ Increase in turbidity and suspended solids levels in river water ■ Sewage from workers camp 	<p>Prepare and implement LD-P2M2. Further details are provided in <i>Section 6.3</i> of the Chapter 6.</p> <p>Wastewater Discharge</p> <ul style="list-style-type: none"> ■ Septic tank and toilet facility at base camp as per National Water Services Commission (SPAN) requirements ■ Sewage discharge to meets the limit of Environmental Quality (Sewage) Regulations 2009 ■ Proper desludging and other maintenance works on the sewage treatment system ■ Installation of oil and grease traps
Geology and geotechnics	<ul style="list-style-type: none"> ■ Slope failure ■ Falling rocks ■ Permanent loss of limestone ■ Alter of landforms 	<ul style="list-style-type: none"> ■ Adequate buffer zone/setback ■ Slope benching with appropriate protection measures (runoff and erosion control) ■ Geotechnical measures for identified hazard areas ■ Periodical monitoring and maintenance of the slopes
Freshwater ecology	Loss of biodiversity	All temporary silt trap and sedimentation pond must be properly designed and installed to avoid direct sedimentation enters the river
Socio-economic	<ul style="list-style-type: none"> ■ Affected the livelihood of locals ■ Affected the tranquillity of locals 	<ul style="list-style-type: none"> ■ The blasting activity must be done during normal working hours only ■ Early notification must be made to the locals prior to blasting activity

6 MITIGATION MEASURES

TABLE 6.1 (cont'd) P2M2 for construction of a dam project

ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACT	POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)
CONSTRUCTION STAGE		
Air quality	<ul style="list-style-type: none"> ■ Suspension of dust and particulate matter ■ Exhaust emission 	<ul style="list-style-type: none"> ■ Water spraying must be carried out periodically for suppressing dust during dry period ■ Wash through must be provided at each entrance of the site construction
Noise and vibration	<ul style="list-style-type: none"> ■ Noise disturbance due to frequent movement of large vehicles ■ Noise from piling activities ■ Noise from construction activities 	<ul style="list-style-type: none"> ■ Perimeter hoarding to reduce noise propagation ■ Regular maintenance for vehicle and machinery ■ PPE for workers ■ Scheduling of certain activities (piling, transportation via heavy vehicles, etc.) outside to be within working hour only ■ Establish grievance mechanisms for disturbance complaints
Water quality	<ul style="list-style-type: none"> ■ Increase in turbidity and suspended solids levels in river water ■ Sewage from workers camp 	<p>Prepare and implement LD-P2M2. Further details are provided in <i>Section 6.3</i> of the Chapter 6.</p> <p>Wastewater Discharge</p> <ul style="list-style-type: none"> ■ Septic tank and toilet facility at base camp as per National Water Services Commission (SPAN) requirements ■ Sewage discharge to meets the limit of Environmental Quality (Sewage) Regulations 2009 ■ Proper desludging and other maintenance works on the sewage treatment system ■ Installation of oil and grease traps
Hydrology	<ul style="list-style-type: none"> ■ Flash flood and localised flood ■ Change of existing hydrologic regime 	All LD-P2M2 installed on-site must be maintained at all times
Soil erosion	Surface erosion and sedimentation	Prepare and implement LD-P2M2. Further details are provided in <i>Section 6.3</i> of the Chapter 6 .
Geology and geotechnics	<ul style="list-style-type: none"> ■ Slope failure ■ Change of surface morphology 	Construction should follow the design specifications to minimise the impact on soil and rock stability
Health and safety	<ul style="list-style-type: none"> ■ Accident risk at construction site ■ Health risk to workers and locals from prolonged exposure to air emission pollutants and dust ■ Transmission of communicable diseases and vector-borne diseases 	<p>Health</p> <ul style="list-style-type: none"> ■ Implementation of P2M2 on air pollution ■ Clean water supply and proper solid waste disposal ■ Housekeeping to prevent mosquito breeding ■ Periodical health checks on workers <p>Safety</p> <ul style="list-style-type: none"> ■ To employ a Health, Safety and Environment (HSE) Officer ■ PPE requirement ■ Workers to have CIDB green card ■ Preparation of Emergency Response Plan (ERP) ■ Provision of sufficient training

TABLE 6.1 (cont'd) P2M2 for construction of a dam project

ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACT	POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)
CONSTRUCTION STAGE (cont'd)		
Waste management	Solid waste and scheduled waste management	<ul style="list-style-type: none"> ■ The contractor is fully responsible for proper waste management at site ■ Scheduled waste must be stored in a secure storage area as per Environmental Quality (Scheduled Wastes) Regulations 2005
Land use	Land use change	Permanently changed in land use within the project area
Archaeology	Loss of archaeological site	Project Proponent must works closely with Jabatan Warisan Negara and any other relevant agencies
Terrestrial flora	Loss of fauna	Construction roads and base camps must be fully utilised to minimise disturbances to the natural ecology
Terrestrial fauna	<ul style="list-style-type: none"> ■ Illegal poaching ■ Human-wildlife conflict ■ Wildlife displacement ■ Disturbance to wildlife ■ Loss of habitats 	<ul style="list-style-type: none"> ■ Ban on poaching and illegal hunting ■ Delineate work area to ensure no accidental encroachment ■ Wildlife Management Plan ■ Reforestation Plan ■ Monitor displaced and stranded wildlife ■ Provide sufficient environmental flow to maintain biological function of water bodies ■ Notify the relevant authorities (FDPM or DWNP) of any sighting of rare, endangered, threatened and near extinct wildlife for further actions
Freshwater ecology	Damaging river habitat and deteriorate water quality	<ul style="list-style-type: none"> ■ Contractors must abide to guidelines published by DID for river reserve and river corridor ■ Prepare and implement LD-P2M2. Further details are provided in <i>Section 6.3</i> of the Chapter 6.
Anthropology	<ul style="list-style-type: none"> ■ Wildlife migration into villages ■ Tension and worries among the locals 	<ul style="list-style-type: none"> ■ Project Proponent to work closely with DWNP ■ Construction workers are forbidden to enter local villages without any purposes
Socio-economic	<ul style="list-style-type: none"> ■ Employment opportunity ■ Locals exposed to incidents or accidents ■ Conflict between locals and construction workers 	<ul style="list-style-type: none"> ■ Sub-contracting works and supply of essential materials can be provided by the locals. This will improve their income. ■ Job openings must be circulated to the locals
FIRST RESERVOIR FILING (IMPOUNDMENT STAGE)		
Air quality	Production of noxious gas (e.g.: H ₂ S and CH ₄) due to leftover biomass degradation	Water quality and odour levels must be continuously monitored to prevent health impact to the workers and locals nearby
Water quality	<ul style="list-style-type: none"> ■ Depletion of dissolved oxygen level ■ Water quality stratification ■ Biodegradation 	Water quality levels must be continuously monitored

6 MITIGATION MEASURES

TABLE 6.1 (cont'd) P2M2 for construction of a dam project

ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACT	POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)
FIRST RESERVOIR FILING (IMPOUNDMENT STAGE) (cont'd)		
Hydrology	Alteration of river regime from lotic (flowing water) to lentic (slow water)	Environmental flow study must be carried out to maintain water quality and river ecology during and after reservoir filing
Geology and geotechnics	<ul style="list-style-type: none"> ■ Micro-seismic activity ■ Slope failure ■ Induce tremor/small-scale earthquake due to water pounding 	Seismic activity must be continuously monitored during the first reservoir filling
Hydrogeology	<ul style="list-style-type: none"> ■ Change in groundwater level near the reservoir ■ Water losses ■ Slope instability 	Groundwater condition must be monitored
Terrestrial flora	<ul style="list-style-type: none"> ■ Submerged of the remnant vegetation ■ Remnant biomass on impoundment water quality 	<ul style="list-style-type: none"> ■ Remnant biomass must be collected and transported to legal disposal site while only minor biomass is left for inundation ■ Reforestation plan of disturbed areas must take into consideration of the original flora species composition
Terrestrial fauna	<ul style="list-style-type: none"> ■ Permanent loss of wildlife habitat or their roaming areas ■ Species survival 	<ul style="list-style-type: none"> ■ Inundated areas must be monitored for any displaced wildlife and this wildlife must be rescued and placed to safe ground
Anthropology	<ul style="list-style-type: none"> ■ Inundation of existing access roads ■ Stress to the relocation of affected locals 	<ul style="list-style-type: none"> ■ The facilities in the new settlements must be in place and functional ■ Negotiations and compensations must done through relevant agencies such as UPEN and JAKOA
Archaeology	Inundation of historic or cultural site	<ul style="list-style-type: none"> ■ Surface survey and excavation must be arranged and carried out before impoundment works ■ Project Proponent must works closely with Jabatan Warisan Negara and any other relevant agencies
Socio-economic	<ul style="list-style-type: none"> ■ Health ■ Mobility ■ Loss of assets 	<ul style="list-style-type: none"> ■ All affected settlements, farms and crops must be equally compensated ■ locals must be well-educated with regards to safe drinking water, sanitation and hygiene
OPERATION STAGE		
Air quality	Production of noxious gas (e.g.: H ₂ S and CH ₄)	Water quality and odour levels must be continuously monitored to prevent health impact to the workers and locals nearby
Noise and vibration	Change of the ground vibration profile	Micro-seismic pattern must be monitored to detect any tremors or small-scale earthquake

TABLE 6.1 (cont'd) P2M2 for construction of a dam project

ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACT	POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)
OPERATION STAGE (cont'd)		
Water quality	<ul style="list-style-type: none"> ■ Deterioration of water quality ■ Depletion of sediment/aggregate/nutrients downstream 	<ul style="list-style-type: none"> ■ Controlled use of fertilizer and pesticide ■ Controlled development within the catchment area ■ Sufficient buffer zone for development surrounding the catchment area ■ Periodical monitoring of water quality within and surrounding the project area
Hydrology	<ul style="list-style-type: none"> ■ Risk of accidental outflows ■ Reduced flooding downstream (dam as flood mitigation) 	<ul style="list-style-type: none"> ■ Dam break study must be carried out to assess potential downstream hazard ■ Environmental flow study must be carried out to fulfill minimum requirement for aquatic life and human need.
Soil erosion	Erosion of access roads and borrow areas	<ul style="list-style-type: none"> ■ Slopes are required to be periodically monitored and maintained ■ Slope maintenance and rehabilitation in the case of erosion and failure
Geology and geotechnics	Risk of structural failure	Micro-seismic pattern must be monitored to detect any tremors or small-scale earthquake
Terrestrial fauna	<ul style="list-style-type: none"> ■ Reduce habitat availability ■ Creation of new riparian habitat 	<ul style="list-style-type: none"> ■ Viaduct/Animal crossings ■ Signage to warn road users ■ Human-Wildlife Conflict (HWC) resolution mechanism
Freshwater ecology	Reduced in stream fishing (fish barrier)	Stocking the reservoir with selective native species will replenish the losses resulting from the disappearance. The fish should be allowed to growth up to market size.
Anthropology	Livelihood changes	Project Proponent must work closely with relevant agencies such as JAKOA; to improve Orang Asli income
Socio-economic	<ul style="list-style-type: none"> ■ Employment opportunity ■ Economic opportunity (local business) 	<ul style="list-style-type: none"> ■ Sub-contracting works and supply of essential materials can be provided by the locals. This will improve their income. ■ Job openings must be circulated to the locals
Waste management	Generation of solid waste	<ul style="list-style-type: none"> ■ Adequate bins and disposal sites ■ Regular disposal services
Ecotourism	Creation of new ecotourism activities	Project Proponent must work closely with relevant agencies such as Ministry of Tourism, Arts and Culture; to improve Orang Asli income
REHABILITATION STAGE		
Safety and health	Failure or mis-operation of the dam if not mitigated	Project Proponent to conduct Dam Rehabilitation Study as specified in MyDAMS (DID, 2017)

TABLE 6.1 (cont'd) P2M2 for construction of a dam project

ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACT	POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)
ABANDONMENT STAGE		
Safety and health	Dismantling and removal of construction material from the site	<ul style="list-style-type: none"> ■ An abandonment plan shall be submitted to DOE at least three months prior to project abandonment. In the event of abandonment, this plan shall be followed closely to allow for a systematic and proper abandonment. ■ All scheduled wastes shall be properly disposed of at a licensed disposal facility upon project abandonment ■ Ample time should be allowed for the demolishing and removal of on-site equipment, machinery and building structure ■ Appropriate cover vegetation to be established on cleared area to ensure no severe soil erosion ■ All construction waste should be properly disposed by the Proponent such that it will not be a burden to the local council

6.3 LAND-DISTURBING POLLUTION PREVENTION AND MITIGATION MEASURES (LD-P2M2)

The LD-P2M2 document addresses on how to prevent, reduce and eliminate pollutants from land-disturbing activities including but not limited to **SITE CLEARING/LOGGING AND EARTHWORK**. It refers mainly on the BMPs comprising activities, facilities, measures, planning or procedures used to minimise accelerated erosion and sedimentation as well as other pollutants, and to manage runoff water to protect and maintain the quality of soil, or inland or Malaysia waters, and the existing and designated uses of waters before, during and after land disturbing activities.

The formulation of LD-P2M2 must be conducted based on the following guidelines produced by the Department of Environment (DOE):

- i) Guidance Document for Addressing Soil Erosion and Sediment Control Aspects in the EIA (DOE); and
- ii) Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (DOE).

The LD-P2M2 document is prepared by taking into consideration all land disturbance activities which include mobilisation at the earliest stage up to the demobilisation at the last stage of a development

At the EIA stage, the elements of LD-P2M2 should be considered as conceptual although still site specific. This is because the LD-P2M2 plan/layout should be formulated according to the existing condition of the site via the latest topographical survey and site catchment runoff.

The LD-P2M2 can be further refined later in the EMP stage (adjustments on BMP design to be made based on actual site condition), and compiled as a stand-alone document to be submitted together with the EMP report for approval. The LD-P2M2 document should be regularly updated (when necessary, based on site conditions) to ensure that it can be fully

6.3.1 Work Breakdown Structure

A work breakdown structure (WBS) for the project activities must be produced to list all activities or work packages that must be performed in the project (although each work package may have several activities within it). An example of a WBS is shown in *Figure 6.1*. If any of the project activity involves land disturbance including sub-components under WBS, LD-P2M2 must be submitted and approved by the DOE.

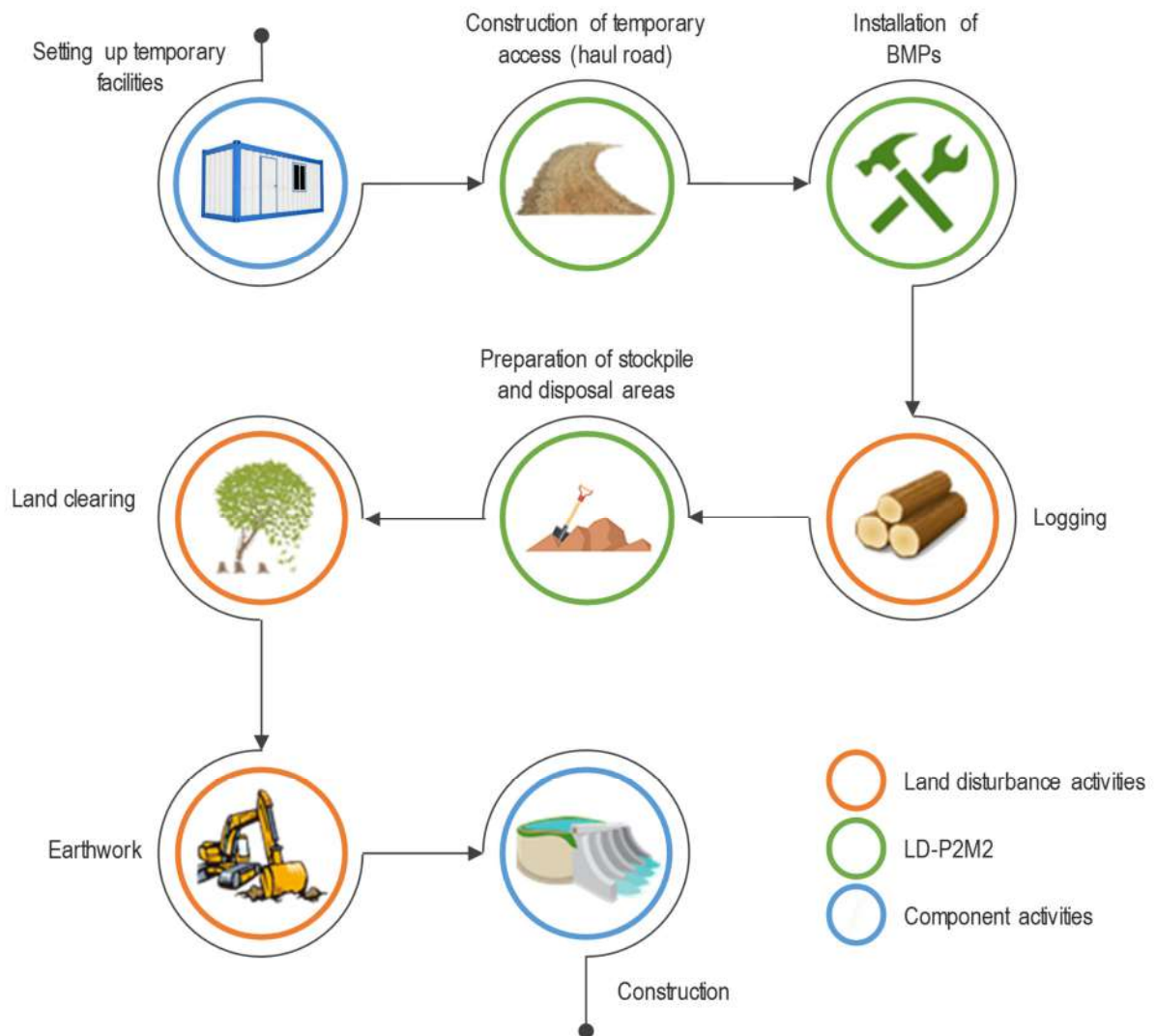


FIGURE 6.1 Example of a WBS

6.3.2 LD-P2M2 Checklist

The LD-P2M2 document should cover all the basic information required as specified in the Guidance Document. For ease of reference, a submission checklist is shown in *Table 6.2* which was adapted from EGIM. It is important to note that all submissions must be accompanied by the relevant technical drawings and maps.

TABLE 6.2 LD-P2M2 checklist for EIA report submission

COMPONENT	INFORMATION REQUIRED	PAGE IN EIA REPORT
Project activity and implementation	<ul style="list-style-type: none"> ■ Phasing plan ■ Project implementation schedule ■ Description of construction activities ■ Construction timeline, including BMP installation ■ Construction method statement 	
Information and analysis on project site and development	<ul style="list-style-type: none"> ■ Selected weather and rainfall data ■ Site runoff velocity and flow rates (pre and post development) ■ Description of soil and geological characteristics ■ Description of adjacent areas that may be affected by land disturbance ■ List of drainage, streams and river onsite, including receiving water bodies ■ List of BMP proposed ■ Access roads and project components located outside of project boundary ■ Earthworks cut and fill volume ■ Availability of materials ■ Biomass management ■ Construction and domestic waste management ■ Spill prevention and control plan ■ Soil loss prediction (pre, during and post development as well as with and without BMP scenarios) ■ Projected runoff flows ■ Calculation for BMP (sediment traps/basins, check dams, etc.) 	
Map of site plan with existing condition	<ul style="list-style-type: none"> ■ Topographic survey map ■ Geological terrain map ■ Erosion risk map ■ Land use map ■ Site development plan 	

Source: EGIM (DOE)



*Bakun Dam, Sarawak
Photo by Gem Lyn on Unsplash.com*

6.3.3 Best Management Practice

Best management practice (BMP) for LD-P2M2 must be proposed in accordance to the Guidelines on LD-P2M2 (DOE, 2017). There are two types of BMPs which are structural BMPs and non-structural BMPs.

Non-structural BMPs involve management of people and monitoring of the effectiveness of BMPs. The cooperation and integration of different parties are crucial in ensuring the success of an LD-P2M2 plan.

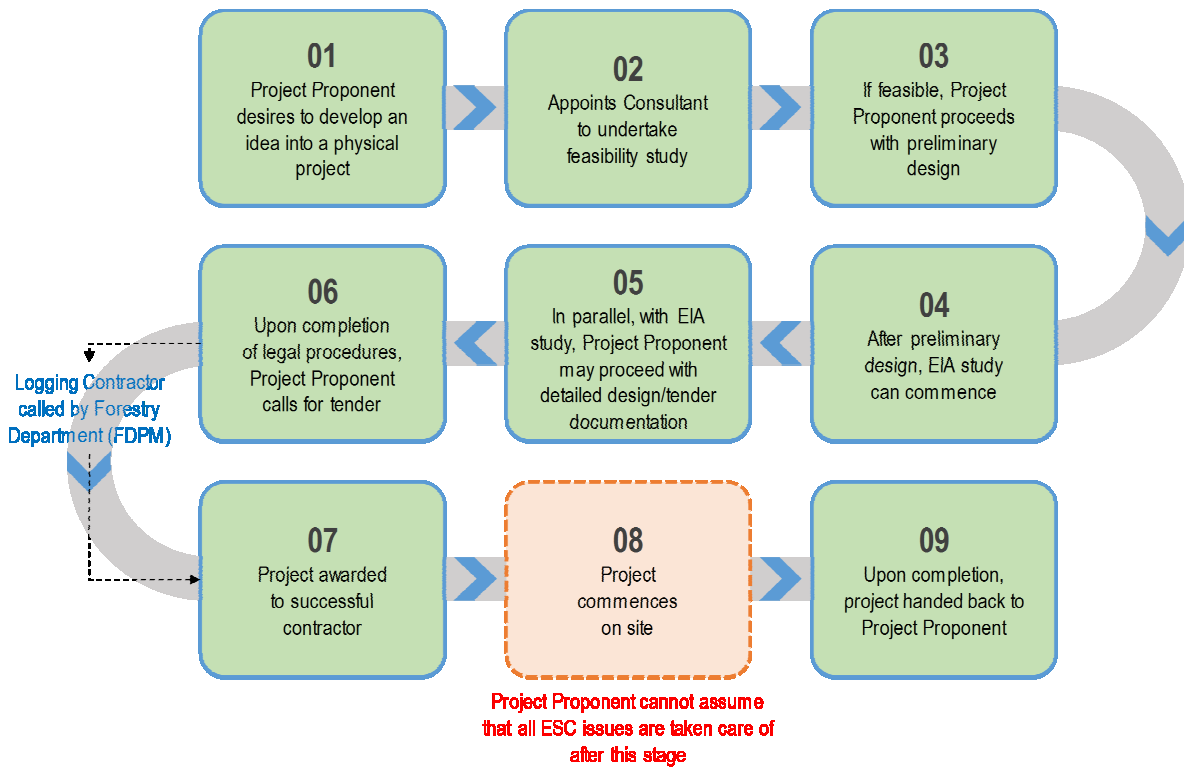
■ Structural BMPs

Structural BMPs such as sediment trap, silt fence and Active Treatment System (ATS) can be calculated and engineered. Thus, it can be assumed that all design of structural BMPs will be in accordance to both DOE and DID guidelines.

■ Non-structural BMPs

Despite the fact that structural BMPs can be designed appropriately, problems may arise from the actual implementation of the BMPs on site, in which the non-structural BMPs must be executed.

This can be seen from projects involving forest clearing or logging. Logging contractors are appointed by FDPM, making it difficult for the Project Proponent to control their activities. Hence, the management of this factor must be parked under the Environmental Monitoring Committee (EMC) in which the Project Proponent can control the logging contractor while actively engaged with FDPM. A coordination committee headed by State Admin, consist of State DOE, State FDPM, Project Proponent and logging contractor must be established. This is illustrated in *Figure 6.2* and *Figure 6.3*.



* Erosion and sediment control (ESC) issues will occur after Step 8, thus a functional and practical Environmental Management Committee (EMC) must be established

FIGURE 6.2 Obstacle in managing logging contractor under FDPM

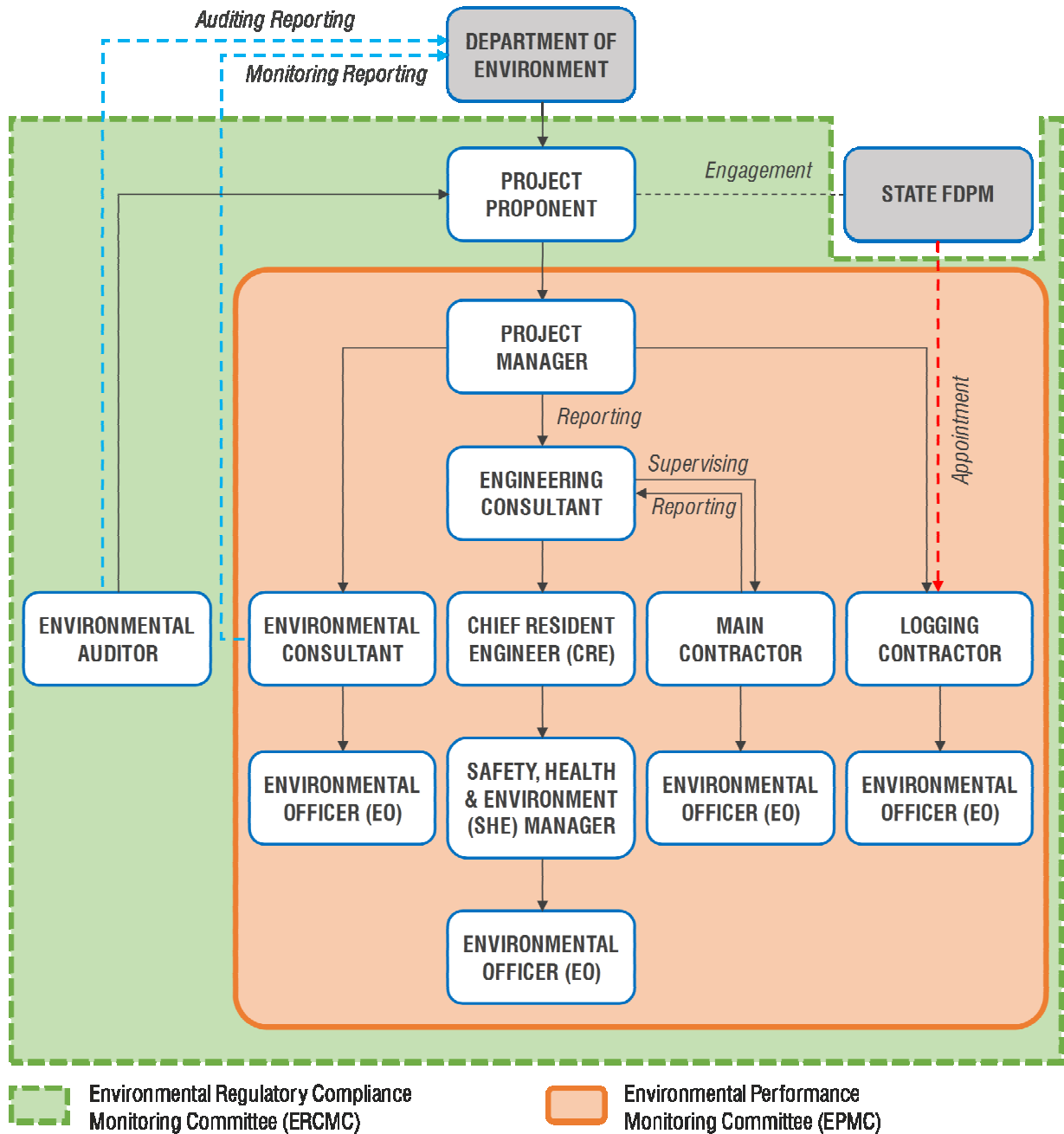


FIGURE 6.3 Example of an organisation chart of an EMC for projects involving logging activity

6.4 ENVIRONMENTAL OFFSET

According to *Australian Environmental Offsets Act 2014* an **environmental offset** is defined as an activity undertaken to counterbalance a **significant residual impact** of a prescribed activity on a prescribed environmental matter.

An environmental offset compensates for unavoidable impacts on significant environmental matters, (e.g. valuable species and ecosystems) on one site, by securing land at another site, and managing that land over a period of time, to offset those significant environmental matters which were lost.

Figure 6.4 provides a simple illustration of the basic concept of providing an environmental offset. It illustrates land containing environmental values at one site being cleared for development. Those environmental values are then ‘replaced’ by providing an environmental offset at another site, which contains those same environmental values which were impacted as a result of the development.

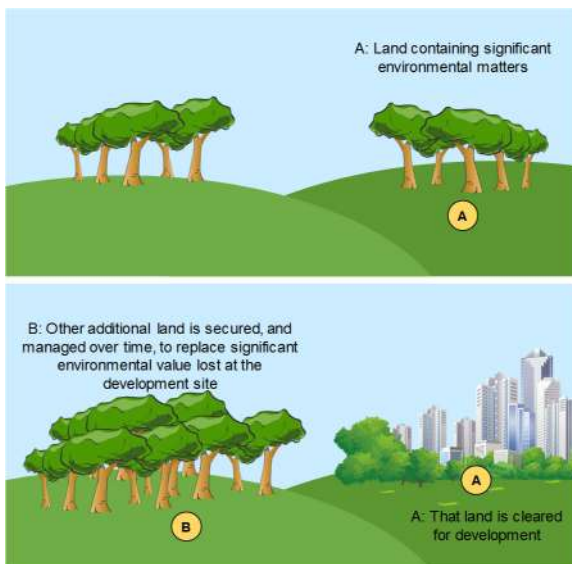


FIGURE 6.4 Concept of environmental offset

WHEN IS AN ENVIRONMENTAL OFFSET REQUIRED?

An environmental offset may be required as a condition of approval, following consideration of avoidance and mitigation measures when prescribed activity is likely to result in a significant residual impact on a prescribed environmental matter(s). Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment.

Environmental offset is a method in mitigating the environmental impacts that still occur even after appropriate mitigation measures were put in place. In short, environmental offset can be defined as measures that compensate for:

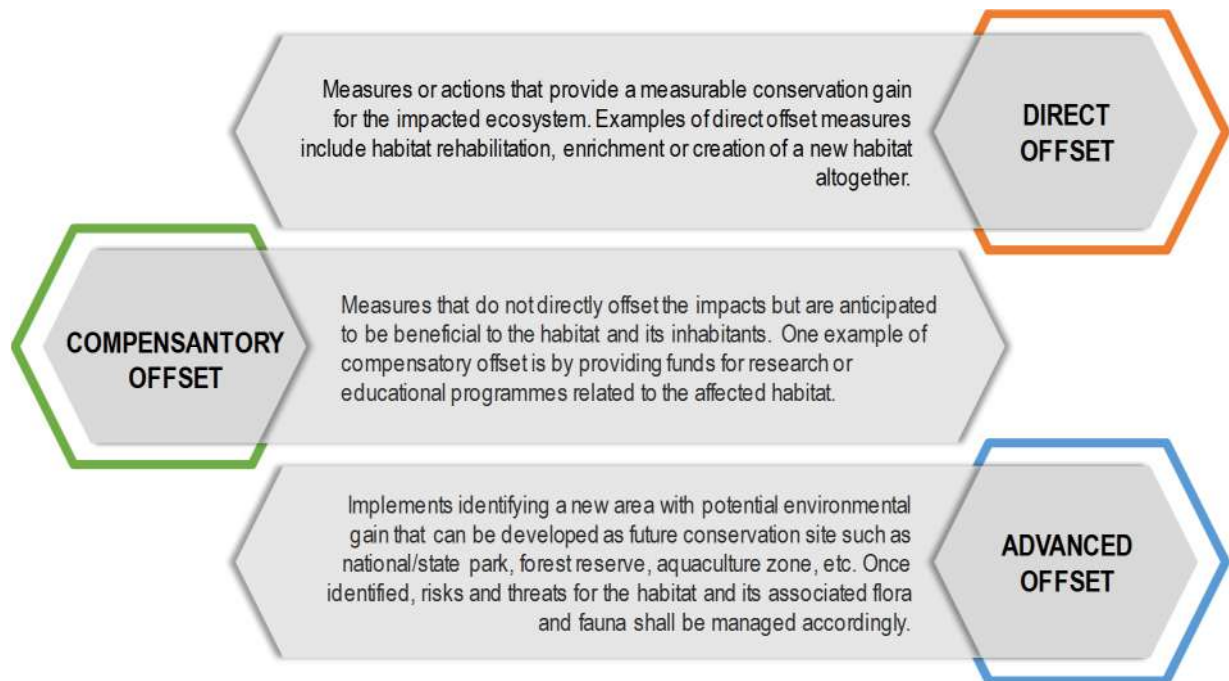
- i) residual impacts of the development; and
- ii) impacts that lead to environmental trade-off (total loss of habitat).

Environmental Protection Agency (2006) defines environmental offsets as “environmentally beneficial activities undertaken to counterbalance an adverse environmental impact, aspiring to achieve ‘no net environmental loss’ or a ‘net environmental benefit’ outcome”.

Certain habitats or ecosystems, once affected, cannot be replaced or have the capacity or resilience to return to their original state. As such, environmental offset can be undertaken to:

- i) create new habitat elsewhere;
- ii) enhance existing habitat elsewhere that have similar characteristics; and
- iii) enhance the growth and population of its associated organisms at the impacted area.

6.4.1 Types of Environmental Offset



6.4.2 Selection for Environmental Offset

There are several factors that need to be considered in selecting the most appropriate offset measures to be implemented. They include:

- i) Time to achieve conservation gain – The conservation gain is required in short, medium or long term;
- ii) Level of certainties to success – The probability of the offset programme to provide the desired effect;
- iii) Site suitability – The availability of site that is able to provide a good chance of success within the stipulated timeframe using viable budget and expertise;
- iv) Consultation with stakeholders – Support from stakeholders is needed in formulating a holistic approach to the offset implementation; and
- v) Appropriate and transparent governance – A thorough and transparent supervision is needed during the implementation of the offset programme.



CHAPTER 7

Post-EIA

Klang Gate Dam, Selangor
Photo by DNASB



7.1 INTRODUCTION

Post-EIA refers to the stage where the EIA has been approved and the Project Proponent has decided to commence with the construction and operation of the Project. It is perhaps the most important stage in the EIA cycle. This is when the EIA study will show its worth by being a planning tool for minimising negative environmental impacts and avoiding costly mistakes in project implementation.

In general, post-EIA can be divided into three main stages, namely:

- i) pre-construction;
- ii) earthwork and construction; and
- iii) operation.

7.2 ENVIRONMENTAL MAINSTREAMING AGENDA AND SELF-REGULATION CULTURE

Environmental mainstreaming agenda is adopted in the EIA procedure to enhance its effectiveness in alleviating the negative impacts on the environment arising from the project development.

Environmental mainstreaming agenda and self-regulation culture

1. full responsibility and accountability in implementing appropriate P2M2 falls under the purview of the Project Proponent
2. the Project Proponent must also demonstrate regulatory compliance to the COA and other environmental requirements throughout the project implementation stages.
3. The Project Proponent stands to reap benefits by embracing the environmental mainstreaming and self-regulation aspirations
4. a potent business strategic tool where positive image of good governance and corporate social responsibility could be portrayed to the public, enhancing public's acceptance of the project.

7.3 ENVIRONMENTAL MAINSTREAMING TOOLS

DOE has formulated a set of Environmental Mainstreaming Tools (EMTs) in order to assist the Project Proponent in achieving the state of self-regulation. The EMTs to be implemented in the organisations are as illustrated in *Figure 7.1*.

Rigorous implementation of the EMTs is expected to result in the Project Proponent achieving environmental excellence (EE). EE is exhibited in the intrinsic values of being:

- i) environment conscious (where environmental agenda is factored into management and decision-making process);
- ii) achievement of sustained environmental regulatory compliance;
- iii) high degree of environmental transparency and accountability; and
- iv) strong commitment to continuous environmental improvement.



FIGURE 7.1 Environmental mainstreaming tools

ENVIRONMENTAL POLICY (EP)

The EP of the Project Proponent must use strong and unequivocal statements to convey their environmental commitment to their employees, clients, stakeholders and the public. It must be disseminated to all relevant parties and translated into action in the:

- work procedures;
- materials purchasing policy;
- business decision-making process; and
- cascades down to the supply chain.

ENVIRONMENTAL BUDGETING (EB)

Sufficient budget must be set aside solely for the purpose of taking measures to comply with the environmental regulatory requirements and other environmental-related efforts. The EB must also include the cost for:

- setting up of laboratory facilities;
- provision of personnel; and
- purchase of performance monitoring equipment.

ENVIRONMENTAL MONITORING COMMITTEE (EMC)

The EMC consists of:

- Environmental Regulatory Compliance Monitoring Committee (ERCMC)
The committee is set up at the policy level and shall be chaired by the Project Proponent's Chief Executive Officer or the Chairman. It meets on a minimum once a year.
- Environmental Performance Monitoring Committee (EPMC)
The committee is set up at the working level and shall be chaired by a senior official of the Project Proponent. It meets on a monthly basis, or at a minimum, once in a quarter year.

ENVIRONMENTAL FACILITY (EF)

The primary components of the EF include:

- effluent treatment system;
- air pollution control system;
- Best Management Practices (BMPs); and
- support facilities such as laboratory, performance monitoring (PM) equipment, on-line instrumentation system and waste management infrastructure.

ENVIRONMENTAL COMPETENCY (EC)

The relevant personnel involved in discharging various environmental responsibilities within an organisation need to possess the required competencies. The personnel include those who have been assigned the task to perform DOE-regulated functions such as:

- supervising BMP;
- waste management;
- air pollution control; and
- effluent treatment systems.

The Project Proponent must draw up a comprehensive training programme to produce competent persons and trained support staff to ensure full compliance with DOE requirements in the regulated activities.

ENVIRONMENTAL REPORTING & COMMUNICATION (ERC)

A formal communication channel must be established for reporting environmental concerns and system upsets which warrant prompt actions to be instituted. Internal reporting can be initiated to report on a regular basis the regulatory compliance status of the organisation to the Chief Executive Officer and various heads of the department within the organisation.

Updates of new environmental requirements and their implications can be disseminated to the relevant project personnel. Environmental reporting and communication (ERC) requires systematic analysis of PM data, which must be summarised in appropriate format for easy understanding and communication and shall be maintained for management review purposes.

ENVIRONMENTAL TRANSPARENCY (ET)

In order to foster rapport with immediate neighbours (residential, industrial, etc.), promote green image and improve public confidence, the Project Proponent is encouraged to be more transparent in their environmental compliance and achievement.

Example of transparency approach are:

- display or communicate compliance status via website, pamphlet, etc.;
- notice board at project site; and
- preparation of Environmental Sustainability Report (ESR).

7.4 ROLES AND RESPONSIBILITIES DURING POST-EIA STAGE

During the post-EIA stage, implementation of COA and P2M2 described in the EIA report require the involvement of several parties on both DOE and the Project Proponent side.

Fundamentally, there are five different parties involved, namely:

- DOE;
- Project Proponent;
- Environmental Officer;
- Environmental Consultant; and
- Environmental Auditor.

ROLES AND RESPONSIBILITIES

Department of Environment (DOE)	<p>DOE acts as the enforcer of EQA 1974. The major roles and responsibilities of DOE in the post-EIA stage include the following:</p> <ol style="list-style-type: none"> i) Reviewing and approving LD-P2M2 plan and EMP; ii) Facilitate the Project Proponent in matters related to the implementation of EMP and compliance to environmental regulations; iii) Ensuring appropriate implementation of COA and other related environmental regulations through periodical enforcement checks/visits; iv) Taking appropriate legal action for occurrence of non-compliances via Notice, Prohibition or Stop Work Order, Compound and Prosecution; and v) In some cases, DOE may be supported by other authorities or agencies in their respective field or jurisdiction.
Project Proponent	<p>The major roles and responsibilities of the Project Proponent include the following:</p> <ol style="list-style-type: none"> i) Formulating an EP of the organisation with respect to the EIA project, which shall be communicated to the stakeholders, consultants, contractors and other parties involved in the project planning and implementation; ii) Establishing an organisational structure which clearly shows the emplacement of an EO; iii) Allocation of sufficient funds with itemised budget required for water quality monitoring, air quality and noise monitoring, for implementation of EMP including P2M2. P2M2 shall be those which can be described as: <ul style="list-style-type: none"> ■ state-of-the-art technologies; ■ BAT; or ■ industry best practices. iv) Appointing an EO at the stage of post-EIA to be charged with responsibilities to execute environmental quality control and performance monitoring functions during the construction and operation phases of the project implementation. Service of an EO can also be obtained from an Environmental Service Provider. However, this is allowed during the construction phase only. The Project Proponent shall employ their own EO at the operational stage; v) Establishing a project EPMC to monitor: <ul style="list-style-type: none"> ■ environmental performance; ■ effectiveness of P2M2; and ■ status of regulatory compliance of the project. <p>The EPMC shall be represented by all relevant parties involved in project implementation and chaired by a senior member representing the Project Proponent. The EPMC shall meet at a minimum of once in every three months and the minutes of the meeting shall be recorded;</p> vi) Setting up a mini laboratory, wherever appropriate, to facilitate the implementation of an environmental performance monitoring programme. This mini laboratory shall be adequately equipped with relevant resources including staff and portable analytical testing equipment; and vii) Ensuring the EMP including temporary and permanent P2M2 are implemented and maintained according to industry's best practices (BAT and BMP).

ROLES AND RESPONSIBILITIES

Environmental Officer	<p>The EO is the main project personnel responsible for ensuring regulatory compliance at the project implementation stage. The roles and core duties of the EO include the following:</p> <ul style="list-style-type: none"> i) Implementing the EMP and installing temporary and permanent P2M2. ii) Preparing Environmental Performance Monitoring Document (EPMD). EPMD describes in detail how EIA approval conditions are going to be complied and how performance monitoring of the various P2M2 will be conducted to ensure the optimal functionality of the P2M2 is maintained. The details shall include, among others: <ul style="list-style-type: none"> ■ performance monitoring equipment/instruments; ■ sampling protocols; and ■ analysis. iii) Performing or supervising the conduct of performance monitoring (PM) programme as specified in the EPMD. iv) Preparing Performance Monitoring Report (PMR): <ul style="list-style-type: none"> ■ PMR discusses the results of the performance monitoring conducted as described in the EPMD; ■ PMR shall also make some definitive conclusions on the overall performance of the P2M2 and suggest improvement measures to be taken if necessary; and ■ PMR shall be submitted to the EPMC and maintained for the inspection of the DOE officers. v) Communicating the status of environmental regulatory compliance of the project during the construction and operation phases to the Project Proponent. vi) Maintaining a detailed record of major upset conditions encountered, if any, for the duration of the project construction and operation stages. The date of occurrences, nature and causes of upset conditions, and the corrective actions taken shall be recorded. vii) Acting as an environmental advisor to the Project Proponent in advising him to undertake additional efforts, if any, to further ensure effective implementation of EMP including temporary P2M2 on a sustained basis.
Environmental Consultant	<p>The duties of the Environmental Consultant are:</p> <ul style="list-style-type: none"> i) ensure the Project Proponent is briefed on the requirements of the COA and other related environmental requirements; ii) prepare the LD-P2M2 and EMP documents; iii) inform the Project Proponent on the environmental protection commitment that they shall take in implementing the project; and iii) define the necessary environmental monitoring programmes in accordance with the objectives and requirements of the EMP.
Environmental Auditor	<p>An EIA project will necessitate the appointment of a third-party environmental auditor during the post-EIA stage. The audit team should be independent from the Project Proponent to ensure the objectivity of the audit as well as its findings and conclusions.</p> <p>The roles and responsibilities of the environmental auditor are:</p> <ul style="list-style-type: none"> i) plan the audit procedures according to the Environmental Audit Guidance Manual: <ul style="list-style-type: none"> ■ scope; ■ checklist; ■ date; and ■ timetable. ii) notify the audit visit dates to DOE and the Project Proponent; iii) ensure the efficient and effective conduct and completion of the audit within the audit scope and plan; and iv) prepare and submit the audit report to DOE.

7.5 ENVIRONMENTAL MANAGEMENT PLAN

An EMP translates the P2M2 recommended in the EIA report and the COA into action. The EMP is a concrete plan of action which is explicit, illustrative, action-oriented, time-bound and definitive.

EMP is by nature a living document which needs to be revised and updated. Among the situations that require the EMP to be revised are:

- i) variations in project concept, activities and its execution method*;
- ii) changes in project phasing*;
- iii) modifications to P2M2*;
- iv) replacement of important personnel e.g. EO, auditor, etc.

*Note: *Several aspects of the changes may relate to specific COA imposed by DOE, thus any changes to that aspects must be approved by DOE beforehand.*

The EMP document states the following in explicit terms:

- i) What actions will be taken
 - project concepts
 - project details
- ii) What measures will be instituted
 - P2M2
 - Safety measures
- iii) What structures will be built
 - Project components
 - construction method statement
- iv) When the actions will be executed
 - project phasing
 - project work programme

7.5.1 Preparation of EMP

The Project Proponent and the Consultant (must be a Qualified Person) who has been tasked to prepare the EMP shall study and understand the P2M2 recommended in the EIA report and the COA. The typical steps to carry out the EMP are outlined in *Figure 7.2*.

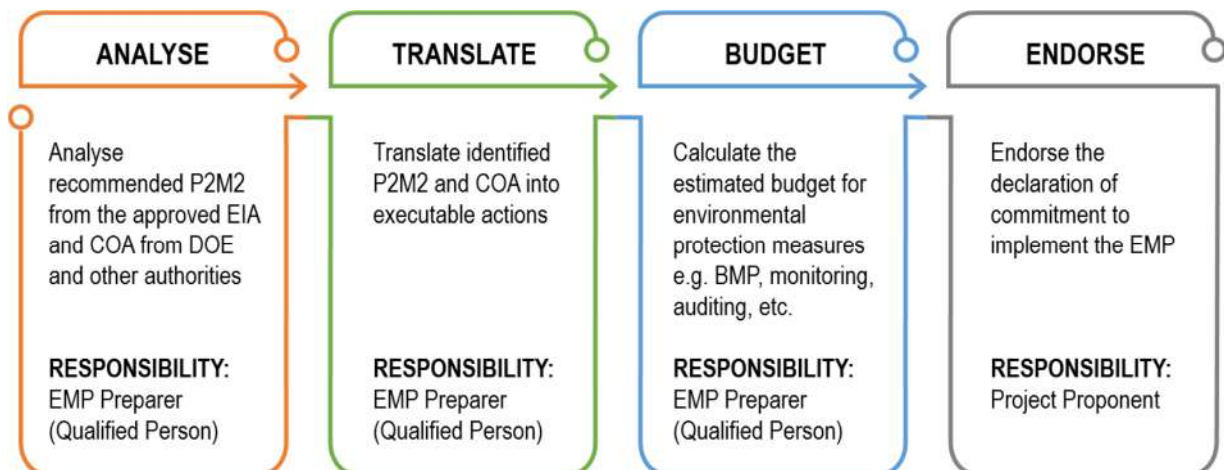


FIGURE 7.2 Typical steps in EMP preparation

7.5.2 Preparation of Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2)

The LD-P2M2 document is a legal pledge made by the Project Proponent to take efforts, measures, actions or due diligence in accomplishing the overarching goal of protecting the environment and in mitigating the environmental impact during the implementation of the proposed development project.

The LD-P2M2 document gives guidance to the Project Proponent's personnel especially the EO in supervising the implementation of the LD-P2M2 that includes the installation, inspection and maintenance of the BMP as well as in preparing the required documentation and reports.

Focus of the LD-P2M2 is on the prevention, mitigation and control of discharge from the development area containing the major pollutant (suspended solids) resulting from land disturbing activities.

The LD-P2M2 document is to be attached or inserted into the EMP as part of the EMP submission requirement.

■ Content of LD-P2M2 Document

Generally, the following shall be prepared and provided in the LD-P2M2 document:

i) Narrative Description

The narrative describing the:

- a) project description;
- b) existing site conditions;
- c) conditions after development;
- d) major land disturbing activities;
- e) total site area;
- f) total disturbed area;
- g) soil types;
- h) design criteria for P2M2;
- i) expected rainfall;
- j) runoff velocities and peak flows; and
- k) illustration of how, what, where, why and when P2M2 is to be installed, inspected and maintained.

ii) Schedule of Construction (Land Disturbing) Activities

Schedule of construction activities detailing the project phasing, construction of stages and sequences that progress with the implementation of each of the LD-P2M2 in a timely manner. It is imperative that the implementation of BMP should be prioritised first before any land-disturbing activity is allowed to commence.

Holding a pre-construction meeting to be attended by the Project Proponent, EO, project contractors and subcontractors is an example of an initial construction sequence conducted prior to any land-disturbing activities.

iii) LD-P2M2 Plan and Construction Notes

A plan consisting of maps and/or site plans showing the existing geomorphology and land use of the site, to be overlaid with the site development map that depict the proposed land disturbing activities or earthworks, inclusive of proposed area alterations and the locations of all P2M2 facilities. Construction notes which refer to general instruction of P2M2 applications shall be included in the LD-P2M2 plan or written on a separate sheet.

iv) Method Statement

Method Statement refers to Environmental Method Statement that details how, what, where, why and when the elements of environmental protection will be integrated and implemented into each of the land-disturbing activity. The typical land disturbing activities include but are not limited to:

- a) site land clearing;
- b) excavation of cuttings;
- c) forming of embankments and fills;
- d) excavation of foundation pits, trenches and tunnels or viaduct;
- e) stream or river diversion;
- f) stream or river crossing;
- g) in-stream works; and
- h) drilling of boreholes.

Further details on formulating an effective LD-P2M2 can be referred to in the Guidelines on LD-P2M2 (DOE).

7.5.3 EMP Report Format

The EMP shall follow the general specifications and format, and shall contain five chapters as explained below:

<p>Chapter 1 INTRODUCTION</p>	<p>Provide information on:</p> <ul style="list-style-type: none"> ■ Project layout as approved in the Development Order by Local Authority; ■ Project implementation schedule; and ■ Name of the EMP prepare and the consulting firm.
<p>Chapter 2 POLICY</p>	<p>Provide information on:</p> <ul style="list-style-type: none"> ■ Company’s corporate policy statement on environmental management and protection; and ■ Commitment by the top management on the mainstreaming of environmental agenda and instilling of self-regulation in the development project and on ensuring continuous compliance with the environmental regulatory requirements.
<p>Chapter 3 ORGANISATIONAL STRUCTURE</p>	<p>Provide information on:</p> <ul style="list-style-type: none"> ■ Organisation chart of the company’s top management with responsibilities on environmental management and protection (provide names, positions, mobile phone contact numbers and e-mail addresses); ■ Name, mobile phone contact number and e-mail address of environmental manager, EO, engineering consultant, contractor, site supervisor and competent person* (wherever relevant and available); (*Note: Competent person is a person certified by DOE through the certification program administered by EiMAS); and ■ Name of environmental consultant and accredited laboratory conducting environmental monitoring, analysis of environmental samples and submitting reports to DOE.
<p>Chapter 4 TRAINING REQUIREMENT</p>	<p>Provide information on:</p> <ul style="list-style-type: none"> ■ Plan for staff training in order to develop competency to discharge responsibilities on environmental requirements and compliance. The training areas shall include maintenance and performance monitoring of all P2M2, wherever relevant.
<p>Chapter 5 ENVIRONMENTAL REQUIREMENT</p>	<p>Provide information on:</p> <ul style="list-style-type: none"> ■ EIA Approval Condition (COA); ■ Environmentally-related COA from other authorities e.g. DID, DWNP, FDPM, etc.; ■ LD-P2M2 document; ■ P2M2 to be implemented as in <i>Table 7.1</i>.

TABLE 7.1 Pollution Prevention and Mitigation Measures (P2M2) to be implemented

PROJECT ACTIVITIES AND ENVIRONMENTAL ISSUES CONCERNED	IMPACT	P2M2 RECOMMENDED IN EIA REPORT	P2M2 TO BE IMPLEMENTED

Note: The contents of the above table are to be derived from “Summary of Impacts and Pollution Prevention and Mitigation Measures” recommended in the EIA Report and additional requirements stipulated in the EIA Approval Condition (COA). P2M2 shall be those which can be described as “state of the art technologies” or “industry best practices”.

Chapter 5
**ENVIRONMENTAL
 REQUIREMENT**
 (cont'd)

- Water pollution control:
 - i) Water pollution control monitoring;
 - ii) Effluent treatment;
 - iii) Temporary sillage and sewage treatment;
 - iv) Permanent sillage and sewage treatment; and
 - ii) Control of oil and grease, concrete wash, etc.
- Control of air pollution and noise:
 - i) Air pollution control monitoring; and
 - ii) Air pollution control.
- Materials and waste management:
 - i) Raw materials and stockpiles;
 - ii) Solid waste;
 - iii) Biomass;
 - iv) Spoils/dredge materials/construction waste;
 - v) Open burning avoidance; and
 - vi) Housekeeping.
- Scheduled waste management:
 Management of scheduled waste to comply with the Environmental Quality (Scheduled Waste) Regulations 2005.
- Emergency Response Plan (ERP):
 Name and contact details of the professional who has been tasked to prepare the ERP.
- Abandonment and closure plan:
 In a particular case where the Project Proponent intends to abandon a project whether it is in the construction stage or after it has started operation, an abandonment and closure plan shall be prepared.
- Declaration and Checklist
 - i) **Declaration** - The Project Proponent is required to make a declaration that all actions/measures/plans outlined in the EMP will be implemented as in *Figure 7.3*. The form is required to be filled out and submitted to DOE together with the EMP document.
 - ii) **Checklist** - A checklist to assist the Consultant in the EMP preparation and to summarise the EMP actionable items is given in *Figure 7.4*.

DECLARATION BY PROJECT PROPONENT/AUTHORISED PERSON

I certify that the Environmental Management Plan (EMP) has been prepared with my knowledge and I shall undertake the responsibility to ensure the actions, plans and pollution prevention and mitigation measures (P2M2) stated in the EMP will be implemented. I have provided sufficient allocation for the implementation of the EMP and P2M2.

Project Title:

Project Address/Location:

Name of Project Proponent/Authorised Person

Signature :

Date :

Source: EGiM (DOE)
FIGURE 7.3 Declaration by Project Proponent/ Authorised Person

ENVIRONMENTAL MANAGEMENT PLAN PREPARATION CHECKLIST

Project Title:

Name of Project Proponent:

Name of Consultant:

RECOMMENDED POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2) AND EIA APPROVAL CONDITIONS (COA) COMPLIANCE CHECKLIST

P2M2 Recommended or COA Number	Actionable Item in EMP on Page	Notes

Name of Project Proponent/Authorised Person

Signature :

Date :

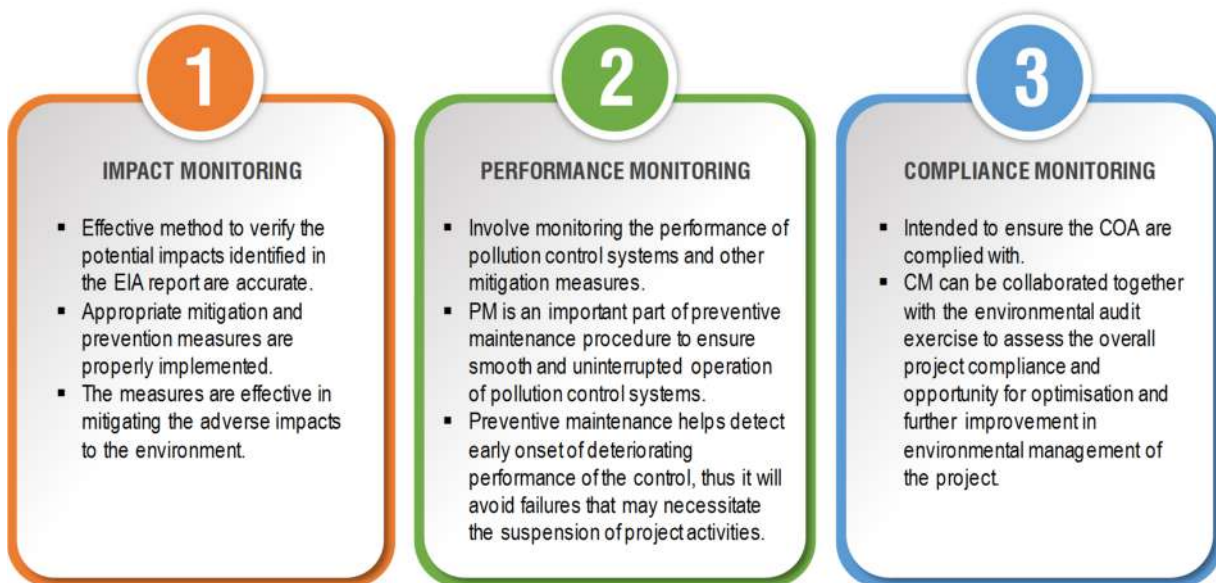
Source: EGiM (DOE)
FIGURE 7.4 Environmental Management Plan preparation checklist

7.6 ENVIRONMENTAL MONITORING

Environmental monitoring is an imperative process during the post-EIA stage. Specifically, environmental monitoring shall be conducted after the EMP document has been approved and the physical work of the project is about to commence.

In general, monitoring activities can be grouped into three different aspect, namely:

1. Impact Monitoring (IM)
2. Performance Monitoring (PM)
3. Compliance Monitoring (CM)



7.6.1 Monitoring Programme

The purpose of a monitoring programme is to provide information that the predicted impacts from a project are within the environmental acceptable limits, and to provide early warning information of unacceptable environmental condition.

Monitoring for key sectors should begin before construction to determine the baseline conditions. Subsequently, monitoring conducted during construction and operation will determine the degree and significance of impacts that will occur during these phases of the project.

The monitoring programme should be designed to do the following:

- i) provide scientifically sound information useful for determining the status of the environment;
- ii) provide information to predict future effects; and
- iii) provide information for management decisions on possible mitigation.

■ Monitoring of Physical Environment

Monitoring of physical environment is generally designed for the purpose of observing the impact to the environment as well as ensuring compliance to a set of standards or level. In general, the monitoring of physical environment covers the following components:

- i) water quality;
- ii) air quality; and
- iii) noise and vibration.

Monitoring of surface water quality should focus on the impacts that may materialise from the effect of sediment, pesticide and fertilizer discharge into the water bodies. Monitoring should be conducted upstream of the point of discharge and downstream from the discharge in any receiving water body considered environmentally significant (e.g. rivers, lakes, water intakes). Expected pollutants (e.g. suspended sediments, nutrients) should be measured together with important parameters for environmental preservation and human health.

Meanwhile, air quality monitoring of dust (particulate matter), noise and vibration are central in measuring the level of nuisance generated during the construction stage to the sensitive receptors. These also related to the safety and well-being of the personnel working for the project as well as the properties and its inhabitant in the surrounding area.

The operation of dam project will cause changes to the hydrology and morphology of the adjacent environment. Diversion of surface water will also cause reduction in downstream flows. As such, direct and/or indirect monitoring of water quality and downstream flow regime should be conducted.

■ Monitoring of Biological Environment

The advantage of biological monitoring over physical parameters of the environment is that it measures the actual effect of a pollutant on living organisms in their natural habitat. Generally, biological monitoring is far more time consuming and expensive than physical monitoring. Therefore, the biological monitoring programme has to be considered thoroughly and devised in a way that the feedback can be significant.

Biological monitoring methods and subjects vary greatly and are likely to be site specific. In order to establish a good and rigorous monitoring procedure, it is imperative that the objective and purpose of the biological monitoring are clear.

For a dam project that is intersecting wildlife trails, monitoring at the constructed wildlife crossing structures can be done together with DWNP.

■ Suggested Environmental Monitoring Programme

Ideally, environmental monitoring programme for any EIA project shall be tailored to suit the specific project activities, location and forecasted impacts. Nevertheless, this Guideline has set out a suggested environmental monitoring programme that was contrived based on the typical issues that occur during the implementation of dam projects. The suggested environmental monitoring programme is shown in *Table 7.2*.

TABLE 7.2 Suggested environmental monitoring programme for dam projects

CATEGORY	PROJECT STAGE	PARAMETER	PLACE OF MEASUREMENT	FREQUENCY
Ambient water quality	During construction	As stated in: <ul style="list-style-type: none"> ■ NWQS; ■ MMWQS; ■ NLWQS; or ■ Malaysia Groundwater Standard and Index 	Surrounding water bodies e.g. river, lake estuarine, groundwater and marine	Monthly
		<ul style="list-style-type: none"> ■ Suspended solids ■ Turbidity 	Outlet of silt traps	<ul style="list-style-type: none"> ■ Daily ■ Within period of 24 hours after rain is recorded to be equal to or exceeds 12.5 mm
	During operation	As stated in NWQS or MMWQS	<ul style="list-style-type: none"> ■ Reservoir ■ Downstream of dam 	Monthly
Ambient air quality	During construction	Particulate matter	<ul style="list-style-type: none"> ■ Boundary of project area ■ Sensitive receptor 	Monthly
	During operation			Quarterly
Noise	During construction	Leq	<ul style="list-style-type: none"> ■ Boundary of project area ■ Sensitive receptor 	Monthly
	During operation			Quarterly
Vibration	During construction	Peak particle velocity	<ul style="list-style-type: none"> ■ Boundary of project area ■ Sensitive receptor 	Monthly
	During operation			Quarterly
Hydrology	During construction	River/stream flow rate	<ul style="list-style-type: none"> ■ Downstream of project area ■ Sensitive receptor 	Continuous
	During operation			Continuous
BMPs	During construction	Structural integrity, functionality, practicality and frequency of maintenance of all BMPs	At all installed BMPs: <ul style="list-style-type: none"> ■ Earth drains ■ Silt fence ■ Silt trap 	Within a period of 24 hours after rain is recorded to be equal to or exceeds 12.5 mm
Wildlife (with DWNP)	Before construction	Target species	Wildlife trails	Continuous
	During construction	Target species	Wildlife crossing structures	Monthly
	During operation			Quarterly
Dam safety	During operation	As specified in the Malaysia Dam Safety Management Guidelines (MyDAMS) (DID, 2017)		

7.7 ENVIRONMENTAL AUDIT

Third-party environmental audit provides a systematic accumulation of evidence about the project's compliance status to the regulatory requirements relevant to the project. The environmental audit can also be viewed as a performance improvement tool where the Proponent gains a better understanding on their current standard of environmental management. Ideally, the audit process shall start after the EMP has been approved but before the commencement of physical work at site.

Audit requirements are guided by the Environmental Audit Guidance Manual (2011) published by DOE. The audit must be undertaken by an independent, third party, DOE-registered auditor.

In EQA 1974 (Act 127):

“Section 33(A). Environmental Audit

(1) The Director General may require the owner or occupier of any vehicle, ship or premises, irrespective of whether the vehicle, ship or premises are prescribed under section 18 or otherwise, to carry out an environmental audit and to submit an audit report in the manner as may be prescribed by the Minister by regulations made under this Act.”

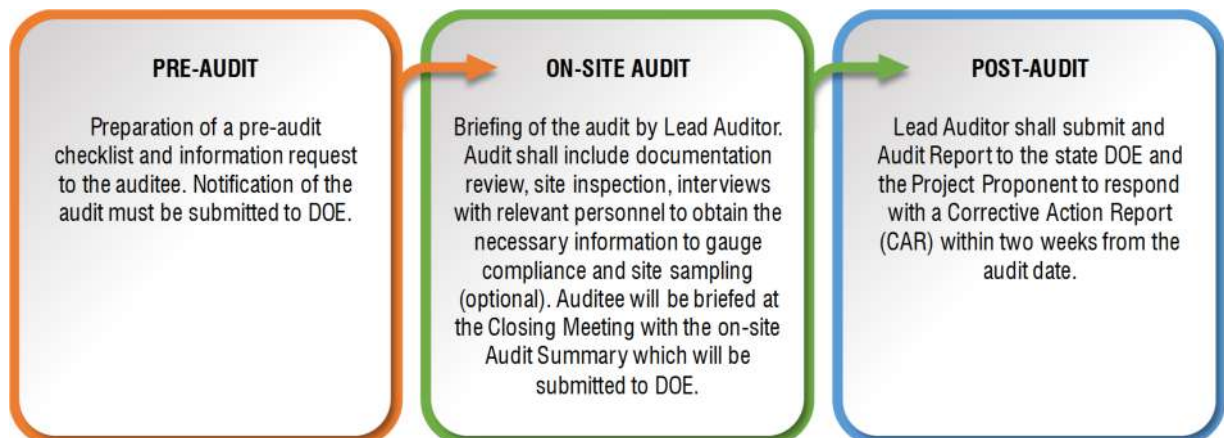


FIGURE 7.5 Typical audit process

7.8 ENVIRONMENTAL SUSTAINABILITY REPORT

Environmental Sustainability Report (ESR) is an organisational report that gives information about environmental performance, compliance and monitoring. This report can be taken as part of the self-regulation approach whereby it is for the internal use of the organisation, rather than for submission to DOE. ESR can be made up of several different report that relates to three important stages of project cycle management, namely evaluation, monitoring and audit.

In general, there are two main types of environmental report:

- i) Compliance Report:
 - Form EIA 2-18;
 - EMP and LD-P2M2;
 - Audit reports; and
 - Minutes of meeting (ERCMC and EPMC).

7 POST-EIA

- ii) Monitoring Report:
- Environmental Monitoring Report (EMR);
 - BMP Check Reporting (ESC Online Reporting);
 - *In-situ* measurement data;
 - Inventory of scheduled wastes; and
 - Implementation of EMT.

Pertinent findings from the environmental reports mentioned above shall be collated, digested, summarised and presented in an executive summary form that is the ESR.

The environmental reports are mainly prepared by the EO and the Environmental Consultant. These two shall ensure that information from the ground is compiled and presented in an easy to understand format covering the essential aspects on environmental performance of the project. Subsequently, the ESR report shall be made available to the EMC for their purview.

It is proposed that the content and format of the ESR report are as follows:

Section 1 PROJECT STATUS AND PROGRESS

- Physical progress of the project/operation
- Financial progress of the project/operation
- List of achieved and future requirement/milestone
- Status of P2M2 implementation
- Status of environmental budgeting
- Update of environmental reports submitted/to be submitted

Section 2 ENVIRONMENTAL MONITORING DATA

- Summary of recent compliance monitoring data
- Summary of recent performance monitoring data
- Summary of recent impact performance monitoring data
- Overview of P2M2 effectiveness
- Highlights of upset conditions and/or non-compliances
- Proposed mitigation and/or non-compliances

It is important that a good record keeping-practice is established as all types of records as well as correspondence related to environmental management shall be retained throughout the duration of the project. Among the importance of good record-keeping practice are as follows:

- i) the record serves as evidence/proof of actions taken;
- ii) provide evaluation results;
- iii) allow for communication between the committees (ERCMC and EPMC);
- iv) help in decision-making process based on administrative and technical findings;
- v) evidence of compliances and non-compliances;
- vi) create sense of accountability; and
- vii) provide summary of analysis and interpretation.

Section 3 MATERIAL AND/OR WASTE MANAGEMENT

- Summary of material storage and waste generation
- Summary of SW inventory
- Capacity status for material and waste storage
- Overview of waste disposed and/or recycled

Section 4 AUDIT AND INSPECTION

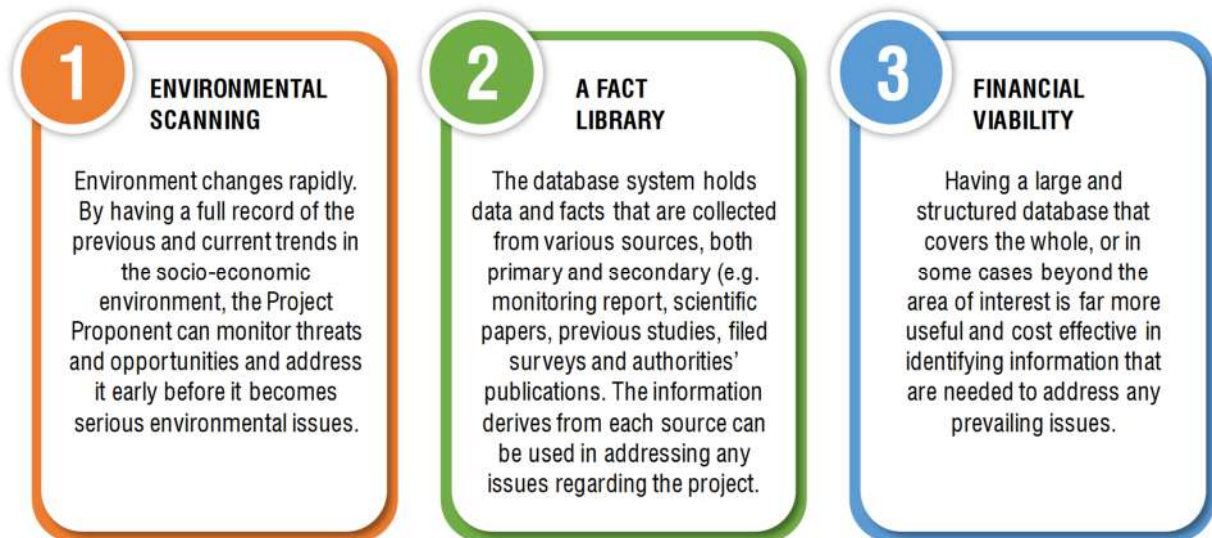
- Summary of findings from:
 - i) daily site inspection;
 - ii) third-party audit; and
 - iii) authorities enforcement visit.

Section 5 OVERALL COMPLIANCE STATUS

- Status of overall compliance
- Highlights of pertinent issues regarding non-compliances
- Compliance matter needing higher management attention

7.9 ENVIRONMENTAL DATABASE

The implementation of EIA projects may encounter possible issues from various sources such as authorities, stakeholders and the public. Thus, it is recommended that an environmental database is established in order to assist the Project Proponent in managing those issues in an effective way. There are three main importance in setting up an environmental database, as illustrated below.



7.9.1 Approach and Methodologies

It is advisable that various data and documents related to the project is kept in digital form so that they can be easily retrieved when needed. Common methodologies that can be used in setting up the environmental database are as below:

- i) **Data definition** – Creation and modification that defines the arrangement of the data;
- ii) **Update** – Insertion, modification and deletion of the actual data;
- iii) **Retrieval** – Providing information in a form directly usable or for further processing by other applications. The retrieved data may be made available in a form basically the same as it is stored in the database or in a new form obtained by altering or combining existing data from the database; and
- iv) **Administration** – Registering and monitoring users, enforcing data security, monitoring performance, maintaining data integrity, dealing with concurrency control and recovering information that had been corrupted by unexpected event such as system failure.



CHAPTER 8

TOR and EIA Checklist

Empangan Timah Tasoh, Perlis
Photo by Iffah Ishak on Unsplash.com

8.1 INTRODUCTION

This chapter provides checklists to assist the Qualified Person in preparing the:

- i) Terms of Reference (TOR)/Environmental Scoping Information (ESI); and
- ii) Environmental Impact Assessment (EIA).

Both checklists must be filled in and incorporated at the front of the respective reports. Besides the Qualified Person, these checklists can also be used by the EIATRC as a reference.

The checklists are:

- i) Checklist for TOR/ESI as per in *Table 8.1*; and
- ii) Checklist for EIA as per in *Table 8.2*.



8 CHECKLIST

TABLE 8.1 Checklist for TOR/ESI

ITEM	ADEQUACY CHECK		PAGE IN TOR/ESI	REMARKS
	YES	NO		
1.0	Is the project a NEW development?			
2.0	Is the project an *AMENDMENT to an existing development? If so,			
	a)	Was there an EIA for the existing development?		
	b)	Does the addition involve new area development? If so, how much and where?		
	<i>*Amendment such as increase in reservoir storage capacity, additional water intake point, add-on weir and other relevant components that may impact the surrounding environment</i>			
3.0	Has policies compliance been met by the Project Proponent?			
	a)	Federal approval		
		■ NPPC		
		■ Others		
	b)	State approval		
	c)	Land status/acquisition		
	d)	Land use compatibility		
	e)	ESAs		
	f)	Others		
		■ FDPM		
		■ DWNP		
		■ DID		
		■ PLANMalaysia		
		■ JAKOA		
	■ PTG			
4.0	Who were involved in the scoping tasks?			
	a)	Project Proponent		
	b)	Engineering consultants		
	c)	Environmental consultant		
	d)	Affected public/stakeholders		
	e)	Government agencies		
	f)	Others		
5.0	Does the project involve the following activities?			
	a)	Survey		
	b)	Establish accessibility		
	c)	Base camp and site facilities		
	d)	Logging activity*		
	e)	Quarrying activity		
	f)	Earthworks and haul roads		
	g)	Mobilisation of workers, equipment and materials		
	h)	Site clearing and biomass removal		
	i)	Construction of intakes and spillway		

Notes: Logging activity within Forest Reserve will be carried out by the respective State FDPM where many of the trees are valuable.

TABLE 8.1 (cont'd) Checklist for TOR/ESI

ITEM	ADEQUACY CHECK		PAGE IN TOR/ESI	REMARKS
	YES	NO		
5.0	j) Diversion			
	k) Drainage works			
	l) Civil and structural works			
	m) Electrical and mechanical works			
	n) Testing and commissioning works			
	o) Construction materials handling and storage			
	p) Process controls			
	q) Air pollution control system			
	q) Industrial effluent treatment system			
	r) Sewage effluent treatment system			
	s) Noise/vibration controls			
	t) Safety controls			
	u) Waste generations			
	v) Weed control			
w) Others				
6.0	Land use on site and surrounding areas			
	a) Are the following features intersected by the Project?			
	■ Rivers and/or lakes			
	■ Coastal areas			
	■ Wetlands/Mangroves			
	■ Coral reefs/Seagrass beds			
	■ Forest reserve			
	■ Agriculture			
	■ Aquaculture			
	■ Built-up areas			
	■ Tourism/recreational areas			
	■ Orang Asli settlements			
	■ Orang Asli roaming area/ <i>kawasan rayau</i>			
	■ Wildlife roaming area			
	■ Archaeology area			
	b) Are the environmental issues with each feature identified?			
7.0	Timeline			
	a) Project implementation schedule (by stage)			
8.0	Project information provided			
	a) Project concept and layout			
	b) Project activities			
	c) Project components			
	d) Material sources and storage			
	e) Infrastructure, utilities and amenities requirement			

8 CHECKLIST

TABLE 8.1 (cont'd) Checklist for TOR/ESI

ITEM		ADEQUACY CHECK		PAGE IN TOR/ESI	REMARKS
		YES	NO		
9.0	Site Suitability Assessment				
	a) Siting constraints/suitability addressed?				
	b) Have the affected public been informed/consulted?				
	c) Alternative project layout provided?				
	d) Best available technology (BAT) considered?				
	e) No-project option considered?				
10.0	Significant impacts scoped and prioritised?				
	a) Identified impacts				
	■ Water quality				
	■ Air quality				
	■ Noise and vibration				
	■ Safety impact				
	■ Health impact				
	■ Geology				
	■ Hydrology				
	■ Flood risk				
	■ Soil erosion				
	■ Terrestrial flora				
	■ Terrestrial fauna				
	■ Ecology				
	■ Waste generation				
	■ Others				
	b) For each significant impact, were the methods and scope sufficient for impact assessment?				
c) Were mitigation measures proposed to address the significant impact?					

TABLE 8.2 Checklist for EIA

ITEM	ADEQUACY CHECK		PAGE IN EIA	REMARKS
	YES	NO		
1.0	Executive Summary (brief and concise)			
	a) In Bahasa Malaysia			
	b) In English			
2.0	Introduction			
2.1	a) Title of the project			
	b) Project Proponent details			
	c) EIA Consultant details			
	d) Project location (boundary coordinates) in A3 size			
	e) Relevant maps showing project location and ESAs			
2.2	Legal requirements			
3.0	Terms of Reference			
4.0	Statement of Need			
	a) Principal reasons for proposed project (include relevant supporting documents)			
	b) Aim of project			
5.0	Project Options			
	a) Alternatives considered?			
	b) Project optimisation done?			
6.0	Project Description			
6.1	a) Project Concept:			
	b) Layout plan			
	c) Size and land requirement			
	d) Project component			
	e) Method statement			
	f) Labour requirement			
	g) Raw material requirement			
	h) Infrastructure/Utilities/Amenities			
6.2	Project activities: Construction			
6.3	Project activities: Operational			
6.4	Project Implementation schedule (chart)			
7.0	Description of Existing Environment			
7.1	a) Physico-chemical			
	■ Land use, land use zoning and compatibility			
	■ Topography/Bathymetry			
	■ Geology and soil			
	■ Hydrology			
	■ Hydrogeology			
	■ Soil erosion			
	■ Climate			

8 CHECKLIST

TABLE 8.2 (cont'd) Checklist for EIA

ITEM	ADEQUACY CHECK		PAGE IN EIA	REMARKS
	YES	NO		
7.1	■ Water quality			
	■ Ambient air quality			
	■ Ambient noise			
	■ Vibration			
	b) Biological (where applicable)			
	■ Terrestrial flora			
	■ Terrestrial fauna			
	■ Marine ecology			
	■ Freshwater ecology			
	c) Socio-economy			
	■ Anthropology			
	■ Public Health			
	■ Historical, cultural and archaeological aspects			
	■ Ecotourism			
■ Stakeholders' Engagements				
d) Environmentally Sensitive Areas				
7.2	Technical Studies (where applicable):			
	a) Social Impact Assessment (SIA)			
	b) Traffic Impact Assessment (TIA)			
	c) Health Impact Assessment (HIA)			
	d) Heritage Impact Assessment			
	e) Wildlife Management Plan (WMP)			
	f) Topographic survey			
	g) Soil Investigation (SI) study			
	h) Hydraulic and Hydrology study			
	i) Geotechnical study			
	j) Geological Terrain Mapping			
	k) Erosion and Sediment Control Plan (ESCP)			
8.0	Evaluation of Impacts			
8.1	Detailed assessment of impacts during:			
	a) Pre-construction stage			
	i) Survey			
	■ Sending surveyors into new areas			
	■ Cutting sights lines through vegetation			
	■ Establish accessibility			
	ii) Investigation			
	■ Introduction or workforce in new areas			
	■ Establishing base camps			
	■ Putting in access tracks			
■ Drilling holes and/or digging pits				

TABLE 8.2 (cont'd) Checklist for EIA

ITEM	ADEQUACY CHECK		PAGE IN EIA	REMARKS
	YES	NO		
8.1	iii) Land acquisition			
	■ Acquire land			
	■ Resettlement of affected occupants			
	iv) Others			
	b) Construction stage			
	i) Temporary occupation			
	■ Construction of temporary buildings, storage facilities and working areas			
	■ Water supply			
	■ Solid waste disposal			
	■ Sewage disposal			
	■ Workforce			
	■ Pest control			
	■ Machine servicing & maintenance			
	■ Resources abstraction – logging, mining			
	ii) Site preparation			
	■ Demolition and removal of structures			
	■ Removal and disposal of vegetation			
	■ Tree felling			
	■ Constructing access roads			
	■ Constructing temporary drainage			
	■ Operating equipment (chainsaw, bulldozers)			
	iii) Diversion works			
	■ Drainage works			
	■ Operation of equipment			
	■ Diversion of surface water			
	iv) Dam construction			
	■ Operation of equipment (bulldozers, diggers, trucks, scrapers)			
	■ Construction of haul roads			
	■ Cutting/quarrying/ blasting, borrow areas			
	■ Transportation of construction materials			
	■ Filling/Pouring/Grouting			
	■ Building structures (concrete or rollcrete)			
	v) Intakes and spillways			
■ Operation of equipment				
■ Alteration of surface water hydrology				
vi) Reservoir filling				
■ Raising groundwater levels				
■ Inundation of land				
■ Vegetation decomposition				
■ Alteration of surface water hydrology				

8 CHECKLIST

TABLE 88.2 (cont'd) Checklist for EIA

ITEM	ADEQUACY CHECK		PAGE IN EIA	REMARKS
	YES	NO		
8.1	vii) Demobilisation			
	■ Demobilisation and removal of temporary buildings			
	■ Waste removal/ disposal (including rubbish, equipment and liquid wastes)			
	■ Rehabilitation of occupied site			
	viii) Others			
	c) Operational stage			
	i) Reservoir presence			
	■ Wetland			
	■ Evaporation			
	■ Micro-seismic			
	■ Community severance			
	■ Provision of habitat for disease vectors			
	ii) Reservoir usage			
	■ Aquaculture			
	■ Fishing			
	■ Recreation			
	■ Water discharge			
	■ Sediment flushing			
	■ Drawdown			
	■ Flood mitigation			
	iii) Dam presence			
	■ Dam safety			
	■ Dam break			
	■ Barrier presence			
	iv) Weed control			
	■ Manual and mechanical cutting			
	■ Use of herbicides			
	v) Catchment			
	■ Repair of slope failures and erosion			
	■ General maintenance			
	■ Resettlement of catchment occupants			
	vi) Decommissioning - Abandonment			
	■ Dewatering of reservoir			
	■ Decommissioning of dam			
	■ Removal of sediment			
	■ Demolition of dam			
	■ Restoration of reservoir area			

TABLE 8.2 (cont'd) Checklist for EIA

ITEM		ADEQUACY CHECK		PAGE IN EIA	REMARKS
		YES	NO		
8.1	vii) Others				
9.0	Pollution Prevention and Mitigation Measure (P2M2)				
9.1	Environmental Aspects				
	a) Water pollution				
	b) Air pollution				
	c) Noise and vibration				
	d) Waste management				
	e) Socio economy				
	f) Land traffic				
	g) Others				
10.0	Environmental Management Plan (EMP)				
10.1	Environmental Mainstreaming Tools:				
	a) Environmental policy (EP)				
	b) Environmental budgeting (EB)				
	c) Environmental monitoring committee (EMC)				
	d) Environmental facility (EF)				
	e) Environmental competency (EC)				
	f) Environmental reporting and communication (ERC)				
	g) Environmental transparency (ET)				
10.2	LD-P2M2				
10.3	Environmental Monitoring Programme:				
	a) Impact monitoring (IM)				
	b) Performance monitoring (PM)				
	c) Compliance monitoring (CM)				
	■ Location of monitoring points				
	■ Frequency of monitoring				
	■ Parameters to be measured				
	■ Environmental quality criteria				
■ Procedures for reporting					
10.4	Environmental Audit Programme				
10.5	Environmental Sustainability Report				
10.6	Environmental Database				
11.0	Study Findings				
12.0	Reference				
13.0	Appendices				

CHAPTER 9 EIA Report Format



*Kenyir Dam, Terengganu
Photo by Mior Zulkarnain Mohd Zamhuri on Flickr*



9.1 INTRODUCTION

DOE has stipulated a specific format for the EIA report, as detailed in Appendix 9 of EGiM. The standard EIA report format encompasses the cover page, preliminary pages, chapters arrangement and appendices. It is important that format is followed to ensure the final EIA report able to meet the required standard set by DOE.

9.2 REPORT COVER

The EIA report cover shall follow the arrangement as shown in *Figure 9.1*.

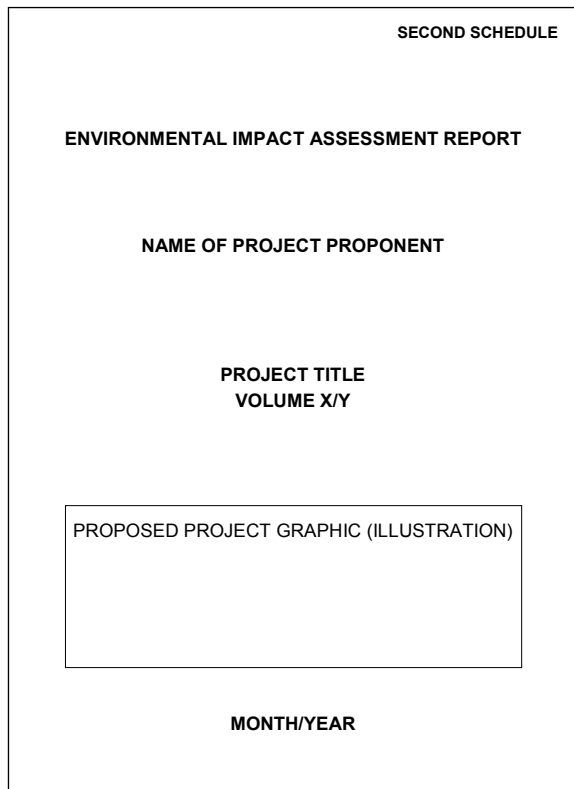


FIGURE 9.1 Format for EIA report cover

9.3 PRELIMINARY PAGES

The preliminary pages are an important part of the EIA report that shall not be overlooked. Items that must be provided here are:

- i) Environmental Pledge by the Project Proponent;
- ii) Declaration by the Qualified Person; and
- iii) Executive Summary.

■ Environmental Pledge by the Project Proponent

The environmental pledge is a document that state the Project Proponent is fully aware on the environmental protection required and affirm their commitment in undertaking the pollution control measures specified in the EIA report. The pledge shall be written on the official letterhead of the Project Proponent’s company, as illustrated in *Figure 9.2*.

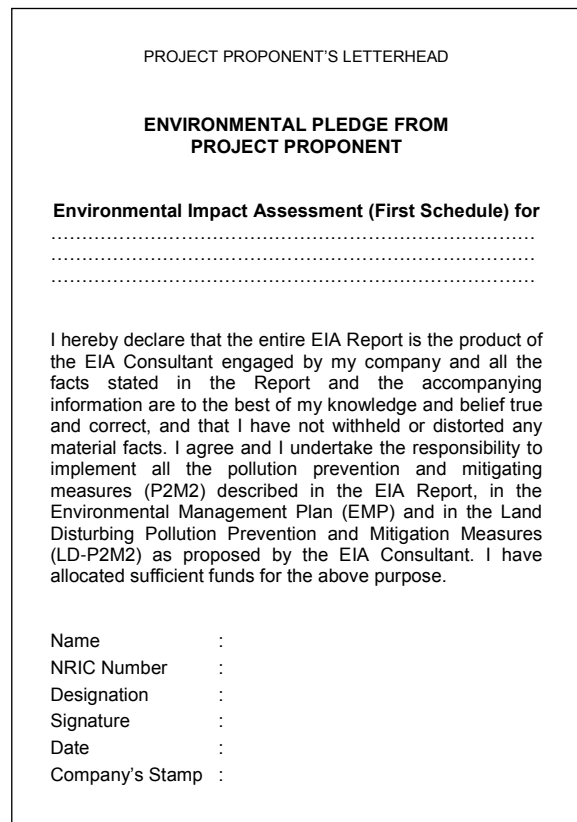


FIGURE 9.2 Environmental Pledge by the Project Proponent

■ Declaration by the Qualified Person

EIA Team Leader, as the Qualified Person, shall make a declaration that the EIA report was prepared truthfully, and the Project Proponent was briefed on the environmental protection requirement stated in the EIA report. The declaration must be written on the official letterhead of the Qualified Person’s company, as shown in *Figure 9.3*.

EIA STUDY TEAM LEADER'S LETTERHEAD

**DECLARATION FROM
EIA STUDY TEAM LEADER**

Environmental Impact Assessment (First Schedule) for
.....
.....
.....

I declare that the entire EIA Report is the product of my own and the work of my team members (i.e. other consultants who are also Qualified Persons) who worked under my supervision and all the facts stated in the Report and the accompanying information are to the best of my knowledge and belief true and correct, and that I have not withheld or distorted any material facts. I have briefed the Project Proponent on the content of the Report and highlighted to him all the pollution prevention and mitigating measures (P2M2) described in it, and in the Environmental Management Plan (EMP), and in the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), and the Project Proponent has agreed to implement them (i.e. P2M2).

Name of EIA Consultant Team Leader :
NRIC Number :
Designation :
Signature :
Date :
Company's Stamp :

FIGURE 9.3 Declaration by the Qualified Person

■ Executive Summary

Executive Summary is a gateway to the main EIA. Thus, it shall succinctly summarise the details of the proposed project, its main issues as well as the proposed P2M2 to be implemented. The Executive Summary is intended not only to be reviewed by DOE and other agencies, but also to be read by the public. As such, it must be written in non-technical language.

The Executive Summary must be prepared in English and Bahasa Malaysia, whereby both versions must be presented in infographic and similar format. Information that needs to be included in the Executive Summary are:

- i) Name/Title of the Project;
- ii) Name and contact details of the Project Proponent and the Qualified Person (contact person, address, telephone number and e-mail);
- iii) Location of the project (coordinates, lot number, district name);
- iv) Description of the project and the surrounding existing environment;
- v) Relevant maps showing project location and sensitive receptors;
- vi) Tabulation of potential impacts, their magnitude and the proposed P2M2, as shown in *Table 9.1*; and
- vii) Description of relevant monitoring programmes (performance monitoring, compliance monitoring, and impact monitoring).

TABLE 9.1 Summary of potential impacts, their magnitude and proposed P2M2

SIGNIFICANT POTENTIAL IMPACTS	MAGNITUDE OF SIGNIFICANT POTENTIAL IMPACTS	PROPOSED P2M2	REFERENCE PAGE IN EIA REPORT

9.4 MAIN TEXT OF THE EIA REPORT

The main text or body of the EIA report shall contain at least the following chapters as summarised below:

<p>Chapter 1 INTRODUCTION</p>	<ul style="list-style-type: none"> ■ The type of project and its specific location shall be specified in the project title. ■ Relevant maps showing project location and sensitive receptors. ■ Identify the Project Proponent by providing details on: <ul style="list-style-type: none"> i) company's name; ii) authorised person/contact person; and iii) contact details (address, telephone number and email). ■ Provide the details of the EIA consulting firm, which are: <ul style="list-style-type: none"> i) company's name; ii) EIA Team Leader and the registration number; iii) Subject Matter Consultants and the registration number; and iv) contact details (address, telephone number and e-mail). ■ State the relevant prescribed activity related to the project. ■ Provide definitive statement on the conformance of the project to the: <ul style="list-style-type: none"> i) NPP; ii) Structure Plan; iii) Local Plan; iv) Regional Plan (inter-state planning); v) SZIRA; and vi) EESIM.
<p>Chapter 2 TERMS OF REFERENCE</p>	<ul style="list-style-type: none"> ■ Provide the TOR of the EIA study which has been endorsed by DOE; and ■ Cite reference of the endorsement.
<p>Chapter 3 STATEMENT OF NEED</p>	<ul style="list-style-type: none"> ■ Outline the background of the project and the reasons for it being proposed; ■ Establish social, economic or other needs for the project; ■ Conclude with definitive statement on the aim and purpose of the project; and ■ Substantiate the statement with accurate facts and figures.
<p>Chapter 4 PROJECT OPTION</p>	<ul style="list-style-type: none"> ■ Discuss the advantages and disadvantages from the technical, economic, social and environmental perspective; and ■ Project options that can be deliberated are: <ul style="list-style-type: none"> i) site options; ii) layout options; iii) alignment options; iv) technology options; v) raw materials options; vi) construction method options; vii) operation options; and viii) no project/scaled-down project options.

<p>Chapter 5 PROJECT DESCRIPTION</p>	<ul style="list-style-type: none"> ■ Describe the project according to: <ul style="list-style-type: none"> i) size and capacity; ii) land requirements; iii) raw materials required; iv) energy and water source and consumption; v) labour requirement; vi) transportation; vii) ancillary facilities; and viii) special infrastructural requirements. ■ Provide related maps and diagrams; ■ Summarise the technical, economic and environmental features that are essential to the project; ■ State the project implementation schedule and the project lifespan; and ■ Describe the operation and maintenance activities.
<p>Chapter 6 EXISTING ENVIRONMENT</p>	<ul style="list-style-type: none"> ■ Define the zone of study; ■ Describe in qualitative and quantitative terms the baseline conditions for: <ul style="list-style-type: none"> i) physico-chemical; ii) biological; iii) social; and iv) economic setting. ■ Outline in great details the ESAs and areas of special or unique scientific, socio-economic or cultural values; and ■ Sources of information must be explained. Uncertainties of the information must be discussed.
<p>Chapter 7 EVALUATION OF IMPACTS</p>	<ul style="list-style-type: none"> ■ Present analysis of the predicted impacts in quantitative and qualitative terms; ■ The impacts shall be characterised according to: <ul style="list-style-type: none"> i) magnitude; ii) extent; iii) duration; and iv) significance. ■ Discussion on impact identification and prediction shall cover the following aspects: <ul style="list-style-type: none"> i) zone of impact shall be based on the complexity of the project and supported by appropriate modelling exercise; ii) the nature of environmental effect; and iii) the source and nature of impact. ■ Describe the methodologies used for predicting impacts; ■ Indicate general impacts of pollutant emission in the study area based on the output of modelling exercise (if applicable). Contours of pollution shall be presented on maps; ■ All modelling exercise shall undergo the completed stages of modelling which area: <ul style="list-style-type: none"> i) model verification; ii) calibration; and iii) validation. ■ Quantify the environmental and development trade-offs anticipated from the proposed project using cost-benefit evaluation technique.

<p>Chapter 8 MITIGATION MEASURES</p>	<ul style="list-style-type: none"> ■ Discuss all the mitigation measures which have been incorporated into the design and implementation of the project; ■ The mitigation measures shall be identified for each potential adverse impact at each stage of the project implementation; ■ Mitigation measures can be structural, non-structural, procedural or administrative; ■ The proposed mitigation measures must adhere to: <ul style="list-style-type: none"> i) Guidance Document for addressing soil erosion and sediment control; ii) Guidance Document for the preparation of LD-P2M2; and iii) Other relevant guidelines and guidance document issued by DOE. ■ Selected mitigation measures must be considered as the “state-of-the-art”, or “BAT” or “industry best practices”.
<p>Chapter 9 ENVIRONMENTAL MANAGEMENT PLAN</p>	<ul style="list-style-type: none"> ■ Outline the detailed framework for the EMP document to be prepared after the EIA is approved; ■ Proposed the appropriate monitoring programme that covers performance monitoring, compliance monitoring and impact monitoring; and ■ Discuss the proposal for environmental audit programme.
<p>Chapter 10 STUDY FINDINGS</p>	<p>Draw appropriate conclusions of the study findings from the perspective of the impacts of the proposed project.</p>
<p>REFERENCES</p>	<p>Provide full citation of all the references used.</p>

9.5 APPENDICES

Relevant data, information or analysis that was not incorporated in the main text of the EIA report shall be compiled in the Appendices. These includes the following:

- i) certificate of analysis of laboratory tests from data collection activities;
- ii) input data and results of modelling studies;
- iii) field work report during existing environment study;
- iv) supporting documents such as SSA, ESI, etc.; and
- v) relevant public engagement documents such as list of attendance, meeting minutes, photographs, etc.

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ATTACHMENT 1

Project Description



CONTENT	DESCRIPTION
Project location	<ul style="list-style-type: none"> ■ Site location on satellite image within 5 km radius ZOS and ZOI (if required) ■ Site location on topography map and land use map ■ Project boundary and layout (with coordinates) ■ Description of location in relation to identifiable landmarks (e.g. city centers, rivers, main roads, town, forest)
Existing site description	Descriptions of general environmental features of the project site within 5 km radius
Project components	Descriptions of each project component and detailed design or layout plan: <ul style="list-style-type: none"> ■ access road (temporary and permanent) ■ main dam ■ main reservoir ■ spillway ■ diversion works ■ saddle dam ■ re-regulating weir (for hydro-power dam) ■ power station (for hydro-power dam) ■ penstock (for hydro-power dam) ■ logging and vegetation clearing ■ quarry and construction materials ■ other associated works
Project concept	<ul style="list-style-type: none"> ■ Detailed explanation on the selected type of dam, materials, technology, plant capacity, dam capacity and functions ■ Process flow diagram ■ Lifespan of the dam
Project activities	<ul style="list-style-type: none"> ■ Method statement for key project activities during pre-construction, construction, operation stages (including for logging, quarrying and impounding) ■ Manpower and vehicle requirements ■ Transportation materials/resource (volume, no. of trips, routes, location) ■ Workers camps location including waste management ■ Working platform ■ Disposal area (spoil, biomass) ■ Storage area, <i>matau</i>
Infrastructure, utilities and amenities requirement	Details of the estimated demand for: <ul style="list-style-type: none"> ■ water supply ■ power supply ■ sewerage ■ telecommunications ■ road system ■ waste management
Project implementation schedule	<ul style="list-style-type: none"> ■ Estimated timeline for each project stage starting from project planning to construction and operational stages ■ Details of each project stage ■ Provide in Gantt chart

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 Qualified Person to determine the relevant information required for environmental assessment and compliance

ATTACHMENT 2

Proposed Procedures for Sampling Practices for
Water, Air, Noise and Vibration



ATTACHMENT 2

ENVIRONMENTAL COMPONENT	SAMPLING STATION SELECTION
1. WATER QUALITY	
a) Surface water:	
i) Lake	<ul style="list-style-type: none"> ■ Avoid areas near structures to avoid point sources of contamination), unless these structures are targeted for the study ■ Use <i>in situ</i> field measurements to determine the vertical and lateral distribution of water quality. This is because the water is stagnant and commonly become stratified and water quality can vary greatly among the stratified sectors.
ii) River or stream	<ul style="list-style-type: none"> ■ Identify stream where constituents are well mixed along the cross section. ■ Far enough above and below confluences of streamflow or point sources of contamination to avoid sampling at a cross section where flows are poorly mixed or not unidirectional. ■ At a stream reach where representative samples can be collected safely during all flow regimes.
iii) Marine	<ul style="list-style-type: none"> ■ Sampling shall be done during low tide which represent worst water quality condition ■ Sampling sites should form a gradient away from the source (e.g., STP outfall) towards the ecosystem of concern (coral reefs, aquaculture, etc.)

GOOD PRACTICES	QUALITY CONTROL	REFERENCE																
<p><u>In-situ water quality sampling:</u></p> <ul style="list-style-type: none"> ■ Before taking an instrument into the field, field personnel must be familiar with the contents of the operating manual for that specific instrument, and ensure that it is stored, calibrated, maintained and used as per manufacturer’s instructions. ■ Detailed records of calibration and maintenance must be kept. Calibration must be undertaken as per the instrument manufacturer’s instructions. ■ Sensors on sondes should be kept moist or wet at all times, and not be allowed to dry out. ■ Do not allow the sonde to touch the substrate as there is a risk of damage to the sensors from sticks, rocks, debris and anoxic sediments. Thoroughly clean the sonde if it has accidentally made contact with the substrate before taking any further readings. ■ Depth can be determined in a boat by using the depth sounder. ■ Stratification with the water column can occur for a number of parameters, therefore depth profiling is necessary in waterbodies deeper than 5 m. ■ Follow the manufacturer’s direction for taking the readings. Allow the readings to stabilise. Typical readings for dissolved oxygen, electrical conductivity and pH in potable (drinking), fresh and marine water are presented in Table 1. <p>Table 1: Typical ranges for dissolved oxygen, conductivity and pH in different water types</p> <table border="1"> <thead> <tr> <th>PARAMETER</th> <th>POTABLE WATER</th> <th>FRESH WATER</th> <th>MARINE WATER</th> </tr> </thead> <tbody> <tr> <td>Dissolved oxygen (DO)</td> <td></td> <td colspan="2">Typical concentrations under ambient conditions 6–10 mg/L. Values may be higher if algal blooms are present, or lower if anoxic conditions are present.</td> </tr> <tr> <td>Electrical conductivity (EC)</td> <td>50–500 µS/cm</td> <td><1,500 µS/cm</td> <td>~52,000 µS/cm</td> </tr> <tr> <td>pH</td> <td></td> <td colspan="2">6–8.5. These may be lower if acid rock drainage or acid sulfate soils/ sediments are present. The total range of pH values is generally 0–14.</td> </tr> </tbody> </table> <p>Source: Department of Environment and Science, Queensland (2018)</p>	PARAMETER	POTABLE WATER	FRESH WATER	MARINE WATER	Dissolved oxygen (DO)		Typical concentrations under ambient conditions 6–10 mg/L. Values may be higher if algal blooms are present, or lower if anoxic conditions are present.		Electrical conductivity (EC)	50–500 µS/cm	<1,500 µS/cm	~52,000 µS/cm	pH		6–8.5. These may be lower if acid rock drainage or acid sulfate soils/ sediments are present. The total range of pH values is generally 0–14.		<p>The collection of quality control samples is essential in order to provide confidence in the results of a sampling program, and is part of the overall quality assurance program. The following methods are advisable to be conducted in order to quality control the sample.</p> <ul style="list-style-type: none"> ■ Blanks A blank sample is a sample named so that it is indistinguishable from the other samples. This means the source and chemical composition of the samples are not known to the analyst. Blind samples can determine variability within a laboratory or bias and variability between two or more laboratories. ■ Replicates Replicate samples are obtained by collecting two or more samples across a site at the same time. Replicate samples provide estimates of the sample variability, including experimental sampling error and analytical error. 	<ul style="list-style-type: none"> ■ ASEAN Marine Water Quality Management Guidelines and Monitoring Manual ■ Monitoring and Sampling Manual Environmental Protection (Water) Policy 2009 - State of Queensland, Australia ■ National Field Manual for the Collection of Water-Quality Data - US Geological Survey, 2018
PARAMETER	POTABLE WATER	FRESH WATER	MARINE WATER															
Dissolved oxygen (DO)		Typical concentrations under ambient conditions 6–10 mg/L. Values may be higher if algal blooms are present, or lower if anoxic conditions are present.																
Electrical conductivity (EC)	50–500 µS/cm	<1,500 µS/cm	~52,000 µS/cm															
pH		6–8.5. These may be lower if acid rock drainage or acid sulfate soils/ sediments are present. The total range of pH values is generally 0–14.																

ATTACHMENT 2

ENVIRONMENTAL COMPONENT	SAMPLING STATION SELECTION
1. WATER QUALITY (cont'd)	
a) Surface water (cont'd):	

GOOD PRACTICES	QUALITY CONTROL	REFERENCE
<ul style="list-style-type: none"> ■ Record the measured values in a notebook, and save the reading if a memory function is available. Record the following details: <ol style="list-style-type: none"> i) site details (e.g. site code, site name, waterway, GPS co-ordinates); ii) date and time of measurement; and iii) any factor that may have affected the measurement (e.g. presence of an algal bloom, recent rainfall, etc.). <u>Ex-situ water quality sampling:</u> <ul style="list-style-type: none"> ■ Prior to leaving for the field, inspect all equipment and ensure it is in good working order and has been cleaned appropriately. Make sure if you are using an intermediate container that is appropriate for the analytes/s being sampled for. ■ Samples should be collected directly into the laboratory supplied containers when sampling waters where possible, as this will reduce the risk of contamination. Direct sample collection is the preferred procedure if the environment is safe (e.g. during low flow conditions), and sample bottles do not contain preservative. ■ On reaching the sampling site, prepare a clean work area and ensure all equipment that you will require is unpacked and easily accessible. ■ Pre-label all sample containers if possible. ■ For surface water sampling, water is collected at the surface of the water with hand. A small air space should be left to allow the sample to be mixed before analysis; ■ For station that is deeper than 5 m, deploy the water sampler and lower into a representative area of water and to the required depth (surface: 0.2d, middle: 0.5d, bottom: 0.8d). Ensure the bottom of the sampler is at least 1 m above the riverbed/seabed; ■ Refill by deploying the water sampler, lowering the sampler to the required depth and triggering the sampler. ■ Remove the sampler from the water and fill the labelled sampler containers. Do this quickly to avoid sediment particles from settling to the bottom of the water sampler. Recap the sample containers. ■ Complete a final check that details on the sample container are correct. ■ Place the sample container in a cooler box (with ice or ice bricks) or refrigerator and chill. Double bag samples if using ice. ■ Thoroughly rinse discrete depth sampler three times with high quality deionised water, allow to dry and store in a clean location prior to reuse at further sampling sites. ■ Fill out the chain of custody form. 		

ATTACHMENT 2

ENVIRONMENTAL COMPONENT	SAMPLING STATION SELECTION
1. WATER QUALITY (cont'd)	
b) Groundwater	<ul style="list-style-type: none"> ■ Implement safety precautions and site preparations before the commencement of the groundwater sampling ■ The total depth and depth to the water level should be measured within the bore before any purging and sampling. ■ Using a pump for purging and sampling a bore ensures that representative sample of water residing in the aquifer will be obtained. ■ Make sure the pumping technique is consistent and every sample is obtained following the same procedure. ■ Purge the well and monitor field measurements. Purging the well of standing water is generally required to ensure that the sample water will be withdrawn directly from the aquifer. ■ During sample collection, make sure that the pump discharge line or the bailer does not contact the sample container. ■ All samples requiring preservation must be preserved immediately at the time of sample collection.
2. AIR	<ul style="list-style-type: none"> ■ The site should be representative of the area selected that reflect concentrations and fluctuations of air pollution of air pollutant within the area. ■ The stations should be away from: <ul style="list-style-type: none"> i) nearby sources of air pollution at least 25 m away from domestic chimneys. ii) absorbing surfaces at least 1m away from absorbing building material. iii) area where considerable building or land use changes are foreseen in the near future. ■ The site where the station is located should fulfil one or more of the following requirements depending on the types of instruments used: <ul style="list-style-type: none"> i) it should be available for a long period. ii) it should preferably be accessible any time throughout the year. iii) electrical power of sufficient rating should be available. iv) it should be vandal-proof. v) it may need to be protected for extreme of temperatures.
3. VIBRATION	<ul style="list-style-type: none"> ■ The vibration assessment should normally be at the nearest building. ■ The best position for the monitoring point would often be on the floor slab or foundation. ■ Monitoring points should be accessible to all parties concerned.

GOOD PRACTICES	QUALITY CONTROL	REFERENCE
<p><u>In-situ water quality sampling:</u> (Refer to surface water column)</p> <p><u>Ex-situ water quality sampling:</u></p> <ul style="list-style-type: none"> ■ Confirm that the location conforms to the network design of the study, with respect to areal and depth distribution. ■ Document land-use/land-cover characteristics of the watershed with respect to study objectives and potential effects on groundwater. Consider the effects of features such as landfills, waste-disposal or industrial sites, etc. ■ Review subsurface geology and verify that the existing or newly developed well is within the desired geologic units. ■ Evaluate the site for accessibility with respect to equipment needed for well installation and sample collection. ■ Measure and record the water level in existing wells by using steel or electrical tape. If the well does not have an access point for measuring water levels, note this fact in the station folder. ■ Review seasonal water-level declines that could make the well unsuitable for use as a sampling site. ■ Check that the yield of water is adequate for sampling; typically, a minimum of 0.25 gallons (approximately 1 litre) per minute is adequate. 		
<ul style="list-style-type: none"> ■ Identifying type of pollutants to be monitor and use the established standard or guideline as the priority. ■ Determine the size and location of the monitoring stations to ensure that the measurements taken are adequate and representative of the air quality conditions of the area. ■ Determine the time and duration of the sampling aligns with the monitoring objective. ■ Determine the type of monitoring equipment or system to be use. ■ Determine the appropriate sampling frequency to ensure that the data collected is sufficient for statistical analysis. 	<p>All air measuring equipment shall be properly calibrated in accordance with current standards and thereafter, or recommendations governing the calibration of such equipment in accordance to the equipment manufacturer's instructions.</p>	<p>Methods for Measurement of Air Pollution, Part 14: Guidelines for Planning the Sampling of Atmosphere. IS 5182 (Part 14): 2000</p>
<ul style="list-style-type: none"> ■ Vibration measurements shall usually include: <ul style="list-style-type: none"> i) background (ambient) vibration levels at a receiver location or at the real property boundary of a source; ii) these may be undertaken at locations prior to a project development; and iii) it could also be undertaken in the absence of the source operating (for example with a plant not operating, or without construction activities). ■ Vibration measured indoors may be undertaken outdoors or indoors on building floor slabs or foundation as the case may be. ■ Vibration could be assessed against an absolute numerical vibration limit and/or assessed based on the increase of the vibration levels with respect to the ambient level without the offending source. ■ Assessment of vibration levels against an acceptance limit is fairly straight forward, as it merely requires comparison of the measured level against the permissible levels. 	<p>All vibration measuring equipment shall be properly calibrated in accordance with current standards and thereafter, or recommendations governing the calibration of such equipment in accordance to the equipment manufacturer's instructions.</p>	<p>The Planning Guidelines for Vibration Limits and Control in the Environment - Department of Environment (DOE), Malaysia</p>

ENVIRONMENTAL COMPONENT	SAMPLING STATION SELECTION
4. NOISE	<ul style="list-style-type: none">■ Site selection depends on the purpose for which the measurement is made and is typically at locations that may be affected by noise or for which a noise severity assessment is to be undertaken.■ The site can be residential and other noise sensitive premises, commercial or industrial premises.■ The measurement shall be at the receptors' property boundary.

GOOD PRACTICES	QUALITY CONTROL	REFERENCE
<ul style="list-style-type: none"> ■ Baseline noise measurements shall require noise levels to be measured continuously over a day night time period that are divided into the following periods: <ul style="list-style-type: none"> i) day: 7.00 am to 10.00 pm; and ii) night: 10.00 pm to 7.00 am the following day. ■ Microphone positions shall be mounted at least above 1.2 m above the ground and at least 3.5 m away from any reflecting surfaces other than the ground. ■ The microphone shall be orientated so that it is most uniformly sensitive to the incident sound from prevailing noise source. ■ Any non-representative or temporary noisy sources, such as roadworks, construction works (unless the construction work is the subject of assessment) shall be avoided where feasible. ■ The noise parameters to be measured shall be L_{Aeq} and the L_{max} over the nominated measurement interval. ■ The measurements may include other statistical parameters such as the L_{90}, L_{50} and L_{10}, or a full statistical distribution of the sound pressure levels recorded over the measurement interval. ■ Results to be reported shall be L_{Aeq} Day, L_{Aeq} Night and L_{Aeq} 24 hours. ■ Other statistical parameter s such as the L_{90}, L_{50}, L_{10} and L_{max} levels should also be reported in situations when noise levels are fluctuating in nature. 	<ul style="list-style-type: none"> ■ Calibration of sound level meters and noise monitoring units should be conducted by a calibration laboratory or original equipment manufacturer at intervals not exceeding two years or other frequency determined by DG or recommended by manufacturer. ■ It is recommended that calibrated reference sound sources used to check calibration in the field (sound level calibrators) should also be calibrated at two years interval. ■ A field check of instrument calibration shall be made before and after each set of measurements, using a calibrated reference sound source to ensure accuracy of ± 1 dB. ■ Notwithstanding the above, where instrumentation used for long term permanent monitoring to be checked at regular intervals (once every 6 months) to ascertain reliability and stability of the monitoring system. ■ If during a field check of instrument calibration, the sound level meter reading differs from the calibrated reference level, the difference must be noted. Any measurements taken in the interval since calibration was last checked should be adjusted accordingly. In all cases, where a difference in field calibration of more than 1 dB is noted between consecutive checks, measurement data obtained during the previous interval should be discarded. 	<p>Guidelines for Environmental Noise Limits and Control (Third Edition) - Department of Environment (DOE), Malaysia</p>

ATTACHMENT 3

National Water Quality Standards for Malaysia (NWQS)



NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA (NWQS)

PARAMETER	UNIT	CLASS				
		I	IIA/IIB	III#	IV	V
Al	mg/l	NL	-	(0.06)	0.5	>0.5
As	mg/l	NL	0.05	0.4(0.05)	0.1	>0.1
Ba	mg/l	NL	1	-	-	-
Cd	mg/l	NL	0.01	0.01* (0.001)	0.01	>0.01
Cr (IV)	mg/l	NL	0.05	1.4 (0.05)	0.1	>0.1
Cr (III)	mg/l	NL	-	2.5	-	-
Cu	mg/l	NL	0.02	-	0.2	>0.2
Hardness	mg/l	NL	250	-	-	-
Ca	mg/l	NL	-	-	-	-
Mg	mg/l	NL	-	-	-	-
Na	mg/l	NL	-	-	3 SAR	
K	mg/l	NL	-	-	-	-
Fe	mg/l	NL	1	1	1(Leaf) 5 (Others)	
Pb	mg/l	NL	0.05	0.02* (0.01)	5	>5
Mn	mg/l	NL	0.1	0.1	0.2	>0.2
Hg	mg/l	NL	0.001	0.004 (0.0001)	0.002	>0.002
Ni	mg/l	NL	0.05	0.9*	0.2	>0.2
Se	mg/l	NL	0.01	0.25 (0.04)	0.02	>0.2
Ag	mg/l	NL	0.05	0.0002	-	-
Sn	mg/l	NL	-	0.004	-	-
U	mg/l	NL	-	-	-	-
Zn	mg/l	NL	5	0.4*	2	>2
B	mg/l	NL	1	3.4	0.8	>0.8
Cl	mg/l	NL	200	-	80	>80
Cl ₂	mg/l	NL	-	(0.02)	-	-
CN	mg/l	NL	0.02	0.06 (0.02)	-	-
F	mg/l	NL	1.5	10	1	>1
NO ₂	mg/l	NL	0.4	0.4 (0.03)	-	-
NO ₃	mg/l	NL	7	-	5	>5
P	mg/l	NL	0.2	0.1	-	-

Notes:

1. NL : Natural levels or absent
2. * : At hardness 50 mg/l CaCO₃
3. # : Maximum (unbracketed) and 24-hour average (bracketed) concentrations
4. N : Free from visible film sheen, discolouration and deposits

ATTACHMENT 3

PARAMETER	UNIT	CLASS					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/l	0.1	0.3	0.3	0.9	2.7	>2.7
Biochemical Oxygen Demand	mg/l	1	3	3	6	12	>12
Chemical Oxygen Demand	mg/l	10	25	25	50	100	<100
Dissolved Oxygen	mg/l	7	5-7	5-7	3-5	<3	<1
pH	-	6.5-8.5	6-9	6-9	5-9	5-9	-
Colour	TCU	15	150	150	-	-	-
Electrical Conductivity	µS/cm	1000	1000	-	-	6000	-
Floatables	-	N	N	N	-	-	-
Odour	-	N	N	N	-	-	-
Salinity	%	0.5	1	-	-	2	-
Taste	-	N	N	N	-	-	-
Total Dissolved Solid	mg/l	500	1000	-	-	4000	-
Total Suspended Solid	mg/l	25	50	50	150	300	300
Temperature	°C	-	Normal +2 °C	-	Normal +2 °C	-	-
Turbidity	NTU	5	50	50	-	-	-
Faecal Coliform**	count/100 ml	10	100	400	5000 (20000)a	5000 (20000)a	-
Total Coliform	count/100 ml	100	5000	5000	50000	50000	>50000

Notes:

1. N : No visible floatable materials or debris, no objectional odour or no objectional taste
2. * : Related parameters, only one recommended for use
3. ** : Geometric mean
4. a : Maximum not to be exceeded

WATER CLASSES AND USES

CLASS	USES
Class I	<ul style="list-style-type: none"> ■ Conservation of natural environment. ■ Water Supply I – Practically no treatment necessary. ■ Fishery I – Very sensitive aquatic species.
Class IIA	<ul style="list-style-type: none"> ■ Water Supply II – Conventional treatment required. ■ Fishery II – Sensitive aquatic species.
Class IIB	Recreational use with body contact.
Class IV	Irrigation.
Class V	None of the above.

ATTACHMENT 4

Malaysia Groundwater Standard and Index



MALAYSIA GROUNDWATER STANDARD AND INDEX

Standard Kualiti Air Tanah Bagi Rawatan Air Mentah Secara Konvensional
(Drinking Water)

PARAMETER	UNIT	STANDARD	PARAMETER	UNIT	STANDARD
Total Coliform	MPN/100 mL	5,000	Mercury	mg/L	0.001
<i>E. coli</i>	MPN/100 mL	5,000	Cadmium	mg/L	0.003
Turbidity	NTU	1,000	Arsenic	mg/L	0.01
Warna	TCU	300	Sianida	mg/L	0.07
pH	-	5.5 - 9.0	Plumbum	mg/L	0.05
Temperature	°C	Normal ± 2	Chromium	mg/L	0.05
Conductivity	µS/cm	1,000 [#]	Cuprum	mg/L	1.0
Jumlah Nilai Ambang	mg/L	1,500	Zinc	mg/L	3.0
Chloride	mg/L	250	Natrium	mg/L	250
Ammonia	mg/L	1.5	Sulphate	mg/L	250
Nitrate	mg/L	10	Selenium	mg/L	0.01
Iron	mg/L	1.0	Silver	mg/L	0.05
Fluoride	mg/L	1.5	Magnesium	mg/L	150
Kekerasan	mg/L	500	Oil	mg/L	0.3
Manganese	mg/L	0.2	Pesticides	mg/L	0.00003 - 0.03*
COD	mg/L	10	Phenol	mg/L	0.002
MBAS	mg/L	1.0	Nickel	mg/L	0.05
BOD	mg/L	6	Gross alpha	Bq/L	0.1
Nitrit	mg/L	0.4 [#]	Gross beta	Bq/L	1.0

Note:

* Aldrin / Dieldrin, DDT, Heptachlor, Methoxychlor, Lindane, Chlordane, Endosulfan, hexachlorobenzene, 2,4,5 - T, 2,4 - D, 2,4 - DB, Alachlor, Aldicarb, Carbofuran, MCPA, Permethrin

[#] Adapted from *Class IIA, National Water Quality Standards*

ATTACHMENT 4

Groundwater Quality Standard for Agricultural Use

PARAMETER	UNIT	STANDARD	BENEFICIAL USE
Aluminium	mg/L	5.0	Agricultural
Arsenic	mg/L	0.1	Agricultural
Cadmium	mg/L	0.01	Agricultural
Chromium	mg/L	0.1	Agricultural
Cuprum	mg/L	0.2	Agricultural
Manganese	mg/L	0.2	Agricultural
Nickel	mg/L	0.2	Agricultural
Natrium	me/L	3.0 (SAR ¹ < 3)*	Agricultural
Chloride	me/L	4.0	Agricultural
Zinc	mg/L	2.0	Agricultural
Boron	mg/L	0.7	Agricultural
Conductivity	µS/cm	700	Agricultural
Nitrate and Nitrite	mg/L	100	Ternakan
Sulphyte	mg/L	1,000	Ternakan
TDS	mg/L	3,000	Ternakan

Note:

* milliequivalent per litre

¹ Sodium Absorption Ratio

SAR dikira berdasarkan persamaan berikut: $SAR = Na / \text{square root of } (Ca + Mg/2)$ (semua di dalam me/L)

Groundwater Quality Standard for Industrial Use

PARAMETER	UNIT	STANDARD
Alkaline	mg/L	300
COD	mg/L	30
Chloride	mg/L	100
Iron	mg/L	0.3
Manganese	mg/L	0.2
pH	-	6.5 - 8.0
Silica	mg/L	20.0
Sulphate	mg/L	200
TDS	mg/L	450
Suspended solids	mg/L	5
TOTAL	mg/L	250

ATTACHMENT 5

Malaysia Marine Water Quality Standards (MMWQS)



MALAYSIA MARINE WATER QUALITY STANDARDS (MMWQS)

PARAMETER ($\mu\text{g/l}$) unless otherwise stated	CLASSIFICATION					
	CLASS 1	CLASS 2	CLASS 3	INTERIM CLASS EI	INTERIM CLASS E2	INTERIM CLASS E3
	Sensitive Marine Habitats	Fisheries (including Mariculture)	Industry, Commercial Activities and Coastal Settlements	Estuaries		
Coastal Plain				Lagoon	Complex Distributary Network	
Dissolved Oxygen (mg/l)	>6.0	>5.0	>3.0	>5.0	>5.0	>5.0
Total Suspended Solid (mg/l)	25.0	50.0	100.0	30.0	30.0	30.0
Phosphate	5.0	75.0	670.0	100.0	180.0	180.0
Nitrate	10.0	60.0	700.0	200.0	570.0	430.0
Ammonia	35.0	50.0	320.0	5.0	10.0	10.0
Mercury	0.04	0.04	0.04	0.04	0.04	0.04
Cadmium	0.50	2.00	3.00	1.00	1.00	1.00
Chromium (VI)	0.14	10.00	20.00	10.00	10.00	10.00
Copper	1.30	2.90	8.00	1.00	1.00	1.00
Cyanide	2.00	7.00	14.00	5.00	5.00	5.00
Lead	2.20	8.50	12.00	1.30	2.00	2.00
Zinc	7.00	50.00	100.0	16.00	5.00	5.00
Arsenic (III)	1.00	3.00	3.00	3.00	1.00	1.00
Aluminium	27.00	27.00	55.00	27.00	27.00	27.00
TBT	0.001	0.010	0.050	0.002	0.002	0.002
PAH	100.0	200.0	1000.0	5.0	5.0	5.0
Total Phenol	1.0	10.0	100.0	10.0	10.0	10.0
Oil & Grease (mg/l)	0.01	0.14	5.00	1.00	1.00	1.00
Faecal Coliform (cfu/100 ml)	70	70	70	70	70	70
Temperature ($^{\circ}\text{C}$)	$\leq 2^{\circ}\text{C}$ increase over maximum ambient					
pH	6.5 – 9.0					
Marine litter	Free from marine litter					

ATTACHMENT 6

New Malaysian Ambient Air Quality Standards



NEW MALAYSIAN AMBIENT AIR QUALITY STANDARDS

POLLUTANTS	AVERAGING TIME	AMBIENT AIR QUALITY STANDARD		
		IT-1 (2015)	IT-2 (2018)	Standard (2020)
		$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
Particulate Matter with the size of less than 10 micron (PM_{10})	1 year	50	45	40
	24 hour	150	120	100
Particulate Matter with the size of less than 2.5 micron ($\text{PM}_{2.5}$)	1 year	35	25	15
	24 hour	75	50	35
Sulfur Dioxide (SO_2)	1 year	350	300	250
	24 hour	105	90	80
Nitrogen Dioxide (NO_2)	1 year	320	300	280
	24 hour	75	75	70
Ground Level Ozone (O_3)	1 year	200	200	180
	8 hour	120	120	100
*Carbon Monoxide (CO)	1 year	35	35	30
	8 hour	10	10	10

ATTACHMENT 7
Guidelines for Environmental Noise
Limits & Control



GUIDELINES FOR ENVIRONMENTAL NOISE LIMITS AND CONTROL

FIRST SCHEDULE

Recommended Permissible Sound Level (L_{Aeq}) by Receiving Land Use for New Development

RECEIVING LAND USE CATEGORY	L_{Aeq} DAY 7.00 am – 10.00 pm	L_{Aeq} NIGHT 10.00 pm – 7.00 am
Low density residential, noise sensitive receptors, institutional (school, hospital, worship)	55 dBA	50 dBA
Suburban residential (medium density), recreational	60 dBA	55 dBA
Urban residential (high density), mixed development	65 dBA	60 dBA
Commercial business zones	65 dBA	60 dBA
Industrial zones	70 dBA	65 dBA

SECOND SCHEDULE

Recommended Permissible Sound Level (L_{Aeq}) by Receiving Land Use for Existing Built Up Areas

RECEIVING LAND USE CATEGORY	L_{Aeq} DAY 7.00 am – 10.00 pm	L_{Aeq} NIGHT 10.00 pm – 7.00 am
Low density residential, noise sensitive receptors, institutional (school, hospital, worship)	60 dBA	55 dBA
Suburban and urban residential, mixed development	65 dBA	60 dBA
Commercial business zones	70 dBA	65 dBA
Industrial zones	75 dBA	75 dBA

Note: The above prescribed L_{Aeq} limits are representative noise levels consistent with developed areas without noise disturbance generally deemed acceptable to majority of receptors occupying in premises at the respective land category.

THIRD SCHEDULE

Recommended Permissible Sound Level (L_{Aeq}) to be Maintained at the Existing Noise Climate

EXISTING LEVELS	RECOMMENDED PERMISSIBLE LEVELS
L_{Aeq}	Existing L_{Aeq}

Notes:

- Existing L_{Aeq} is determined from baseline measurements of the prevailing noise in the absence of the new noise sources(s); typically undertaken just prior to the operations of the new road, railway line or industrial premises operations, or alternatively with the noise source(s) being assessed to be temporarily disabled.
- Due to uncertainty in measurements, noise levels within ± 1.5 dBA of the existing L_{Aeq} is acceptable and deemed maintained at the existing noise climate.

FOURTH SCHEDULE

Limiting Sound Level (L_{Aeq}) from Road Traffic (for New Roads and/or Redevelopment of Existing Roads)

RECEIVING LAND USE CATEGORY	L_{Aeq} DAY 7.00 am – 10.00 pm	L_{Aeq} NIGHT 10.00 pm – 7.00 am
Noise sensitive areas, low density residential areas	60 dBA	55 dBA
Suburban and urban residential (medium and density)	65 dBA	60 dBA
Commercial and mixed development	70 dBA	65 dBA
Industrial	75 dBA	75 dBA

Note: in situations where the existing sound levels of receptors are higher than limits prescribed above, or within (less than) 2 dBA of the above prescribed limits, the maximum permissible levels stipulated in Schedule 3 shall apply.

FIFTH SCHEDULE

Limiting Sound Level (L_{Aeq} and L_{max}) from Railway and Transit Trains (for New Railway and Transit Lines and Realignment)

RECEIVING LAND USE CATEGORY	L_{Aeq} DAY 7.00 am – 10.00 pm	L_{Aeq} NIGHT 10.00 pm – 7.00 am	L_{max} Day & Night
Noise sensitive areas, low density and suburban residential areas	60 dBA	55 dBA	75 dBA*
Urban residential areas	65 dBA	60 dBA	80 dBA*
Commercial and mixed development	70 dBA	65 dBA	80 dBA*
Industrial	75 dBA	75 dBA	NA

Note:

- * L_{max} noise levels prescribed herein are for train pass-by events only; assessed on trains pass-by events averaged over one hour (i.e. averages of train pass-by L_{max} noise levels from all trains in one hour). Care in measurements must be exercised to ensure the L_{max} levels being measured and assessed are not from extraneous noise sources (typically road traffic vehicle pass-by, horns, siren, etc.) not related to train pass-by events.
- In situations where the existing L_{Aeq} sound levels of receptors are higher than limits prescribed above or within (less than) 2 dBA of the prescribed limits, the maximum permissible L_{Aeq} levels stipulated in Schedule 3 shall apply.

SIXTH SCHEDULE

Maximum Permissible Sound Levels (Percentile L_{10} and L_{max}) of Construction, Maintenance and Demolition Work by Receiving Land Use

RECEIVING LAND USE CATEGORY	NOISE PARAMETER	DAY 7.00 am – 7.00 pm	EVENING 7.00 pm – 10.00 pm	NIGHT 10.00 pm – 7.00 am
Residential, sensitive areas (Note 2**)	L_{10}	75 dBA	70 dBA	75 dBA
	L_{max}	90 dBA	85 dBA	85 dBA
	L_{Aeq}	-	-	*Note 1
Commercial and mixed development	L_{10}	80 dBA	80 dBA	75 dBA
Industrial	L_{10}	80 dBA	80 dBA	80 dBA

Notes:

- *At night-time, the maximum permissible levels as stipulated in Schedule 3 for respective residential density type shall apply.
- **Limits for daytime L_{Aeq} or reduction of L_{10} levels in vicinity of sensitive premises (such as schools and hospitals) may be exercised by the Local Authority or Department of Environment. In such situations, limits for daytime $L_{Aeq} + 3$ dBA based on Schedule 3 may apply.
- There are no prescribed limits for L_{max} and L_{Aeq} levels for construction noise for commercial and industrial land use. Assessment of L_{Aeq} levels if required shall be based on comparison against prevailing ambient noise (Schedule 3).

ATTACHMENT 8

Schedule of Recommended Vibration Limits



SCHEDULE OF RECOMMENDED VIBRATION LIMITS**SCHEDULE 1**

Recommended Limits for Damage Risk in Buildings from Steady State Vibration

DAMAGE DESCRIPTION	VERTICAL VIBRATION PEAK VELOCITY V_{max} [mm/s] (0 TO PEAK) (10-100 Hz)
Safe	Less than 3
Caution level (damage not necessarily inevitable)	3 to 5
Minor damage	5 to 30
Major damage	More than 30

Source: ISO DP 4688:1975

SCHEDULE 2

Recommended Limits for Damage Risk in Buildings from Short Term Vibration

TYPE OF STRUCTURE	VIBRATION VELOCITY V_i [mm/s] AT FOUNDATION (AS DEFINED BY THE RESPECTIVE RATING CURVES OF FIGURE 1)	VIBRATION VELOCITY V_i [mm/s] AT PLANE OF FLOOR OF UPPERMOST FULL STOREY (ALL FREQUENCIES)
Industrial buildings and buildings of similar design	Curve C	40
Commercial building, dwelling and buildings of similar design and/or use	Curve B	15
Structures that, because of their particular sensitivity to vibration, do not correspond to those listed above, or of great intrinsic value (e.g. residential houses, or buildings that are under preservation order)	Curve A	8

Source: DIN 4150/3

SCHEDULE 3

Recommended Limits for Damage Risk in Buildings from Single Event Impulsive Excitation*

TYPE OF STRUCTURE	GROUND VIBRATION PEAK PARTICLE VELOCITY V_{max} [mm/s]	
	AT LOW FREQUENCY <40 Hz	AT HIGH FREQUENCY >40 Hz
Industrial buildings and buildings of similar design	40	50
Commercial buildings, dwelling and buildings of similar design and/or use	20	50
Structures that, because of their particular sensitivity to vibration, do not correspond to those listed above, or of great intrinsic value (e.g. residential buildings, or buildings that are under preservation order)	12	50

* Single event impulsive excitation not exceeding 3 occurrences per day.

Source: Adapted from DIN 4150/3 and Swiss Standard for Vibration Damage to Buildings

SCHEDULE 4
Acceptable Road Traffic Induced Vibrations in Buildings

TYPE OF BUILDING AND FOUNDATION	RECOMMENDED VERTICAL VELOCITY LIMIT V_{max} [mm/s]
Especially sensitive buildings, and buildings of cultural and historical value	1
Newly built buildings, and/or foundation of a foot plate (spread footings)	2
Buildings on cohesion piles	3
Building on bearing piles or friction piles	5

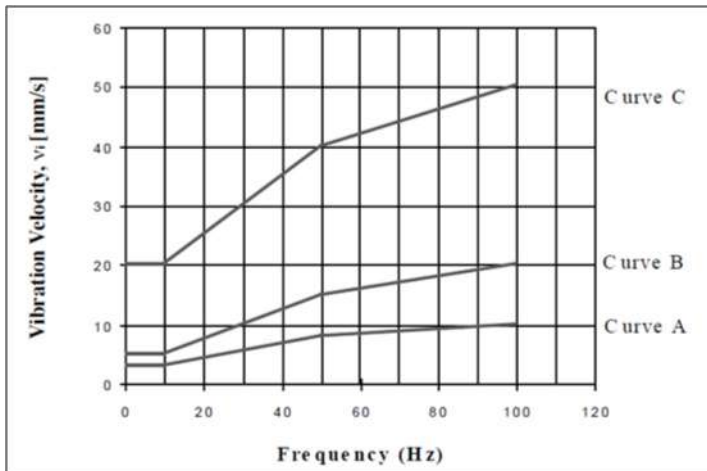


FIGURE 1 Foundation vibration velocity limiting values for vectorial sum of vibration levels in three orthogonal axes

SCHEDULE 5
Recommended Limits for Human Response and Annoyance from Steady State Vibrations

RECEIVING LAND USE CATEGORY	DAY TIME (7.00 am – 10.00 pm)	NIGHT-TIME (10.00 pm – 7.00 am)
Vibration sensitive areas	Curve 1	Curve 1
Residential	Curve 2 to Curve 4	Curve 2
Commercial, business	Curve 4 to Curve 8	Curve 4
Industrial	Curve 8 to Curve 16	Curve 8 to Curve 16

SCHEDULE 6
Recommended Limits for Human Response and Annoyance from Short Term Vibrations

RECEIVING LAND USE CATEGORY	DAY TIME (7.00 am – 10.00 pm)	NIGHT-TIME (10.00 pm – 7.00 am)
Vibration sensitive areas	Curve 1	Curve 1
Residential	Curve 8 to Curve 16	Curve 4
Commercial, business	Curve 16 to Curve 20	Curve 16 to Curve 20
Industrial	Curve 32	Curve 32

The above stipulated curves are defined in Figure 2 and 3. The base Curve 1 is based on the vibration perception threshold for human response as defined by BS 6472:1992 and ISO 2631. The designated numbers of subsequent curves are multiplying factors of the base curve.

Source: ISO 2631 and BS 6472

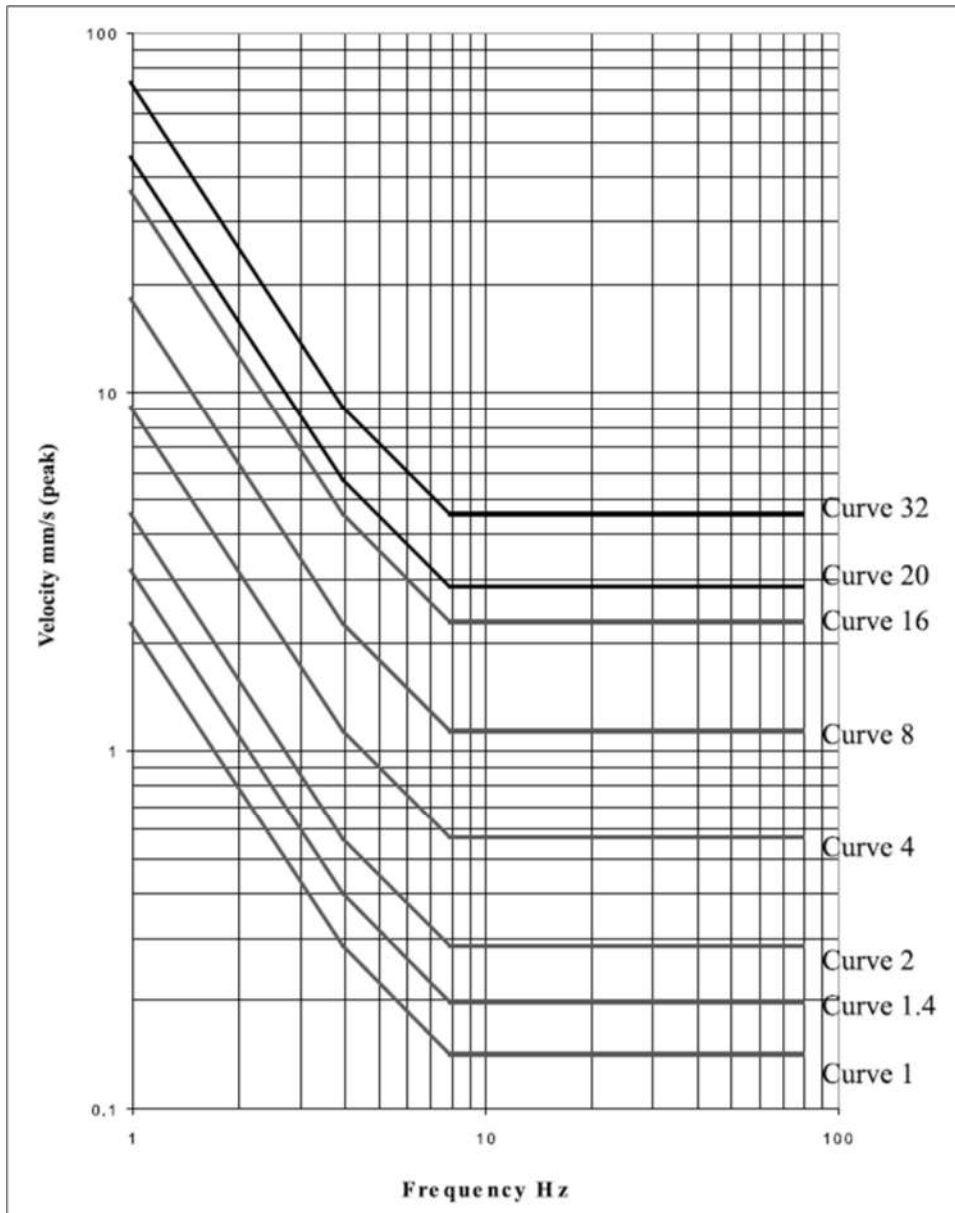


FIGURE 2
Building vibration z-axis curves for peak velocity

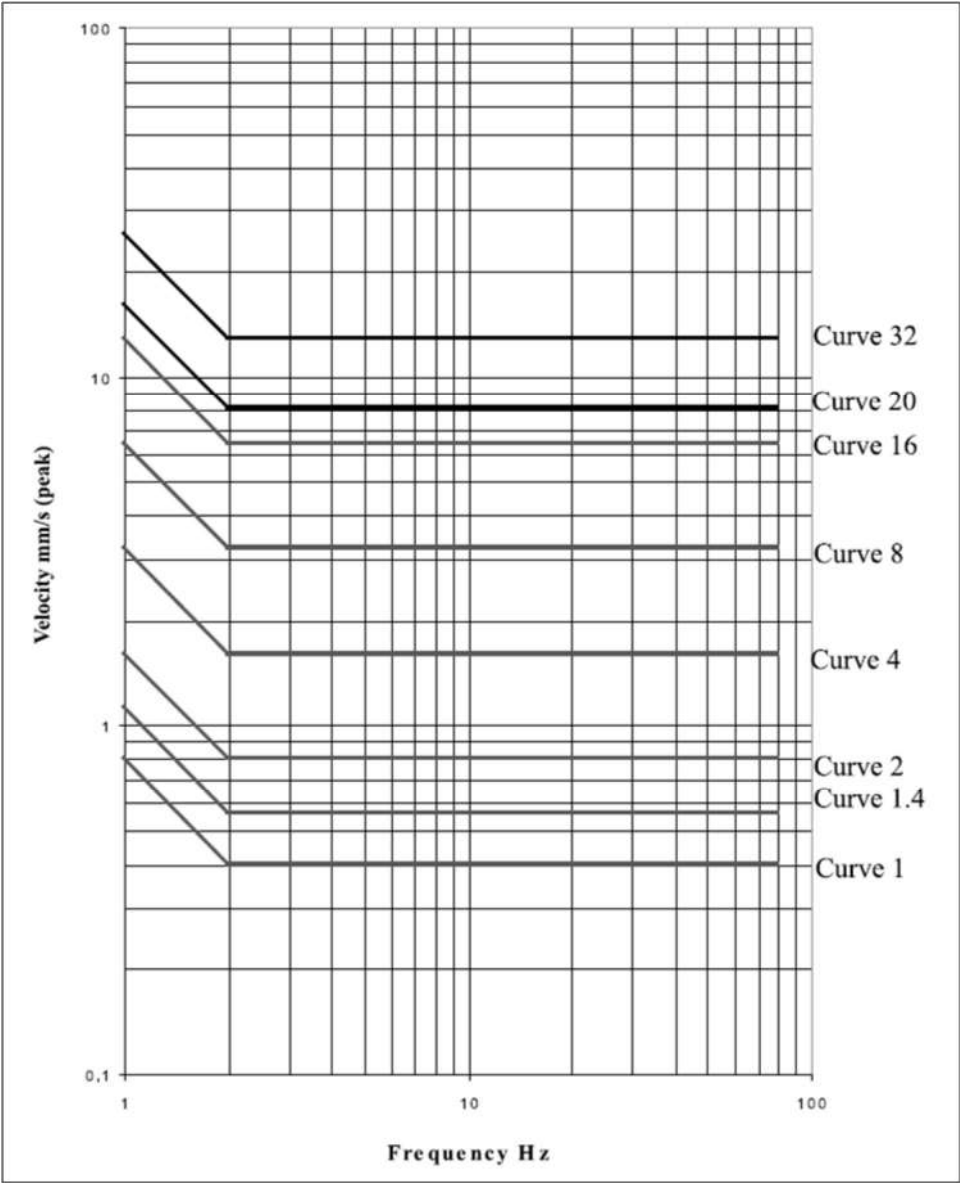


FIGURE 3
Building vibration x and y-axis curves for peak velocity