EIA GUIDELINES

WASTE TREATMENT AND DISPOSAL - SEWAGE

Department of Environment
Ministry of Environment and Water, Malaysia

Department of Environment, Malaysia

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The EIA Guidelines for Waste Treatment and Disposal (Sewage) has been developed and established under the Eleventh Malaysia Plan (2016-2020) to strengthen and empower the implementation of Environmental Impact Assessment (EIA) procedure in Malaysia in accordance with the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 of the Environmental Quality Act 1974 (Act 127).

DOE had appointed ERE Consulting Group Sdn. Bhd. to prepare this guideline. Special acknowledgement and appreciation for their effort in developing this guideline as well as the DOE Steering Committee for providing guidance and support throughout its development.

This guideline has been developed with involvement and support from various government agencies, industrial players, non-governmental organisations (NGOs) as well as individual experts in sewage management. Their various contributions, both through representations in the Technical Committee and through information discussions, are much appreciated and graciously acknowledged.

DOE wish to acknowledge the contributions of Sewerage Services Department, Suruhanjaya Perkhidmatan Air Negara, Ministry of Health Malaysia, PLANMalaysia, Department of Irrigation and Drainage, Public Works Department Malaysia, Department of Mineral and Geoscience Malaysia and other related agencies.

DOE would also like to appreciate the contributions of industries and consultant such as Indah Water Konsortium Sdn. Bhd., MMC Pembentungan Langat Sdn. Bhd., Majaari Services Sdn. Bhd., AMR Environmental Sdn Bhd., and Europasia Engineering Services Sdn. Bhd. for sharing their expertise.

Finally, DOE wish to acknowledge the contributions from all those individuals who have shared their knowledge and experience for the development of this guideline.

PREFACE

In pursuing green growth for sustainability and resilience, holistic sewage and sludge management was identified as a target in the Green Technology Master Plan Malaysia (2017-2030). Holistic sewage and sludge management aims to improve managed sanitation facilities and reduce the impact of pollution at receiving rivers and disposal sites.

The development of sewage treatment plants (STPs) and sludge treatment facilities (STFs) is critical in resolving sewage discharge and sludge disposal issues as these activities are also associated with environmental and social risks.

As Malaysia transitions into a developed nation, population growth and urbanization have resulted in an increase in the volume of sewage generated coupled with more complex characteristics of sewage. As the government pursues sustainable solutions, new sewage and sludge management systems and technologies will be adopted.

STP and STF projects are prescribed activities under Activity 14(c) Sewage of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 where Project Proponents are required to conduct an environmental impact assessment (EIA). The EIA is an important assessment tool to ensure that the development of STP and STF projects are aligned with the requirements of the Department of Environment (DOE) Malaysia, and other relevant technical agencies and stakeholders.

This guideline aims to provide Project Proponents and Qualified Persons with relevant information for the preparation of a comprehensive EIA report that meets the requirements described above. It takes into cognisance the most recent policy framework, legal requirements, and guidelines from all related technical agencies. The guideline outlines data requirements, assessment tools and standards, and describes potential mitigation measures that may be implemented to reduce environmental and social risks. In complying with this guideline, it is anticipated the development STP and STF projects shall result in positive economic and social benefits while ensuring that the sustainability of environment is preserved.

NORLIN BINTI JAAFAR
Director General
Department of Environment

CHAPTER 1 INTRODUCTION

SUMMARY

SCOPE OF THE EIA GUIDELINES

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FIRST SCHEDULE

Activity 14(c)(i)
Construction sewage treatment plant (STP) with 20,000 population equivalent or more

Activity 14(c)(ii)
Sludge treatment facilities (STF)

SCOPE OF PRESCRIBED ACTIVITY

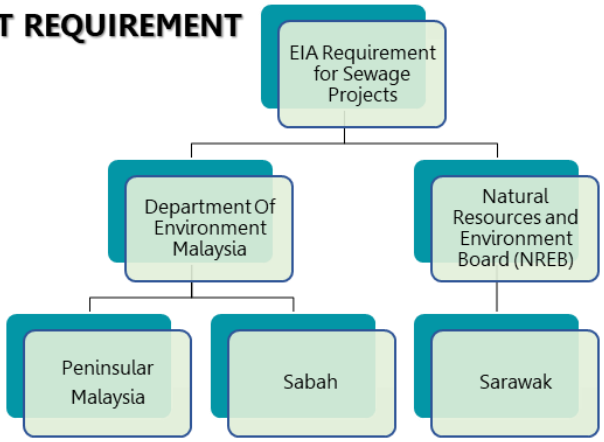
Activity 14(c) (i)

- Construction and operation of new STPs with design capacity of 20,000 PE or more.
- Upgrading of existing STPs (where the initial design capacity is less than 20,000 PE) with a final design capacity of 20,000 PE or more.
- Upgrading of existing STPs (where the initial design capacity is 20,000 PE or more), if an EIA was not conducted previously.
- Upgrading additional 20,000 PE or more for existing STP (where initial design capacity 20,000 PE or more and EIA was conducted previously)
- scope of assessment does not encompass sewerage components i.e. sewer lines and pumping stations

Activity 14(c) (ii)

- All STFs located off-site as dedicated sludge treatment and disposal facilities.
- scope of assessment extends over all treatment facilities (i.e. primary, secondary and tertiary treatment) including sludge transportation.

EIA REPORT REQUIREMENT



TERMS & DEFINITIONS

Sewage
Liquid discharges containing human excreta, animal or vegetable matters in suspension or solution derived from domestic activities and being generated from household, commercial, institutional and industrial premises

Population Equivalent
Equivalent in terms of fixed population of a varying or transient population or other activity

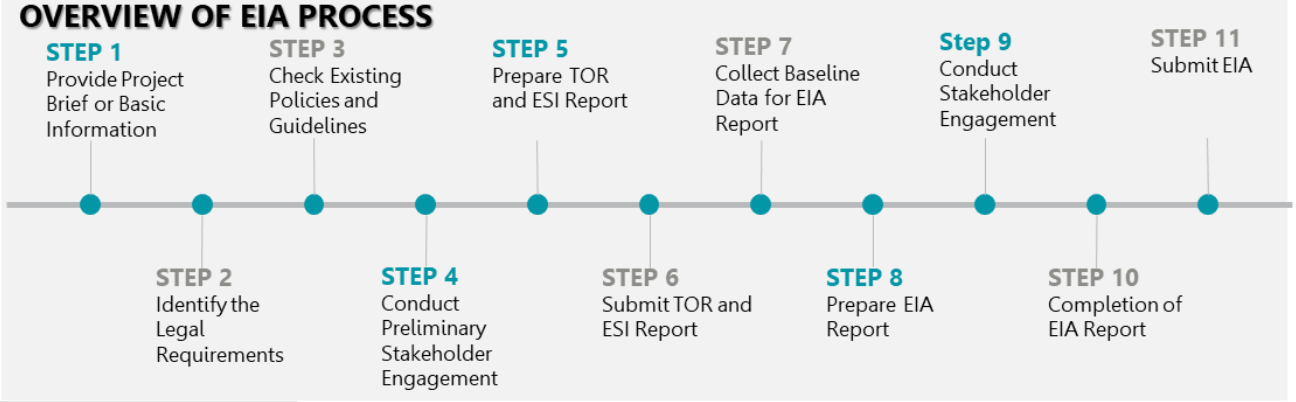
Sewage Treatment System
Facility designed and constructed for the purpose of reducing the potential of the sewage to cause pollution

Sewage Sludge
Residual mixture of solid and liquid produced during the partial or full treatment of sewage excluding treated sewage effluent discharged through a disposal pipe

Sludge
Any deposit of particulate matter settled from a liquid

Sludge Treatment Facility
Facility for sewage sludge treatment

OVERVIEW OF EIA PROCESS



CHAPTER 2 ENVIRONMENTAL PROJECT PLANNING

SUMMARY

RELEVANT LEGISLATIONS

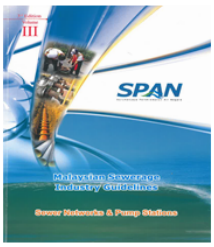
- Environmental Quality Act 1974
- Water Services Industry Act 2006
- Suruhanjaya Perkhidmatan Air Negara Act 2006
- Environmental Quality (Sewage) Regulations 2009
- Environmental Quality (Clean Air) Regulations 2014
- Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015
- National Land Code 1965 (Act 56)
- Environmental Quality (Scheduled Waste) Regulations 2005

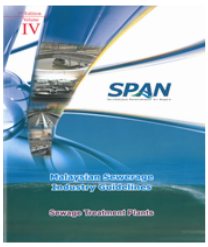
POLICIES AND GUIDELINES

Sustainable Development Goals (SDGs)

Green Technology Master Plan Malaysia

National Urbanisation Policy and Plan





RELEVANT REQUIREMENTS AT VARIOUS PROJECT IMPLEMENTATION STAGE

1 Pre-Planning	2 Planning & Design	3 Pre-Construction	4 Construction	5 Pre-Operation	6 Operation	7 Pre-Abandonment / Closure	8 Abandonment / Closure
• Feasibility • Site Selection • Technology Selection • Land Status • SI Report	• EIA, TIA Studies • Sewerage Planning & Design Approval • ESCP • DO Submission	• Development Approval • EMP Construction • Written Notification • License to Contravene • Notice to Start Work	• Environmental Monitoring, Reporting & Audit • Competent Person • Notice of immediate Inspection of Sewerage Work	• EMP Operation • Drainage & Stormwater Management Plan • Notice of Final Inspection	• Environmental Monitoring, Reporting & Audit • Competent Person • Written & Emission Declaration • Renewal of License	• Abandonment Plan • Closure Plan	• Environmental Monitoring • Environmental Reporting

STAKEHOLDER ENGAGEMENT

RELEVANT STAKEHOLDERS

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

ENGAGEMENT METHODS

- Interview
- Questionnaire
- Townhall Meeting
- Forums or Workshops
- Focus Group Discussion

DOCUMENTATION & REPORTING

- Details of the programme
- Attendance list of participants
- Copies of survey forms
- Brief summary of findings from event
- Video or voice recordings

CHAPTER 3 TERMS OF REFERENCE SUMMARY

ENVIRONMENTAL SCOPING

- Gather and analyse information
- Identify significant environmental issues
- Prioritise significant issues for EIA
- Determine approach, methodology and tools for assessment
- Identify potential P2M2s
- Submit TOR and ESI for DOE assessment and endorsement

SITE SUITABILITY ASSESSMENT

Considerations in project alternatives and options:

- Project siting
- Process technology options
- P2M2s technology options
- Project component and design
- Social aspect

STUDY BOUNDARY

- **Zone of study (ZOS):** generally 5-km radial zone from project boundary
- **Zone of impact (ZOI):** vary depending on the size of project, extent shall be determined by the Qualified Person

BASELINE DATA REVIEW

- **Physical:** land use, topography and terrain, geology and hydrogeology
- **Environmental:** surface water quality, groundwater quality, marine water quality, air and noise
- **Biological:** terrestrial and aquatic flora, terrestrial and aquatic fauna
- **Socio-economic:** demography, public health, development needs and potential
- **Infrastructure and utilities:** Physical communications, points of access and transportation routes

DETERMINATION OF KEY PROJECT ACTIVITIES

Based on four main common activities:

- Pre-construction phase
- Construction phase
- Operation phase
- Abandonment phase

IDENTIFICATION OF SIGNIFICANT IMPACTS AND PRIORITY SETTING

- Key issues are determined based on their importance
- Criteria for determining significance of environmental impacts: magnitude, permanence, reversibility, cumulative effects

RELATED KEY ISSUES

- Soil erosion & sedimentation
- Water quality
- Air quality & odour
- Waste management
- Noise & vibration
- Groundwater quality
- Quantitative risk
- Health impact
- Socio-economic
- Traffic

ESTABLISHMENT OF STUDY REQUIREMENT

- Address identified impacts of the project activities
- Type of study is dependent on the scale and extent of Project Site
- Qualified Person shall provide methodologies, assessment, and expected outputs

SELECTION OF MITIGATION MEASURES

- To be identified based on **Best Available Techniques Economically Achievable (BATs), Best Management Practices (BMPs)** and other options for **P2M2s**
- To be described qualitatively and further detailed in EIA study

STUDY TEAM

- **EIA Study**: Appointment of **Qualified Person** as stipulated in Section 34A(2) of the Environmental Quality Act 1974
- **Pollution Control System Design:** Qualified Consultant must be **Professional Engineer** registered under Section 10(2) of the Registration of Engineers Act 1967 (Revised 2015)
- **Preparation of LD-P2M2:** Registered consultant with **Certified Professional in Erosion and Sediment Control (CPESC) certification**

PREPARATION OF TOR/ESI

To follow format detailed under the Guidance Document for Preparing TOR according to EGIM

CHAPTER 4 BASELINE DATA SUMMARY

BASELINE DATA COLLECTION

Purpose

To provide an overview of the existing environment to determine the suitable approach and methodology for the impact assessment

Primary Source

Field studies i.e. site survey, aerial photos, SI report, sampling and monitoring activities etc.

Secondary Source

Desktop studies i.e. topography map, satellite imagery, local authority, past studies, etc.

BASELINE MONITORING AND ANALYSIS

Samples collected must be analysed by a SAMM accredited laboratory
Laboratory report or COA shall be included in the EIA as appendix

Air Quality

Parameters and criteria as referred in Malaysia Ambient Air Quality Standards (MAAQS) 2013

Odour

Parameters may include perceived odour (DT) and odour concentration (ou/m^3)

Noise

Parameters and criteria as referred in the Guidelines for Environmental Noise Limits and Control Third Edition, 2019

Vibration

Parameters and criteria as referred in The Planning Guidelines for Vibration Limits and Control in the Environment Second Edition, 2007

Surface Water Quality

Parameters and criteria as referred in the National Water Quality Standards (NWQS)

Marine Water Quality

Parameters and criteria as referred in the Malaysian Marine Water Quality Standards (MMWQS)

Groundwater Quality

Parameters and criteria as referred in Malaysia Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water)

Note:
Parameters for baseline monitoring shall be dependent on the project needs as described in the TOR and ESI

GOOD PRACTICES FOR SAMPLING

Water Quality

- ✓ Sites must be easily and safely accessed under all weather conditions
- ✓ Sampling depth is measured from the water surface to the middle of the sampler
- ✓ A bottle that is to be used for transport or storage of the sample should be rinsed three times with portions of the sample before being filled. This does not apply, however, if the storage/transport bottle already contains a preservative chemical
- ✓ A small air space should be left in the sample bottle to allow the sample to be mixed before analysis

Air Quality

- ✓ Identify location of potential on-site emission sources, as identified from the review of site background information or from preliminary on-site inspections
- ✓ Sampling station location should be representative of the area selected
- ✓ Identify potential off-site emission sources located upwind of the sampling location(s). Study local wind patterns to determine the location of off-site sources.
- ✓ As a general rule, the distance away from the obstruction should be 10 times the height of the obstruction

Noise & Vibration

- ✓ The sound level meter may be hand held for spot readings, but for extended monitoring shall be mounted onto a tripod A noise reading should always be taken at least 1.2–1.5 metre above the ground)
- ✓ Measurement location shall be at least 3.5 m away from walls, buildings or other sound reflecting structures
- ✓ Measurements cannot normally be made if the wind speed exceeds 5 m/s at the microphone position.
- ✓ Relevant standards for noise measurement include ISO 1996-1:2016, BS 5228-1:2009

Groundwater Quality

- ✓ Always sample from the anticipated cleanest, i.e., least contaminated location, to the most contaminated location
- ✓ Sample containers for samples suspected of containing high concentrations of contaminants shall be stored separately
- ✓ Purged water should be monitored for pH, specific conductance and turbidity and volume recorded
- ✓ All samples requiring preservation must be preserved as soon as practically possible, ideally immediately at the time of sample collection

CHAPTER 5 EVALUATION OF IMPACTS SUMMARY

SOIL EROSION & SEDIMENTATION

Typical Input
- Rainfall erosivity factor
- Soil erodibility factor
- Slope length and degree factor
- Land-cover management factor
- Conservation practice factor
- Runoff volume
- Peak discharge

Impact Assessment
- RUSLE, MUSLE
- Manual calculation or aid of software

Output
- Annual soil erosion rate
- Sediment yield
- Potential soil erosion risk map
- Impact significance evaluation

WATER QUALITY

Typical Input
- Flowrate of water bodies and flowrate of pollutant
- Pollutant Water Quality Data
- River water quality
- Marine water quality

Impact Assessment
- Mathematical models
- Simple mass balance models

Output
- Graph of concentration of pollutants over spatial for normal scenario and worst scenario

Evaluation Criteria
- Environmental Quality (Sewage) Regulations 2009
- NWQS/MMWQS

GROUNDWATER QUALITY

Typical Input
- Topography
- Pollutant Water Quality Data
- Groundwater Level
- Rainfall data
- Hydraulic conductivity
- Geology
- Pumping rate
- Well yield

Impact Assessment
- Mathematical models

Output
- Contaminant transport map.
- Geophysics plot (if necessary)

Evaluation Criteria
- Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water)

AIR QUALITY & ODOUR

Typical Input
- Source data
- Meteorological data
- Terrain data
- Building data
- Sensitive receptors

Impact Assessment
- Air Dispersion Modelling Software

Output
- MAIC
- GLC
- Dispersion contours
- Impact significance evaluation

Evaluation Criteria
- Environmental Quality (Clean Air) Regulations 2014
- MAAQS 2013
- OAAQC 2003
- IAQM, 2018

NOISE

Typical Input
- Sound power level, sound pressure level
- Source classification and mobile sources
- Existing background noise and existing noise sources
- Type of noise
- Propagation factors
- Directionality
- Ground effect
- Location and height of source
- Total attenuation from factors

Impact Assessment
- Calculation of increased noise level for worse case scenario

Output
- Absolute numerical noise limit
- Change in noise levels relative to an existing baseline level

Evaluation Criteria
- Guidelines for Environmental Noise Limits and Control 3rd Edition 2019

WASTE

Typical Input
- Source of waste
- Waste generation rate
- Number of workers

Impact Assessment
- Estimation of total amount of waste

Output
- Weight of estimated waste generated
- Volume of estimated waste
- Impact significance evaluation

QUANTITATIVE RISK

Typical Input
- Hazardous substance data
- Equipment specifications
- Possible accident scenario
- Failure frequency data
- Meteorological data

Impact Assessment
- Consequence modelling software for normal case and worst-case

Output
- Individual risk
- Societal risk
- Individual risk contours
- F-N Curve
- Impact significance evaluation

Evaluation Criteria (Individual Risk)
- Industry: 1 x 10^{-5} fatalities/person/year
- Public: 1 x 10^{-6} fatalities/person/year

HEALTH

Typical Input
- Community health data
- Local health statistics
- Air quality assessment result
- Water quality assessment result
- Groundwater quality assessment result

Impact Assessment
- HRA using qualitative and quantitative risk assessments

Output
- Health risk calculation at certain level of exposure
- Impact significance evaluation

Evaluation Criteria (Public Health)
- Non-carcinogenic: Hazard quotient (HQ) < 1
- Carcinogenic risk: Generally acceptable risk (10^{-4} to 10^{-6})

SOCIO-ECONOMIC

Typical Input
- Details of demographics
- Local economic profile
- Feedback from stakeholders engagement

Impact Assessment
- Social impact matrix

Output
- Risk matrix with socio economic concerns and the magnitude of impact

Evaluation Criteria
- Manual for SIA for Project Development 2nd Edition 2018

VIBRATION

Typical Input
- Reference PPV from reliable publication
- Distance from equipment / activities to receiver
- Attenuation rate of the ground

Impact Assessment
- Equation for prediction of vibration level

Output
- Prediction of PPV
- Damage risk in structural damage
- Level of human annoyance

Evaluation Criteria
- The Planning Guidelines for Vibration Limits and Control in the Environment 2nd Edition 2007

CHAPTER 6 MITIGATION MEASURES SUMMARY

PURPOSE

- Avoid negative impacts by selecting alternatives to implement preventive measures
- Adopt relevant mitigation measures and BMPs to minimize impacts when an impact cannot be avoided
- Enhance and amplify the beneficial impacts
- Ensure residual impacts are kept within acceptable levels

PRINCIPLES OF ADOPTION OF P2M2

Need and extent of P2M2s shall correspond to the significance of the predicted impact

Priority shall be given to control at source rather than to rectifying impacts

Proposed P2M2 should be **project-specific** and designed for site conditions

Adequate explanation on the design and function of P2M2s should be include in EIA

Project Proponent is encouraged to use **new technology** provided it is proven effective

P2M2s require regular **inspection, maintenance and rehabilitation**

Effectiveness of P2M2s shall be documented through **monitoring programme**

Qualified Person should propose **BMPs** based on the findings of the EIA

APPROACHES TOWARDS P2M2 ADOPTION

Key P2M2s that are applicable include:

- Water Pollution Control
- Air Pollution/Odour Control
- Noise and Vibration Control
- Erosion and Sediment Control
- Solid Waste / Scheduled Waste Management

Other mitigation measures:

- Safety and Health
- Traffic

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

Project Activity and Implementation

- Phasing plan
- Project implementation schedule
- Description of construction activities
- Construction schedule
- Construction method statements

Information and Analysis on Project Development

- Selected weather and rainfall data
- Site runoff velocity and flow rates
- Description of site soil and geological characteristics
- Description of adjacent affected areas by land disturbance
- List of waterways
- List of P2M2s proposed
- Access roads and project components outside boundary
- Earthworks cut and fill volume
- Availability of rocks materials
- Biomass ,solid and hazardous waste management
- Spill prevention and control plan
- Soil loss prediction
- Calculation for sediment traps/basins and runoff flows

Map of Site Plan with Existing Conditions

- Topographic survey map
- Geological terrain map
- Erosion risk map
- Landuse map
- Site development plan map

CHAPTER 7 ENVIRONMENTAL MANAGEMENT PLAN

SUMMARY

EMP FRAMEWORK

- Monitoring of water quality of receiving water body by Accredited Lab
- Monitoring of TSS and Turbidity at inlets and outlets of sediment structures
- Monitoring of sewage discharge
- In-situ monitoring of TSS and Turbidity after rain event
- Monitoring of air, noise and vibration qualities depending on receptor sensitivity
- Planning, construction and maintenance of LD-P2M2 on site
- P2M2 notification and implementation
- Identification of need of competent persons to undertake specific task on site
- Description and implementation details of EMT
- Any other green initiatives undertaken
- Clear documentation on any transfer of ownership or proponent of approved EIA
- Allocation and reporting of sufficient resources to undertake project activities
- Temporary / permanent abandonment / project closure plan details for all phases
- Implementation of 5S concept in good housekeeping practices

AUDIT PROGRAMME

Pre-Audit

- ✓ Preparation of pre-audit checklist and information request to the auditee
- ✓ Submission of notification of audit to DOE and auditee

On-Site Audit

- ✓ Briefing to auditee by Lead Auditor
- ✓ Include documentation review, site inspection, interviews with relevant personnel
- ✓ Auditee briefed at Closing Meeting
- ✓ On-site Audit Summary submitted to state DOE

Post Audit

- ✓ Lead Auditor shall submit an Audit Report to DOE within 14 calendar days after site audit
- ✓ Auditee shall develop a Corrective Action Plan for any non-compliances which shall be submitted to DOE within 21 calendar days after site audit

SELF-REGULATION

7 ENVIRONMENTAL MAINSTREAMING TOOLS

- Environmental Policy
- Environmental Facility
- Environmental Budget
- Environmental Monitoring Committee
- Environmental Competency
- Environmental Reporting and Communication
- Environmental Transparency

ABANDONMENT PLAN

- ✓ Project abandonment can occur during the construction stage or operation stage of the Project due to unforeseen circumstances.
- ✓ The Project Proponent must submit a project abandonment plan to the DOE prior to the abandonment of the Project
- ✓ In essence, the project abandonment plan shall address the environmental issues arise from the decommissioning including demolition and dismantling activities

EMERGENCY RESPONSE PLAN

- ✓ Clear, written policies that designate a chain of command, listing names and job titles of the people (or departments) who are responsible for making decisions, monitoring response actions and recovering back to normal operations; Indicate arrangements that should be put in place with the local emergency authorities before facility start up.

CHAPTER 8 REPORTING AND REVIEW SUMMARY

EIA REPORT

Data Deliverables

- All relevant data collected during the EIA Study shall be make available
- Sampling results, modelling databases, baseline data, metadata

Conclusion to the EIA Report

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

EIA REPORT SUBMISSION AND REVIEW PROCESS

Components	First Schedule Activities
Submission of Report	• DOE State
TOR/ESI Report Submission	• Three (3) hardcopies and one (1) softcopy in PDF format via email • Distribution of softcopy (CD) to agencies/AI/NGO for comments
EIA Report Submission	• Three (3) hardcopies and one (1) softcopy (CD) to DOE State • One (1) softcopy (CD) to DOE HQ • Distribution of softcopy (CD) to agencies/AI/NGO for comments • Softcopy of ES and RE in infographic
Review Timeline	• Twenty-five (25) working days (5 weeks)
Public Participation in EIA Study	• Required
Public Display of EIA Report	• Not required
Advertisement of EIA Report	• Not required

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LIST OF ABBREVIATIONS

ALARP	As Low as Reasonably Practicable
APCS	Air Pollution Control System
ASR	Air Sensitive Receptors
BACT	Best available control technology
BAT	Best Available Techniques
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
CePSO	Certified Environmental Professional in Scrubber Operation
CePSTPO	Certified Environmental Professional in Sewage Treatment Plant Operation
CePSWaM	Certified Environmental Professional in Scheduled Waste Management
CESSWI	Certified Erosion, Sediment and Storm Water Inspector
CISEC	Certified Inspection of Sediment and Erosion Control
CM	Compliance Monitoring
CO	Carbon Monoxide
COA	Conditions of Approval (EIA)
COA	Certificate of Analysis
COD	Chemical Oxygen Demand
CPESC	Certified Professional in Erosion and Sediment Control
DID	Department of Drainage and Irrigation
DO	Dissolved Oxygen
DOA	Division of Agriculture
DOE	Department of Environment
DOF	Department of Fisheries
DOSH	Department Of Occupational Safety And Health
DOSM	Department of Statistics Malaysia
EB	Environmental Budgeting
EC	Environmental Competency
EESIM	Environmental Essentials for Siting Of Industries In Malaysia
EF	Environmental Facility
EGIM	Environmental Impact Assessment Guideline
EIA	Environmental Impact Assessment
EMC	Environmental Monitoring Committee
EMP	Environmental Management Plan
EMR	Environmental Monitoring Reports
EMT	Environmental Management Teams
EMT	Environmental Mainstreaming Tools
EP	Environmental Policy

EPMC	Environmental Performance Monitoring Committee
ERC	Environmental Reporting and Communication
ERCMC	Environmental Regulatory Compliance Monitoring Committee
ESCP	Erosion and Sedimentation Control Plan
ESI	Environmental Scoping Information
ET	Environmental Transparency
GA	Government Agencies
GLC	Ground Level Concentration
GPS	Global Positioning Systems
GPT Plans	Gross Pollutant Traps Plans
HIA	Health Impact Assessment
HQ	Hazard Quotient
HRA	Health Risk Assessment
H_2S	Hydrogen Sulphide
IM	Impact Monitoring
IWK	Indah Water Konsortium
JAKOA	Jabatan Kemajuan Orang Asli (Department of Orang Asli Development)
PWD	Public Works Department (JKR)
JMG	Department of Mineral and Geoscience
JPBD	Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia (Federal Department of Town and Country Planning (PLANMalaysia))
JPP	Jabatan Perkhidmatan Pembentungan (Sewerage Services Department)
DFPM	Department of Forestry Peninsular Malaysia
JUPEM	Jabatan Ukur dan Pemetaan Malaysia
LCR	Lifetime Cancer Risk
LUAS	Lembaga Urus Air Selangor
MAIC	Maximum Average Incremental Values
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
MoH	Ministry of Health
MSIG	Malaysian Sewerage Industry Guideline
MSO	Malaysian Stormwater Organisation
MUSLE	Modified Universal Soil Loss Equation
NGO	Non-Governmental Organisations
NH_3-N	Ammoniacal Nitrogen
NO_2	Nitrogen Dioxide
NSCP	National Sewerage Catchment Plan
NTU	Nephelometric Turbidity Units
O_3	Ozone

OSD Plans	Onsite Detention Plans
P2M2	Pollution Prevention and Mitigation Measures
PE	Population Equivalent
PERHILITAN	Jabatan Perlindungan Hidupan Liar dan Taman Negara
PM	Performance Monitoring
PM_{10}	Particulate Matter < 10 micron
$PM_{2.5}$	Particulate Matter < 2.5 micron
PTG	Pejabat Tanah dan Galian
QRA	Quantitative Risk Assessment
RUSLE	Revised Universal Soil Loss Equation
SAMM	Skim Akreditasi Makmal Malaysia
SDG	Sustainable Development Goals
SI	Soil Investigation
SIRIM	Standard and Industrial Research Institute of Malaysia
SLM	Sound Level Meter
SO_2	Sulphur Dioxide
SPA	State Planning Authority
SPAN	Suruhanjaya Perkhidmatan Air Negara, National Water Services Commission
SR	Self-Regulation
SSA	Site Suitability Assessment
STF	Sludge Treatment Facilities
STP	Sewage Treatment Plant
STS	Sewage Treatment System
SV	Sludge Volume
TELOS	Technical, Economic, Legal, Operational and Scheduling
TIA	Traffic Impact Assessment
TMDL	Total Maximum Daily Load
TNB	Tenaga Nasional Berhad
TOR	Terms of Reference
TSS	Total Suspended Solids
UN	United Nations
WGR	Waste Generation Rates
WRF	Weather Research and Forecasting
ZOI	Zone of Impact
ZOS	Zone of Study

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LIST OF FIGURES

EIA GUIDELINES

Waste Treatment & Disposal
-Sewage

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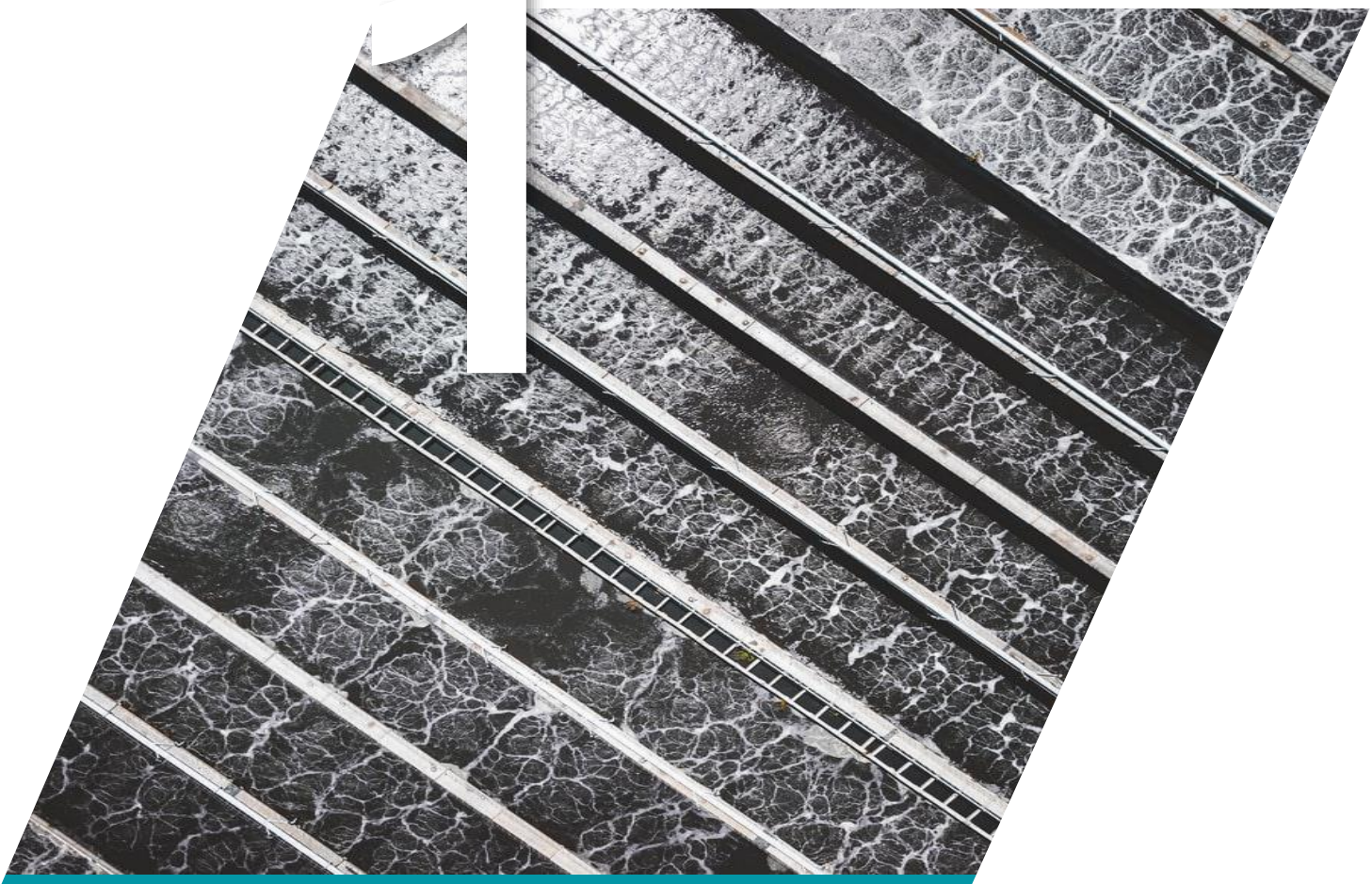
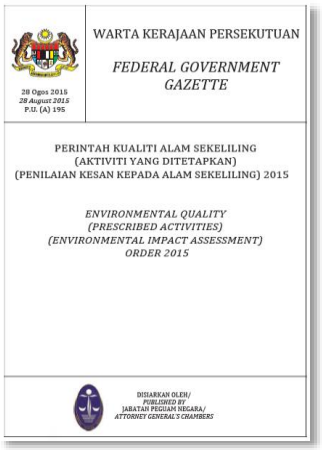


INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION


WARTA KERAJAAN PERSEKUTUAN

FEDERAL GOVERNMENT GAZETTE

28 Ogos 2015
28 August 2015
P.U. (A) 195

PERINTAH KUALITI ALAM SEKELILING
(AKTIVITI YANG DITETAPKAN)
(PENILAIAN KESAN KEPADA ALAM SEKELILING) 2015

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

DISIARKAN OLEH/
PUBLISHED BY
JABATAN PEGUAM NEGARA/
ATTORNEY GENERAL'S CHAMBERS

The '**Environmental Impact Assessment (EIA) Guideline for Waste Treatment and Disposal – Sewage"** (hereinafter referred to as the 'Guideline') is newly issued to align with the latest amendments in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, of the Environmental Quality Act 1974 (Act 127).

The amended Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 was gazette on 28 August 2015 with a revised list of Prescribed Activities. The Prescribed Activities are now divided into the First Schedule (21 Prescribed Activities) and the Second Schedule (17 Prescribed Activities).

In the context of this Guideline, the prescribed activities are classified under **Activity 14(c) - Waste Treatment and Disposal (Sewage)** where the preparation and submission of an EIA report is required as stipulated in Section 34A of the Environmental Quality Act (EQA) 1974.

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

The Guideline shall be read together with the Environmental Impact Assessment Guideline in Malaysia (EGIM), published by DOE. Compliance with the requirements set out in the Guidelines and EGIM will fulfil the obligations of the Project Proponent as stated under Section 34A (2C) of the EQA 1974.

1.2 GUIDELINES OBJECTIVES

1.3 SCOPE OF THE EIA GUIDELINES

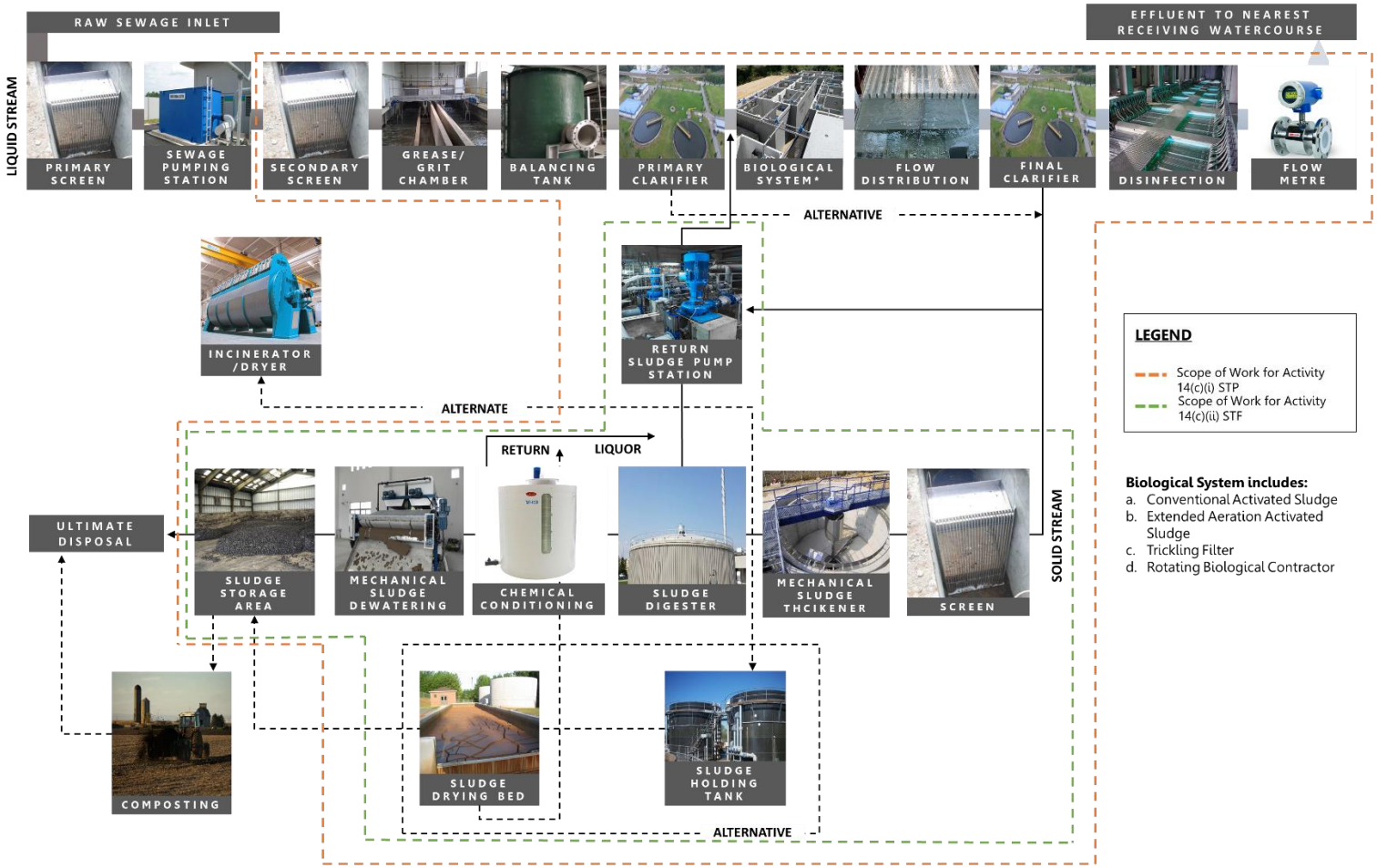
The scope of the Guideline covers 2 prescribed activities for First Schedule of Activity 14(c) of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 (**Table 1-1**). **Figure 1-1** illustrates the possible inter-relationships within these prescribed activities.

Table 1-1 List of Prescribed Activities under Activity 14(c)– Sewage

First Schedule	
Activity 14(c)(i)	Construction of sewage treatment plant (STP) with 20,000 population equivalent or more
Activity 14(c)(ii)	Sludge treatment facilities (STF)

There is no Second Schedule for Activity 14(c)(i) and 14(c)(ii). Activity 14(c)(i) and Activity 14(c)(ii) hereinafter shall be referred to as the "**Sewage Project**".

Figure 1-1 Inter-relationship within Prescribed Activities 14(c)(i) and 14(c)(ii)– Sewage



Source: Malaysian Sewage Industry Guideline, Volume IV: Sewage Treatment Plants (SPAN, 2009)

1.4 TERMS AND DEFINITIONS

In order to design STP, Project Proponent need to estimate the population equivalent (PE). Each PE value is varies depending on type of premises as stipulated in Malaysian Sewerage Industry Guideline Volume IV. For example, a recommended value of 5 PE per house for residential area and 3 PE per 100 m^2 gross area for commercial area. The definition of PE and other related terms for Sewage Projects are described in **Table 1-2**.

The proposed terms and definitions that will be adopted in this Guideline has been based on an interpretation of relevant documents published by DOE and other related government agencies, registered bodies and institutions, primarily the Water Services Industry Act 2006 (Act 655) and Environmental Quality (Sewage) Regulations 2009 of the Environmental Quality Act 1974 (Act 127).

Table 1-2 Terms and Definition for Sewage Project

Sewage	
Any liquid discharges containing human excreta, animal or vegetable matters in suspension or solution derived from domestic activities and being generated from household, commercial, institutional and industrial premises including discharges from water closets, basins, sinks, bathrooms and other sanitary appliances but excluding rain water and prohibited effluent[1]	Any liquid waste or wastewater discharge containing human, animal, domestic or putrescible matter in suspension or solution, and includes liquids containing chemicals in solution either in the raw, treated or partially treated form[2]
Domestic Sewage	
Wastewaters that are discharged from a residential dwelling, from public toilets, from laundries, from toilets, kitchens and canteens that are located in commercial, institutional and industrial buildings, and from hospitals and restaurants. Manufacturing related process wastewaters that are suitably pre-treated so that its pollutant characteristics are similar to that of untreated sewage may also be considered to be covered by this definition[3].	
Population Equivalent	
Equivalent in terms of fixed population of a varying or transient population or other activity, for example industrial or commercial contributing to flow to the sewerage treatment system[2].	
Sewage Treatment Works	
Facility designed to accept and process sewage or sewage sludge before disposal to a receiving medium but does not include septic tanks[1]	

Sewage Treatment System
Any facility designed and constructed for the purpose of reducing the potential of the sewage to cause pollution[2]
Sewerage System
Includes all physical facilities involved with the collection of sewage at source, conveyance to a treatment facility, its treatment to conform to effluent discharge standards and finally either to its disposal to the environment, or its reuse as irrigation waters or other accepted purpose.[3]
Sewage Sludge
Residual mixture of solid and liquid produced during the partial or full treatment of sewage but does not include treated sewage effluent discharged through a disposal pipe[1]
Sludge
Any deposit of particulate matter settled from a liquid, including deposit resulting from physical, chemical, biological or other treatment of sewage[2].
Sludge Treatment Facility
A facility for sewage sludge treatment through processes such as sludge stabilization, thickening, hygienization, and drying.[4]

Note:
[1] Water Services Industry Act 2006 (Act 655).
[2] Environmental Quality (Sewage) Regulations 2009.
[3] Malaysian Sewerage Industry Guidelines, Volume I, 2008
[4] Nowak (2006). Optimizing the Use of Sludge Treatment Facilities at Municipal WWTPs.

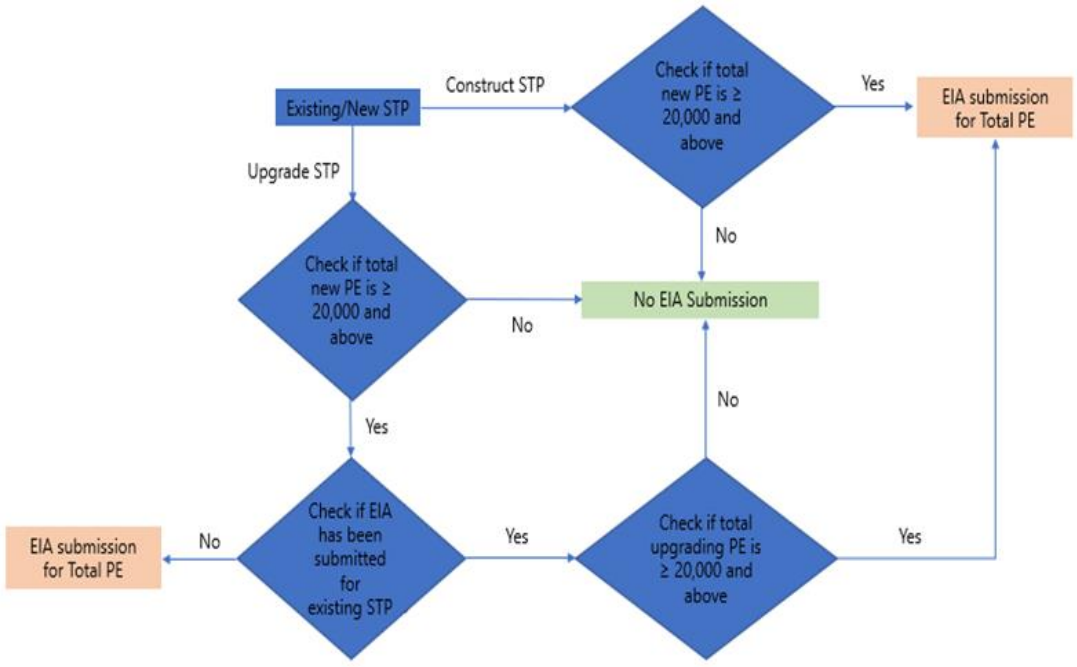
1.5 SCOPE OF THE PRESCRIBED ACTIVITY

The scope of the prescribed activities under Activity 14(c) of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 are shown in **Table 1-3. Figure 1-2** shows the flowchart for constructing new and upgrading of STP.

Table 1-3 Scope of Activity 14(c) under the First Schedule

Activity	Scope of Activity
Activity 14(c)(i) Construction of STP with 20,000 PE or more	1. Construction and operation of new STPs with design capacity of 20,000 PE or more. 2. Upgrading of existing STPs (where the initial design capacity is less than 20,000 PE) with a final design capacity of 20,000 PE or more. 3. Upgrading of existing STPs (where the initial design capacity is 20,000 PE or more), if an EIA was not conducted previously. 4. Upgrading additional 20,000 PE or more for existing STP (where initial design capacity 20,000 PE or more and EIA was conducted previously) Notes: • The scope of assessment extends over all treatment facilities (i.e. pre-treatment, primary, secondary and tertiary treatment) including sludge treatment, if located within the same premise. • The scope of assessment does not encompass sewerage components i.e. sewer lines and pumping stations (unless specifically requested by DOE). • If the STP is associated with another prescribed activity, the STP can be incorporated as part of a single EIA provided that the Project Proponent has the information on the STP.
Activity 14(c)(ii) Sludge Treatment Facilities (STF)	1. All STFs located off-site as dedicated sludge treatment and disposal facilities. Notes: • The scope of assessment extends over all treatment facilities (i.e. primary, secondary and tertiary treatment) including sludge transportation.

Figure 1-2 Flowchart For Constructing New and Upgrading Of STP



The examples of scenarios for scope of activity are as below:

1. An existing STP with 10,000 PE will be upgraded to 15,000 PE design capacity. The Project Proponent is not required to prepare an EIA report.

2. An existing STP with 10,000 PE will be upgraded to 20,000 PE final design capacity. The Project Proponent is required to prepare an EIA report.

3. An existing STP with 20,000 PE will be upgraded to 25,000 PE final design capacity. However, an EIA was not previously prepared based on the initial design capacity of 20,000 PE. The Project Proponent is required to prepare an EIA report.

4. An existing STP with 100,000 PE and EIA was conducted previously based on the design capacity 100,000 PE will be upgraded to 120,000 PE final design capacity. The Project Proponent is required to prepare an EIA report.

5. An existing STP with 100,000 PE and EIA was conducted previously based on the design capacity 100,000 PE will be upgraded to 110,000 PE final design capacity. The Project Proponent is not required to prepare an EIA report

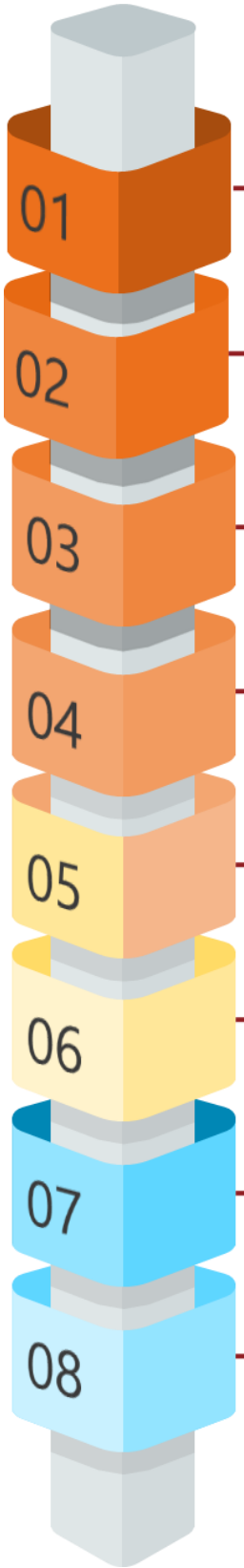
6. An existing STP comprising of five equal modules with a final design capacity of 100,000 PE is only operating with a single module of 20,000 PE. If additional modules are commissioned for operation and an EIA was previously prepared based on the final design capacity of 100,000 PE, the Project Proponent is not required to prepare an EIA.

7. An existing STP comprising of five equal modules with a final design capacity of 100,000 PE is only operating with a single module of 20,000 PE. If additional modules are commissioned for operation and an EIA was not previously prepared based on the final design capacity of 100,000 PE, the Project Proponent is required to prepare an EIA.

8. A Project Proponent is developing a housing project with an area of 150 hectares (Activity 16). An STP with 20,000 PE design capacity (Activity 14 (c)) will be constructed within the development to treat sewage from the residential area. Project Proponent can submit single EIA covering both scope of assessment.

1.6 STRUCTURE OF THE EIA GUIDELINES

This Guideline is divided into eight chapters as shown below:



INTRODUCTION
Provides the general overview of the guidelines including the scope and definition of activities covered as well as the environmental assessment process.

ENVIRONMENTAL PROJECT PLANNING
Provides the bird's-eye-view on all the relevant legal requirements and policies involve throughout the entire lifecycle of the Activity 14(c) projects.

TERMS OF REFERENCE (TOR)
Provides guidance for the preparation of TOR/ESI from the screening and scoping exercises. Impacts to be addressed and how to assess the impacts in the EIA study are outlined in this chapter.

BASELINE DATA
Provides guidance for the baseline data collection and analysis for the EIA study. This chapter not only focuses on the primary data collection but also the secondary data collection.

EVALUATION OF IMPACTS
Provides guidance for the evaluation of impacts which covers the typical input, appropriate methods and tools, intended output and the evaluation criteria for impact assessment.

MITIGATION MEASURES
Provides guidance on the selection of suitable mitigation measures to minimise the environmental impacts as well as residual impacts identified in the EIA Study.

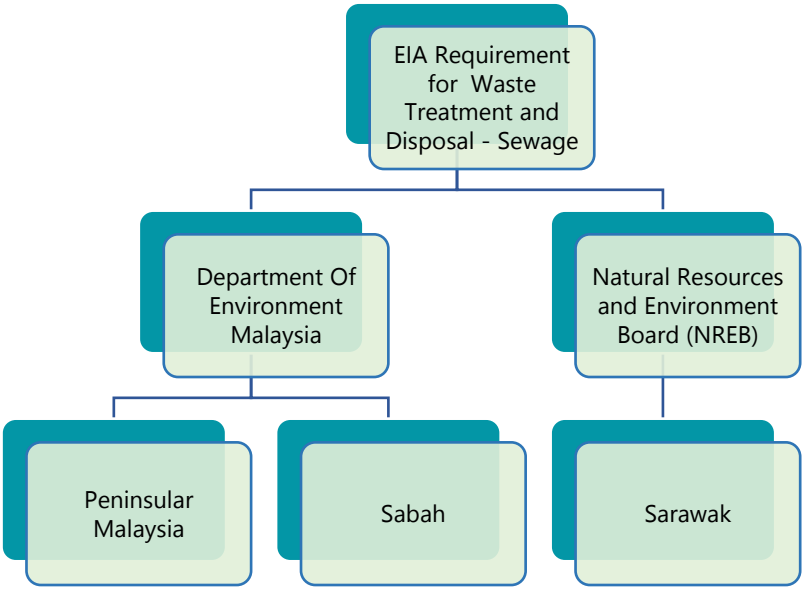
ENVIRONMENTAL MANAGEMENT PLAN (EMP)
Provides guidance on the formulation of the Environmental Management Plan (EMP) with the incorporation of Guided Self-Regulation (GSR) element.

REPORTING AND REVIEW
Provides guidance on the preparation of the EIA report including the submission and approval process in line with the EIA Guidelines in Malaysia 2016 published by DOE.

1.7 EIA REPORT REQUIREMENT

An EIA report is required for any prescribed activities under Section 34A of the Environmental Quality Act 1974. Any new Sewage Project falls under Activity 14(c) of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, which is applicable in Peninsular Malaysia and Sabah. The Project Proponent shall submit an EIA report to the Director-General of DOE for approval. However, Activity 14(c) of EIA Order 2015 does not apply in the state of Sarawak. The EIA requirement for Waste Treatment and Disposal – Sewage is shown in **Figure 1-3**.

Figure 1-3 EIA Requirement for Waste Treatment and Disposal – Sewage Projects



1.8 OVERVIEW OF THE EIA PROCESS

An EIA is a study to identify, predict, evaluate and communicate both the adverse and beneficial impacts of a proposed project on the environment. It also specifies any pollution prevention and mitigation measures (P2M2s) that are required to minimise significant environmental impacts throughout the project cycle.

Table 1-4 below shows the step-by-step guide of the EIA process. Relevant chapters to be referred in the guidelines are given in the reference column.

Table 1-4 Step-by-Step Guide for EIA Process

Step		Description	Reference
STEP 1	Provide Project Brief or Basic Information	• The Project Proponent must provide the basic information to enable the Qualified Person to understand the scope of the project and carry out the screening process. • The requirement for the First Schedule EIA study will be determined.	• Chapter 1 of the Guidelines.
STEP 2	Identify the Legal Requirements	• The Qualified Person shall identify all legal requirements relevant to the project based on the information provided by the Project Proponent.	• Chapter 2 of the Guidelines.
STEP 3	Check Existing Policies and Guidelines	• The Project Proponent is required to clear all policy and administrative matters related to the project before submitting the EIA report to the DOE.	• Chapter 2 of the Guidelines.
STEP 4	Conduct Preliminary Stakeholder Engagement	• The Project Proponent and the Qualified Person should engage with the DOE and the relevant GAs to determine the requirements to be included in the TOR report. • The Qualified Person can also engage with other relevant stakeholders to obtain site information and data for the scoping.	• Chapter 2 of the Guidelines.
STEP 5	Prepare TOR and ESI Report	• ESI and TOR must be prepared before the preparation of the EIA report. • The Qualified Person shall obtain secondary data to assist in the Environmental Scoping. • At this point in time, qualitative data is sufficient for the scoping of significant impacts for the TOR. • Relevant information required for the TOR includes: ✓ Site Suitability Assessment (SSA). ✓ Determination of the study boundary. ✓ Overview of baseline data. ✓ Identification of key project activities. ✓ Identification of significant impacts and priority setting. ✓ Selection of mitigation measures.	• Chapter 3 of the Guidelines.
STEP 6	Submit TOR and ESI Report	• The Qualified Person shall review all data obtained during scoping to prepare the TOR report based on DOE requirements in the EGIM.	• Chapter 3 of the Guidelines.
STEP 7	Collect Baseline Data for EIA Report	• Baseline data collection shall be carried out after the TOR endorsement to obtain detailed information of the existing environment on the project site and its surroundings.	• Chapter 4 of the Guidelines.

	Step	Description	Reference
STEP 8	Prepare EIA Report	• The major studies and components of the EIA report shall cover the following: ✓ Identify and predict significant environmental issues and impacts. ✓ Assess and evaluate the significant environmental issues and impacts. ✓ Identify suitable P2M2s. ✓ Provide the Environmental Management Plan (EMP) framework. ✓ Conclude the EIA study findings. • Project description shall cover the following (refer to **Appendix A** for more detail): ✓ Project Location ✓ Project Components ✓ Process Technology ✓ Detailed Design for Pollution Control System ✓ Mass Balance Calculation ✓ Project Activities ✓ Infrastructure, Utilities and Amenities Requirement ✓ Project Implementation Schedule	• Chapter 5,6 & 7 of the Guidelines.
STEP 9	Conduct Stakeholder Engagement	• The Project Proponent and Qualified Person are recommended to engage with the relevant stakeholders particularly those who are affected by the project. • The engagement aims to seek their thoughts and feedback. • Key points for the engagement are as follows: ✓ Project background. ✓ Potential environmental issues. ✓ Proposed P2M2s. • All findings from the engagement shall be incorporated and addressed in the EIA report when necessary.	• Chapter 2 of the Guidelines.
STEP 10	Completion of EIA Report	• The results of assessments and studies required by other GAs have to be incorporated into the EIA report but not necessary to append the individual reports. • The EIA report shall be prepared according to the EGIM.	• Chapter 8 of the Guidelines.
STEP 11	Submit EIA	• The EIA report shall be submitted to DOE State for review. • The Qualified Person shall follow requirements and procedures for First Schedule EIA	• Chapter 8 of this Guidelines.

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EIA GUIDELINES

Waste Treatment & Disposal
-Sewage

2

ENVIRONMENTAL PROJECT PLANNING

CHAPTER 2

ENVIRONMENTAL PROJECT PLANNING

2.1 INTRODUCTION

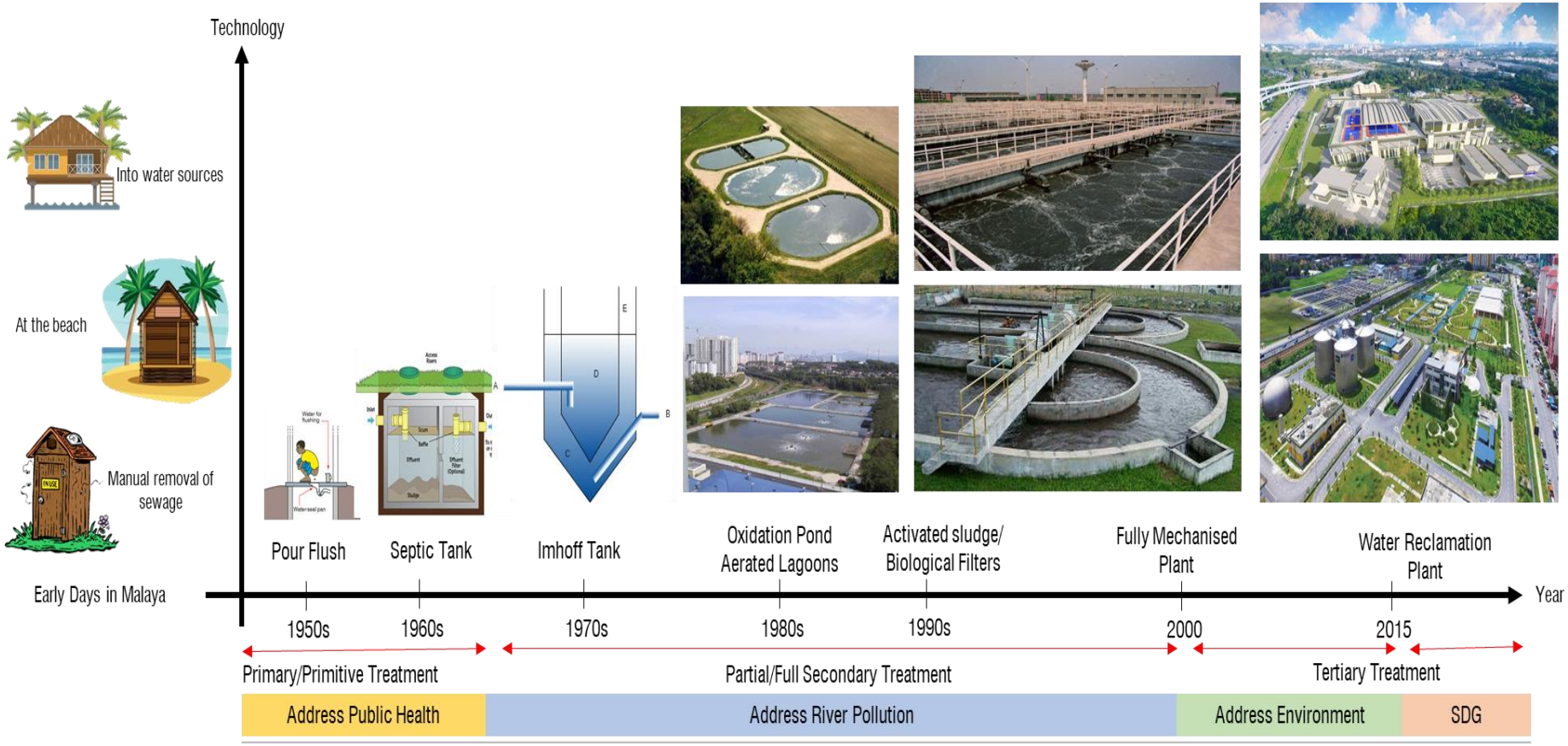
An Environmental Impact Assessment (EIA) is an important part of integrated planning for Sewage Projects. This Guideline aims to provide guidance for Project Proponent on the preparation of related documents in compliance with related regulations from the pre-planning stage to abandonment/closure stage. It will also guide Project Proponent on complying with requirements from related technical agencies and the approving authority for Sewage Projects. This process is important in order to ensure that the EIA report meets approval requirements.

This Guideline identifies key areas of environmental concerns during the project planning stage and provides a means to identify types of measures to mitigate and/or reduce adverse environmental impacts at an early stage. A summary of the EIA process can be found in Environmental Impact Assessment Guideline in Malaysia (EGIM).

2.2 OVERVIEW OF SEWAGE MANAGEMENT

Sewerage systems in Malaysia have undergone significant changes over the last five decades. Prior to the 1950s, sewage was not treated and was disposed directly into water sources such as rivers or the sea. The advancement of sewerage systems to addresses public health issues began with primary treatment i.e. pour flush and septic tank systems. These evolved into secondary treatment technologies to address the impact of river pollution i.e. Imhoff tanks, oxidation ponds/aerated lagoons and activated sludge/biological filters. Today, tertiary treatment technologies i.e. fully mechanised plants and water reclamation facilities are common. Tertiary treatment aims to address environmental issues, as part of the United Nations' Sustainable Development Goals where the management of waste will contribute towards climate change mitigation. **Figure 2-1** shows an overview of sewage management in Malaysia.

Figure 2-1 Overview of Sewage Management in Malaysia



Source: IWK, 2011

2.3 RELEVANT LEGISLATIONS

The Environmental Quality Act (EQA) 1974 (Act 127) and the Environmental Quality (Sewage) Regulations 2009 are the main legal instruments governing sewage activities, in addition to other key legislations which are described in **Table 2-1**. As new laws/regulations may be enacted and existing laws/regulations may be amended, Qualified Person must refer to the most updated laws/regulations.

Table 2-1 Key Legislations Governing the Sewage Projects

No	Legislations	Details
1	Environmental Quality Act 1974	EQA provides for indirect control and regulation of environmental pollution due to sewage management activities.
2	Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015	Lists the activities under sewage which is subjected to conduct environmental impact assessment.
3	Suruhanjaya Perkhidmatan Air Negara Act 2006	An Act to provide for the establishment of the Suruhanjaya Perkhidmatan Air Negara with power to supervise and regulate sewerage services and to enforce the sewerage services laws for related matters.
4	Water Services Industry Act 2006	An Act to provide for and regulate water supply services and sewerage services for matters incidental thereto.
5	National Land Code 1965 (Act 56)	An Act to regulate the management of land in terms of land tenure, registration of titles relating to land, transfer of land, leases and charges in respect of land, easements and other rights and interests in land.
6	Environmental Quality (Sewage) Regulations 2009	The regulations specify the management of sewage discharge and sludge disposal. Sewage concentration limits are stipulated in these regulations.
7	Environmental Quality (Clean Air) Regulations 2014	Under these regulations, emission from odour scrubber (if any) is subjected to the Best Available Techniques (BAT). Air pollutant emission concentration limits for these activities are stipulated in these regulations.
8	Environmental Quality (Scheduled Waste) Regulations 2005	These regulations specify the management of scheduled waste in STP and STF

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

2.4 POLICY AND GUIDELINES COMPLIANCE

At the time of reporting, the Ministry of Environment and Water (KASA) was drafting the National Sewerage Policy. The National Sewerage Policy should provide solutions through a national sewerage development plan focussing on issues related to sewerage catchment and local sewerage plans, facilities and infrastructure together with the operation and management of the sewage industry. Generally, sludge management aims to reduce the amount of sludge production; produce a safe and hygienic material; and apply reuse/recycle technology instead of disposal.

It is important to note that, policies are not rigid but dynamic with periodic updates. It is the responsibility of the Project Proponent and Qualified Person to engage with relevant agencies during planning stage to obtain and apply the most recent policies. Other policies that should be incorporated in a Sewage Project are described in the following sub-sections**.**

2.4.1 Sustainable Development Goals

The 17 Sustainable Development Goals (SDGs) were adopted by all United Nation Member States in 2015. Goal 6 on Clean Water and Sanitation states that clean, accessible water for all is an essential part of the world we live in. The targets for Goal 6 are described as follows:

Source: The United Nations Development Programme

i. By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
ii. By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.
iii. Support and strengthen the participation of local communities in improving water and sanitation management.

As sewage flows into freshwater ecosystems, it also relates with Goal 15: Life on Land as the first target 15.1 is to conserve and restore terrestrial and freshwater ecosystems.

Source: The United Nations Development Programme

2.4.2 Green Technology Master Plan Malaysia

The Green Technology Master Plan Malaysia was published by the Ministry of Energy, Green Technology and Water Malaysia in 2017. 2 targets were set such as 100% sludge and 33% treated sewage to be recycled by 2030. Strategies to meet the targets related to the sustainable management of sewage are described as follows:

Source: Ministry of Science, Technology and Innovation

i. Sludge from Sewage Treatment Plants (STPs) can be recycled as biosolids for fertiliser of non-food crop agriculture, energy production and raw materials for other green technology products.
ii. Existing research, development and commercialisation management mechanisms shall be strengthened through the establishment of a working group consisting of various technology provider water and sewage operators.
iii. A National committee on Sustainable Waste Management shall be established to increase coordination on the management of seven types of waste (including sewage and scheduled waste) based on a life-cycle approach.
iv. Public STPs shall aim to receive trade effluent from industry in view of reducing pollution at the point source. This is not only intended to reduce enforcement and monitoring cost by the Government but also to integrate treatment plants.
v. A National Sewerage Catchment Plan (NSCP) shall be formulated for the following applications:

    - To guide the preparation of sewerage development plans;
    - To determine investments required for sewerage infrastructure;
    - To encourage resource recovery from point source up to by-products of sewage treatment;
    - To promote participation amongst stakeholders in order to create awareness within the sewerage sector.

2.4.3 National Urbanisation Policy and Plan

The National Urbanisation Policy 2 for 2016-2025 was published by Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia (JPBD) in 2016. One of the objectives in Principle 5: Green Development and Clean Environment, is to have an efficient and capable water management.

Source: Ministry of Housing and Local Government

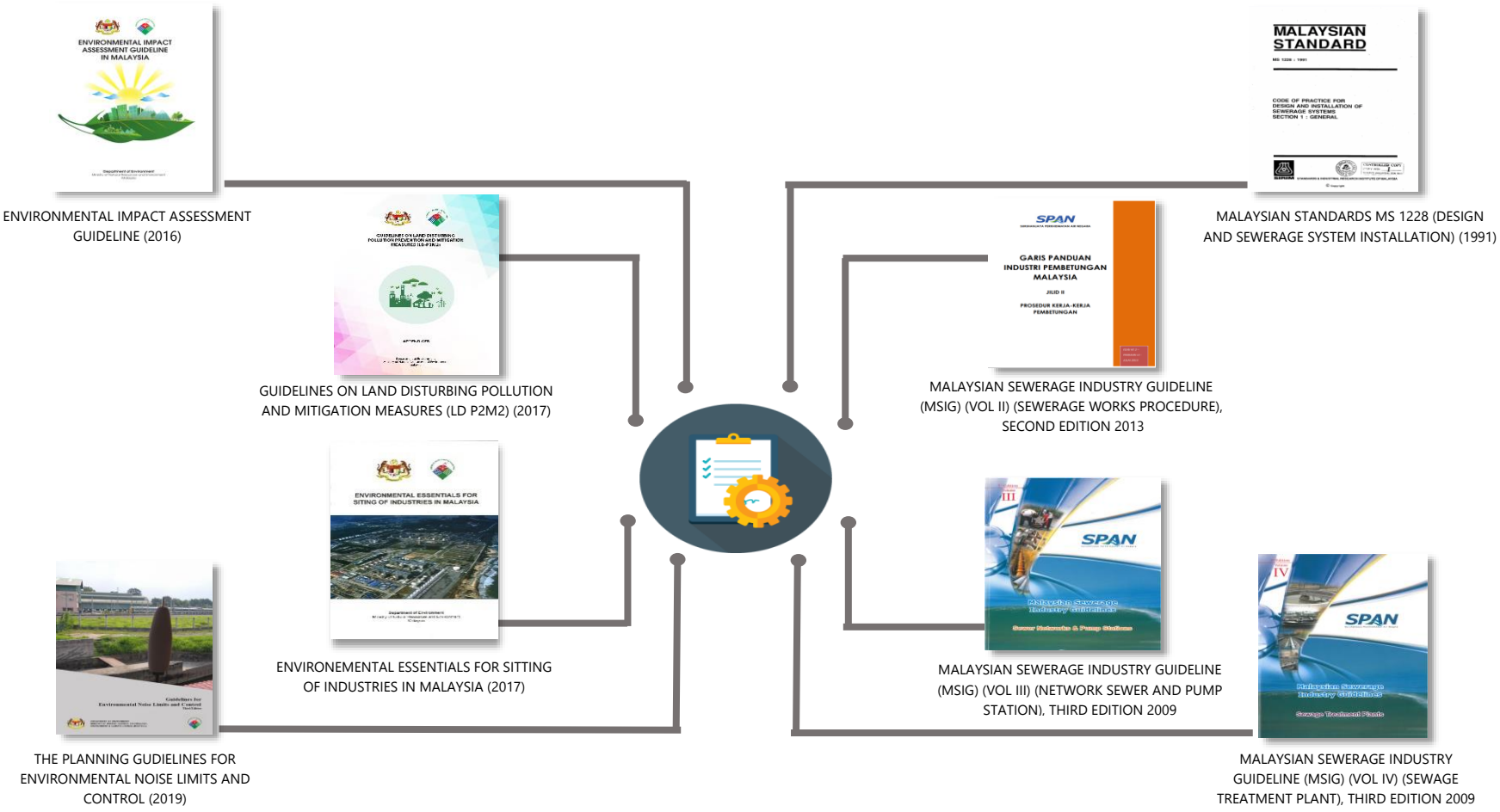
Two action plans related to sewage development and management are described under Strategy 5.4.1: Management of Water Pollution within Urban Area as follows:

i. Upgrade sewage treatment plants with environmentally-friendly technologies to decrease sewage pollution on water resources.
ii. Ensure that villages in urban areas are provided with centralised sewerage systems.

2.5 GUIDELINES AND GUIDANCE DOCUMENT

Project Proponent shall prepare an EIA by referring to the following guidelines (**Figure 2-2)** published by the Department of Environment (DOE), National Water Services Commission (SPAN), and the Standard and Industrial Research Institute of Malaysia (SIRIM). It is the responsibility of the Project Proponent and Qualified Person to engage with relevant agencies to obtain and apply the most recent guidelines.

Figure 2-2 List of Guidelines and Guidance Documents



2.6 INTEGRATION OF ENVIRONMENTAL COMPLIANCE INTO PROJECT PLANNING

Project Proponent shall address all legal requirements on the environment and other associated requirements as required for the EIA approval process. Environmental compliance is not all about fulfilling the requirements from the DOE and other Government Agencies (GAs) for the EIA study but needs to be seen at a bigger perspective throughout the entire cycle of the project.

A typical project cycle involves many phases and inputs from technical specialists and consultants for submissions as required by various approving authorities, as shown in **Table 2-2**. A summary of relevant requirements at various project implementation stages is shown in **Figure 2-3.** By addressing these requirements at an early stage of the project, the Project Proponent can:

- Avoid any legal implications by the relevant authorities.
- Allocate sufficient budget to safeguard the environment (not only focusing on the EIA study).

Figure 2-3 Summary of Relevant Requirements at Various Project Implementation Stages

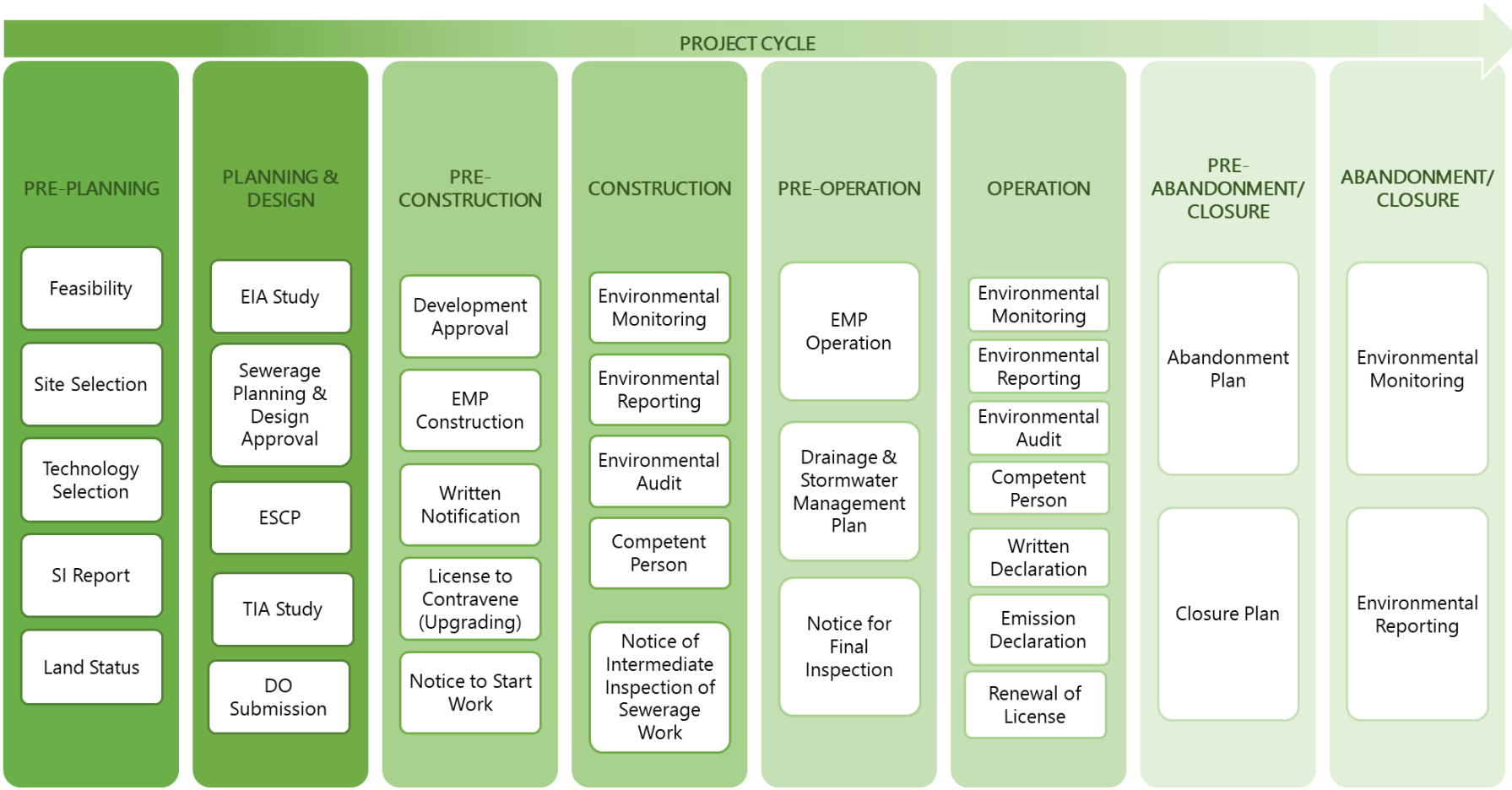


Table 2-2 List of Relevant Requirements at Various Project Implementation Stages

Project Stage	Requirement	Details	Legal Provision
Pre-Planning	Feasibility Study	• Assessment on TELOS – Technical, Economic (e.g.- environmental cost and Project cost), Legal, Operational and Scheduling.	-
	Site Selection	• Site suitability assessment.	-
	Technology Selection	• Create a technology shortlist.	-
	Soil Investigation (SI)	• Nature and characteristics of sub-soil below the ground level.	• Geological Survey Act 1974 (act 129).
	Land Status	• Compatibility of the land.	• National Land Code 1965 (Act 56).
Planning & Design	**Department of Environment (DOE)**		
	Environmental Impact Assessment (EIA)	• TOR and ESI • Statement of need • Project options • Project description • Existing environment • Evaluation of impacts • Mitigation measures • Environmental Management Plan (EMP)	• Environmental Quality Act (EQA) 1974. • Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015. • Environmental Quality (Sewage) Regulations 2009. • Environmental Quality (Clean Air) Regulations 2014. • Environmental Quality (Scheduled Wastes) Regulation 2005
	Department of Mineral and Geoscience (JMG)		
	Geological & Hydrogeological Assessment Report –to be integrated in EIA report (if required)	• Subsurface geological profile: drilling/geophysical survey. • Permeability test results.	• Geological Survey Act 1974 (act 129). • Geological Survey (Notification of Development of Wells and Excavations) Regulations 2013.

Project Stage	Requirement	Details	Legal Provision
		• Construction materials – clay liner, clay blanket & filter sand. • Detailed groundwater regime. • Potential groundwater, soil and rock pollution and mitigative measures. • Proposed groundwater monitoring network. • Flood prone area	
	Department of Environment (DOE) / Ministry of Health (MOH)		
	Health Impact Assessment (HIA) – to be integrated in EIA report	• Screening • Scoping • Description of existing public health status • Health Risk Assessment (HRA)	• Environmental Quality Act (EQA) 1974.
	National Water Services Commission (SPAN)		
	Sewerage Planning Approval	• Form WSIA/PDC/1 Application for Sewerage Planning Approval	• Water Services Industry (Planning, Design and Construction of Sewerage System and Septic Tank) Rules 2013
	Sewerage Design Approval	• Form WSIA/PDC/2 Application for Sewerage Works Design Approval	
	Department of Irrigation and Drainage (DID)		
	Erosion and Sedimentation Control Plan (ESCP)	• Annual soil erosion rate. • Sediment yield. • Proposed erosion and sedimentation control measures. • Inspection and maintenance.	• Street, Drainage and Building Act 1974 [Act 133].

Project Stage	Requirement	Details	Legal Provision
	Public Works Department (PWD)		
	Traffic Impact Assessment (TIA) – (if required)	• Road & junction characteristics. • Traffic count survey. • Existing traffic condition evaluation. • Traffic forecast. • Impact assessment. • Mitigation measures.	• Road Transport Act 1987 [Act 333]. • Town and Country Planning Act 1976 [Act 172].
	Local Authority (PBT)		
	Development Order (DO)	• Approvals of various submissions to the technical agencies: ✓ EIA report – DOE ✓ ESCP report – DID ✓ TIA report – PWD ✓ Geotechnical Report – JMG (if required) ✓ TNB ✓ IWK ✓ BOMBA ✓ DOSH ✓ PTG ✓ State Water Authorities ✓ Various departments under Local Authority ✓ Others	• Town and Country Planning Act 1976 [Act 172].

Project Stage	Requirement	Details	Legal Provision
Pre-Construction	**State Water Authorities**		
	Approval if the development is within river reserve, zone of protection or any areas required by the state water authorities.	• Land Status • Layout Plan • Structure design plan • Survey Plan • ESCP Report and ESCP Plan	• State Water Enactment and/or related regulations
	Department of Environment (DOE)		
	Environmental Management Plan (EMP) for Construction	• Company's environmental policy. • Organisational structure. • Training requirements. • Environmental requirements. • Environmental Mainstreaming Tools (EMT).	• Environmental Quality Act (EQA) 1974
	Written Notification	• First Schedule – Notification for new source of sewage discharge or release • Form AS/PUB/N-SCRUBBER - Written Notification on Air Emission Sources (Air Pollution Control System (Scrubber).	• Environmental Quality (Sewage) Regulations 2009. • Environmental Quality (Clean Air) Regulations 2014
	License to Contravene (for Upgrading STP)	• Form 1 (Regulation 2) Application for a licence or transfer of a licence under the environmental quality Act 1974	• Environmental Quality (Sewage) Regulations 2009. • Environmental Quality (Licensing) Regulations 1977
	National Water Services Commission (SPAN)		
	Notice to Start Work	• Form WSIA/PDC/6 Notice Of Commencement Of Sewerage Works	• Water Services Industry (Planning, Design and Construction of Sewerage System and Septic Tank) Rules 2013

Project Stage	Requirement	Details	Legal Provision
Construction	**Department of Environment (DOE)**		
	Environmental Monitoring	• Performance, compliance and impact monitoring such as: ✓ Ambient air monitoring. ✓ Noise monitoring. ✓ Silt trap discharge sampling. ✓ Surface water sampling.	• Environmental Quality Act (EQA) 1974
	Environmental Reporting	• Form EIA 1-18 – EIA Project Information Status. • Form EIA 2-18 – EIA Approval Conditions Compliance Report.	• Environmental Quality Act (EQA) 1974
	Environmental Audit	• Audit Site Administrative Details. • Regulatory Compliance Summary. • Audit Findings. • Recommendations.	• Environmental Quality Act (EQA) 1974
	Competent Person	• Certified Erosion, Sediment and Storm Water Inspector (CESSWI). • Certified Inspection of Sediment and Erosion Control (CISEC). • Environmental Officer (EO)	• Environmental Quality Act (EQA) 1974
	National Water Services Commission (SPAN)		
	Notice Of Intermediate Inspection Of Sewerage Works	• Form WSIA/PDC/7 Notice Of Intermediate Inspection Of Sewerage Works	• Water Services Industry (Planning, Design and Construction of Sewerage System and Septic Tank) Rules 2013

Project Stage	Requirement	Details	Legal Provision
Pre-Operation	**Department of Environment (DOE)**		
	Environmental Management Plan (EMP) for Operation	• Company's environmental policy. • Organisational structure. • Training requirements. • Environmental requirements. • Environmental Mainstreaming Tools (EMT).	• Environmental Quality Act (EQA) 1974
	National Water Services Commission (SPAN)		
	Notice of Final Inspection	• Form WSIA/PDC/8 Notice of Final Inspection	• Water Services Industry (Planning, Design and Construction of Sewerage System and Septic Tank) Rules 2013
	Department of Irrigation and Drainage (DID)		
	Drainage and Stormwater Management Plan	• Project Location and Site Descriptions. • Proposed Project Development. • Site Identifications. • Hydrological Data Analysis. • Development of Stormwater Management Master Plan. • Drainage and Conveyance System Plans. • Wet/Dry Pond Plans. • Onsite Detention (OSD) Plans. • Gross Pollutant Traps (GPTs) Plans. • Filtration Plans. • Infiltration Plans.	• Street, Drainage and Building Act 1974 [Act 133].

Project Stage	Requirement	Details	Legal Provision
Operation	**Department of Environment (DOE)**		
	Environmental Monitoring	• Performance, compliance and impact monitoring such as: ✓ Ambient air monitoring (if necessary). ✓ Odour monitoring ✓ Noise monitoring. ✓ Sewage treatment plant (STP) discharge sampling. ✓ Surface water sampling. ✓ Groundwater sampling (if required).	• Environmental Quality Act (EQA) 1974
	Environmental Reporting	• Form EIA 1-18 – EIA Project Information Status. • Form EIA 2-18 – EIA Approval Conditions Compliance Report.	• Environmental Quality Act (EQA) 1974
	Environmental Audit	• Audit Site Administrative Details. • Regulatory Compliance Summary. • Audit Findings. • Recommendations.	• Environmental Quality Act (EQA) 1974
	Competent Person	• Certified Environmental Professional in Scheduled Waste Management (CePSWaM). • Certified Environmental Professional in Sewage Treatment Plant Operation – CePSTPO • Certified Environmental Professional in Scrubber Operation (CePSO). • Environmental Officer (EO)	• Environmental Quality Act (EQA) 1974 • Environmental Quality (Sewage) Regulations 2009. • Environmental Quality (Clean Air) Regulations 2014.

Project Stage	Requirement	Details	Legal Provision
Operation	Written Declaration	• Form AS/PUB/DECLARE – Written Declaration on Design and Construction of Air Pollution Control System	• Environmental Quality (Clean Air) Regulations 2014.
	Emission Declaration	• Form AS/PUB/EMISSION - Emission Declaration of Air Emission Sources Under Regulations 18 of the Environmental Quality (Clean Air) Regulation, 2014.	• Environmental Quality (Clean Air) Regulations 2014.
	License Fee	• Method of computing sewage-related license fee	• Environmental Quality (Sewage) Regulations 2009
Pre-Abandonment /Closure	**Department of Environment (DOE)**		
	Abandonment/ Closure Plan	• Overall decommissioning and abandonment/ closure strategy.	• Environmental Quality Act (EQA) 1974
Abandonment /Closure	**Department of Environment (DOE)**		
	Environmental Monitoring	• Stack monitoring (if required). • Odour Monitoring • Surface water sampling. • Groundwater sampling (if required).	• Environmental Quality Act (EQA) 1974
	Environmental Reporting	• Report on the post abandonment/ closure.	• Environmental Quality Act (EQA) 1974

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

2.7 STAKEHOLDER ENGAGEMENT

2.7.1 Identification of Stakeholder

The EIA process has adequate mechanisms to enable stakeholders to provide feedback for the decision-making process by relevant approving authorities. These mechanisms are addressed in the preparation of the Terms of Reference (TOR) and EIA reports of the project. There are two stages of stakeholder engagement as follows:

- **Stage 1** – Preliminary engagement before the preparation of TOR.
- **Stage 2** – Engagement during the preparation of EIA.

Stakeholders can be divided into six groups (**Figure 2-4**).

Figure 2-4 Relevant Stakeholder to be Engaged in the EIA Process

[Note: There is no requirement for public engagements (public display and public comment) for Prescribed Activities under the First Schedule as stipulated in the Sub-regulation 3(3) of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) order 2015. However, voluntary public engagement is highly encouraged.]

Each group has specific roles and responsibilities; the key to a successful EIA is by meeting the requirements of each group, so far as is practicable.

2.7.2 Roles and Responsibilities

Table 2-3 below provides the list of relevant stakeholders related to Sewage Projects. However, Project Proponent and Qualified Person may identify and engage other stakeholders which may be relevant based on the nature and location of the project.

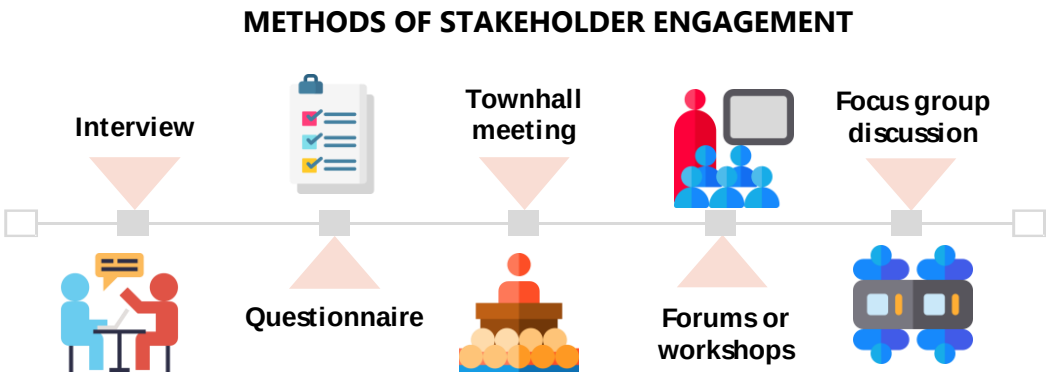
Table 2-3 Roles and Responsibilities of Stakeholders in the EIA Study

Stakeholder	Roles and Responsibilities
Department of Environment (DOE)	• Administration of the EIA process under EQA 1974. • Responsible for the issuance of the COA for the EIA. • Post EIA approvals, monitoring and enforcement.
Project Proponent	• Plan, develop and/or manage the project. • Responsible for obtaining all necessary approvals for the project. • Involved in the management of the project at all stages of development.
Government Agencies: • National Water Services Commission (SPAN) • Sewerage Services Department (SSD) • Department of Mineral and Geoscience (JMG). • Public Works Department (PWD). • Department of Drainage and Irrigation (DID). • Federal Department of Town and Country Planning (PLANMalaysia). • Ministry of Health (MoH). • State Water Authority	• Provide relevant inputs in respective areas and expertise. • Review the impacts of the project to their respective area of interest. • Ensure the impacts are within the acceptable levels.
Approving Authority • Federal agencies. • State agencies. • Local authorities.	• Ensure the impacts are within the acceptable levels. • Give approval to the project after due consideration.
Sewerage Services Provider • Indah Water Konsortium Sdn Bhd (IWK) • PWD Sabah/JPP Sabah • Majaari Services Sdn Bhd • Private operators • Local authorities	• To ensure that the operation of STPs and STFs comply with all approval conditions and regulations by implementing pollution prevention and mitigation measures (P2M2)
Affected Groups: • Local community. • Business/ land owner.	• Give relevant inputs for protection of local interest. • Give feedback to the impact findings.
Interest Groups: • NGO's related to environment. • Experts/Environmental practitioners.	• Provide inputs based on their technical knowledge and expertise.

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 identify the relevant stakeholders to engage for the project.

2.7.3 Method of Engagement

Several methods of engagement may be adopted for stakeholder engagement. Each method has its own advantages and disadvantages. The Qualified Person may determine the most suitable method to gain effective inputs. For example, one-to-one interviews can generate detailed feedback compared with forums or workshops but may require more time and resources.



2.7.4 Documentation and Reporting

The process of stakeholders engagement shall be adequately documented and reported in the EIA report. The stakeholder engagement report shall contain the following:

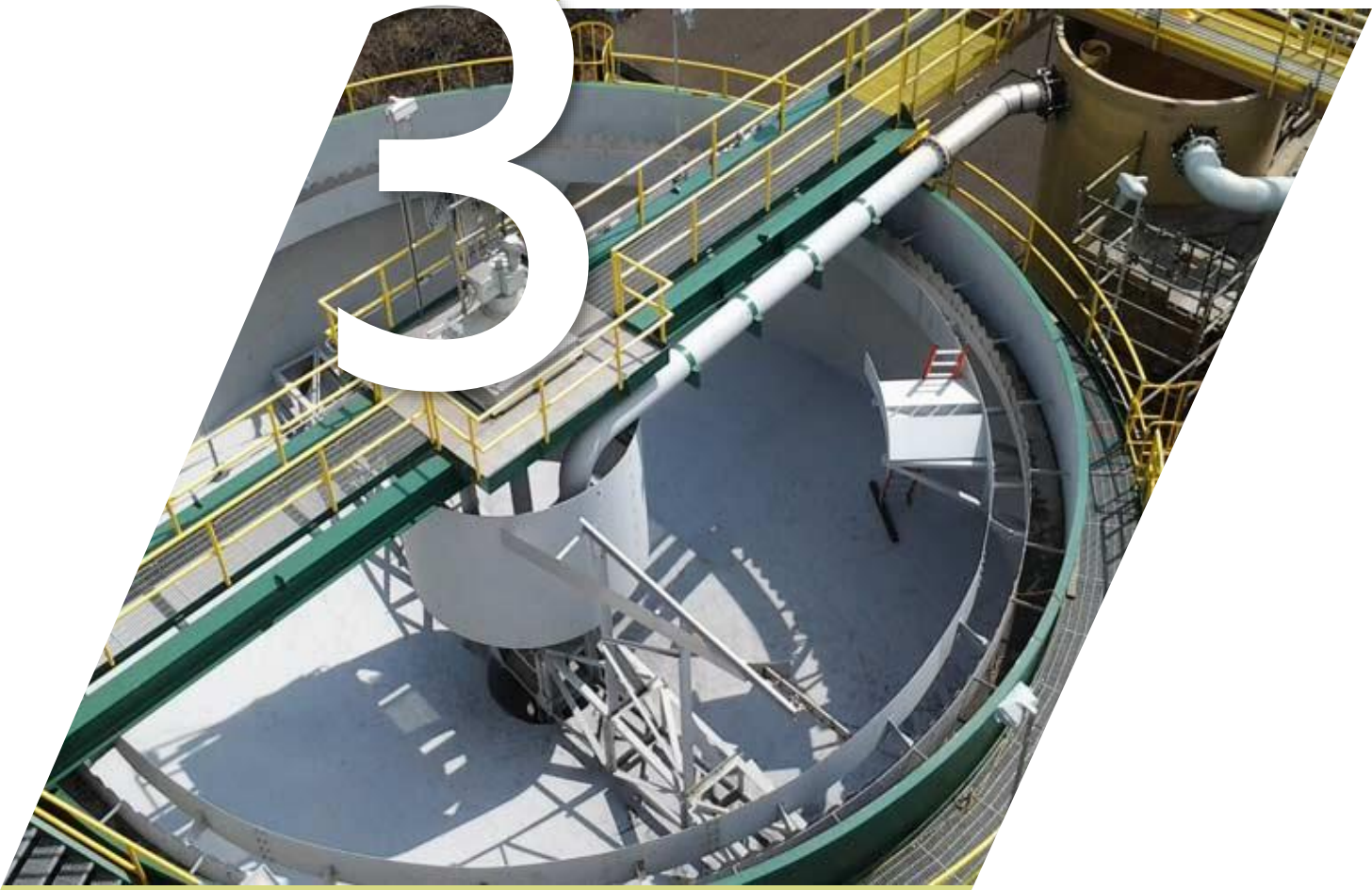
- Details of the engagement (dates, venue, itinerary).
- Attendance list of participants.
- Copies of survey forms (if required).
- Brief summary of findings from the engagement e.g. reports, minutes of meeting, list of questions and responses, photographs of events.
- Video or voice recordings (optional and only as reference).

The report shall form part of the appendix in the EIA report, and feedback from stakeholders and responses from the Project Proponent shall be clearly stated and discussed in the EIA report.

EIA GUIDELINES

Waste Treatment & Disposal -Sewage

3



TERMS OF REFERENCE

CHAPTER 3

TERMS OF REFERENCE

3.1 INTRODUCTION

The Terms of Reference (TOR) is the first major milestone in the Environmental Impact Assessment (EIA) process. Typically, the TOR will:

- Define the types of information required for the EIA Report.
- Determine the scope of the EIA in relation to various aspects of the Project.
- Specify the assessments or studies to be performed based on the identified scope.
- Identify EIA team members responsible for performing the assessments or studies.
- Determine the study timeline.
- Outline the methodologies and standards to be used in the evaluation of impacts.

This Chapter aims to guide the Project Proponent and Qualified Person through the various steps in the preparation and submission of the TOR which shall be submitted to the Department of Environment (DOE) for endorsement.

3.2 ENVIRONMENTAL SCREENING

An Environmental Screening is carried out to determine if a proposed project or its activities is a Prescribed Activity under the Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015. The Environmental Screening is also used to determine compliance with all other Federal and/or state policies before proceeding with an EIA. Project Proponent or Qualified Person shall consult DOE if any uncertainty arises.

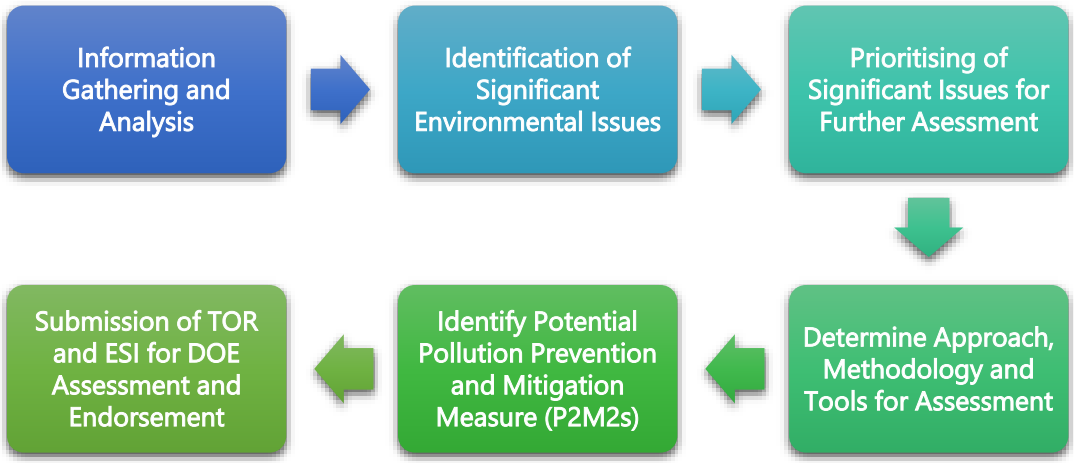
3.3 ENVIRONMENTAL SCOPING

An Environmental Scoping is the process of determining and documenting key environmental issues related to the Project while ensuring that relevant information is provided to decision makers in a focused and clear manner. There are several objectives of the scoping, as follows:

- Sets the limits, boundaries and focus of the EIA Study.
- Defines the key environmental concerns which need to be addressed in detail.
- Determines the required baseline data.
- Sets the level of assessment and evaluation criteria.

Figure 3-1 shows the general flow path of the scoping exercise:

Figure 3-1 Flow Path for Environmental Scoping



3.4 SITE SUITABILITY ASSESSMENT

A site suitability assessment (SSA) shall be undertaken to determine if the selected site is compatible and free of any restrictions. Restrictions may be overcome through alternative options in terms of project concept, layout, design and methodologies or through the application of adequate mitigation measures. This SSA will allow DOE to evaluate the acceptability of the selected site with reference to any environmental factors.

For Sewage Projects, these options are evaluated during the preparation of a sewage master plan, sewage development plan and feasibility studies whereby certain criteria are used such as site characteristics and project requirements. The criteria used are assessed and ranked based on priority to determine the best option.

Pollution prevention and mitigation measures (P2M2s) and best management practices (BMPs) will be incorporated in the option selected as part of the scoping exercise. A 'No Project' option shall also be assessed and its implications discussed comparatively with the 'With Project' option.

Table 3-1 shows the examples of project alternatives and options while site selection criteria for Sewage Projects are appended in **Appendix B**.

Table 3-1 Considerations in Project Alternatives and Options

No	Options	Considerations
1	Project siting	• Adherence to national, state and local policies and plans such as National Physical Plan, State Structure Plans, and Local Plans. • Site constraints to the project and vice versa. • Location and proximity to sensitive receptors (e.g.: water intake point, water recreational park, aquaculture ponds) • Buffer/setback availability and requirements. • Any alternative sites proposed for the project.
2	Process technology options	• Availability of technology to minimise impacts. • Best available technology (BAT) options. (**Appendix C**). Project Proponent may refer to other emerging technologies from USEPA or other country but must get approval from SPAN • Benchmarking with alternative technology. • Green technology adoption. • Cleaner production concept adoption
3	Pollution prevention and mitigation measures (P2M2s) technology options	• Availability of technology to minimise impacts. • Best available control technology (BACT) options (**Appendix C**). • Benchmarking with alternative technology. • Green technology adoption. • Waste to wealth and 4R concept (reduce, reuse, recycle and recover) adoption • Zero waste or near zero emissions options.
4	Project component and design	• Layout consideration. • Choice of construction methods.
5	Social	• Need for land acquisition or relocation. • Location of workers' camp. • Location within or close to sensitive land & historical sites, cemeteries, places of worship. • Location within or close to populated areas, parks and scenic areas.

Note: The list is not exhaustive and additional criteria / information may be required by relevant agencies. It is the responsibility of the Project Proponent and Qualified Person to engage with relevant agencies on a case-by-case basis.

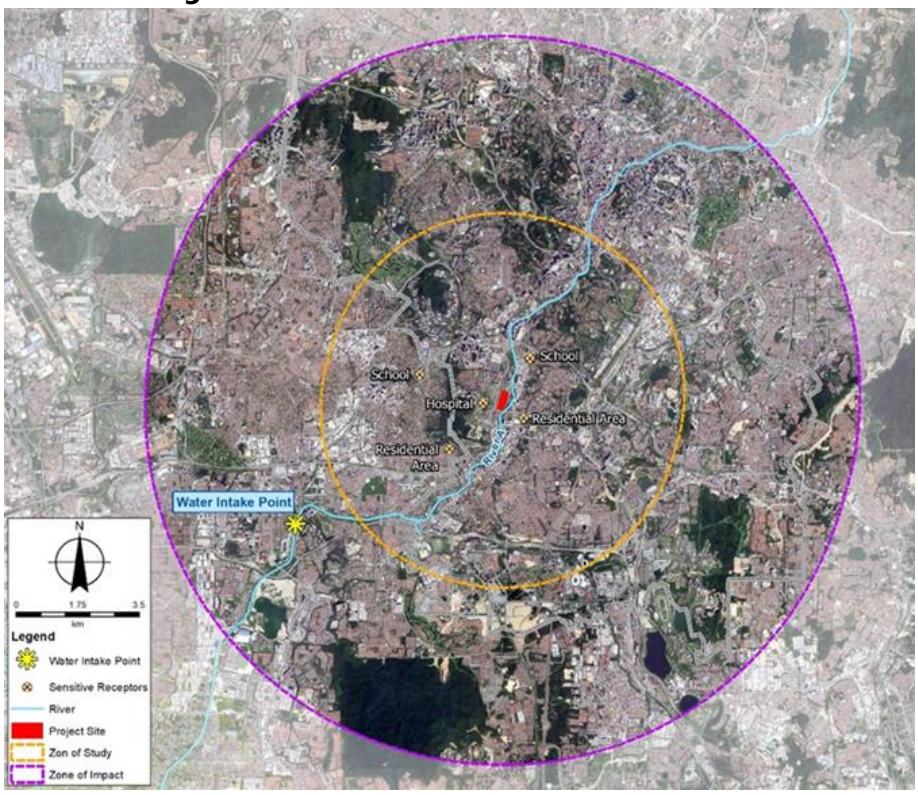
3.5 STUDY BOUNDARY

The Study Boundary for each of the significant environmental elements shall be identified in the scoping exercise. These boundaries establish the limit of the EIA so that only necessary information is gathered for the assessment of potential impacts on sensitive receptors. There are two types of boundaries which are described as follows (**Figure 3-2**):

1. **Zone of Study (ZOS)** – The study area generally encompasses a 5-km radial zone from the project boundary. Qualified Person shall define the limits of the spatial boundary for each environmental element depending on the location of the sensitive receptors.

2. **Zone of Impact (ZOI)** - The spatial area of any potential impacts may extend beyond the ZOS, and can vary depending on the size of the project. The extent of the ZOI shall be determined by Qualified Person based on the nature and extent of significant impacts. For example, if there is a water intake point located outside of the ZOS but still within the impact range of the sewage discharge from the project, it should be considered as ZOI.

Figure 3-2 Illustration of ZOS and ZOI



3.6 BASELINE DATA REVIEW

The accuracy of the prediction of impacts is dependent on understanding the cause-effect relationship in relation to changes to the physical, chemical, biological and human characteristics of the environment.

The scoping exercise defines the components of data required and the extent of baseline data collection. Construction of a comprehensive database with regards to the significant issues is important to ensure that the true understanding of the characteristics of the environment could be well established. Justification for the selection of environmental baseline components (i.e. water quality, air quality, noise and vibration sampling) should be included in the TOR/ESI.

If certain environmental aspects have been identified as not significant in the scoping exercise, then that aspect could be omitted from the EIA study and therefore no baseline information need to be gathered. For instance, if vibration impact is not significant, then no baseline for vibration is needed for the EIA study. **Table 3-2** shows an indicative list of required baselines for all the Sewage Prescribed activities. Baseline data can be obtained through primary data (sampling exercise) and secondary data (literature review from other related reports at similar location of the Project)

Table 3-2 List of Required Baselines for Sewage Activities

No	Key Areas	Required Information	
1	 Physical	• Land use • Topography and terrain • Geology and hydrogeology	• Hydrology and river system • Climate and meteorology • Traffic
2	 Environmental	• Surface water quality • Groundwater quality (if required) • Marine water quality (if required)	• Air quality including odour • Noise and vibration
3	 Biological	• Terrestrial and aquatic flora • Terrestrial and aquatic fauna • Environmental sensitive areas	
4	 Socio-economic	• Demography • Public health • Development needs and potential	• Infrastructure facilities • Economic activities

No	Key Areas	Required Information	
5	 Infrastructure and utilities	• Availability of power supply and water supply • Physical communications	• Points of access and transportation routes • Essential infrastructure • Public amenities

Note: The list is not exhaustive and additional baseline information/sampling may be required by relevant agencies. It is the responsibility of the Project Proponent and Qualified Person to engage with relevant agencies on case-by-case basis.

3.7 DETERMINATION OF KEY PROJECT ACTIVITIES

Typically, there are four main phases involved throughout the entire lifecycle of the development of sewage treatment plant and sludge treatment facility, namely:

- Pre-construction phase;
- Construction phase;
- Operation phase; and
- Abandonment phase

Generally, key project activities during pre-construction, construction and abandonment phases are quite common in nature. Some of the activities during these phases revolve around civil and structural activities particularly earthworks activities.

On the other hand, activities during the operation phase are different for each of the prescribed activity. These activities shall be determined by the Qualified Person together with the Project Proponent's team to make sure focus is given to address the key project activities. A list of key project activities for the development Sewage project is appended in **Appendix D**.

3.8 IDENTIFICATION OF SIGNIFICANT IMPACTS AND PRIORITY SETTING

3.8.1 Priority Setting

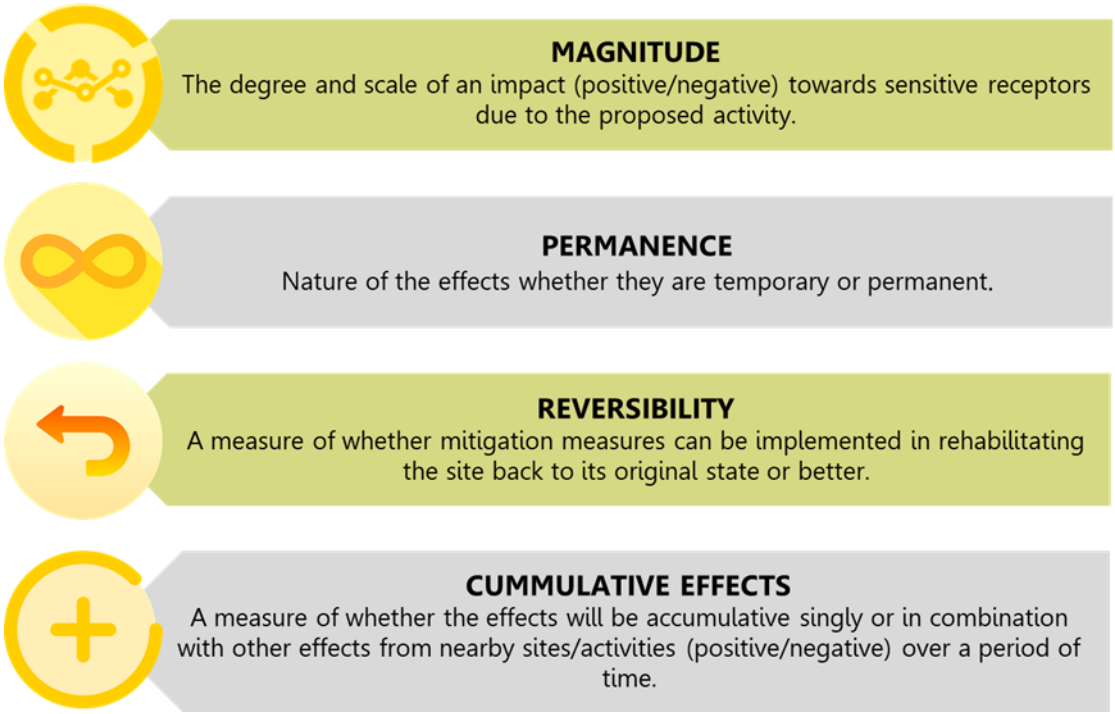
Following the identification of key project activities, a short list of key environmental issues is drawn up. This involves:

- **Categorization and grouping** of the effects under particular environmental components such as air, water quality, noise quality, odour etc.

- **Priority setting:** Key issues or concerns are determined by decision makers based on the importance or uncertainty of the significance on environmental impacts. Issues that can be excluded from further assessment are identified and reasons for their exclusion are documented for the EIA. Further issues, considered beyond the scope of the EIA, that need resolution are listed.

There are several criteria that need to be considered in setting the priority of the significant impacts to be studied in the EIA (**Figure 3-3**). By considering all these criteria, the Qualified Person can use the Environmental Scoping Matrix (ESM) as one of the methods to produce a priority list or the likely significance of environmental impacts to be studied in the EIA **(Appendix E)**. The impact significance will be further evaluated based on the impact assessment results in the EIA stage.

Figure 3-3 Criteria for Determining Significance of Environmental Impacts



3.8.2 Key Issues Related to Sewage Projects

Key issues related to the sewage projects that should be highlighted in the EIA report are shown in **Table 3-3**. The key issues identified below have taken into consideration the way forward for the sewage projects whereby an integrated sewage and sludge management is envisaged.

Table 3-3 Key Issues Related to Sewage Projects

Key Issues	Potential Impacts
 Water quality	• Generation of treated sewage discharge into nearest waterbody. • Operation failure of STP equipment to treat sewage due to faulty equipment and raw sewage overflow.
 Air quality & odour	• Generation of dust during construction stage • Soot and smoke from illegal open burning during construction stage • Generation of odour from STPs and STFs creates nuisance to the surrounding receptors. • Possible generation of biodegradation gases such as hydrogen sluphide, ammonia, etc. • Generation of black smoke from genset.
 Noise & vibration	• Noise and vibration generated during construction from piling activities. • Noise and vibration from equipment such as pump and blower during operation.
 Soil erosion & sedimentation	• Risk of soil erosion during earthworks and site clearing that will increase the sediment loading in the nearby waterbodies.
 Quantitative risk	• Accidental fire and toxic dispersion due unintended releases of hazardous substances in confined spaces.
 Health impact	• Health risks (risk of communicable disease) to the local residents and workers from prolonged exposure. • Inhalation of bad odour or hazardous emissions released into the atmosphere or confined spaces. • Ingestion of sewage effluent discharged into the river or groundwater.
 Waste management	• Generation of waste from the following processes: i. Domestic, solid waste and grit from screening process using screen chamber, grit chamber and grease chamber in STPs. ii. Sludge waste from sludge treatment process. iii. Scheduled waste from maintenance activities in STPs and STFs

Key Issues	Potential Impacts
 Socio-economic	• Change in socio-economic environment caused by daily operation of STPs and STFs (positive/negative).
 Traffic	• Spillage of sludge onto public road may create traffic impedance and inconvenience to the road users • Increased traffic in the road network system during sludge transportation activity.

Note: The key issues listed above may differ according to the project activities and inputs. The Qualified Person shall further scrutinize the key issues and potential impacts that will be generated from the specific prescribed activity. Refer to **Chapter 5.2** for further guidance.

3.9 ESTABLISHMENT OF STUDY REQUIREMENT

Several individual studies are required to address the identified impacts from the Project activities. The type of study is dependent on the scale and extent of the Project Site by considering the adjacent land uses and sensitive receptors. The Qualified Person shall provide the methodologies, assessment / modelling tools, and expected outputs for each study.

Table 3-4 shows the general studies required for Sewage Project. Consultation between Qualified Person and related government agencies is important to ensure all the requirements by government agencies are covered in the EIA report.

Table 3-4 List of General Studies to be included in EIA Report

No	Type of Study	Government Agencies	Activity First Schedule	
			Sewage Treatment Plant	Sludge Treatment Facilities
1	Water Quality Assessment	DOE	√	√
2	Air Quality and Odour Assessment	DOE	√	√
3	Noise/Vibration Assessment	DOE	√	√
4	Erosion Soil Control Plan (ESCP)	DID	√	√
5	Soil Erosion and Sedimentation Assessment	DID	√	√
6	Land Disturbing Pollution Prevention and Mitigation Measures (LDP2M2)	DOE	√	√
7	Health Impact Assessment (HIA)	DOE/MOH	√	√

No	Type of Study	Government Agencies	Activity First Schedule	
			Sewage Treatment Plant	Sludge Treatment Facilities
8	Soil Investigation (SI)	JMG	√	√
9	Geological Report	JMG	√	√
10	Socio Economic Study	DOE	√	√
11	Waste Management	DOE	√	√
12	Traffic Impact Assessment	PWD	If required	
13	Flood Assessment	DID	If required	
14	Hydrogeological Assessment	DOE/JMG	If required	
15	Quantitative Risk Assessment (QRA)	DOE/DOSH	If required	
16	Ecological Study – terrestrial or aquatic flora and fauna	PERHILITAN / DFPM/DOF	If required	

Note: The list is not exhaustive and additional studies may be required by relevant agencies. It is the responsibility of the Project Proponent and Qualified Person to engage with relevant agencies on case-by-case basis.

3.10 SELECTION OF MITIGATION MEASURES

After the significant impacts have been determined, possible mitigation measures shall be identified based on the Best Available Techniques (BATs), Best Management Practices (BMPs) from similar projects and other options for pollution prevention and mitigation measures (P2M2s) to address identified impacts. Possible mitigation measures for pre-construction, construction, operation and abandonment phases shall be described qualitatively in this section and to be further detailed in the EIA study. **Table 3-5** shows the example of brief descriptions of possible mitigation measures to be implemented.

Table 3-5 Brief Descriptions for Mitigation Measures

No	Environmental Impacts	Descriptions of Mitigation Measures
1	 Land acquisition	Engage the affected communities with regards to land acquisition and relocation at the early stage to minimize adverse impacts and ensure adequate support and fair compensation. This to be further detailed in the Socio-Economic Study.
2	 Water quality	Treatment of sediment and sewage is to ensure no degradation of water quality in receiving water bodies. Implement best management practices at Project Site to avoid accidental discharge and spillage.

No	Environmental Impacts	Descriptions of Mitigation Measures
3	 Soil erosion & sedimentation	Implement land disturbing pollution prevention and mitigation measures (LD-P2M2) to minimize soil erosion and sedimentation to receiving water bodies.
4	 Air quality and odour	Control of point and fugitive sources air emissions and odour.
5	 Noise & vibration	Control noise level and vibration levels to acceptable limits during construction and operational phases to minimize nuisance to the communities.
6	 Health risk	Protection of social well-being and health of surrounding population within the impact zone.
7	 Solid wastes and scheduled waste	Implement best management practices to handle the biomass, sludge, solid and scheduled wastes.
8	 Fire & explosion risk	Safety and risk planning and management to minimise risks of fire and explosion as a result of accidental events.
9	 Ecology	Minimise disturbance to the ecology by formulating and implementing wildlife management plan, river ecosystem management/restoration plans, and aquatic fauna management/ restoration plans (if necessary)
10	 Traffic	Minimize traffic congestion during the construction and operation phases by formulating and implementing traffic management plans.

3.11 STUDY TEAM

The Project Proponent is required to appoint a Qualified Person to conduct an EIA for any prescribed activities (i.e. Sewage Project) as stipulated in Section 34A (2) of the Environmental Quality Act 1974. A Qualified Person is an individual who is registered with the DOE (i.e. Environmental Consultant or Subject Specialist**). Figure 3-4** shows the proposed study team to be considered for the preparation of the EIA report for the Sewage Project. The EIA Team Leader shall identify his or her team members according to the potential environmental issues that may arise.

3.11.1 Alignment Requirement for Engaging Qualified Consultants to Prepare Detailed Design Pollution Control System at the EIA Stage

The DOE has announced a new requirement that the EIA Team Leader shall include a Qualified Consultant under the EIA study team to prepare the detailed design for the pollution control system. The pollution control systems in this notice referred to:

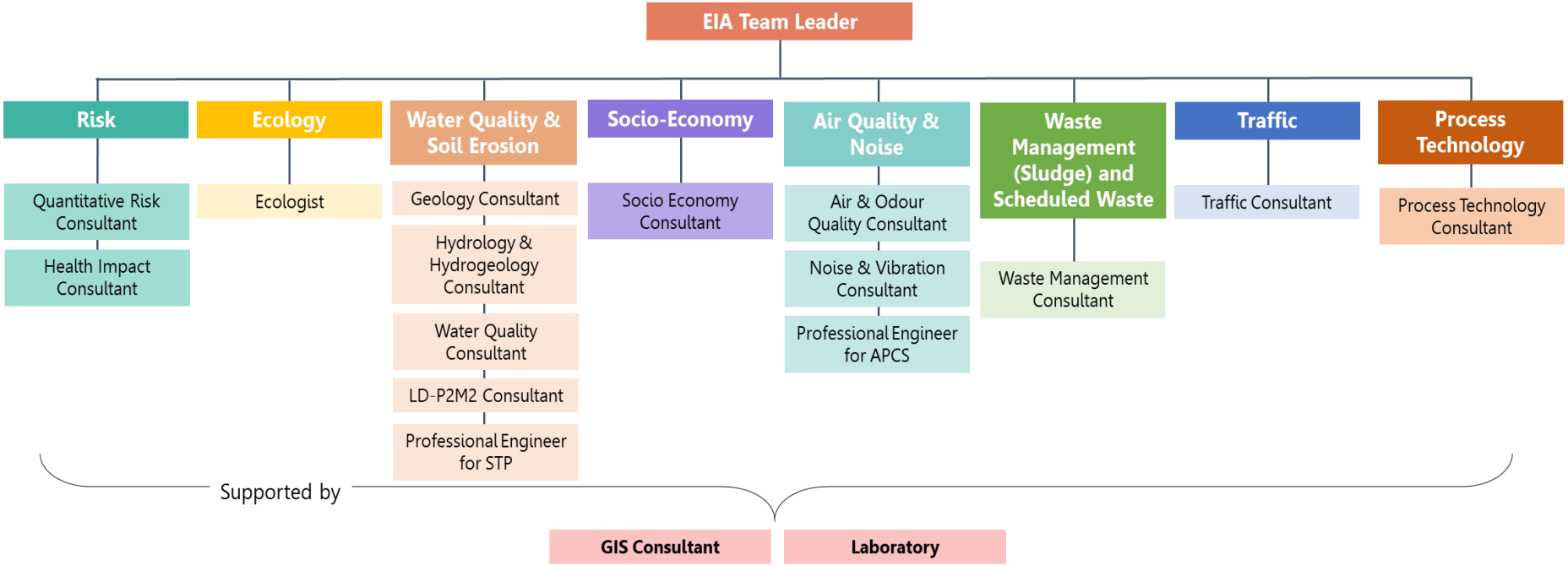
- Air Pollution Control System (APCS);
- Sewage Treatment Plant (STP).

The Qualified Consultant must be a professional engineer who is registered under Section 10(2) of the Registration of Engineers Act 1967 (Revised 2015).

3.11.2 Requirement for Engaging Competent Professionals to Prepare Land Disturbing Pollution Prevention and Mitigation Measure (LD-P2M2)

Another requirement from the DOE is the engagement of a Competent Professional to prepare the Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) whenever there are land disturbing or site preparation activities. This requirement is specified in the Appendix 4 - Guidance Document for the Preparation of the Document on Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) EGIM. The Qualified Professional must be a registered consultant and holds a Certified Professional in Erosion and Sediment Control (CPESC) certification recognised by DOE.

Figure 3-4 Proposed EIA Team



Notes:

1. For ecologist, the type of expertise required will need to be determined depending on the type, nature and location of the proposed Project
2. A geology and hydrogeology consultant is a person registered under the Board of Geologist in accordance to the Geologist Act 2008 (Act 689)
3. A Professional Engineer is a person registered under Section 10(2) of the Registration of Engineers Act 1967 (Revised 2015).
4. LD-P2M2 means Land Disturbing Pollution Prevention and Mitigation Measures
5. Appointed laboratory conducting environmental monitoring and analysis of environmental samples shall be accredited with Skim Akreditasi Makmal Malaysia (SAMM).
6. STP means Sewage Treatment Plant.
7. APCS means Air Pollution Control System.

3.12 PREPARATION OF TOR/ESI

Results from the screening and scoping exercises are translated into the Environmental Scoping Information (ESI) and subsequently into the Terms of Reference (TOR). The ESI identifies the issues to be addressed in detail, whereas the TOR sets the objectives, defines the scope, and establishes the strategy and schedule for the EIA process to address these issues.

If any new information which was not highlighted in the scoping report or at the time of TOR comes to the attention of the DOE, new components and parameters can be added in the EIA study. **Table 3-6** shows the typical contents of a TOR document which follows the format detailed in the Guidance Document for Preparing TOR under Appendix 8 of the EGIM.

Table 3-6 Contents of a Typical TOR for EIA Report

No	Contents	Description
1	 Introduction	This Terms of Reference is for the preparation of an Environmental Impact Assessment (EIA) Study for "Project Title".
2	 List of Consultant/ Study Team	Details of each individual (must be registered with DOE) who will carry out the EIA study, which include: • DOE Registration number. • Academic background. • Experience. • Area of study. • Declaration (signatures). 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 EIA should be directed.
3	 Project Scope	List out those components of the Project which fall under the Prescribed Activities under the EIA Order, and describe with enough details to understand the scope of the significant project work components without the technical details, including a well described engineering implementation programme of the Project.

No	Contents	Description
4	 Alternatives Consideration	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.
5	 Significant Environmental Impacts to be Studied	List and describe potential significant environmental impacts which will potentially be affected by the project works.
6	 Study Boundary	Delineate study boundaries for each significant environmental element to be investigated, identify the critical sensitive receptors and study the impacts on the sensitive receptors.
7	 Assessment Standards	List out standards, criteria, acceptable limits, etc that will be used to obtain baseline data and assess the environmental impacts.
8	 Study Timeline	Details of all studies/investigations to be carried out: who, where, when, how, etc. with indicative dates.
9	 Consideration of Concurrent Projects	List out potential concurrent or planned projects that may result in cumulative impacts.
10	 Description of Modelling Tools and Assessment Methodologies	List out modelling tools, methodologies, etc for undertaking impact assessment and evaluation of significance. Provide name of models, applicability of models and tools, verifiability of results, how results are verified and the extent of accuracy of these tools.

No	Contents	Description
11	 Possible Mitigation Measures	Outline possible mitigation measures or best management practices from similar projects that may be used to address the environmental impacts of the project.

EIA GUIDELINES

Waste Treatment & Disposal
-Sewage

4

BASELINE DATA

CHAPTER 4

BASELINE DATA

4.1 INTRODUCTION

An EIA shall contain a description of the existing environment before project development (termed as "baseline conditions") that may or may not be affected directly or indirectly from the proposed project.

Objectives for the description on baseline conditions include:

a. Identify existing environmental conditions which may influence project design decisions (e.g. site layout, structural or operational characteristics)
b. Identify sensitive issues or areas requiring mitigation or compensation
c. Provide input data to analytical models for prediction of impacts
d. Provide baseline reference for compensation during project implementation stages

The following Chapters shall detail the requirements for baseline data collection as part of the EIA.

4.2 BASELINE DATA COLLECTION AND ANALYSIS

Usually, preliminary baseline data are required for the preparation of TOR/ESI. This is to provide an overview of the existing environment to determine the suitable approach and methodology for the impact assessment. For example, if the project were to discharge effluent into the estuarine area, suitable modelling tools and water sampling approaches should be used to consider the tidal effect.

The approach and methodology in obtaining detailed baseline data and technical studies will be identified in the TOR/ESI. Generally, the detailed baseline data, particularly baseline monitoring (e.g. air, water and noise), can be carried out once the DOE endorses the TOR.

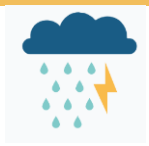
Baseline data can be collected from the following sources:

1) Primary source (field studies); and
2) Secondary source (desktop studies).

Baseline studies may address the main components listed in **Table 4-1**

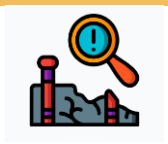
Table 4-1 List of Requirements for Main Baseline Components

Components	Requirements	Data Sources
Physical		
 Land-use	• Land use maps and photos. • Description of existing and future land use. • Identification of Environmentally Sensitive Areas (ESAs) and impact receptors. • Land-use compatibility assessment.	**Primary Source:** ✓ Site survey. ✓ Aerial photos (Drone). **Secondary Source:** ✓ Topography map (JUPEM). ✓ Satellite imagery (Google Earth). ✓ Structure Plan and Local Plan (PLANMalaysia). ✓ Local Authority. ✓ Industrial park developer. ✓ Past studies and literature within the project area.
 Geology and Hydrogeology	• Description of local and regional geology. • Locations of aquifer and groundwater abstraction wells.	**Primary Data** ✓ Sub-strata survey such as geophysical work (if necessary). **Secondary Source:** ✓ Geological maps (JMG). ✓ Hydrogeological maps (JMG). ✓ Past studies and literature within the project area.
 Soil and Terrain	• Soil investigation (SI). • Soil erosion potential. • Description of existing topography. • Construction suitability map.	**Primary Source:** ✓ Site survey. ✓ SI report. ✓ Land surveyor report. **Secondary Source:** ✓ Soil erosion risk map (DOA). ✓ Reconnaissance soil map (DOA). ✓ Past studies and literature within the project area.

Components	Requirements	Data Sources
 Hydrology and Drainage	• Description of hydrological systems within project area and zone of study or zone of impact, whichever is greater. • Flood prone areas. • Drainage network.	**Primary Source:** ✓ Site survey. **Secondary Source:** ✓ Topography map (JUPEM). ✓ Flood map (DID). ✓ Drainage network (Local Authority). ✓ Past studies and literature within the project area.
Environmental		
 Climate	• Climate data (minimum 10 years). • Surface air data. • Upper air data.	**Secondary Source:** ✓ METMalaysia. ✓ 5th Generation Mesoscale Model (NCAR MM5). ✓ Weather Research and Forecasting (WRF) mesoscale model.
 Water Quality	**Surface Water:** • Sampling and analysis of surface water quality. • Measurement of flow rate in waterways and calculation of pollution load at the project area (if required). • Locations of water pollution sources. • Identification of downstream receptors such as water intake points, fish cage cultures, recreational park, etc. • River hydraulic data. • River water quality trends. **Groundwater (if required):** • Sampling and analysis of ground water quality. • Identification of ground water flow regime. **Marine Water (if necessary):** • Sampling and analysis of marine water quality. • Marine sediment (if necessary)	**Primary Source:** ✓ Water sampling. ✓ Site survey. **Secondary Source:** ✓ Hydraulic data (DID). ✓ State Water Authority (e.g. LUAS). ✓ Groundwater (JMG). ✓ Environmental Quality Report and Environment Quality Monitoring System (DOE). ✓ Compendium of Environment Statistics by the Department of Statistics (DOSM). ✓ Past studies and literature within the project area.

Components	Requirements	Data Sources
 Air Quality	• Sampling and analysis of ambient air quality/odour of the project site and nearby sensitive receptors. • Locations of air pollution sources. • Identification of air sensitive receptors. • Air quality trends.	**Primary Source:** ✓ Air monitoring. ✓ Site survey. **Secondary Source:** ✓ Environmental Quality Report and Environment Quality Monitoring System (DOE). ✓ Compendium of Environment Statistics by the Department of Statistics (DOSM). ✓ Past studies and literature within the project area.
Odour 	• Sampling and analysis of odour of the project site and nearby sensitive receptors. • Locations of odour sources. • Identification of air sensitive receptors.	**Primary Source:** ✓ Odour measurement. ✓ Site survey. **Secondary Source:** ✓ Past studies and literature within the project area.
 Noise and Vibration	• Measurement and analysis of ambient noise and vibration levels of the project site and nearby sensitive receptors. • Locations of noise pollution sources. • Identification of sensitive receptors.	**Primary Source:** ✓ Noise and vibration monitoring. ✓ Site survey. **Secondary Source:** ✓ Past studies and literature within the project area.
Biological		
 Ecology	• Description of existing ecology and habitats. • Identification of ESAs (forest reserve, wildlife reserves and sanctuaries, wetlands, mangroves, fisheries, etc.). • Presence of endemic, rare, threatened, endangered and near extinct flora and fauna.	**Primary Source:** ✓ Ecological survey. **Secondary Source:** ✓ DFPM. ✓ PERHILITAN. ✓ DOF. ✓ DOE. ✓ Past studies and literature within the project area.

Components Socio-economic	Requirements	Data Sources
 Demography	• Data on demography and socio-economic profiles of stakeholders within the ZOI.	**Primary Source:** ✓ Field survey. ✓ Public engagement (if required) **Secondary Source:** ✓ Local profile reports from community leaders. ✓ Population Census (DOSM). ✓ Local Plans (Local Authority). ✓ Past studies and literature within the project area.
 Public Health	• Communicable disease data (monthly data for at least 1 year). • Chronic non-communicable disease (yearly data for at least 5 years). • Disease prevalence within the ZOI. • Health issues within the ZOI. • Site specific exposure (not mandatory).	**Primary Source:** ✓ Field survey. **Secondary Source:** ✓ State Health Department. ✓ Past studies and literature within the project area.
 Road Network and Traffic	• Access to the project site. • Existing traffic condition within and surrounding the project site.	**Primary Source:** ✓ Traffic survey. ✓ Traffic Impact Assessment (TIA) report. **Secondary Source:** ✓ Road Traffic Volume Malaysia (PWD). ✓ Past studies and literature within the project area.
 Infrastructure, Utilities and Amenities	• Availability of existing and future utilities (water, electricity, waste management, road networks, telecommunications, etc.). • Identification of existing and proposed sewerage lines.	**Secondary Source:** • Water Supply Authority/Providers. • Indah Water Konsortium (IWK) or State-based Sewerage Operator. • Tenaga Nasional Berhad (TNB). • PWD. • Local Authority.

Components	Requirements	Data Sources
		• Past studies and literature within the project area.
Cultural/Heritage		
 History, Culture and Archaeology	• Locations of historical and cultural sites. • Location of Orang Asli areas and settlements.	**<u>Secondary Source:</u>** ✓ National Heritage Department. ✓ Department of Museum. ✓ JAKOA. ✓ Past studies and literature within the project area.

Note: The list is not exhaustive, and not all items listed above are applicable to all EIA studies. The subject areas to be covered in the baseline study should focus only on those aspects that are likely to be affected. The areas generally depend on the nature, scale, location of the proposed project, and the extent of the impact.

4.3 BASELINE MONITORING AND ANALYSIS

Baseline monitoring is one of the primary sources of data. These data are collected to complement the information identified during the TOS/ESI stage for detailed assessment. Additionally, DOE also has the right to request for more additional baseline data if the Project imposes significant impact(s) or the baseline data collected does not represent the extent of impact of the project.

The baseline monitoring area shall be carried within the boundary of the project site and nearby sensitive receptors within the Zone of Study (ZOS) as mentioned in **Chapter 3.5**. However, if the impacts are predicted to be much farther away, the Qualified Person shall include the sensitive receptors within the Zone of Impact (ZOI) in the baseline monitoring programme. For example, if there is a water intake point located outside of the ZOS but still within the impact range of the sewage discharge from the project, the water sample shall be collected there.

Generally, the validity of baseline data collection for an EIA study is within two (2) years from the date of field monitoring. If the duration of EIA study extend for more than 2 years, the collected baseline data can still be used provided that the Qualified Person can justify that there is no significant changes to the surrounding physical, biological and human environments within the Zone of Impact of the project site.

Samples collected must be analysed by a *Skim Akreditasi Makmal Malaysia* (SAMM) accredited laboratory. This includes ensuring that the analysis method for each parameter is SAMM accredited. The laboratory report or at least the Certificate of Analysis (COA) shall be included in the EIA as an appendix. The list of baseline monitoring and analysis is appended in **Appendix F**.

4.3.1 Good Practices for Sampling

Water Quality

Qualified Person can refer to field work and sampling guideline from UNEP/WHO for good practice water quality sampling . Some general practices to be considered from the procedure when conducting water quality sampling are as follow:

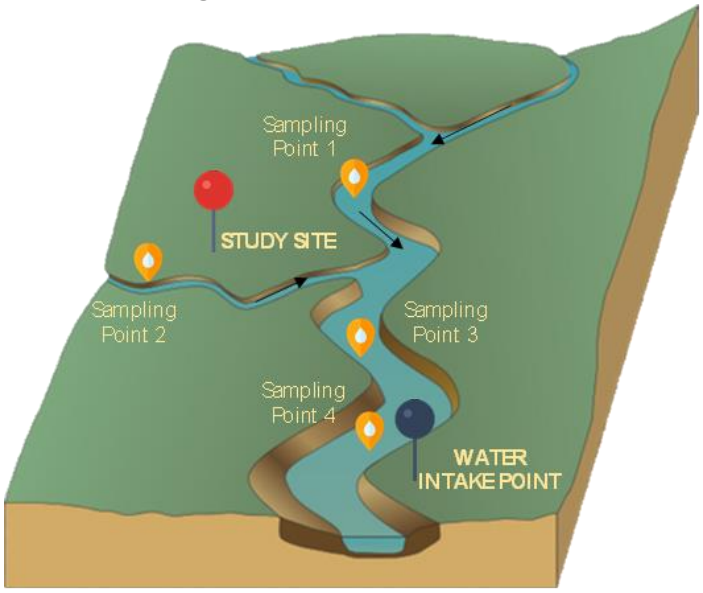
- Sites must be easily and safely accessed under all weather conditions.
- Sampling depth is measured from the water surface to the middle of the sampler.
- A bottle that is to be used for transport or storage of the sample should be rinsed three times with portions of the sample before being filled. This does not apply, however, if the storage/transport bottle already contains a preservative chemical.
- The temperature of the sample should be measured and recorded immediately after the sample is taken.
- At any time that the sample bottles are not closed, their tops must be kept in a clean place.
- A small air space should be left in the sample bottle to allow the sample to be mixed before analysis.
- All measurements taken in the field must be recorded in the field notebook before leaving the sampling station.
- All supporting information should be recorded in the field notebook before leaving the sampling station. Such conditions as the ambient air temperature, the weather, the presence of dead fish floating in the water or of oil slicks, growth of algae, or any unusual sights or smells should be noted.
- Samples should be transferred to sample bottles immediately after collection if they are to be transported.
- Sample bottles should be placed in a box for transport to the laboratory. Sturdy, insulated plastic boxes will protect samples from sunlight, prevent the breakage of sample bottles, and should allow a temperature of 4 °C to be attained and maintained during transport.

Example of water sampling is shown in **Figure 4-1** to **Figure 4-3**

Figure 4-1 Example of river water sampling

Figure 4-2 Example of water quality testing with DO meter

Figure 4-3 Examples of water sampling locations



Note:

Sampling Point 1 & 2

To obtain baseline river water quality before sewage discharge point

Sampling Point 3

To obtain baseline river water quality after sewage discharge point

Sampling Point 4

To obtain baseline river water quality after sewage discharge point near

Water intake point (if present)

This is to observe the impact of sewage discharge to the water supply operation

Groundwater Quality

Qualified Person can refer to Groundwater Sampling Procedure from USEPA (SESDPROC-301-R4) published in 2017 for good groundwater quality measurement practices. Some general practices to be considered from the procedure when conducting groundwater sampling are as follow:

- Always sample from the anticipated cleanest, i.e., least contaminated location, to the most contaminated location. This minimizes the opportunity for cross-contamination to occur during sampling.
- Sample containers for samples suspected of containing high concentrations of contaminants shall be stored separately.
- Sample collection activities shall proceed progressively from the least suspected contaminated area to the most suspected contaminated area if purging and sampling devices are to be reused. Samples of waste or highly contaminated media must not be placed in the same cooler as environmental (i.e., containing low contaminant levels) or background samples.
- Clean plastic sheeting will be placed on the ground at each sample location to prevent or minimize contaminating sampling equipment by accidental contact with the ground surface.
- Samplers must use new, verified certified-clean disposable or non-disposable equipment cleaned according to procedures contained in SESD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205) or SESD Operating Procedure for Field Equipment Cleaning and Decontamination at the FEC (SESDPROC-206) for collection of samples for trace metals or organic compound analyses.
- 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 as soon as practically possible, ideally immediately at the time of sample collection.
- Sample containers should be placed in an ice-filled cooler as soon as possible after filling. Ice in coolers should be in bags with minimal pooled water and the cooler should be periodically checked and replenished to maintain sample storage temperature.
- In order to determine when a well has been adequately purged, field investigators should monitor, at a minimum, the pH, specific conductance and turbidity of the groundwater removed and the volume of water removed during purging. The measurements should be recorded in a purge table in the field logbook that includes the start time of purging, the parameter measurements at intervals during purging, estimated pumped volumes, depths to water for Low-Flow sampling, and any notes of unusual conditions.

Example of groundwater sampling is shown in **Figure 4-4**

Figure 4-4 Example of groundwater sampling

Air Quality

The Qualified Person should consider the following when placing air sampling station [adopted from the Superfund Program Representative Sampling Guidance, Volume 2: Air (Short-Term Monitoring) 1995 by USEPA and IS 5182 (Part 14):2000 Methods for Measurement of Air Pollution, Part 14: Guidelines for Planning the Sampling of Atmosphere]:

- Location of potential on-site emission sources, as identified from the review of site background information or from preliminary on-site inspections.
- The impact of potential off-site emission sources located upwind of the sampling location(s). Study local wind patterns to determine the location of off-site sources.
- Location of topographic features which affect the dispersion and transport of airborne toxic constituents. Avoid natural obstructions when placing air monitoring stations, and account for channelization around those obstructions. (As a general rule, the distance away from the obstruction should be 10 times the height of the obstruction.)
- Proximity of large water bodies which affect atmospheric stability and dispersion of air contaminants.
- Roadways (dirt or paved) which may generate dust that could mask site contaminants. Traffic patterns may also affect results.
- Vegetation such as trees and shrubs which stabilize soil and slow the process of subsurface contaminants becoming airborne. Vegetation also affects air

flow and scrubs some contaminants from the air. Thick vegetation can make an otherwise ideal air monitoring station location inaccessible.

- Sampling station location should be representative of the area selected.

Noise

Qualified Person can refer to Guidelines for Environmental Noise Limits and Control Third Edition by DOE for good sampling practice for noise measurement. Some general practices to be considered from the guideline when conducting noise measurement are as follow:

- 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 recommended by manufacturer.
- The sound level meter may be hand held for simple spot readings, but shall be mounted onto a tripod during the entire measurement duration for extended monitoring. A standard accessory of extension cable with pre-amplifier may be used to enable the microphone to be installed at higher levels detached from the sound level meter body.
- Care should be taken not to make noises whilst observing the meter in this method and ensuring the least amount of reflective surface from your body is exposed to the meter.
- A noise reading should always be taken at the height of the receptor. If the receptor is at the ground level, take a measurement at the ground level (at least 1.2–1.5 m above the ground) (See **Figure 4-5**).
- The measurement location shall be at least 3.5 m away from walls, buildings or other sound reflecting structures (See **Figure 4-6**). However, when circumstances dictate, measurements may be made at greater heights or closer to a wall and these special conditions must be indicated in the measurement records.
- The microphone must be placed in an open location without any obstructions or affected by reflections or shielded from the noise sources. This includes sound level meter underneath an umbrella or adjacent an air quality measurement equipment (which inherently emits noise)
- Hand held sound level meters shall preferably be manned during the duration of monitoring.
- Unmanned monitoring shall only be undertaken with monitoring units or smart monitors designed for automated unmanned environmental noise monitoring fitted with all-weather waterproof microphone and automatic data logging.
- A wind shield approved by the microphone manufacturer shall be used. Measurements cannot normally be made if the wind speed exceeds 5 m/s at the

microphone position. For continuous remote monitoring, the wind speed may be monitored concurrently with the sound levels.

It is important to note that all noise monitoring shall be carried out in accordance with the relevant standards such as follow:

- ISO1996-1:2016 Acoustics - Description and Measurement of Environmental Noise.
- BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.
- Any new standards that are available from time to time.

Figure 4-5 Minimum height of sound level meter above the ground level

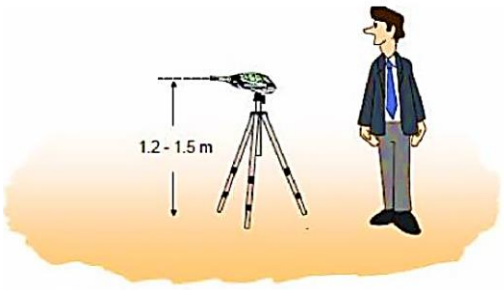
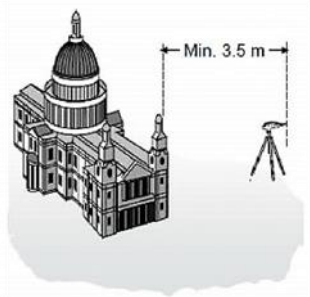


Figure 4-6 Minimum distance to nearest reflective surface outside premises



Vibration

Qualified Person can refer to the Planning Guidelines for Vibration Limits and Control in the Environment by DOE for good sampling practice for vibration. Some general practices to be considered from the guideline when conducting vibration measurement are as follow:

- Vibration measuring equipment shall consist of the following parts: a transducer or pick-up sensor, an amplifying device, an amplitude or level indicator or recorder and/or signal analyser.
- Calibration of all vibration measuring equipment shall be done properly in accordance with current standards or recommendations based on the equipment manufacturer's instructions.
- Monitoring location should normally be at the nearest building and/or locations; and the best position for the monitoring point(s) would often be on the floor slab or foundation. Monitoring points should be accessible to all parties concerned.
- When measuring vibration at the foundation, the transducers for the three axes of vibration shall be placed close to one another in the lowest storey of the building under investigation, either on the foundation of the outer wall or in the outer wall, or in recesses in the outer wall.

- When measuring buildings having no basement, the point of measurement shall lie no more than 0.5 m above ground level. The location of measuring points shall be located on the side of the building facing the source of excitation.
- For buildings of large ground area, measurements shall be taken simultaneously at several points.
- Measurements taken at the foundation and at the uppermost storey, where necessary the vertical axis vibration of floors shall be measured approximately at the centre of the floor area.
- Measurement for blasting and other explosions related impulsive vibration excitation, if measured outside buildings, shall preferably be measured on a hard surface on ground as close to the property of interest or real property boundary as the case may be. Transducers may be buried in the ground if no hard surface is available.
- Vibration measurements shall include:
    - **Background (ambient) vibration levels** at a receiver location(s) and/or at the real property boundary of a source(s). These may be undertaken at locations prior to a project development. It could also be undertaken in the absence of the source(s) operating
    - **Vibration levels at a receiver location(s) and/or at the real property boundary** of a source with the plant operating, construction in progress, and/or completion and operation of a project (transit trains, industrial plant, etc.).
    - **Vibration characteristics** of each source as may be required to evaluate the contribution of each source.
- Vibration measurements shall be undertaken within a frequency range of 1 Hz to 100 Hz minimum.

It is important to note that all vibration monitoring shall be carried out in accordance with the relevant standards such as follow:

- ISO 4866:2010 Mechanical vibration and shock — Vibration of fixed structures — Guidelines for the measurement of vibrations and evaluation of their effects on structures
- BS ISO 4866: 2010 Mechanical vibration and shock. Vibration of fixed structures. Guidelines for the measurement of vibrations and evaluation of their effects on structures.
- ISO 7626-5: 2019 Mechanical vibration and shock. Experimental determination of mechanical mobility. Measurements using impact excitation with an exciter which is not attached to the structure
- BS ISO 7626-5: 2019 Mechanical vibration and shock. Experimental determination of mechanical mobility. Measurements using impact excitation with an exciter which is not attached to the structure
- Any new or revised standards that are available from time to time.

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EIA GUIDELINES

Waste Treatment & Disposal -Sewage

5

EVALUATION OF IMPACTS

CHAPTER 5

EVALUATION OF IMPACTS

5.1 INTRODUCTION

The prediction and evaluation of impacts are carried out by comparing the existing environmental elements against the potential transformations derived from the project activities throughout the Sewage Project development.

There are many methods to predict and evaluate the environmental impacts either qualitatively or quantitatively by considering the environmental elements in their most unfavourable condition (worst-case). It is the responsibility of the Qualified Person to conduct the impact assessment either qualitative or quantitative depending on the significance of the impact.

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

a) **Model/Method** - Established and proven models or methods.
b) **Data** - Adequate, accurate and up-to-date data for assessment.
c) **Results** - Results can be replicated and are reproducible by independent evaluators.
d) **Software** - The use of appropriate and effective software is encouraged.

Qualified Person shall be responsible to select the best method to conduct investigations and generate reliable scenarios and datasets to evaluate the magnitude, extent and significance of any impacts from the project.

5.2 PRESCRIBED ACTIVITY AND KEY ISSUES

There are four main stages involved throughout the entire development of Sewage Treatment Plants (STPs) and Sludge Treatment Facilities (STFs), namely pre-construction, construction, operation and abandonment. The site activities during construction and operation stage shall be identified by the Qualified Person together

with the Project Proponent to ensure that key environmental impacts are properly assessed.

The key environmental impacts expected from the prescribed activities may include water quality, soil erosion & sedimentation, air quality, odour, noise, vibration, solid waste and scheduled waste generation, soil contamination, health risk, fire & explosion risk, ecology, socio-economic and traffic.

Table 5-1 and **Table 5-2** provides the indicative list of the potential environmental impacts to be evaluated in the EIA Study. The list is not exhaustive and depends on the judgement of the Qualified Person as well as requirements from the respective Government Agencies.

Table 5-1 Typical Project Activities and the Key Environmental Impacts for Sewage Treatment Plants

First Schedule, Activity 14(c)(i) - Construction of sewage treatment plant with 20,000 population equivalent or more		
Project Stage	**Project Activities**	**Key Environmental Impacts**
Pre-Construction	Access tracks	• Erosion and sedimentation lead to water pollution • Temporary removal of vegetation • Loss of terrestrial habitat.
	Survey	• Health and safety of workers • Disturbance to potentially pristine environment.
	Site Investigation	• Soil contamination • Groundwater contamination • Noise pollution from drilling activity.
	Land Acquisition	• Social impacts if relocation of occupants is necessary • Impacts due to current loss of land use
Construction	Excavation, trenching, tunneling, laying conduits, filling and resurfacing, road diversion activities.	• Erosion and sedimentation lead to water pollution • Air pollution • Noise pollution • Risk hazard • Traffic congestion.
	Site clearance & site formation.	• Erosion and sedimentation lead to water pollution • Air pollution. • Noise pollution & vibration. • Solid & scheduled wastes.
	Ancillary/Infrastructural works.	

First Schedule, Activity 14(c)(i) - Construction of sewage treatment plant with 20,000 population equivalent or more		
Project Stage	**Project Activities**	**Key Environmental Impacts**
		• Ecology. • Traffic.
	Site construction facilities.	• Water pollution. • Air pollution. • Noise pollution. • Solid & scheduled wastes. • Soil contamination. • Socio-economic.
	Construction of pump-houses, storage tanks, manholes and STPs	• Water pollution • Air pollution • Noise pollution • Vibration during piling • Interference of existing utilities line.
	Abandonment during construction.	• Erosion and sedimentation lead to water pollution • Solid & scheduled wastes. • Soil contamination. • Disease vector breeding
Operation & Maintenance	Conveyance of sewage to site	• Piping leakage leads to soil contamination, groundwater pollution and water pollution.
	Preliminary, secondary and tertiary treatment.	• Water pollution if not treated properly • Noise pollution from pump equipment or pumping stations • Odour nuisance • Air pollution from hydrogen sulphide/ ammonia emission • Public/workers health risk.
	Pumping treated water to discharge	• Water pollution due to malfunction of pump causing the sewage to overflow. • Noise pollution from pump equipment • Ecological impacts to aquatic lives
	Sludge treatment	• Noise pollution from pump equipment • Odour generation during maintenance cleaning of screens, septic wastes, and waste stockpiling • Odour generation from raw sludge storage

First Schedule, Activity 14(c)(i) - Construction of sewage treatment plant with 20,000 population equivalent or more		
Project Stage	**Project Activities**	**Key Environmental Impacts**
	Sludge management (storage, handling and transfer)	• Soil and groundwater contamination (by percolation of faecal material through the soil column into the groundwater table) • Odour generation from sludge storage • Disease vector breeding at sludge storage, reuse or disposal sites
	Occupational and safety measures during operation management	• Noise pollution • Public health hazards (skin contact with sewage) • Air borne pathogens though inhalation • Odour pollution
	Power failure/ abnormal operating conditions	• Air pollution • Odour pollution • Water pollution
Abandonment/Post Closure	Decommissioning, dismantling and removal of plants	• Water pollution. • Soil contamination. • Air pollution. • Odour pollution • Noise pollution. • Solid & scheduled wastes. • Disease vector breeding
	Demolition and disposal of buildings and structures	
	Site restoration/post closure land use plan	
	Post closure environmental monitoring and audit	

Table 5-2 Typical Project Activities and the Key Environmental Impacts for Sludge Treatment Facilities

First Schedule, Activity 14(c)(ii)- Sludge Treatment Facilities		
Project Stage	**Project Activities**	**Key Environmental Impacts**
Pre-Construction	Access tracks	• Erosion and sedimentation lead to water pollution • Temporary removal of vegetation • Loss of terrestrial habitat.
	Survey	• Health and safety of workers • Disturbance to potentially pristine environment.

First Schedule, Activity 14(c)(ii)- Sludge Treatment Facilities		
Project Stage	**Project Activities**	**Key Environmental Impacts**
	Site Investigation	• Soil contamination • Groundwater contamination • Noise pollution from drilling activity.
	Land Acquisition	• Social impacts if relocation of occupants necessary • Impacts due to current loss of land use
Construction	Excavation, trenching, tunneling, laying conduits, filling and resurfacing, road diversion activities.	• Erosion and sedimentation lead to water pollution • Air pollution • Noise pollution • Risk hazard • Traffic congestion.
	Site construction facilities.	• Water pollution. • Air pollution. • Noise pollution. • Solid & scheduled wastes. • Soil contamination. • Socio-economic.
	Site clearance & site formation.	• Erosion and sedimentation lead to water pollution • Air pollution. • Noise pollution & vibration. • Solid & scheduled wastes. • Ecology. • Traffic.
	Ancillary/Infrastructural works.	
	Construction of Sludge Treatment Facilities	• Water pollution • Air pollution • Noise pollution • Vibration during piling and interference of existing utilities line.
	Abandonment during construction.	• Erosion and sedimentation lead to water pollution • Solid & scheduled wastes. • Soil contamination. • Disease vector breeding
Operation & Maintenance	Sludge treatment	• Noise pollution from pump equipment • Odour pollution during maintenance cleaning of screens, septic wastes, and waste stockpiling

First Schedule, Activity 14(c)(ii)- Sludge Treatment Facilities		
Project Stage	**Project Activities**	**Key Environmental Impacts**
		• Odour generation from raw sludge storage
	Sludge management (storage, handling and transfer)	• Soil and groundwater contamination (by percolation of faecal material through the soil column into the groundwater table) • Odour generation from sludge storage • Disease vector breeding at sludge storage, reuse or disposal sites
	Occupational and safety measures during operation management	• Noise pollution • Public health hazards (skin contact with sewage) • Inhalation of air borne pathogens Odour pollution
	Power failure/ abnormal operating conditions	• Air pollution, • Odour pollution • Water pollution
Abandonment/Post Closure	Decommissioning, dismantling and removal of plants	• Water pollution. • Soil contamination. • Air pollution. • Noise pollution. • Solid & scheduled wastes. • Disease vector breeding
	Demolition and disposal of buildings and structures	
	Site restoration/post closure land use plan	
	Post closure environmental monitoring and audit	

5.3 PREDICTION AND EVALUATION OF IMPACTS

The basis for prediction and evaluation of impacts is the methodologies which consequently determine the suitable predictive tools to be used. The TOR and ESI would have determined the significant environmental impacts to be studied and how to assess and evaluate their significance.

There are certain outputs that need to be achieved in order to evaluate the significance of impact. The level of details in the prediction and evaluation of impact 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.
v) Area of impacts (localised versus transboundary).
vi) Probability of cumulative impacts (effects of project on adjacent land areas and vice versa).
vii) Sensitivity of nearby receptors (e.g. Environmentally Sensitive Areas).

[Note: Only significant issues shall be assessed in detail in the EIA. Issues that are not significant shall only be addressed qualitatively. However, the DOE can request for a quantitative assessment with a proper justification.]

The process of prediction and evaluation of impacts begins with the identification of potential impacts, determination of inputs, execution of methods/tools and evaluation of outputs by comparing them with certain established criteria. It is important to make sure the accuracy of the input used for any kind of assessment. The quality of the output is determined by the quality of the input or GIGO (garbage in, garbage out). Any assumptions used in assessment as well as limitations and uncertainties of any data should be stated clearly in the EIA report.

Table 5-3 shows the summary of the prediction and evaluation of impacts for sewage Projects. Details of the relevant assessments to be carried out are described further in the following sub-chapters.

Table 5-3 Summary of Prediction and Evaluation of Impacts

Potential Impacts	Typical Input	Methods and Modelling Tools	Typical Output	Evaluation Criteria
 Soil erosion and sedimentation	• Rainfall erosivity factor. • Soil erodibility factor. • Slope length and degree factor. • Land-cover management factor. • Conservation practice factor. • Runoff volume. • Peak discharge.	• Calculation (i.e. manual or aid of software like ArcGIS) of: ✓ Annual soil erosion rate – Revised Universal Soil Loss Equation (RUSLE). ✓ Sediment yield – Modified Universal Soil Loss Equation (MUSLE).	• Annual soil erosion rate. • Sediment yield. • Potential soil erosion risk map. • Impact significance evaluation.	• Not available.
 Water Quality	• Flowrate of water bodies and pollutant • Hydraulic data (if required) • Pollutant data (i.e. concentration) • River water quality baseline data • Marine water quality baseline data	• Simple mass balance models • Water quality simulation models (one, two or three-dimensional): ✓ QUAL2K ✓ MIKE11 ✓ WASP	• Graph of concentration of pollutants over spatial for normal scenario and worst scenario • Pollution loading calculation (if required)	**Discharge Limits:** • Environmental Quality (Sewage) Regulations 2009 **Ambient Limits:** • National Water Quality Standards for Malaysia • Malaysia Marine Water Quality Criteria and Standard
 Groundwater (if required)	• Topography • Pollutant data (i.e. concentration) • Groundwater level and quality • Rainfall data • Hydraulic conductivity • Geology data • Geophysics work (if necessary) • Pumping rate • Well yield	• Groundwater flow models: ✓ MODLFOW ✓ FEFLOW ✓ Aqua3D ✓ Gold Sim	• Contaminant transport map. • Geophysics plot (if necessary)	**Ambient Limits:** • Malaysia Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water)

Potential Impacts	Typical Input	Methods and Modelling Tools	Typical Output	Evaluation Criteria
 Air pollution	• Air dispersion: ✓ Source data (stack dimension, pollutants etc.). ✓ Meteorological data. ✓ Terrain data. ✓ Building data (building dimension). ✓ Sensitive receptors (residential areas, etc.). • GHG estimation: ✓ Amount or quantity of parameter of concern. ✓ Type of technology. ✓ Emission factor.	• Modelling of air dispersion for normal case and worst-case scenarios using air dispersion modelling software (ADMS): ✓ SCREEN ✓ AERSCREEN ✓ AERMOD ✓ CALPUFF • GHG estimation: ✓ Equation in the 2006 IPCC Guidelines (i.e. Volume 5 – Waste).	• Air dispersion: ✓ Maximum average incremental values (MAIC). ✓ Ground level concentration (GLC). ✓ Dispersion contours. ✓ Impact significance evaluation. ✓ Odour Unit • GHG estimation: ✓ Total CO_2 equivalent. ✓ Opportunities for GHG reduction	**Emission limit:** • Environmental Quality (Clean Air) Regulations 2014. **Ambient limits:** • Malaysia Ambient Air Quality Standard 2013. • Ontario Ambient Air Quality Criteria (OAAQC), 2003.
 Odour Pollution	• Predictive: ✓ Source data (source dimension, odour concentration etc.). ✓ Meteorological data (wind direction, wind speed, etc). ✓ Terrain data (elevation data). ✓ Building data (building dimension).	• Predictive: ✓ Qualitative (e.g. Source-Pathway-Receptor concept). ✓ Semi-quantitative (e.g. screening models, look-up tables & nomographs). ✓ Modelling (e.g. AERMOD & CFD tools). • Observational/Empirical:	• Predictive: ✓ A relative risk score or descriptor. ✓ Estimated concentration. ✓ Predicted concentrations (ou/m^3), usually as 98^{th} percentiles of 1-hour mean.	**Recommended Ambient Limits:** • IAQM Guidance on the assessment of odour for planning – version 1.1.

Potential Impacts	Typical Input	Methods and Modelling Tools	Typical Output	Evaluation Criteria
	✓ Sensitive receptors (residential areas, etc.). • Observational/Empirical: ✓ Intensity, frequency, duration, offensiveness. ✓ Measured concentration (Dilutions-to-Threshold). ✓ Odour diaries. ✓ Community survey. ✓ Complaint records.	✓ Monitoring of odour in ambient air (e.g. sensory & compound analysis). ✓ Actively using the community as the "sensor" (e.g. odour diaries & community surveys). ✓ Passively using the community as the "sensor" (e.g. complaints analysis).	✓ Image representation of flow patterns. • Observational/Empirical: ✓ Odour exposure. ✓ Days (%) on which odour detected above a given intensity. ✓ Percentage (%) annoyed or % experiencing nuisance. ✓ Frequency of complaints.	
 Noise	• Sound power level, sound pressure level • Source classification (area, point, line) and mobile sources • Existing background noise and existing noise sources • Type of noise (continuous, intermittent, impulse) • Propagation factors • Directionality • Ground effect (soft, hard, porous ground) • Location and height of source • Total attenuation from factors such as atmospheric absorption,	Calculation of noise incremental level for normal case and worst-case scenario: ✓ BS 5228-1:2009 ✓ ISO 9613-2 ✓ FHWA Traffic Noise Model Version 2.5 ✓ Calculation of Road Traffic Noise (CRTN) ✓ CadnaA Datakustik ✓ SoundPLAN ✓ GIS based noise model	• Absolute numerical noise limit • Change in noise levels relative to the existing baseline level. • Noise map	**Recommended Ambient Limits:** • Guidelines for Environmental Noise Limits and Control Third Edition, 2019.

Potential Impacts	Typical Input	Methods and Modelling Tools	Typical Output	Evaluation Criteria
	absorbing ground, diffraction by barriers and other miscellaneous factors			
 Vibration	• Reference PPV from reliable publication • Distance from equipment / activities to the receiver • Attenuation rate of the ground	Equation for prediction of vibration level: • Continuous vibration $PPV_{Equipment} = PPV_{Ref}(25/D)^n$ *(in/sec)* • Ground vibration - Australian Standards 2187.2-2006 $V = K_G\,(\frac{R}{Q^{\frac{1}{2}}})^{-B}$	• Prediction of peak particle velocity (PPV) • Damage risk in structural damage • Level of human annoyance	**<u>Recommended Ambient Limits:</u>** The Planning Guidelines for Vibration Limits and Control in the Environment 2nd Edition 2007
 Fire and explosion risks	• Hazardous substance data (i.e physical and chemical properties). • Equipment specifications (i.e pressure, dimension, etc.). • Possible accident scenario (i.e leak, rupture, etc.). • Failure frequency data. • Meteorological data (i.e wind direction, atmospheric stability, etc.).	• Consequence modelling software for multiple and different type of hazard sources for normal case and worst-case scenarios using: ✓ ALOHA. ✓ PHAST. ✓ EFFECTS. ✓ TEREX. ✓ WHAZAN.	• Individual risk. • Societal risk. • Individual risk contour. • F-N Curve (societal risk). • Impact significance evaluation.	**<u>Individual Risk Criteria:</u>** • Industry: 1 x 10^{-5} fatalities/person/year. • Public: 1 x 10^{-6} fatalities/person/year.

Potential Impacts	Typical Input	Methods and Modelling Tools	Typical Output	Evaluation Criteria
 Health risk	• Community health data. • Local health statistics. • Air quality assessment result (inhalation pathway). • Water quality assessment result (ingestion pathway). • Groundwater quality assessment result (ingestion pathway).	Health risk assessment (HRA): • Qualitative risk assessment • Quantitative risk assessment. ✓ Issues identification ✓ Hazard identification. ✓ Dose-response assessment. ✓ Exposure assessment. ✓ Risk characterization ✓ Uncertainty analysis	• Health risk calculation at certain level of exposure: ✓ Non-carcinogenic risk – Hazard Quotient (HQ). ✓ Carcinogenic risk – Lifetime Cancer Risk (LCR). • Impact significance evaluation.	**<u>Public Health Criteria:</u>** • Non-carcinogenic: Hazard quotient (HQ) < 1 • Carcinogenic risk: Generally acceptable risk (10^{-4} to 10^{-6}).
 Socio-Economic Study	• Details of demographics • Local economic profile • Feedback from stakeholder's engagement	• Socio Impact Matrix	Risk matrix tabulation with socio economic concerns and the magnitude of impact	• Manual for Social Impact Assessment (SIA) for Project Development, Second Edition 2018
 Waste	• Incoming waste information • Source of waste • Waste generation rate • Number of workers	Estimation of total amount of waste: • Waste generation rates (WGR) from published literatures are multiplied with the quantity (Q) of waste	• Estimated weight of waste generated (domestic waste, grit, sludge and scheduled waste) • Estimated volume of waste generated (domestic waste, grit, sludge and scheduled waste) • Impact significance evaluation	Not available.

Potential Impacts	Typical Input	Methods and Modelling Tools	Typical Output	Evaluation Criteria
 Ecology	• Type of habitat in the surrounding area • Presence of forest reserves (if any) or other gazetted protected area • Flora composition (terrestrial and aquatic). • Fauna composition (terrestrial and aquatic).	• Basic fieldwork to document existing composition • Secondary data from existing literature	• Type of plants, fish species and wildlife documentation	• IUCN Listing • Protected Aquatic Species

Note: The list is not exhaustive and not all of the above mentioned 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. Proposed assessment models shall be well established and acceptable to DOE.

5.3.1 Soil Erosion Impact Assessment

5.3.1.1 Sources of Pollution

The possible sources of soil erosion impact of an STP or STF are mainly during pre-construction and construction stage (**Table 5-4**).

Table 5-4 Possible Sources of Soil Erosion at Different Stages

Stage	Activities	Possible Source(s)
Pre-Construction	Soil Investigation	• Disturbance of soil from moving vehicles to and from site
	Site Survey	
Construction	Site Clearance	• Disturbance of soil • Uncontrolled erosion and sedimentation
	Establishment of Access Road	
	Mobilisation of Machinery and Equipment	
	Pipeline Installation Works	
	Civil and Structural Works	

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity.

5.3.1.2 Impact Assessment

Methodology

1. Appendix 3 – Guidance Document for Addressing Soil Erosion and Sediment Control Aspects in the Environmental Impact Assessment (EIA) Report, EGIM
2. Guideline for Erosion and Sediment Control in Malaysia (DID, 2010);
3. Urban Stormwater Management Manual for Malaysia (MSMA) 2nd Edition (DID, 2012); and
4. Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) (DOE, 2017).

There are two parameters that need to be considered in the assessment, namely:

1. Annual potential soil loss.
2. Sediment yield.

Annual soil erosion rate can be calculated using the Revised Universal Soil Loss Equation (RUSLE) while the sediment yield can be calculated using Modified Universal Soil Loss Equation (MUSLE). Factors to be considered for RUSLE and MUSLE are as **(Table 5-5)** follows:

Table 5-5 RUSLE and MUSLE Equations

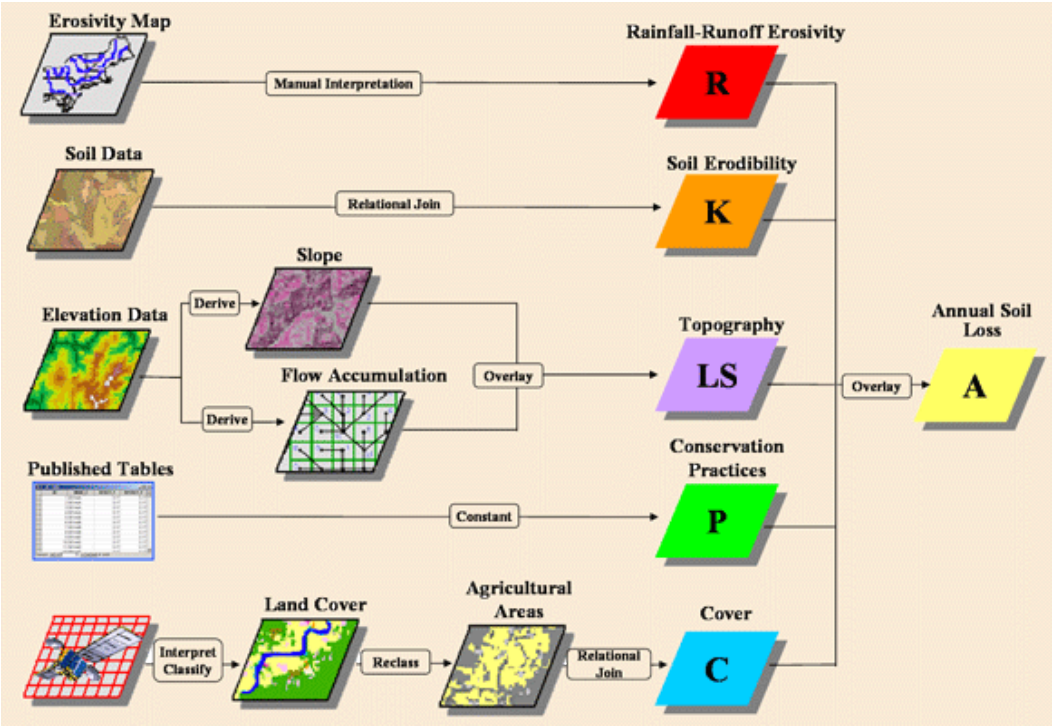
RUSLE	MUSLE
$A = R \times K \times LS \times C \times P$	$Y = 89.6 \times (VQ_p)^{0.56} \times (K \times LS \times C \times P)$
Where, **A** – Average annual potential soil loss (tons/acre/year). **R** – Rainfall-runoff erosivity factor. **K** – Soil erodibility factor **LS** – Slope length and degree factor. **C** – Land cover management factor **P** – Conservation practice factor.	Where, **Y** – Sediment yield per storm event. **V** – Runoff volume in cubic meter. **Q_p** – Peak discharge in m^3/s. **K** – Soil erodibility factor **LS** – Slope length and degree factor. **C** – Land cover management factor **P** – Conservation practice factor.

Source: Urban Stormwater Management Manual for Malaysia (MSMA) 2nd Edition (DID, 2012)

Modelling Tools

The above parameters can be calculated manually or using a geographic information system (GIS) software like ArcGIS. GIS integrates many types of data and analyses spatial location and organizes layers of information into visualizations using maps. **Figure 5-1** shows the protocol of calculation using ArcGIS software. All the factors will be overlaid together to calculate the annual potential soil loss and produce the potential soil erosion risk map.

Figure 5-1 Protocol of Calculation using ArcGIS Software



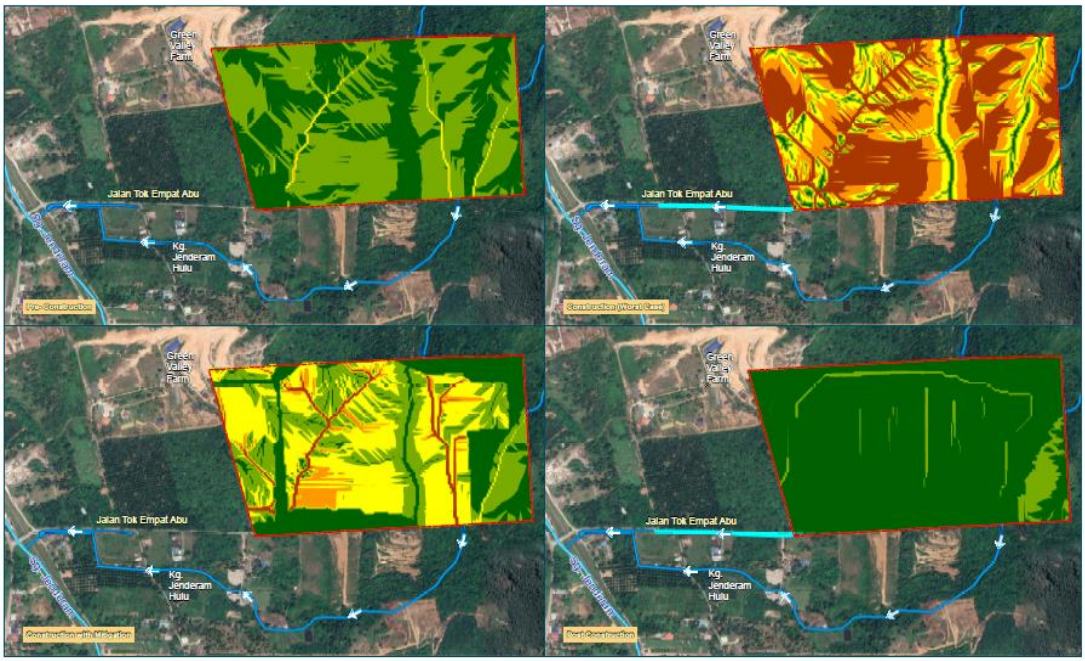
Note: Adopted from Soo Huey Teh, 2011

5.3.1.3 Output

The objective of the assessment is to ensure that the soil erosion and sediment risks are reduced by implementing Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) like cover and conservation practices. At the moment, there are no specific criteria for evaluation to assess the significance of the soil erosion and sediment impacts. Potential soil erosion risk map (**Figure 5-2**) is usually produced for four different scenarios:

- Pre-Construction (existing condition).
- Construction during worst case scenario (bare soil with no mitigation measures).
- Construction with mitigation measures.
- Post Construction.

Figure 5-2 Example of Potential Soil Erosion Risk Map Produced using ArcGIS



5.3.2 Water Quality Impact Assessment

Water quality impact assessment is conducted to predict whether the aquatic life and beneficial users are at risk, or that the assimilative capacity of receiving water body may be exceeded as a result of silt trap/sediment basin discharge during construction stage and sewage discharge during operational stage.

If the prediction modelling result shows significant impact to the water quality of the receiving waterbodies, then suitable mitigation measures such as conducting

pollution loading carrying capacity study shall be considered. Qualified Person may also refer to any available Total Maximum Daily Load (TMDL) Study for the same river within the Project Site area as reference. Department of Environment may request Qualified Person to conduct water quality assessment for related emerging pollutants on a case by case basis of Sewage Project.

5.3.2.1 Sources of Pollution

The possible sources of water pollution of an STP or STF can vary throughout the different stages of the project, namely construction stage, operation & maintenance stage, and abandonment/post closure (**Table 5-6**).

Table 5-6 Possible Sources of Water Pollution at Different Stages

Stage	Activities	Possible Source(s)	Parameter of Concern
Pre-Construction	Soil Investigation	• Disturbance of soil from moving vehicles to and from site	TSS and turbidity
	Site Survey		
Construction	Site Clearance	• Disturbance of soil • Uncontrolled erosion and sedimentation • Discharge of silt trap / sediment basins • Improper disposal or handling of sewage, sullage and garbage by workers • Spillage or leakage from diesel fuel tanks • Biomass disposal on site	TSS and turbidity
	Establishment of Access Road		
	Mobilisation of Machinery and Equipment		
	Pipeline Installation Works		
	Civil and Structural Works		
	Mechanical and Electrical Installation		
Operation & Maintenance	Treatment Process and Effluent Discharge	• Outdated design capacity and technology unable to keep up with the current population • Discharge of untreated/partially treated sewage due to faulty equipment • Leakage or spillage of lubricating oil or hydraulic oil into the waterways	DO, BOD, COD, NH_3-N, TSS Faecal Coliform and e-coli
	Maintenance of Plant Equipment		

Stage	Activities	Possible Source(s)	Parameter of Concern
	Sludge Treatment and Disposal	• Spillage of sludge into existing waterways	
Abandonment / Post Closure	Abandonment of Site	• Bare areas exposed may cause erosion and sedimentation	TSS and Turbidity
	Abandonment of Plant / Facility	• Direct discharge or bypass of untreated sewage	DO, BOD, COD, NH_3-N, TSS Faecal Coliform and e-coli.

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity. The parameters of concern are the typical pollutants but there may be other pollutants which may be present and need to be included on a case-by-case basis.

5.3.2.2 Impact Assessment

Methodology

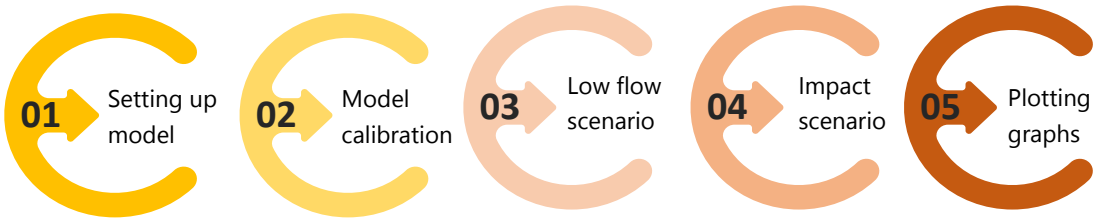
Prior to carrying out water quality impact assessment, the following details must be identified as inputs to the model:

- Potential point source and non-point source pollutions;
- Existing sensitive receptors;
- River data (flowrate and concentrations of pollutants/particles);
- Meteorological data (rainfall); and
- Terrain data (topography).

Baseline water quality sampling shall be carried out at various locations along the waterways near the STP or STF site and sent to an accredited laboratory for analysis. This is to ensure that the model is calibrated according to the actual field measurements.

Modelling shall be carried out for low flow and impact scenarios (normal and worst-case scenario) based on the inputs identified earlier. Modelling results will be plotted out based on the modelled scenarios. The overall methodology for water quality impact assessment is shown in **Figure 5-3**.

Figure 5-3 Methodology for Water Quality Impact Assessment



Modelling Tools

Various assessment tools that can be used for water quality impact assessment. The appropriate tool can be determined based on the scale of sensitivity of sewage projects and the potential scale of impact. Assessment can either be carried out using simple mass balance models or water quality simulation models. Examples of water quality simulation models and their respective features are tabulated in **Table 5-7**:

Table 5-7 Examples of Water Quality Simulation Model

Assessment Tool	Features
WASP8	• Able to dynamically model contaminate fate and transport in rivers, estuaries, lakes, • Can be applied in one, two or three dimensions • Simulation includes temperature, BOD, DO, nutrients, eutrophication, bacteria and other variables
QUAL2K	• One-dimensional river and stream water quality model • Able to represent a well-mixed channel both vertically and laterally with steady state hydraulics, non-uniform steady flow, and diel heat budget and water-quality kinetics • Multiple loadings and abstractions can be input to any reach
MIKE11	• One-dimensional river model for river water quality model • Able to simulate flow and water level, water quality and sediment transport in rivers, flood plains, irrigation canals, reservoirs and other inland water bodies

Note: The list is not exhaustive and not all of the above mentioned may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine suitable modelling tools to assess the impacts. Proposed assessment models shall be well established, acceptable to DOE and that newer predictive models can be used if the models are more robust.

5.3.2.3 Outputs

The main objective from carrying out a water quality impact assessment is to predict the incremental values and ambient values of the discharges towards the waterbody. The ambient limits of river water shall be compared with the National Water Quality Standards for Malaysia and the ambient limits of marine water shall be compared with the Malaysian Marine Water Quality Standards and Index. Whereas, the values of discharge shall be compared with the Environmental Quality (Sewage) Regulations 2009.

Output for water quality assessment to be included in the EIA report are as follows:

i) Describe the input data and the effect of different variations of data to the modelling result

ii) Presentation of predicted pollutants concentrations such as dissolved oxygen (DO), biochemical oxygen demand (BOD), total suspended solids (TSS) and ammoniacal nitrogen (NH_3-N) (example as shown in **Figure 5-4** and **Figure 5-5**)

iii) Calculation of pollution loading carrying capacity if the modelling result shows significant impact to the river water quality. For example, sewage discharge will cause river quality to degrade from Class III to Class IV of NWQS.

iv) Identification of the highly impacted area where sensitive receptors such as water intake, aquaculture ponds, water recreational park, sensitive aquatic species spawning grounds are located.

v) Discussion on the accuracy of modelling results

Figure 5-4 Example of TSS Modelling Result from Sediment Basin Discharge Using QUAL2K

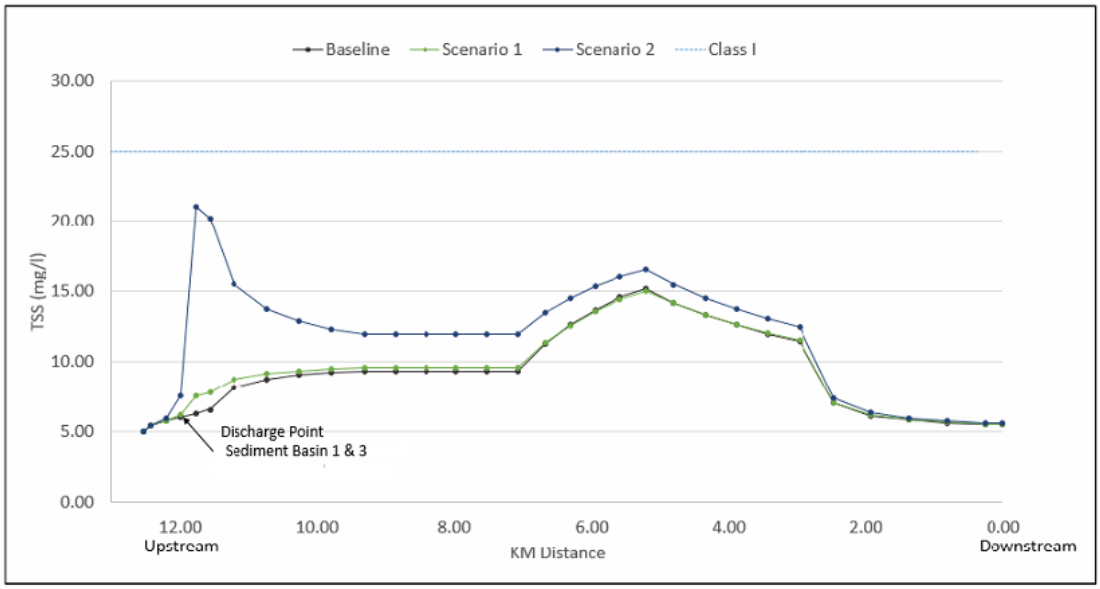
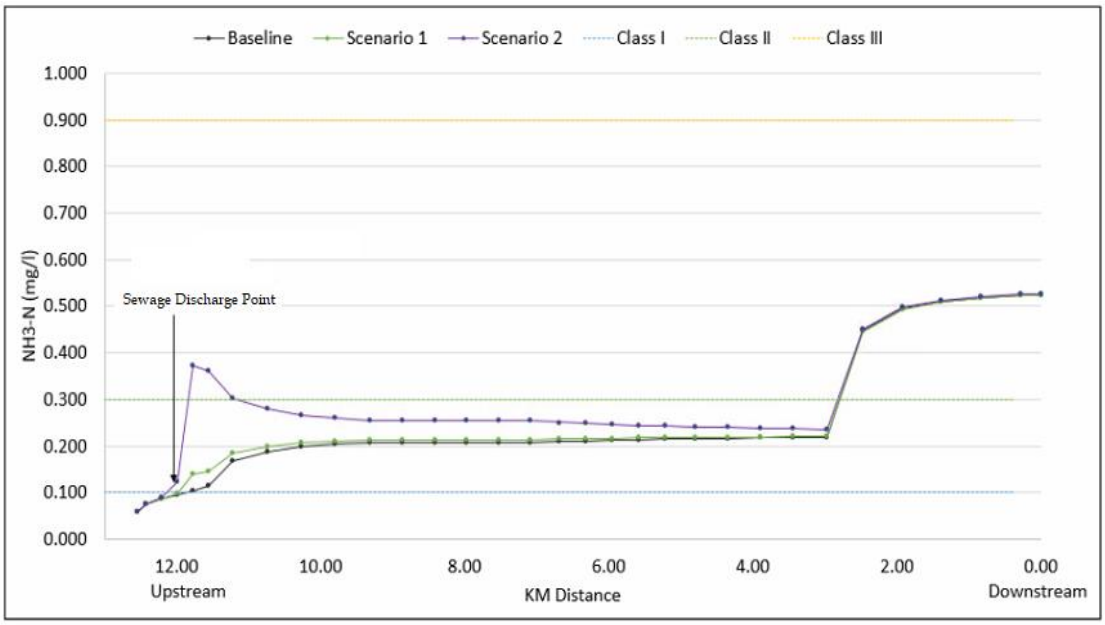


Figure 5-5 Example of NH_3-N Modelling Result from Sewage Discharge Using QUAL2K



5.3.3 Groundwater Quality Impact Assessment (If Required)

Groundwater Quality Impact Assessment for Sewage Project is conducted if the Project site is located near to a groundwater aquifer that is used for portable and non-portable usage. It is the responsibility of the Project Proponent and Qualified Person to engage with relevant agencies in order to determine requirement to conduct groundwater impact assessment.

5.3.3.1 Sources of Pollution

The impact of an STP or STF project on the groundwater quality mainly originates from improper management of wastes and sludges which results in leachate generation and subsequent contamination (**Table 5-8**).

Table 5-8 Possible Sources of Groundwater Pollution at Different Stages

Stage	Activities	Possible Source(s)	Parameter of Concern
Construction	Site Clearance	• Leachate generation from biomass disposal on site	DO, BOD, COD, NH_3-N and TSS.
	Mobilisation of Machinery and Equipment	• Leachate generation from improper disposal or handling of solid wastes by workers	DO, BOD, COD, NH_3-N, and TSS
	Civil and Structural Works		

Stage	Activities	Possible Source(s)	Parameter of Concern
	Mechanical and Electrical Installation	• Spillage or leakage from diesel fuel tanks	
Operation & Maintenance	Sludge Treatment and Disposal	• Mismanagement of sewage sludge causing seepage of faecal material through soil	DO, BOD, COD, NH_3-N, TSS Faecal Coliform and e-coli.
Abandonment / Post Closure	Abandonment of Plant / Facility	• Mismanagement of sewage sludge and solid wastes left on site	DO, BOD, COD, NH_3-N, TSS and Faecal Coliform and e-coli.

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity. The parameters of concern are the typical pollutants but there may be other pollutants which may be present and need to be included on a case-by-case basis.

5.3.3.2 Impact Assessment

Methodology

To develop a model that mimics the catchment behaviour, the following parameters are required as model inputs:

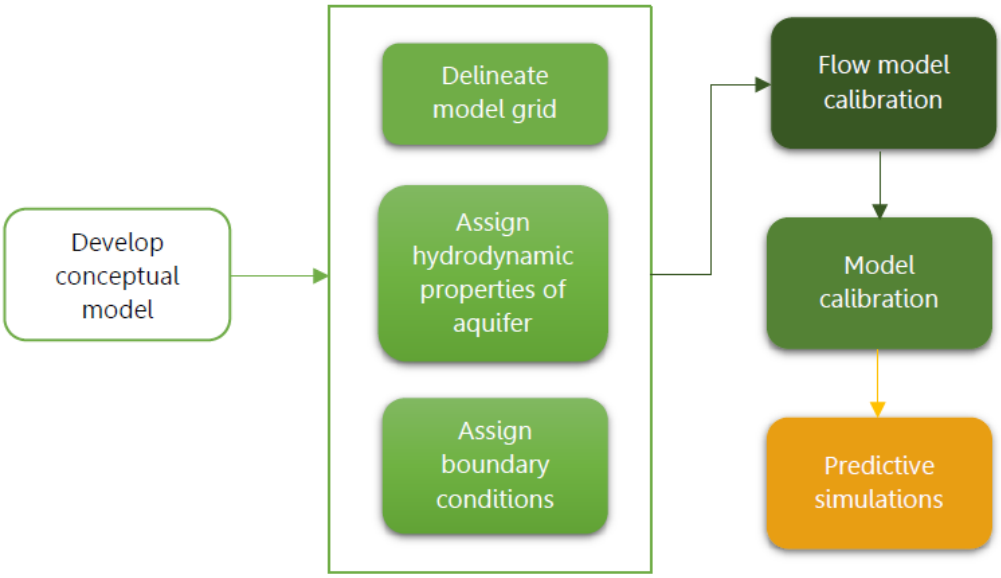
- Topography
- Hydrogeology (piezometric levels, well yield, pump rate, flow boundaries, geology, soil conductivity)
- Hydrology (rainfall, evapotranspiration, inflow and outflow)

The conceptual model developed will facilitate the implementation of an integrated geospatial database framework. A centralized geospatial database of the study basin is first developed to store all required data to develop the model. ArcGIS tools can then be used to delineate the model grid into smaller boundaries. The hydrodynamic properties of the aquifer and boundary conditions are also assigned to the model.

Groundwater flow model calibration will then be carried out with respect to water level measurements collected at intervals over a period of time. Following that, model calibration shall be demonstrated to ensure that the model can successfully simulate the observed aquifer behaviour.

After calibration is completed, the Qualified Person shall proceed to model predictive simulations based on the conditions of the project. The overall process for groundwater quality impact assessment is shown in **Figure 5-6**.

Figure 5-6 Methodology for Groundwater Quality Impact Assessment



Modelling Tools

There are various assessment tools that can be conducted to determine groundwater quality. The appropriate tool can be determined based on the sensitivity scale of different projects and the potential scale of impact. One of the commonly used mathematical model is MODFLOW, FEFLOW and Aqua3D. The features are shown in **Table 5-9**:

Table 5-9 Examples of Groundwater Quality Modelling Tools

Groundwater Model	Features
MODFLOW by USGS	• Three-dimensional groundwater and porous media finite difference model • Able to simulate coupled groundwater/surface-water systems, solute transport, variable-density flow, aquifer-system compaction and land subsidence, parameter estimation and groundwater management • Modular system where new packages (functions) are added frequently • Cannot simulate complex geological features, such as angled faults and simulate steep hydraulic gradients such as rewetting/drying cells using the same code • Hydraulic conductivity must be perpendicular to the face of each model cell.

Groundwater Model	Features
FEFLOW by DHI group	• Two and three-dimensional groundwater and porous media finite element model • Able to model fluid flow, groundwater age, contaminant and heat transport in saturated and unsaturated porous media • Has direct coupling with solute and heat transport and fracture modelling • Accommodates more complex triangular model mesh which allows for better representation of anisotropy • Simulate complex hydrogeological features (such as re-wetting cells)
Aqua3D by Scientific Software group	• Three-dimensional groundwater and solute transport finite element model • Solves transient groundwater flow and contaminants; heat with advection, decay, adsorption and velocity-dependent dispersion and anisotropic flow conditions. • Able to handle flow and transport in saturated aquifers

Note: The list is not exhaustive and not all of the above mentioned may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine suitable modelling tools to assess the impacts. Proposed assessment models shall be well established, acceptable to DOE and that newer predictive models can be used if the models are more robust.

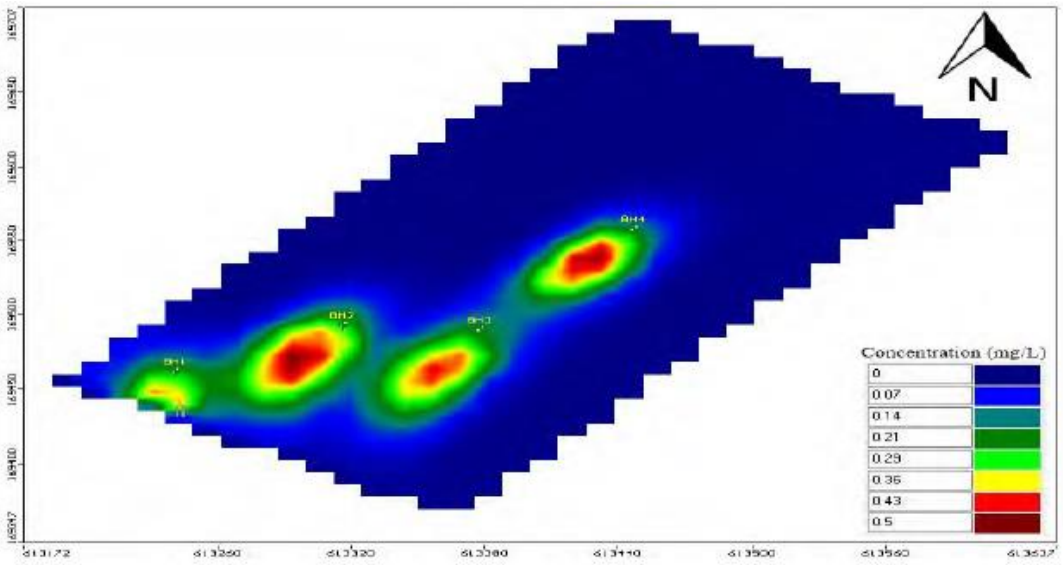
5.3.3.3 Outputs

By carrying out groundwater quality impact assessment, the qualified person shall be able to develop groundwater flow and transport using site-specific parameters, and simulate and predict the potential migration of contaminants. The values of concentration predicted should compare with the limits listed in the Malaysia Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water).

Some of the key information to be included in the report are:

i) Describe the input data and the effect of different variations of data to the modelling result
ii) Presentation of predicted pollutants concentrations (example as shown in **Figure 5-7**)
iii) Identification of the highly impacted surrounding community, especially the sensitive receptors
iv) Discussion on the accuracy of modelling results

Figure 5-7 Example of Simulation Result for COD Contaminant Using MODFLOW



5.3.4 Air Quality and Odour Impact Assessment

Air quality assessment for Sewage project is conducted for dust dispersion due to construction vehicle movement during construction stage. Meanwhile, odour impact assessment is conducted for odour emission from sewage and sludge treatment during operation stage.

Air quality and odour impact assessment is to predict whether the dust and odour emission will cause health risk towards the nearby sensitive receptors such as residential areas, commercial areas, and schools.

5.3.4.1 Sources of Pollution

Possible sources of air pollution for the construction, operation and maintenance, and abandonment or post-closure of STPs or STFs are detailed in **Table 5-10**:

Table 5-10 Possible Sources of Air and Odour Pollution at Different Stages

Stage	Activities	Possible Sources	Parameter of Concern
Construction	Site Clearance Establishment of Access Road	• Generation of dust • Soot and smoke from illegal and	• Dust, PM_{10} and $PM_{2.5}$

Stage	Activities	Possible Sources	Parameter of Concern
	Mobilisation of Machinery and Equipment	indiscriminate open burning of cleared biomass • Deposits of mud and silt on the road	
	Pipeline Installation Works		
	Civil and Structural Works		
Operation & Maintenance	Maintenance of Plant Equipment	• Dust emission from workers and maintenance transportation to and from site	• Hydrogen sulphide • Ammonia • Methyl mercaptan • Odour
	Sewage Treatment and Sludge Treatment and Disposal	• Odour emitting from pre-treatment, primary treatment and secondary treatment of STP • Odour emitting from sludge treatment during thickening, dewatering and storage of sludge • Spilled dry sludge carried away and dispersed by winds • Odour emitting from operation failure of STP and STF.	
Abandonment / Post Closure	Abandonment of Site	• Bare areas exposed may cause erosion and sedimentation	• Dust and PM_{10}
	Abandonment of Plant / Facility	• Odour emitting from abandoned STP and STF	• Hydrogen sulphide • Ammonia • Methyl mercaptan • Odour

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity. The parameters of concern are the typical pollutants but there may be other pollutants which may be present and need to be included on a case-by-case basis.

5.3.4.2 Impact Assessment

Methodology for Air Quality Impact Assessment

The general methodology to conduct air quality assessment is shown in **Figure 5-8**. There are several inputs required for the prediction of the Maximum Average Incremental Concertation (MAIC) and calculation of Ground Level Concentration (GLC) of a specific pollutant. The Ground Level Concentration (GLC) of a specific pollutant at the identified Air Sensitive Receptor (ASR) is calculated by adding the MAIC with the baseline data.

This GLC will then be compared with the ambient limits in the Malaysia Ambient Air Quality Standard (MAAQS) 2013. Other ambient air quality standard limits such as the Ontario Ambient Air Quality Criteria (OAAQC), 2003 can be adopted if the ambient air quality standard limits of certain pollutants are not available in the MAAQS.

Figure 5-8 General Methodology for Air Quality Assessment

Methodology for Odour Impact Assessment

There are various methods to assess the odour impact from the sewage project. Details of the methods can be referred in Bull *et al* (2018) - IAQM Guidance on the assessment of odour for planning – version 1.1.

One of the methods is to predict the odour impact by using ADMS like AERMOD. The general methodology for air quality assessment as shown in **Figure 5-8** can be used for odour impact assessment. The differences are in terms of:

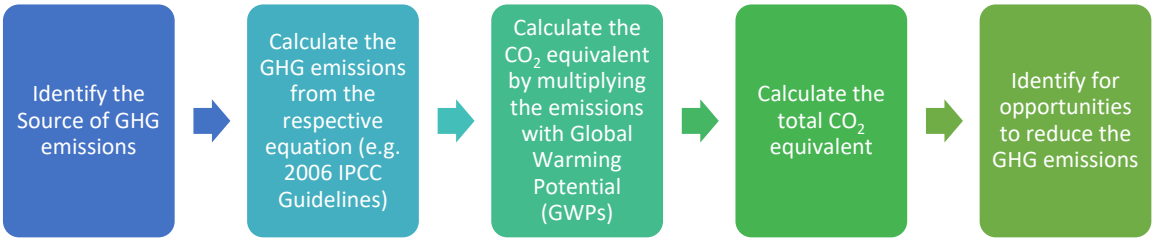
- Odour concentration unit (ou/m^3).
- Compliance limits.
- Evaluation criteria.

At the point of the preparation of this guidance document, the regulations for odour compliance are still in draft stage.

Methodology for Greenhouse Gas Assessment

Greenhouse gas (GHG) emissions from the sewage project can be calculated by following the steps given below:

Figure 5-9 General Methodology for GHG Calculation



The 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) and the 2006 IPCC Guidelines (i.e. Volume 5 – Waste) can be referred to calculate the GHG emissions.

Assessment Tools for Air Quality and Odour Impacts

There are a few Air Dispersion Modelling Software (ADMS) that can be used to predict the maximum average incremental concentration from point, area and volume sources release. AERMOD and CALPUFF are among the most common software used for air modelling. There are several other ADMS available in the market that can be used as well. The comparison of selected ADMS. **Appendix G**

5.3.4.3 Outputs

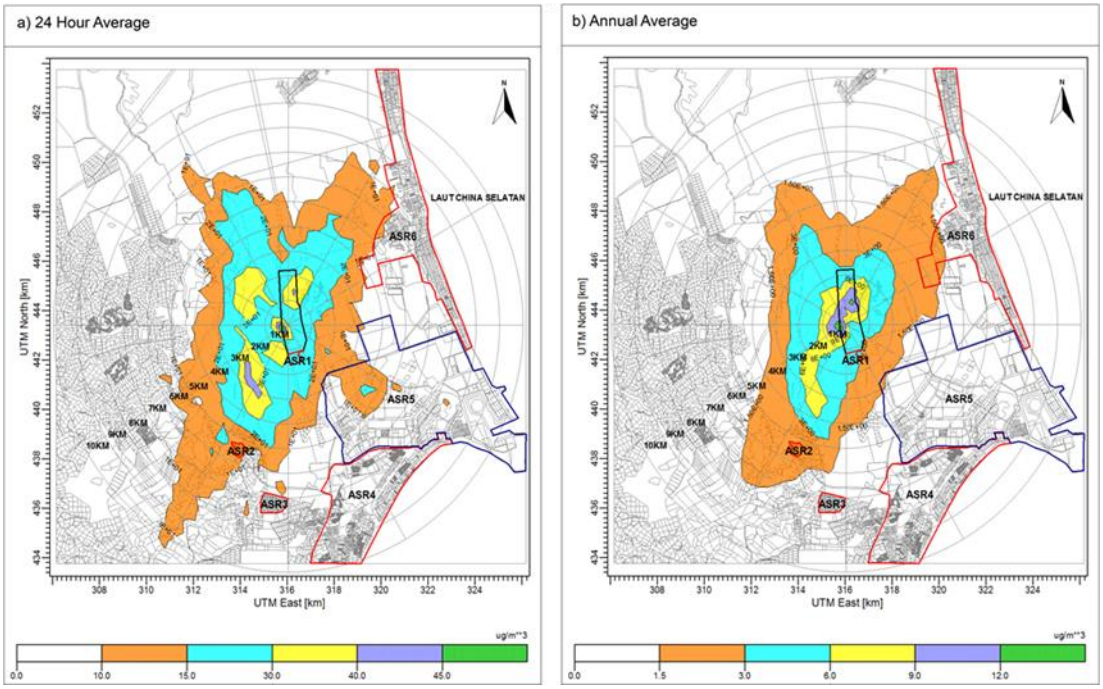
Maximum Average Incremental Concentration (MAIC)

Output from the modelling will be in the form of iso-plots of MAIC of a specific pollutant as shown in **Figure 5-10**. It will show the extent and magnitude of the pollutant dispersion.

Ground Level Concentration (GLC)

As mentioned above, GLC of specific pollutant at the identified ASR is calculated by adding the MAIC with the baseline data. Hence, it is expected that the GLC results at the identified ASR are tabulated in the table and where available compared with the limits in the MAAQS or other ambient air quality standard limits.

Figure 5-10 Example of Air Dispersion Contour using CALPUFF View™



Evaluation Criteria:

The main evaluation criteria used for air quality assessment is the MAAQS as shown in **Table 5-11**. As mentioned above, the Ontario Ambient Air Quality Criteria (AAQC), 2003 can also be adopted if the ambient air quality standard limits of certain pollutants are not available in the MAAQS 2013.

Table 5-11 Malaysia Ambient Air Quality Standard

Pollutants	Averaging Time	Standard 2020 (µg/m³)
Particulate Matter <10 micron (PM_{10})	1-Year	40
	24-Hour	100
Particulate Matter <2.5 micron ($PM_{2.5}$)	1-Year	15
	24-Hour	35
Sulphur Dioxide (SO_2)	1-Hour	250
	24-Hour	80
Nitrogen Dioxide (NO_2)	1-Hour	280
	24-Hour	70
Ground Level Ozone (O_3)	1-Hour	180
	8-Hour	100
Carbon Monoxide (CO) in mg/m^3	1-Hour	30
	8-Hour	10

5.3.5 Noise Pollution Impact Assessment

Noise pollution and vibration impact assessment are conducted for noise emission and vibration due to piling activities during construction stage. Meanwhile, noise pollution impact assessment is conducted for noise emission from machineries in STP and STF during operation stage.

Noise pollution impact assessment is to predict whether the noise emission will cause health and safety risk towards the nearby sensitive receptors such as residential areas, commercial areas, and schools.

5.3.5.1 Sources of Pollution

Noise impact assessment is conducted to predict the noise impact from the Project development towards sensitive receptors such as residential area, public facilities such as school, hospital and others during construction and operation stage. From the assessment, the severity of noise impact and the significance of impact to the sensitive receptors can be determined. The possible sources of noise emission are as shown in **Table 5-12**.

Table 5-12 Possible Sources of Noise Pollution at Different Stages

Stage	Activities	Possible Sources
Construction	Site Clearance	• Noise and vibration emitted from piling works • Noise from stationary equipment such as pumps, power generators and air compressors which run continuously at constant power and speed. • Noise from heavy machinery such as excavators, backhoes and front loaders. • Noise from increment in traffic
	Establishment of Access Road	
	Mobilisation of Machinery and Equipment	
	Pipeline Installation Works	
	Civil and Structural Works	
	Mechanical and Electrical Installation	
Operation & Maintenance	Treatment Process and Effluent Discharge	• Noise generated from process equipment such as pump, blower, draft fan • Noise from increment in traffic
	Maintenance of Plant Equipment	
	Sludge Treatment and Disposal	• Noise from increment in traffic
Abandonment	Abandonment of Plant / Facility	• Dismantling works such as breaking up concrete, brickworks and metals. • Demolition works

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity.

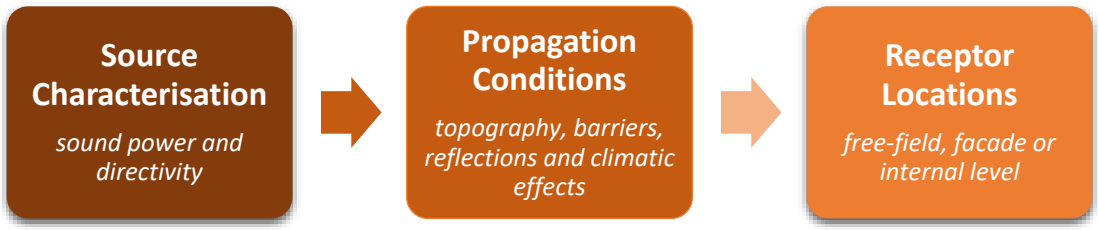
5.3.5.2 Impact Assessment

Methodology

The ultimate aim of any noise assessment is to determine the effect of the expected change in the ambient noise level arising from the proposed development. Prediction of noise at the receptor is estimated based on the sound pressure level generated at source of noise. Different prediction methods may be necessary during site preparation, construction, operation and decommissioning stage. For example, when planning for sewage project, consideration needs to be given to site preparation, fixed plant noise, mobile plant noise, site restoration and vehicle movements.

The basic prediction procedure involves consideration of the nature and noise level of the sources, the propagation along the paths between sources and receptors and location as shown in **Figure 5-11** below:

Figure 5-11 Components of Noise Assessment



Prior to carrying out noise impact assessment, the following information must be identified as inputs to carry out the assessment as shown in **Table 5-13**

Table 5-13 Typical Input for Noise Impact Assessment

Information	Description
Source Characterization	• Sound power level, sound pressure level • Source classification (area, point, line) and mobile sources • Propagation factors (reduction in level with distance from a point source correspond to the sound wave) • Directionality • Ground effect (soft, hard, porous ground) • Location of source • Height of source • Type of noise (continuous, intermittent, impulse) • Phasing of works (if any) • Existing background noise and existing noise sources
Meteorological Effects	• Atmospheric absorption • Atmospheric refraction • Wind speed

Information	Description
	• Temperature gradients
Topographical Effects	• Barriers (types, height) • Reflections from vertical surfaces such as tall building • Total attenuation from factors such as atmospheric absorption, absorbing ground, diffraction by barriers and other miscellaneous factors
Receiver	• Existing background noise and existing noise sources • Land use of receiver (residential, institution, public facilities) • Location of receiver, distance between source to receiver, height of receiver
Attenuation	• Topography of assessment area, ground effect (soft, hard, porous), screening, reflection

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the relevant information required for environment assessment and compliance.

The selection of the assessment method shall depend on the nature of noise source and available information that are needed as input to the assessment method. It is important for the noise assessor to strike a balance between the convenience of a simple model or assessment and the need for accurate predictions. Some of the prediction schemes and models are as **Table 5-14**:

Table 5-14 Examples of Prediction Schemes and Models

Prediction Tools	BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise
	ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation
	FHWA Traffic Noise Model Version 2.5
	Calculation of Road Traffic Noise (CRTN)
Modelling Software	CadnaA Datakustik
	SoundPLAN
	GIS based noise model

Note: The list is not exhaustive and it is the responsibility of the Project Proponent and Qualified Person to determine suitable modelling tools to assess the impacts. Proposed assessment models shall be well established, acceptable to DOE and that newer predictive models can be used if the models are more robust.

5.3.5.3 Outputs

Noise could be assessed against an absolute numerical noise limit or on the change in noise levels relative to an existing baseline level as described in Guidelines for Environmental Noise Limits and Control 2019 Third Edition published by Department of Environment, Malaysia. As for the community annoyance of the noise, assessment will be based on the human perception of the change in ambient noise levels.

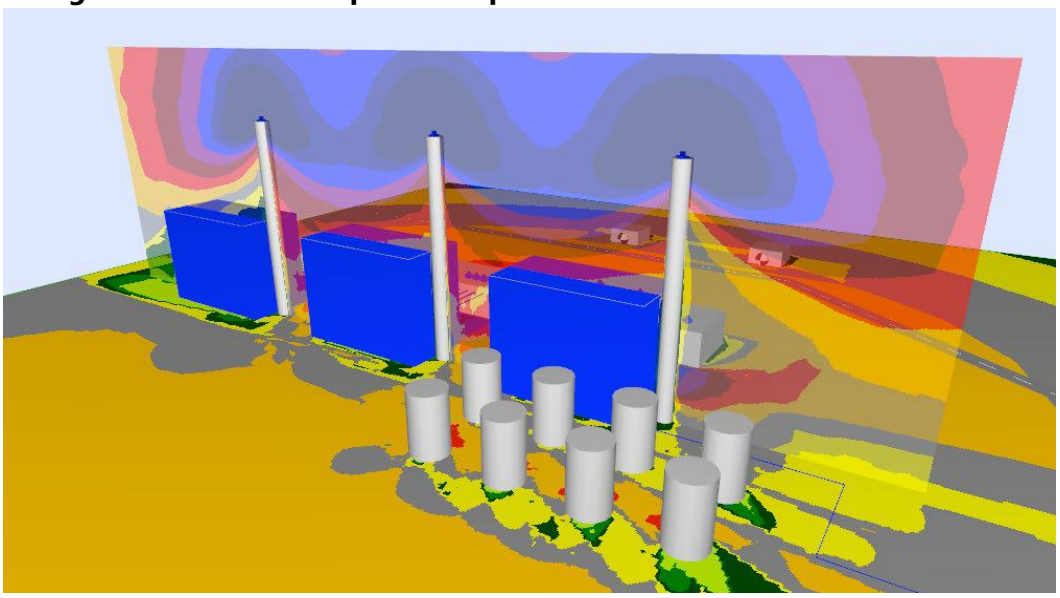
Output for noise impact assessment can presented in tabular form (**Table 5-15)** or noise contours from modelling software **(Figure 5-12**) .

Table 5-15 Example of Output for Noise Impact Assessment in Tabular

Site Activity	Sub Activity	Machinery / Equipment	Sound Power Level (dBA	Sound Pressure Level at 220m (dBA)	Sound Pressure Level of Sub Activity (dBA)
Site Preparation	Site Clearing	Tracked loader (205 kW)	96.0	38.0	48.4
		Tracked excavator (71 kW)	105.0	47.0	
		Bulldozer (240 kW)	103.0	45.0	
Access Road Works	Ground Excavation	Tracked excavator	105	47.0	46.5
		Tracked loader	96.0	38.0	
	Tipping and Spreading Fill	Dump truck (50 t)	107	49.0	49.8
		Tracked excavator	105.0	47.0	
		Bulldozer	103.0	45.0	
	Levelling Ground	Bulldozer	103.0	45.0	46.1
		Grader	101.0	43.0	

Source : ERE Consulting Group Sdn Bhd

Figure 5-12 Example of Output from CadnaA Datakustik Software



Source: CadnaA Datakustik

5.3.6 Vibration Impact Assessment

5.3.6.1 Sources of Pollution

Vibration impact assessment is to predict whether the vibration will cause health and safety risk towards the nearby sensitive receptors such as residential areas, commercial areas, and schools. The main source of vibration is from piling activities during construction stage of STPs or STFs.

The possible sources of pollution for vibration are shown in **Table 5-16**.

Table 5-16 Possible Sources of Vibration Impact

Stage	Activity	Possible Sources
Construction	Site preparation and clearing.	• Drilling or excavation in close proximity to sensitive structure • Blasting activity • Impact equipment such as pile drivers, jackhammers, pavement breakers, rock drills and other pneumatic tools. • Dynamic compaction
	Earthworks	
	Site formation/reclamation.	
	Ancillary/Infrastructural works.	
Operation	Operation of machineries	• Machinery vibration that is caused by: - imbalance of rotating equipment - misalignment of machine - wear (e.g. worn conveyor belts) - looseness (e.g. loose bearing)
Abandonment/ Decommissioning	Dismantling plant	• Dismantling works such as breaking up concrete, brickworks, metals • Demolition works

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity

5.3.6.2 Impact Assessment

Vibration impact during construction stage shall be assessed if there is a significant vibration impact from construction activities to the nearby sensitive receptors.

Methodology

i. Continuous Vibration

The assessment for the prediction of peak particle velocity (PPV) from the construction machinery is estimated by the following formula:

$$PPV_{Equipment} = PPV_{Ref}(25/D)^{n} \quad (in/sec)$$

Where:

PPV_{Ref}	=	Reference PPV at 25 ft
D (ft)	=	Distance from equipment to the receiver
n	=	1.1 (the value related to the attenuation rate through ground)

ii. Ground Vibration

Based on Australian Standards 2187.2-2006, ground vibration is estimated using the following equation:

$$V = K_G \left(\frac{R}{Q^{\frac{1}{2}}}\right)^{-B}$$

Where:

V (mm/s)	=	Peak vector sum ground vibration peak particle velocity (mm/s)
R (metres)	=	Distance from blast area to the nearest structures
K_G, B	=	Site constraints related to site and rock properties for estimation purpose
Q (kg)	=	Maximum instantaneous charge (kg)

iii. Human Annoyance and Discomfort

Human annoyance and discomfort are assessed by comparing the level of peak particle value with the Recommended Limits for Human Response and Annoyance from Short Term Vibrations in accordance to the Planning Guidelines for Vibration Limits and Control in The Environment 2007.

5.3.6.3 Output

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. Based on the assessment, damage risk of building, predicted vibration level and human annoyance from the predicted vibration level will be compared with the permissible levels stated in The Planning Guidelines for Vibration Limits and Control in the Environment Second Edition 2007 published by Department of Environment, Malaysia.

The output for vibration assessment can presented in tabular or in graph form as shown in **Table 5-17**, **Table 5-18 and Figure 5-13.**

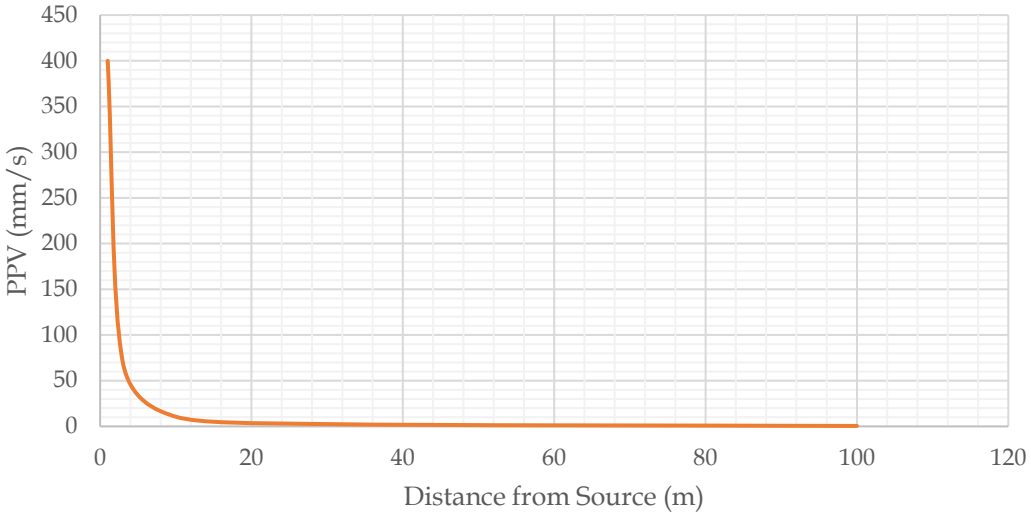
Table 5-17 Sum of Vibration Levels and Recommended Limits for Damage Risk in Building from Short Term / Steady State Vibration

Vibration Axes	Vibration Velocity (mm/s)	Recommended Limits for Damage Risk in Building from Short Term / Steady State Vibration
Transverse (z-axis)		
Vertical (y-axis)		
Longitudinal (x-axis)		
Sum ($\sqrt{(x^2 + y^2 + z^2)}$		

Table 5-18 Sum of Vibration Levels and Recommended Limits for Human Response and Annoyance

Vibration Axes	Vibration Velocity (mm/s)	Recommended Limits for Human Response and Annoyance
Transverse (z-axis)		
Vertical (y-axis)		
Longitudinal (x-axis)		
Sum ($\sqrt{(x^2 + y^2 + z^2)}$		

Figure 5-13 Typical Vibration Levels, PPV with Distance from Source



5.3.7 Quantitative Risk Assessment

Quantitative risk assessment (QRA) for Sewage project is conducted for STP and STF that consists of biogas generates high volume of flammable and toxic gas during operational stage. Quantitative risk assessment is to predict whether the flammable and toxic gas emission will cause safety and health risk towards Plant workers and nearby sensitive receptors such as residential areas, commercial areas, and schools.

5.3.7.1 Source of Hazards

Expected sources of fire hazards mainly exist during operation stage and abandonment of the project. Some of the possible sources are detailed in **Table 5-19**.

Table 5-19 Possible Sources of Fire Hazards at Different Stages

Stage	Activities	Possible Source(s)
Operation & Maintenance	Treatment Process of STP and STF (Biogas Facility)	• Flammable and toxic gases such as methane, carbon dioxide and hydrogen sulphide generated from biogas facility.
Abandonment / Post Closure	Abandonment of Plant / Facility	• Entrapment of flammable gases generated from sewage due to decomposition of organic material

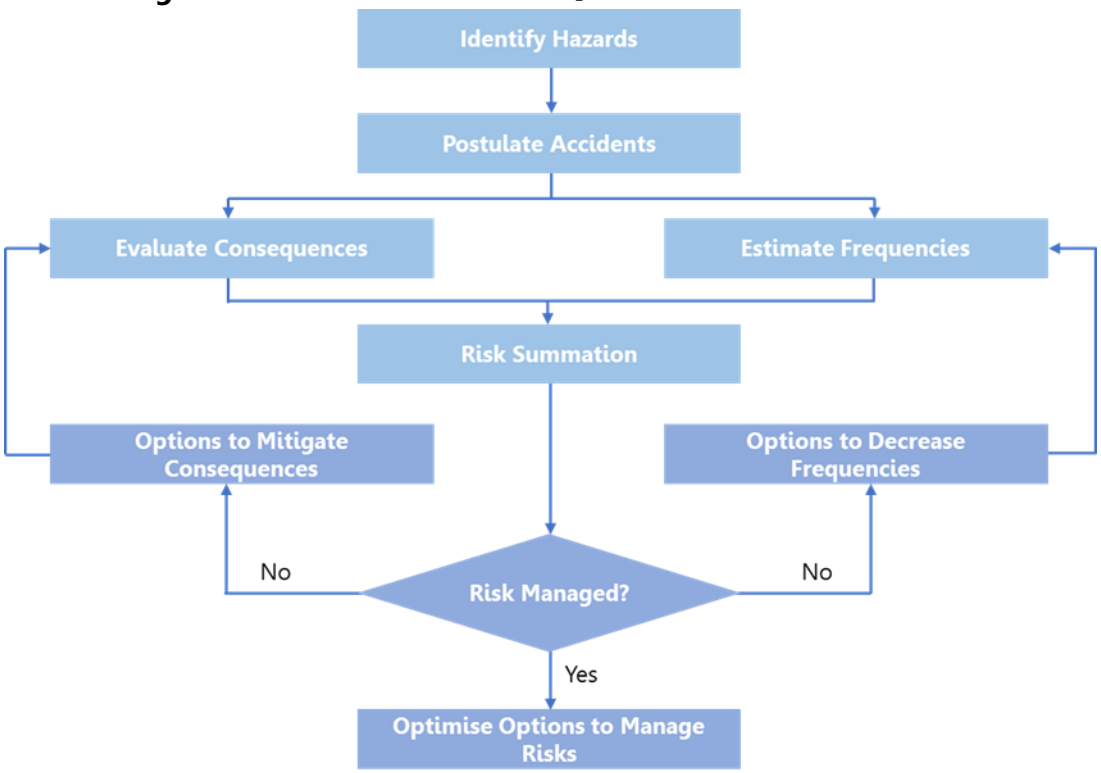
Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity

5.3.7.2 Impact Assessment

Methodology

A QRA shall be carried out according to the Environmental Impact Assessment Guidelines for Risk Assessment (DOE, 2004). The risks of the Sewage Project to the surrounding areas can be analysed by the application of methodology as shown in **Figure 5-14**. As a result, a numerical representation of the frequency and the extent of a specified level of exposure or harm, to specified people or the environment are produced to quantify the risk.

Figure 5-14 Procedure for Quantitative Risk Assessment



Modelling Tools

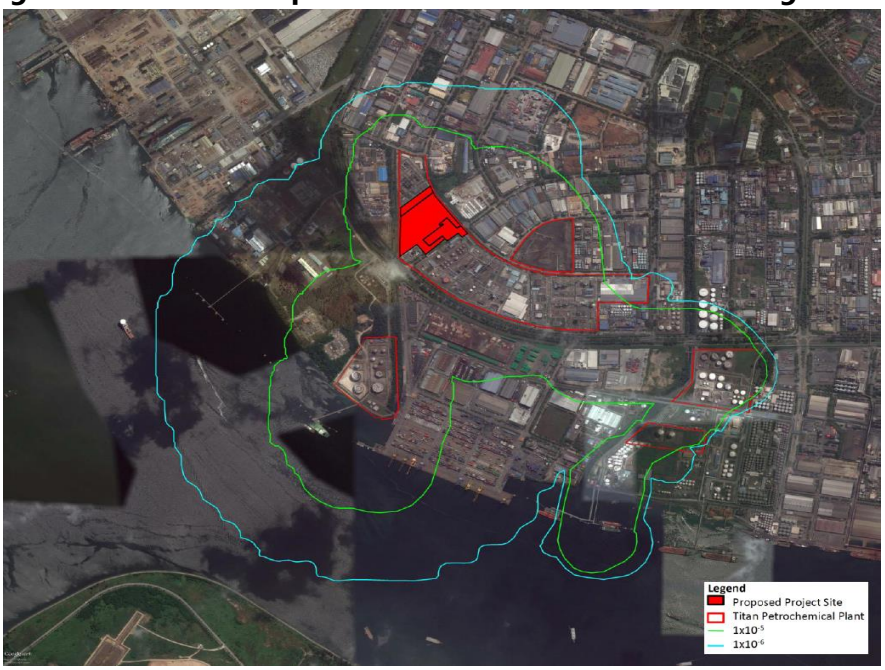
There are a few modelling software packages that can be used to predict the consequences or severity of the pre-identified hazardous events such as fire, explosion and also toxic gas dispersion. ALOHA and PHAST are among the most commonly used software to perform the consequence analysis. A comparison of selected software for consequence analysis is included in **Appendix H**.

5.3.7.3 Outputs

Individual Risk

Individual risk is the probability of fatality in a year of an individual in a given location as a result of the realization of the any hazardous events. The surrounding population is not taken into account in the individual risk calculation. The individual risk results are usually plotted as a series of iso-risk contours originating from the source of hazard. **Figure 5-15** shows the example of individual risk contours produced using PHAST overlaid onto Google Earth.

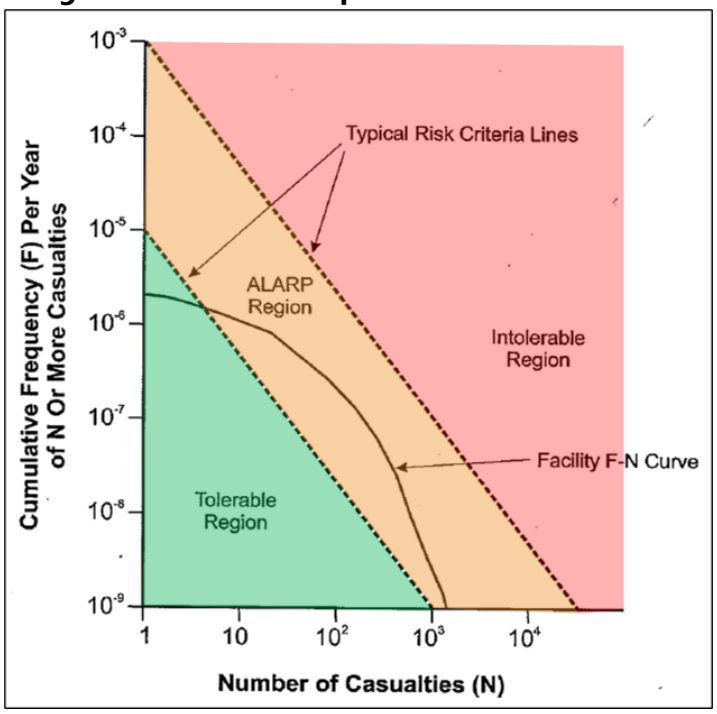
Figure 5-15 Example of Individual Risk Contours using PHAST



Societal Risk

Societal risk provides the actual risk measurement to a given population at or near the source of hazard. Results are usually plotted in the F-N Curve to determine the risk acceptability. F-N Curve provides a logarithmic plot of cumulative frequency of fatal events versus the number of fatalities within a given period of time, usually set for 1 year. **Figure 5-16** shows the example of societal risk F-N Curve.

Figure 5-16 Example of Societal F-N Curve



Evaluation Criteria

The sum of the individual risk calculation for each hazardous event can be compared against the individual risk criteria set in the Environmental Impact Assessment Guidelines for Risk Assessment (DOE, 2004). The recommended risk tolerability criteria for Malaysia are:

- **Industry:** $1x10^{-5}$ fatalities/person/year individual risk contour should not extend beyond industrial developments.
- **Public:** $1x10^{-6}$ fatalities/person/year individual risk contour should not encompass involuntary recipients of industrial risks.

5.3.8 Health Impact Assessment

5.3.8.1 Sources

Some health effects may arise from the construction and operation of STPs or STFs, these sources are detailed in **Table 5-20**.

Table 5-20 Possible Sources of Health Effects at Different Stages

Stage	Activities	Possible Sources
Construction	Site Clearance	• Dust and noise emission from Project site • Disease transmission by construction workers.
	Mobilisation of Machinery and Equipment	
	Civil and Structural Works	
	Mechanical and Electrical Installation	
Operation & Maintenance	Treatment Process and Effluent Discharge	• Poor effluent quality due to poor operation of treatment facility • Sewer gas generated due to decomposition of organic materials
	Sludge Treatment and Disposal	• Leakage and leaching of pathogens and bacteria from wet sludge into the drain and water bodies
Abandonment / Post Closure	Abandonment of Site	• Mismanaged or improper post-closure of site, causing possible accumulation of solid wastes which become breeding grounds for vermin that carries infectious diseases
	Abandonment of Plant / Facility	

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity

5.3.8.2 Impact Assessment

Methodology

Health Impact Assessment (HIA) shall be carried out according to the Guidance Document on Health Impact Assessment (HIA) in the Environmental Impact Assessment (EIA) 2012. There are 4 steps taken in the HIA study as follows:

i) **Step 1** – Screening.
ii) **Step 2** – Scoping.
iii) **Step 3** – Description of Existing Public Health Status.
iv) **Step 4** – Health Risk Assessment (HRA).

Modelling Tools

HRA is the main tool to assess the impact of the proposed project towards the health of the surrounding population. There are two forms of HRA, namely:

- **Qualitative risk assessment** – Merely characterizes or compares the hazard of a chemical relative to others or defines the hazard in only qualitative terms such as mutagen or carcinogen. Qualitative assessment of health concern regarding the risk of communicable diseases should be included.
- **Quantitative risk assessment** – Generates a numerical measure of the risk or safety (i.e. non-carcinogenic and carcinogenic) of a chemical exposure.

Quantitative risk assessment is the preferred assessment for HIA in EIA whenever this is possible. However, certain health risk that may associated with risk due to communicable diseases may not suitable to quantitative risk assessment. Therefore, the Qualified Person shall identify the suitable method to be used for HIA.

There are 6 steps involve in the quantitative health risk assessment as shown **Figure 5-17**. Details of the method can be referred in the guidance document mentioned above.

Figure 5-17 Quantitative Health Risk Assessment Procedure

5.3.8.3 Outputs

Communicable Diseases Risk

The output of HIA is by identifying the risk of communicable diseases due to water pollution and improper management of the area which lead to vector breeding.

Chronic Health Risk

The main objective of HIA is to determine the acceptability of the health risks either in the form of non-carcinogenic risk or carcinogenic risk. Different sets of formula are used to calculate the health risk depending on the route of intake, namely ingestion and inhalation.

Evaluation Criteria

The risk tolerability criteria recommended in the Guidance Document on HIA in Environmental Impact Assessment by DOE Malaysia (2012) are:

- **Non-carcinogenic risk:**
  - ✓ A Hazard Quotient **(HQ) < 1** is categorised as an acceptable risk.
  - ✓ A Hazard Quotient **(HQ) > 1** signifies a hazardous condition.

- **Carcinogenic risk:**
  - ✓ Lifetime excess cancer risk within **10^{-6} to 10^{-4}** are given as a range of acceptable risk; or
  - ✓ Between 1 cancer for every 1 million of exposed population to 1 cancer for every 10,000 of exposed population, over a lifetime duration of 70 years.
  - ✓ Lifetime excess cancer risk $<10^{-6}$ will be deemed as ''clearly acceptable''
  - ✓ Lifetime excess cancer risk $>10^{-4}$ will be deemed as ''clearly unacceptable''.

5.3.9 Socio-Economic Study

Qualified Person is recommended to conduct socio-economic study through stakeholder engagements with sensitive receptors nearby the Project site. Following are the information that should be gathered during the stakeholder engagement.

- Main stakeholders that will be affected by the Project implementation
- Main social concerns from the Project implementation
- Documentation of expectation and suggestion by the main stakeholders

The project activities may affect the people's lifestyle, physical and mental health. It can also impact the public in terms of aesthetics and heritage, perception of belonging, security, and liveability.

5.3.9.1 Sources of Impacts

Community living around the proposed STP or STF will be directly or indirectly affected during pre-construction, construction and operation of the project. Some of the possible concerns that may arise can be due to the project activities are as listed in **Table 5-21**.

Table 5-21 Possible Sources of Socio-Economic Effects at Different Stages

Stage	Activities	Possible Sources
Pre-Construction	Land Acquisition	• Possible relocation or resettlement of community • Possible provision of new employment opportunities for local people (positive impact)
Construction	Site Clearance	• Possible relocation or resettlement of community • Increment of traffic that may cause potential accidents or disturbances if not properly controlled • Possible provision of new employment opportunities for local people • Foreign workers involved may contribute to criminal case within the area
	Establishment of Access Road	
	Mobilisation of Machinery and Equipment	
	Pipeline Installation Works	
	Civil and Structural Works	
	Mechanical and Electrical Installation	
Operation & Maintenance	Treatment Process and Effluent Discharge	• Odour generation which would cause a nuisance to the nearby community • Public trespass or illegal entry into STP or STF may cause incidents/ fatality. • Partially treated/ raw sewage discharge into waterbodies could poses health impacts to the public. • Possible provision of new employment opportunities for local people (positive impact) • Improving sewage and sludge management and reducing illegal sewage
	Sludge Treatment and Disposal	

Stage	Activities	Possible Sources
		discharge and sludge dumping (positive impact).
Abandonment / Post Closure	Abandonment of Plant / Facility	• Health risk due to possible breeding ground for vermin.

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity

5.3.9.2 Impact Assessment

Methodology

The Qualified Person can refer to the Manual for Social Impact Assessment of Project Development Second Edition (2018) as one of the references to conduct socio-economic study. There are 4 steps to follow in conducting socio-economic study:

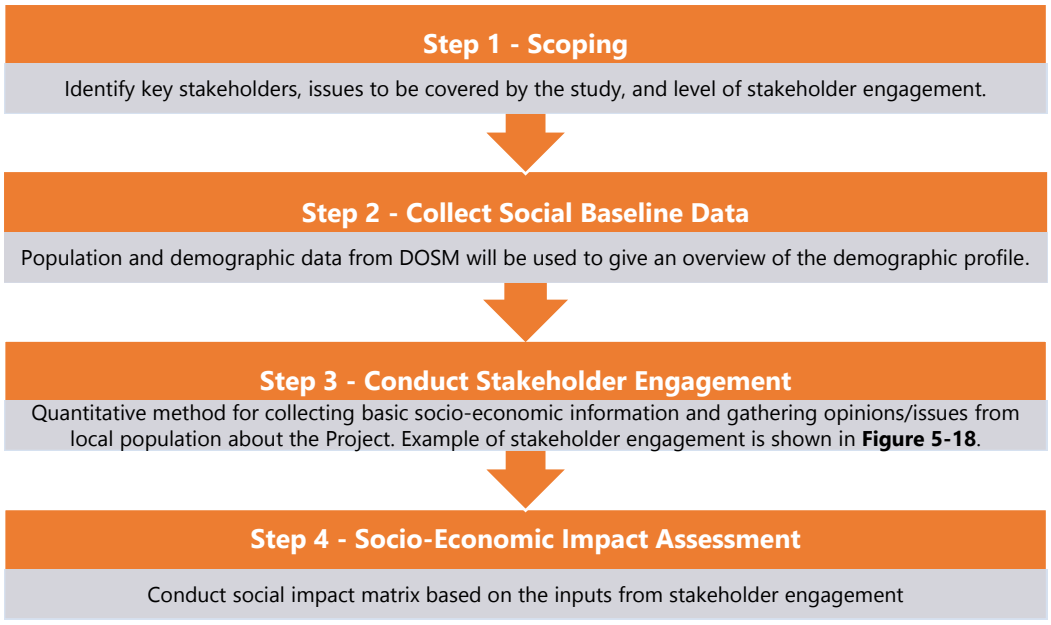
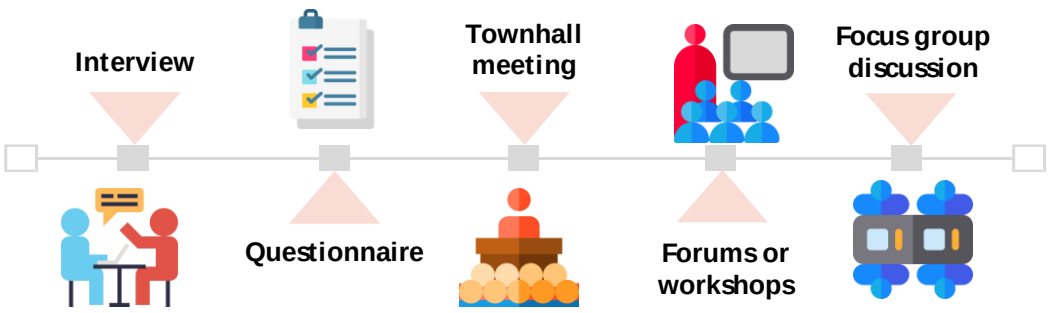


Figure 5-18 Example of Stakeholder Engagement



Assessment Tools

Socio-economic impact analysis can be carried out using the social impact matrix where a list of social impacts is identified from the data collected. The probability of the occurrence and severity of the impact shall then be assessed accordingly by using the equation below. The calculated significance scoring will be ranked on a scale from 1 to 16 (**Table 5-22**). The higher the score is, the more significant the impact will be on the surrounding community.

Table 5-22 Scoring Matrix Scale

Significance = Probability x Severity

Scale for Probability	**Scale for Severity**
1 = Remotely and rarely occurring	1 = Minor social impact
2 = Rarely occurring	2 = Moderate social impact
3 = Frequently occurring	3 = High social impact
4 = Continuously occurring	4 = Severe negative impact

Colour Code	Green	Yellow	Orange	Pink	Red
Score	1-2	3-5	6-7	8-11	12-16
Rating	Not significant	Significant (Low Priority)	Significant (Medium Priority)	Significant (High Priority)	Significant (Very High Priority)
Outcome	No mitigation needed	Continual improvement or control mitigation measures	Preventive measures	Immediate preventive and mitigation measures	Project shall not be approved unless site is relocated or redesigned

Source: Manual for Social Impact Assessment of Project Development Second Edition (2018)

5.3.9.3 Outputs

Output of the socio-economic study may be presented in a risk matrix tabulation or in a discussion format in the EIA reporting. Example of scoring for social impact matrix is shown in **Table 5-23**.

Table 5-23 Example of Social Impact Matrix

Identified Social Impacts	Probability				Average Scale	Severity				Average Scale	Colour Code
	1	2	3	4		1	2	3	4		
1. Influx of foreign/temporary workers in local settlements	0.7	6.9	15.9	76.6	3.7	1.4	6.9	20.0	71.7	3.6	13.3
2. Increased employment/downstream economic opportunities to local communities	37.9	38.6	20.0	3.4	1.9	39.3	44.1	12.4	4.1	1.8	3.4
3. Local communities do not have access to employment/downstream economic opportunities	30.3	25.5	23.4	20.7	2.3	29.0	26.2	24.1	20.7	2.4	5.5
4. Increased security issues in local settlements	1.4	2.8	19.3	76.6	3.7	1.4	2.1	19.3	77.2	3.7	13.8
5. Negative impacts on the environment	1.4	8.3	34.7	55.2	3.4	2.1	8.3	29.9	59.7	3.5	12.0
6. Negative impacts on local lifestyle, cultural and religious values	35.2	36.6	11.0	17.2	2.1	36.6	35.2	11.0	17.2	2.1	4.4
7. Positive impacts on local lifestyle, cultural and religious values	59.7	35.9	4.1	-	1.4	59.7	36.1	3.5	0.7	1.5	2.1
8. Negative impacts on the health of local communities	2.8	6.2	20.0	71.0	3.6	0.7	5.5	24.8	69.0	3.6	13.0
9. Negative impacts due to increase in natural disasters	10.4	20.8	35.4	33.3	2.9	9.7	22.2	34.7	33.3	2.9	8.5
10. Increase in the living conditions of the local communities	38.6	39.3	18.6	3.4	1.9	38.6	40.7	16.6	4.1	1.9	3.5
11. Increase opportunities for rental of temporary housing for foreign/temporary workers	58.6	24.1	11.0	6.2	1.6	57.9	21.4	13.8	6.9	1.7	2.8
12. Increased pressure on existing facilities and amenities originally meant for the local communities	54.5	25.5	13.1	6.9	1.7	55.2	22.8	12.4	9.7	1.8	3.0
13. Increased pressure on natural resources and recreational areas previously only used by the local communities	48.3	26.9	12.4	12.4	1.9	51.7	17.2	15.9	15.2	1.9	3.7

5.3.10 Waste Management Assessment

5.3.10.1 Sources of Pollution

a. Solid Waste

Possible sources of solid waste (domestic waste and sludge) generated from the construction, operation and abandonment of STPs or STFs are detailed in **Tables 5-24.**

Table 5-24 Possible Sources of Solid Waste at Different Stages

Stage	Activities	Possible Sources
Construction	Site Clearance	• Biomass from site clearance • Excess soil from excavation • Domestic wastes such as food waste, paper, food packaging, office supplies waste from workers • Construction waste such as excess concrete, rebar, timber, bricks, and scrap metal • Leftover or trimmed off cables and electrical wiring / parts
	Establishment of Access Road	
	Pipeline Installation Works	
	Civil and Structural Works	
	Mechanical and Electrical Installation	
Operation & Maintenance	Screening	• Collection of solid waste from raw sewage during screening process

Stage	Activities	Possible Sources
	Treatment Process and Effluent Discharge	• Dry sludge and biosolids • Domestic wastes such as food waste, paper, food packaging, office supplies waste from administrative building
	Maintenance of Plant Equipment	• Domestic wastes from maintenance personnel • Packaging waste from overhaul equipment / spare parts during maintenance works
	Sludge Treatment and Disposal	• Dry sludge and biosolids
Abandonment / Post-closure	Abandonment of Site	• Abandoned construction wastes material
	Abandonment of Plant / Facility	• Damaged equipment/structures • Sludge disposal activity

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity

b. Scheduled Waste

Possible sources of scheduled waste generated from the construction, operation and abandonment of STPs or STFs are detailed in **Tables 5-25.**

Table 5-25 Possible Sources of Scheduled Waste at Different Stages

Stage	Activities	Possible Sources
Construction	Site Clearance	• SW 305 Spent lubricating oil • SW 306 Spent hydraulic oil • SW 312 Oily residue from automotive service workshop, oil or grease interceptor • SW 408 Contaminated soil, debris or matter resulting from cleaning-up of a spill of chemical, mineral oil or scheduled wastes • SW 410 Used oil filter from vehicles
	Establishment of Access Road	
	Civil and Structural Works	
Operation & Maintenance	Maintenance of Plant Equipment	• SW 305 Spent lubricating oil • SW 306 Spent hydraulic oil
Abandonment / Post-closure	Abandonment of Site	• SW422 Mixture of scheduled and non-scheduled wastes
	Abandonment of Plant / Facility	

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity

5.3.10.2 Impact Assessment

Solid Waste Generation

Waste estimation from the Project shall be assessed in the construction and operation stage. To estimate the total amount of waste, waste generation rates (WGR) from published literature were multiplied with the quantity (Q) of waste that has been determined from the Project (i.e. estimated area of cleared vegetation, roadworks areas, amount of excavation and demolished structures and number of workers). Example of waste generation rates is shown in **Table 5-26**

Amount of Waste Generated= WGR×Q

Table 5-26 Example of Waste Generation Rates

Project Stage	Category of Waste	Waste Generation Rates
Site clearing	Palm Oil Tree	40.77 tonnes / hectare
	Mangrove	99.4 tonnes / hectare
	Small, growing stands	Low: 26 tonnes/hectare High: 116 tonnes/ hectare
	Mixed small, mature stands	Low: 130 tonnes/hectare High: 155 tonnes/ hectare
	Mature, dense stands	Low: 168 tonnes/hectare High: 414 tonnes/ hectare
	Mature, very dense stands	Low: 427 tonnes/hectare High: 569 tonnes/ hectare
Construction	IBS	0.018 tonne/ m^2
	Conventional	0.046 tonne/ m^2
	Mixed construction method	0.0446 tonne/ m^2
	Demolition	1.3086 tonne/ m^2
Operation	Sludge	0.04 kg/capita/day

Note: This list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible types of waste generated based on the Project activities.

Scheduled Waste Generation

Scheduled waste generated from specific activities such as maintenance of STPs and STFs can be calculated from the mass balance approach.

5.3.10.3 Outputs

The output from the estimation of waste generation shall be presented in the tabular, graph or in any manner which is suitable. The output shall consist of the weight or

volume of waste generation. Examples of output shall contain the category of waste, weight of waste or volume of waste as shown in **Table 5-27**

Table 5-27 Output for Estimated Waste Generation from the Project

Project Stage	Category	Details	Quantity (Q)	Waste Generated	
				Tonne	Percentage (%)
Construction	Biomass				
	Construction Waste				
	Domestic Waste				
	Excavated Materials				
	TOTAL				
Operation	Domestic Waste				
	Sludge				
	TOTAL				

Based on the volume or weight of waste generation, the impacts of improper waste management shall be described in detail relevant to the type and source of waste. The waste impacts shall be described in the following manner (**Table 5-28**):

Table 5-28 Potential Impact from Poor Waste Management

Impacts	Sensitive Receptors
Water Pollution • Increased level of total suspended solids and turbidity due to runoff from excavated materials. • Increased concentration of ammoniacal nitrogen, BOD, COD, and high risk of eutrophication due to high organic content of biomass and domestic waste. • Toxic pollution of river due to illegal dumping of scheduled waste.	Receiving river and its beneficiaries
Flooding • Waterway obstruction and disruption of water flow from illegal dumping of excavated materials, biomass, construction, and domestic waste.	Flood prone areas
Air Pollution • Localised haze and air pollution from open burning of biomass, construction and domestic waste.	Residential and public areas

Impacts	Sensitive Receptors
• Foul odour due to the breakdown of organic matter from domestic waste • Release of toxic fumes from illegal dumping of scheduled waste	
Others • Disease outbreak (e.g. dengue, leptospirosis) due to illegal dumping of biomass, construction, and domestic waste that serves as pest/vermin breeding ground • Littering problem of domestic waste from workers' camps and construction site • Ground contamination from scheduled waste spillage	Residential (including indigenous and local community villages) and public areas

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity

5.3.11 Ecological Impact Assessment

5.3.11.1 Sources of Impacts

The possible sources of ecological impacts from STPs and STFs can vary throughout the different stages of the project (**Table 5-29**).

Table 5-29 Potential Activities Contributing to Ecological Impacts

Project Stage	Activity	Type of Impact
Construction	• Site clearance including earthwork • Establishment of access road • Mobilisation of machinery and equipment • Attracting nuisance wildlife due to construction waste	• Habitat disturbance (terrestrial & aquatic) • Habitat fragmentation • Human-wildlife conflicts
Operation	• Sewage discharge to waterbodies	• Degradation of aquatic habitat quality

Note: The list is not exhaustive and it is the responsibility of the Qualified Person to determine the possible sources of pollution based on the Project activity

5.3.11.2 Impact Assessment

Methodology

Core components that need to be considered in the assessments include:

- Type of habitat in the surrounding area (between 500m – 2km from the project site).
- Presence of forest reserves (if any) or other gazetted protected area in the surrounding area.
- Flora composition (terrestrial and aquatic).
- Fauna composition (terrestrial and aquatic).

Information pertaining to the four core components can be obtained through collation of secondary data and consultation with relevant stakeholders such as:

- State Forestry Departments.
- State Department of Wildlife and National Parks
- State Department of Fisheries.
- Research institutions.
- Local environmental NGOs (e.g. Malaysian Nature Society, WWF-Malaysia)

Where secondary data is not available, quick fieldwork should be conducted (if necessary) to document the existing conditions of the surrounding environment in terms of habitat and species composition (for both terrestrial and aquatic flora and fauna). The collected data can then be used to assess the sensitivity of the surrounding environment and the severity of potential impacts in terms of habitat disturbance and fragmentation, as well as potential loss of terrestrial/aquatic flora and fauna species that are of conservation importance.

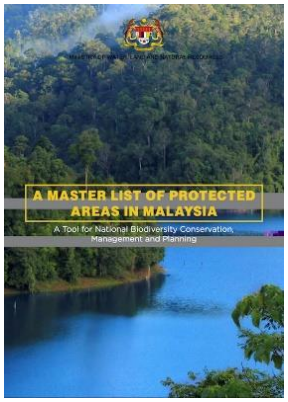
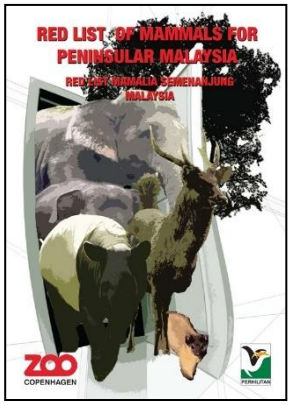
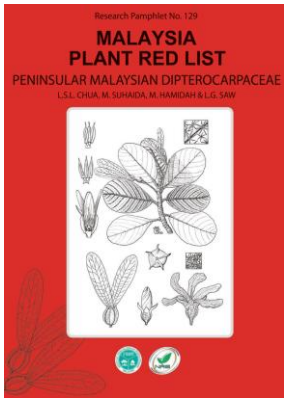
Figure 5-19 Methodology for Ecological Impact Assessment

Assessment Tools

Supporting tools that can be used to facilitate ecological impact assessments are generally in the form of ecological planning documents and species conservation rankings. These supporting tools can be used to assess if the project site is situated within a sensitive landscape, and whether project activities, especially during the

construction and operational stages, may pose threats in terms of species loss (for both flora and fauna) (**Table 5-30**).

Table 5-30 Examples of Supporting Tools for Ecological Assessment

Assessment Tool	Supporting Info
 **Master List of Protected Areas in Malaysia**	• Presents a list of forest reserves that are considered as protected areas for strict conservation. • Covers both Peninsular Malaysia, Sabah and Sarawak. • Examples of forest reserves considered as protected areas: ✓ Water catchment forest ✓ Soil protection forest ✓ Virgin jungle reserves ✓ Wildlife reserves ✓ Bird sanctuaries
 **Red List of Mammals for Peninsular Malaysia**	• Presents a list of mammals that are threatened due to declining population. • Can be used to determine if there are any wildlife in the surrounding landscape that are of conservation importance. • List is ranked using the IUCN Red List categories: ✓ Least Concern ✓ Near Threatened ✓ Vulnerable ✓ Endangered ✓ Critically Endangered ✓ Extinct in Wild ✓ Extinct
 **Malaysia Plant Red List**	• Presents a list of plants, specifically dipterocarps, that are threatened due to declining population. • Can be used to determine if there are any plants in the surrounding landscape that are of conservation importance. • List is ranked using the IUCN Red List categories: ✓ Least Concern ✓ Near Threatened ✓ Vulnerable

Assessment Tool	Supporting Info
	✓ Endangered ✓ Critically Endangered ✓ Extinct in Wild ✓ Extinct

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

5.3.11.3 Output

The objective of the ecological assessment is to ensure that impacts from construction and operational stages such as habitat disturbance and fragmentation are minimised. Specifically, the assessment should aim to determine if there are sensitive aquatic communities (flora and fauna) that needs to be conserved. The assessment should thus facilitate the development of relevant mitigation measures, specifically those to ensure effluent standards are maintained so as to avoid or minimise degradation of aquatic habitats. At the same time, this will help reduce or avoid potential loss of terrestrial / aquatic flora and fauna, if any are present in the surrounding Project site.

The main output of ecological assessments are tables documenting the type of plants, fish species and wildlife that can be found within and around a project site (**Table 5-31** and **Table 5-32**).

Table 5-31 Example of Species Listing with Conservation Status

Family	Common Name	Species Name	Conservation Status	
			IUCN Red List	Local Red List[1]
Sciuridae	Plaintain Squirrel	*Callosciurus notatus*	LC	LC
	Black Giant Squirrel	*Ratufa bicolor*	NT	NT
Cercopithecidae	Long-tailed Macaque	*Macaca fascicularis*	LC	LC
	White-thighed Leaf Monkey	*Presbytis siamensis*	NT	NT
	Dusky Leaf-monkey	*Presbytis obscurus*	NT	NT
Lorisidae	Sunda Slow Loris	*Nycticebus coucang*	VU	NT
Mustelidae	Smooth Otter	*Lutrogale perspicillata*	VU	LC
Suidae	Eurasian Wild Boar	*Sus scrofa*	LC	LC
Cervidae	Barking Deer	*Muntiacus muntjak*	LC	NT
Ursidae	Malayan Sunbear	*Helarctors malayanus*	VU	VU
Tapiridae	Malayan Tapir	*Tapirus indicus*	EN	EN

Family	Common Name	Species Name	Conservation Status	
			IUCN Red List	Local Red List[1]
Elephantidae	Asian Elephant	*Elephas maximus*	EN	VU
Felidae	Leopard Cat	*Prionailurus bengalensis*	LC	NT
	Leopard	*Panthera pardus*	VU	EN

Notes:

[1] Red List of Mammals for Peninsular Malaysia

Legend:

LC – Least Concern
NT – Near Threatened
VU – Vulnerable
P – Protected
TP – Totally Protected
EN – Endangered

Table 5-32 Examples of Protected Aquatic Species in Malaysia

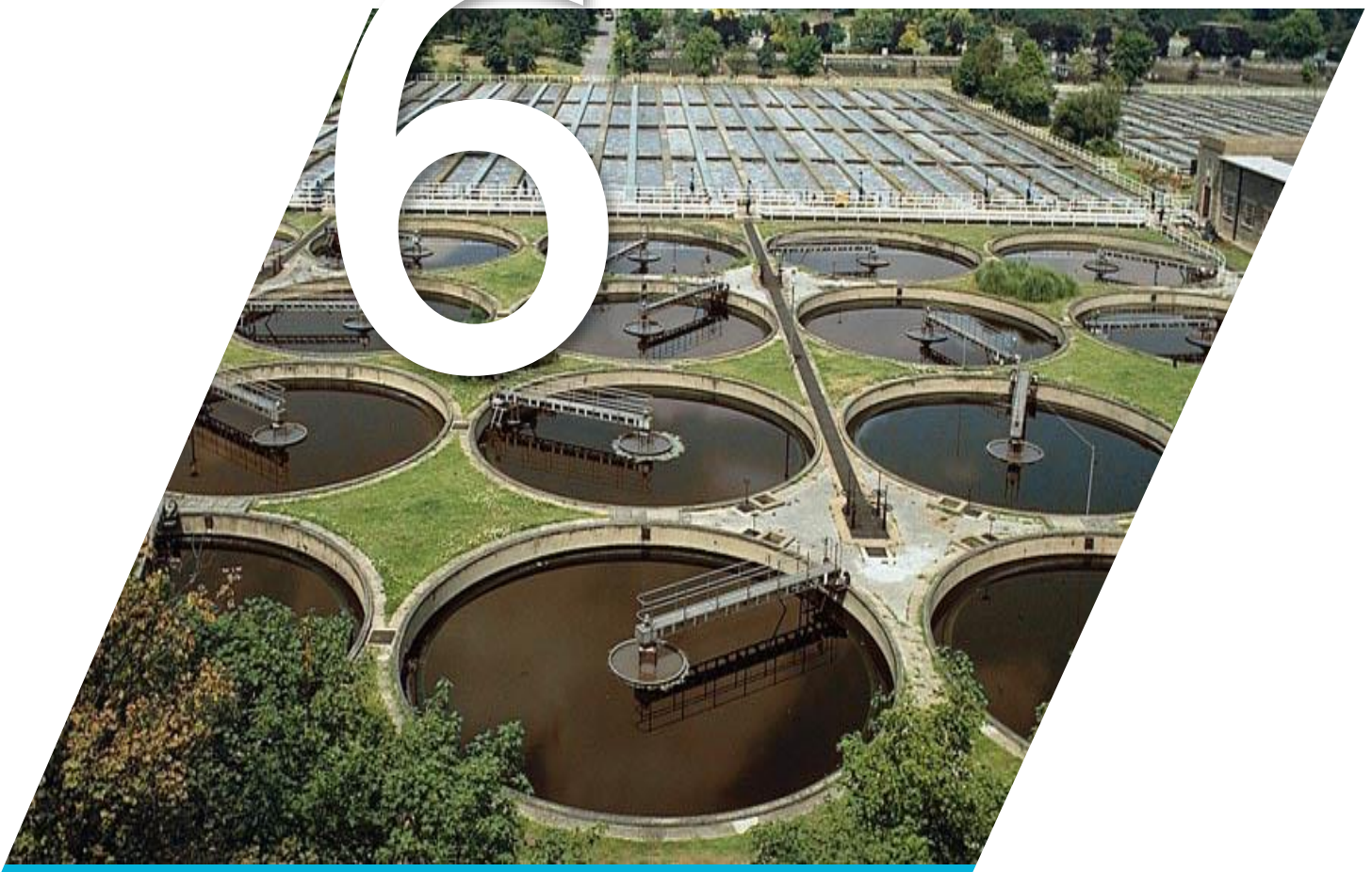
Species Name	Common Name
Enchelosclaris curtisoma	Soft Fin Walking Catfish
Encheloclarias kelioides	Soft Fin Walking Catfish
Betta livida	Emerald spot fighting fish
Betta torni	Pikehead
Parasphromerus harveyi	Harvey's Licorice Gouramy
Scleropages formosus	Asian Bony Tougue

Source: Southeast Asian Fisheries Development Center, (SEAFDEC)

EIA GUIDELINES

Waste Treatment & Disposal
-Sewage

6



MITIGATION MEASURES

CHAPTER 6

MITIGATION MEASURES

6.1 INTRODUCTION

This Chapter aims to focus on the pollution prevention and mitigation measures (P2M2) to reduce the significant adverse environmental impacts identified during the scoping and impact assessment of the EIA. The purpose of implementation of P2M2 are as follows:

i) Avoid negative impacts by selecting alternatives and implement preventive measures
ii) Adopt relevant mitigation measures and best management practices (BMPs) to minimize impacts when an impact cannot be avoided
iii) Enhance and amplify the beneficial impacts
iv) Ensure residual impacts are kept within acceptable levels

This Chapter illustrates the minimum mitigation measures to be implemented by Project Proponent and serves as a guide only. It is the responsibility of the Project Proponent and Qualified Person to detail out the mitigation measures on a case-by-case basis. Project Proponent must understand all P2M2 stated in the EIA and implement all P2M2 throughout the development of the Project.

6.2 PRINCIPLES OF ADOPTION OF P2M2

The main principles of P2M2 adoption are as follows:

i) **The need and extent** of P2M2s required shall correspond to the significance of the predicted impacts. Once an impact is identified as significant, P2M2 shall be recommended in the EIA Report (i.e. type of technologies, engineering design of STP and STF). For minor issues, simple management actions will be sufficient (i.e. operating water bowser for on-site dust control and hoarding installation as on-site noise control).

ii) **Priority** shall be given to control at source (i.e. use of erosion control covers on slopes and platforms to reduce erosion), then to rectify the impacts (i.e. maintenance of silt traps and removal of accumulated silt from drainage).

iii) Proposed P2M2 should not be a generic measure. It has to be **project-specific** and designed for the site conditions. P2M2 should be practical, easy to implement and effective with a minimum cost.

iv) **Adequate explanation** on the design and function of a P2M2 should be included in the EIA report. It can be supported by diagrams, illustrations, photos and maps. The EIA report should also include technical reports and specifications as appendix.

v) Project Proponent is encouraged to use **new technology, green technology, best available technology (BAT), best available control technology (BACT) as well as benchmarking with alternative technology and adopting zero waste concept or zero emissions options.** These options shall be considered by the Project Proponent based on the effectiveness in mitigating the impacts. Project Proponent or the Qualified Person should provide proof and supporting documents that the proposed technology is tried and tested, and able to address the impacts.

vi) P2M2s require regular **inspection, maintenance and rehabilitation**. These shall be incorporated as part of the management requirements of the project, including the allocation of adequate budgets for such purposes.

vii) Effectiveness of P2M2s shall be documented through implementation of a **monitoring programme**.

viii) Qualified Person should propose **Best Management Practices (BMPs)** based on the findings of the EIA for the project site.

The P2M2s and BMPs shall be incorporated into the overall design of the project. Submission of the EIA and the pledge given by the Project Proponent shall reflect the agreement and commitment towards ensuring implementation of the mitigation measures on-site throughout the Project phases.

6.3 APPROACHES TOWARDS P2M2 ADOPTION

At the EIA stage, the Qualified Person shall detail out P2M2 as best as possible in the EIA report. The Project Proponent and Qualified Person shall also recommend any alternative measures and/or introduce newer technology provided it is proven effective.

The key P2M2s that are applicable include:

- Water Pollution Control
- Erosion and Sediment Control Measures
- Air Pollution /Odour Control
- Solid Waste / Scheduled Waste Management

Other mitigation measures that may be required include:

- Noise and Vibration Control
- Safety and Health
- Traffic
- Aesthetics
- Ecological Management

A list of recommended P2M2 for STPs and STFs are detailed in **Appendix I**.

6.4 Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2)

The LD-P2M2 is required for any land disturbing activities during construction phase. Qualified Person should prepare LD-P2M2 document by following Guidance Document for the Preparation of the Document on LDP2M2 in Appendix 4 of the EGIM and Guidelines on LD-P2M2 by DOE.

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

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

Requirement	Information to be included
Project Activity and Implementation	• Phasing plan. • Project implementation schedule. • Description of construction activities. • Construction schedule complete with timeline or charts for P2M2s installation. • Construction method statements.
Information and Analysis on Project Development	• Selected weather and rainfall data. • Site runoff velocity and flow rates (pre- and post-development). • Description of site soil and geological characteristics (type, erodibility, hydrologic group, percentage of dispersible material, excavation depth, etc.). • Description of adjacent affected areas by land disturbance. • List of drainage, streams and river onsite as well as receiving streams and rivers. • List of P2M2s proposed. • Access roads and project components located outside of project boundary. • Earthworks cut and fill volume. • Availability of rocks materials. • Biomass management. • Solid (construction waste) and domestic waste management. • Spill prevention and control plan.

Requirement	Information to be included
	• Hazardous waste management. • Soil loss prediction (pre, during and post-development) for with and without LD-P2M2 implementation scenarios. • Calculation for sediment traps/basins and projected runoff flows.
Map of Site Plan with Existing Conditions	• Topographic survey map. • Geological Terrain Map. • Erosion risk map. • Land use map. • Site development plan map.

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

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EIA GUIDELINES

Waste Treatment & Disposal -Sewage

ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER 7

ENVIRONMENTAL MANAGEMENT PLAN

7.1 INTRODUCTION

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

The EMP shall function as a project implementation tool for the Environmental Management Team to carry out mitigation works on-site. The key contents of the EMP are required to be translated into a format for incorporation into the Bill of Quantities (BQ) for the work scope of the contractors during construction and operation.

Other than mitigation measures, the EMP shall include self-regulation requirements, which are environmental monitoring and audit programme. This is to assess the effectiveness of the P2M2 implementation.

The EMP is a living document that must be updated if there are major changes to the project design, layout or method statement that may result in environmental impacts not originally stated in the EMP.

7.2 EMP FRAMEWORK

During the EIA stage, the project may not have sufficient information on the project work plan to produce a comprehensive EMP. The EMP chapter in the EIA should only be an EMP framework which serve as a guide before the preparation of a full EMP post the EIA approval stage.

The Project Proponent can submit the detailed EMP concurrently with the EIA Report if there is already sufficient information for the EMP. The EMP can later be updated to incorporate the requirements of the COAs. The standard COAs to be included are:

(a) Monitoring of water quality of receiving water body by Accredited Laboratory or any other frequency as determined by DOE.

(b) Monitoring of TSS and Turbidity at inlets and outlets of sediment structures or any other frequency as determined by DOE.

(c) Monitoring of sewage discharge.

(d) In-situ monitoring of TSS and Turbidity after rain event.

(e) Monitoring of air, noise and vibration qualities depending on receptor sensitivity.

(f) Planning, construction and maintenance of LD-P2M2 on site.

(g) P2M2 notification and implementation.

(h) Identification of need of competent persons to undertake specific task on site.

(i) Description and implementation details of EMT.

(j) Clear documentation on any transfer of ownership or proponent of Approved EIA.

(k) Allocation and reporting of sufficient resources to undertake the project activities on-site

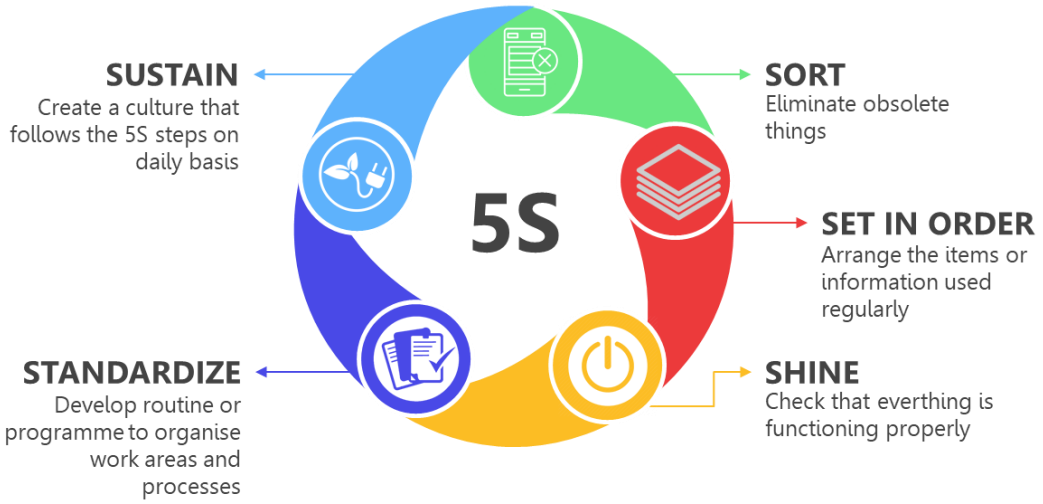
(l) Temporary/permanent abandonment/project closure plan details for all phases.

(m) Implementation of 5S concept in good housekeeping practices (**Figure 7-1**).

(n) Any other green initiatives undertaken for site development activities.

The EMP format shall be based on the requirements stated within the EGIM (or any updated/most current requirements) and shall contain details from the LD-P2M2 Document, and the proposed monitoring and audit programmes.

Figure 7-1 Application of 5S in Upkeeping Environmental Compliances



Note: 5S was developed in Japan by Hiroyuki Hirano

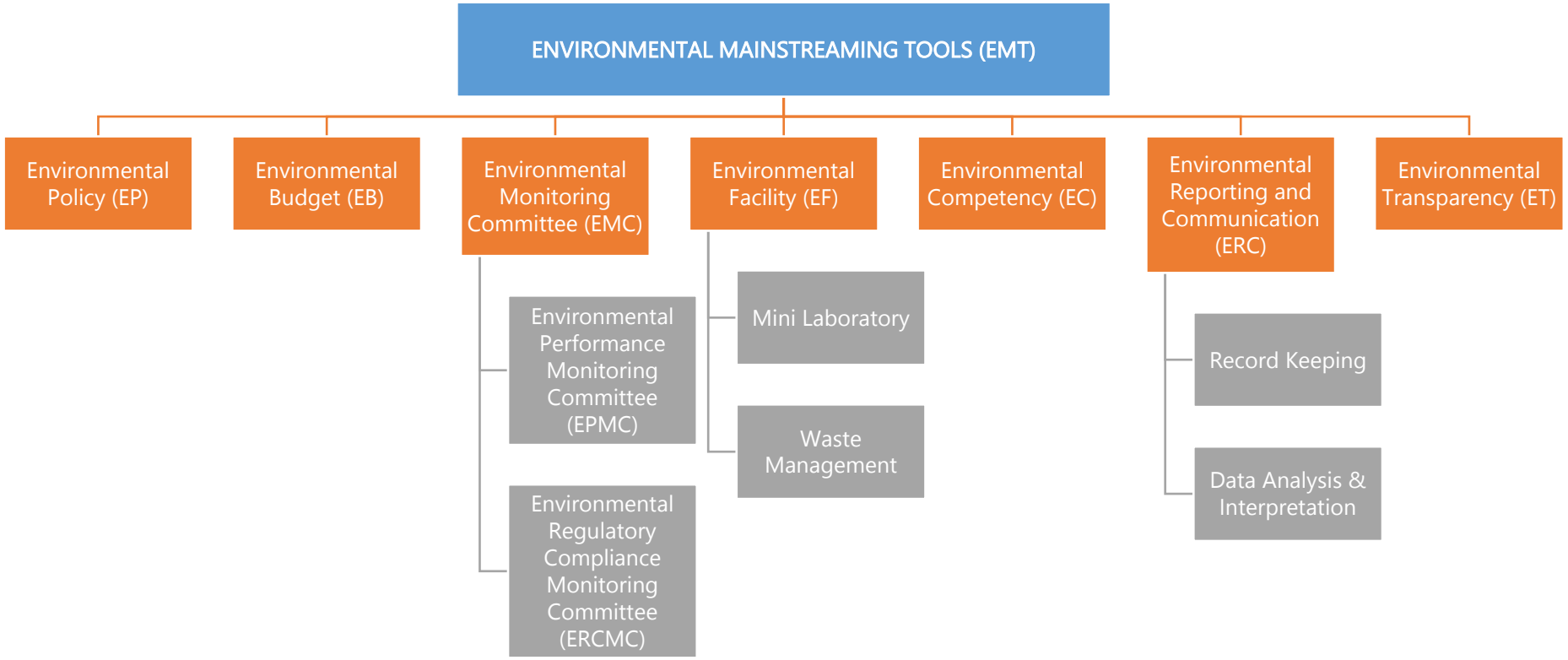
7.3 SELF-REGULATION

Environmental Mainstreaming Tools (EMT) is a strategic tool that allows for the cultural evolution of embracing the environmental agenda at all levels of the organisational structure of the Project Proponent. All key personnel in an organisation can play a role in effectively safeguarding the environment through the execution of Guided Self-Regulation required for all prescribed activities during the project implementation stages. An overview of the EMT is shown in **Figure 7-2**.

7.3.1 Environmental Policy

Environmental Policy refers to the commitment from the Project Proponent on their strong environmental accountability to ensure compliance is through the responsibility of all personnel.

Figure 7-2 Environmental Mainstreaming Tools (EMT)



7.3.2 Environmental Budgeting

A sufficient budget shall be allocated for the implementation of the EMP in the Organisation and shall be reviewed regularly to ensure top priority is given to achieve environmental excellence in its perpetuity.

The Project Proponent has to provide an environmental budget for environmental related commitments, i.e. personnel, P2M2, monitoring, auditing, training, remedial and rehabilitation works.

The budget requirements shall also form part of the bill of quantity (BQ) for the contractors at the contractual stage.

7.3.3 Environmental Monitoring Committee

EMC shall play an important role in identifying all future improvements needed to ensure the EMP has achieved its goal. Implementation of future improvements must be scheduled, and financial resources allocated to ensure that these improvements can be made without delay. The EMC shall comprise of the Environmental Performance Monitoring Committee (EPMC) members and the Environmental Regulatory Compliance Monitoring Committee (ERCMC) Members.

At the operational level, the EPMC is chaired by a senior officer of the organisation. Whereas at the policy level, the ERCMC is headed by the Chief Executive Officer or the chairman of the organisation.

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

7.3.3.1 Environmental Performance Monitoring Committee

EPMC is a committee set up to monitor operations, maintenance and performance of all P2M2s implemented to minimize any adverse impacts of the company's operations on the receiving environment. Members must be appointed by the decision makers in the company and must meet monthly to monitor and report on Environmental Targets met.

The objectives of the EPMC are as follows:

(a) Establish a maintenance programme for pollution control structures, waste management, nuisance factors and all erosion and sedimentation control elements regularly.

(b) Develop training programmes for on-site workers to include awareness of the requirements on good environmental practices and consistent environmental compliance.

(c) Allocate administrative responsibilities for planning and managing the environmental requirements as outlined in the EIA COA.

(d) Ensure the implementation of P2M2.

(e) Implement a monitoring programme (i.e. Impact Monitoring, Compliance Monitoring and Performance Monitoring) to check the effectiveness of the mitigation measures provided.

(f) Ensure that mitigation measures are incorporated in all relevant contracts and design of the site.

7.3.3.2 Environmental Regulatory Compliance Monitoring Committee

ERCMC is a committee set up to monitor the implementation of the EP and to review the regulatory compliance of the EP on a periodically.

The objectives of the ERCMC are as follows:

(a) Implement the EP and make revisions as and when necessary.

(b) Study implications of new environmental regulations on the Company's activities.

(c) Provide financial resources for any environmental improvement projects.

(d) Understand and take ownership of the Company's performance in EM.

(e) Address any non-compliance issues.

7.3.4 Environmental Facility

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

Monitoring is required to show compliance to the relevant standards as stipulated in the Environmental Quality Act 1974 and its subsidiary Regulations.

In addition, Project Proponent and contractors must ensure to comply with all the EIA terms of approval conditions, P2M2 mentioned in EIA report, applicable laws, regulations and guidelines.

7.3.4.1 Mini Laboratory

Project Proponent should set up a mini laboratory on site to ensure immediate results on the performance of P2M2 on site. Qualified Person should analyse the sewage effluent by using proper equipment and follow accredited analysis. In-situ instruments such as pH meter, DO meter, and Turbidity meter should also be provided.

7.3.4.2 Waste Management

The Project Proponent has to establish an efficient waste management system by ensuring that proper waste collection or disposal complies with the environmental regulatory requirements and prevents environmental pollution.

7.3.5 Environmental Competency

Training requirements are needed to ensure competency for environmental management for all relevant site personnel. The competency also acts as a bridge between the Project Proponent to ensure that there is continuous regulatory compliance from the Project Proponent.

The role of the Competent Person is as follows:

(a) Ensures P2M2 is implemented on site.
(b) Conducts and supervises in-situ sampling and testing.
(c) Supervises environmental monitoring.
(d) Ensures corrective actions are implemented.
(e) Conducts daily inspection on site.

(f) Reviews Environmental monitoring reports (EMRs) for compliance to COAs.
(g) Ensure timely submission of the Environmental Monitoring Compliance Reports (EMCRs) and other reports to DOE.

7.3.6 Environmental Reporting and Communication

EMP framework shall contain a reporting schedule for various submissions during the post EIA stage, which includes:

(a) Environmental Management Plan.
(b) Environmental Monitoring Reporting.
(c) Environmental Audit Reporting

The mode of communication between the ERCMC, EPMC and the respective EMTs should be clearly defined. Lines of communication between the Project Proponent and EMC with the relevant stakeholders must also be clearly spelled out, these are not only limited to project site management but also in engagements with affected communities and the general public to manage any potential grievances and expectations.

7.3.7 Environmental Transparency

This refers to the Project Proponent's initiative to be transparent on its implementation and performance of environmental management. Such sharing may be in the form of environmental sustainability report, website, billboard, or fliers.

7.4 MONITORING PROGRAMME

The environmental monitoring programme is an important component of the EMP. Monitoring shall be implemented during the post-EIA stage.

7.4.1 Monitoring Category

Environmental monitoring can be categorised into three main types:

(a) Performance Monitoring (PM)
(b) Compliance Monitoring (CM)
(c) Impact Monitoring (IM)

7.4.1.2 Performance Monitoring

PM relates to the monitoring of the performance treatment systems such as sewage treatment plant (STP), air pollution control systems (APCS) and odour control system.

STPs and STFs operator to ensure system maintenance to be carried out regularly. Examples of maintenance works such as daily check on the technology performance, conducting maintenance on the motor system, and DO probe cleaning.

This shall be undertaken by a Competent Person with expertise in the related treatment system.

7.4.1.3 Compliance Monitoring

CM relates to the monitoring of P2M2 within the site and their performance. Samplings and measurements are usually taken either at the emission or discharge points (i.e. sewage, sediment basin).

This shall be carried out by a Competent Person associated with accredited laboratory.

7.4.1.4 Impact Monitoring

IM may only be required in cases where there is a possibility that the impacts may still affect receptors outside of the project boundary despite the implementation of P2M2. Samplings and measurements are usually taken either from the ambient air, odour, water, noise and vibration and/or from sensitive receptors such as nearby residents and if there are water beneficial activities downstream of the Project.

This shall be carried out by Competent Person associated with accredited laboratory.

7.4.2 Monitoring Programme

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

Details of the monitoring programme are decided upon by the Qualified Person and approved by DOE, before implementation. The monitoring locations, frequencies, parameters to monitor, recommended limits, instrumentation and personnel requirements have to be identified in the EMP. The monitoring programme shall be

tailored for requirements of the Project, based on the site conditions and types of development activities (**Appendix J**).

DOE has the authority to mandate any changes to or requires additional information and data apart from those specified in the EMP.

7.5 AUDIT PROGRAMME

Environmental auditing is a post-EIA evaluation process to determine the effectiveness and performance of the P2M2s in compliance to the COAs by the Project Proponent.

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

7.5.1 Pre-Audit

Preparation of a pre-audit checklist and information request to the auditee. Submission of a notification of audit to DOE and auditee.

7.5.2 On-Site Audit

Briefing to the auditee by Lead Auditor. Audit shall include documentation review, site inspection, interviews with relevant personnel to obtain necessary information to gauge compliance and site sampling (optional). Auditee will be briefed at the Closing Meeting with the on-site Audit Summary submitted to the state DOE.

7.5.3 Post Audit

Lead Auditor shall submit an Audit Report to DOE within 14 calendar days after the site audit. The auditee shall develop a Corrective Action Plan for any non-compliances which shall be submitted to DOE within 21 calendar days of the site audit.

7.6 EMERGENCY RESPONSE PLAN

Emergencies may occur during project implementation and operation. Types of emergencies can be caused by natural hazards and human-induced hazards. Examples of natural hazards include natural disaster such as floods, thunderstorms, forest fires, local and national outbreak, outbreaks due to pathogens with pandemic

potential and pandemic. As for human-induced hazards, the emergencies may be due to technological hazards that can originate from dangerous procedures, infrastructure failures, technological or STPs or STFs conditions or specific human activities. Examples include STPs or STFs pollution, transport accidents, explosions, fires and chemical spills.

Anticipating emergencies and planning a response can greatly lessen the extent of injuries and limit equipment, material and property damage. During EIA stage, it is important for the Project Proponent to provide the expected types of emergencies that may occur in their facility and the basic framework of ERP that shall be included in the EIA report. While it is not possible to plan and be ready for all emergencies, preparedness for emergencies is a means to reduce risks to the project and to the environment. Emergency Response Plan(s) or ERP(s) are intended to provide appropriate guidance on what to do in an emergency.

This guideline is not intended to deal in detail how ERPs are to be formulated. This is best left to the project proponent working in tandem with the relevant authorities, such as the police, fire department, Department of Safety and Health and other emergency services. Nevertheless, ERPs should outline the basic preparedness steps needed to handle the anticipated emergencies and should provide appropriate guidance on what to do during an emergency. A good response plan should include:

- Clear, written policies that designate a chain of command, listing names and job titles of the people (or departments) who are responsible for making decisions, monitoring response actions and recovering back to normal operations;
- Names of those who are responsible for assessing the degree of risk to life and property and who should be notified for various types of emergencies.
- Specific instructions controlling the spread of the damage arising from the emergency situation to the environment including the nearest sensitive receptors
- Procedures for evacuation of surrounding population who are at risk;
- Specific training and practice schedules and equipment requirements for employees who are responsible for rescue operations, medical duties, hazardous responses, firefighting and other responses specific to the work site; and
- The preferred means of reporting fires and other emergencies.

7.7 ABANDOMENT PLAN

Project abandonment can occur during the construction stage or operation stage of the Project due to unforeseen circumstances. The Project Proponent must submit a project abandonment plan to the DOE prior to the abandonment of the Project. In essence, the project abandonment plan shall address the environmental issues arise from the decommissioning including demolition and dismantling activities (but not limited to) such as:

- Air pollution.
- Noise impact.
- Soil erosion.
- Water pollution.
- Solid waste.
- Scheduled waste.

Action plans or measures to be taken shall be outlined in the abandonment plan following all the requirements set by the relevant agencies.

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8

REPORTING AND REVIEW

CHAPTER 8

REPORTING AND REVIEW

8.1 INTRODUCTION

This Chapter provides the format and procedures for an EIA report to be submitted to DOE for approval, after the completion of all other necessary studies and requirements.

8.2 EIA REPORT

An EIA shall be written in a concise manner that is easy to understand and is able to convey the main message to the decision makers. EGIM provides the specifications and format for EIA reporting. The DOE has introduced 3 new elements to improve the existing procedure outlined in EGIM (starting from 1 September 2020) as follows:

- Submission and distribution of TOR/ESI and EIA reports;
- Enhance public display; and
- Restructuring of the Executive Summary.

It will increase the accessibility and dissemination of information digitally. The information will be presented in an easy way to understand, interactive and give high impact on the stakeholders and public understanding.

8.2.1 EIA Report Format

The EIA Report shall typically include the following contents:

(a) Environmental Pledge from the Project Proponent and Declaration from the Qualified Person in the format detailed in Appendix 9 of the EGIM. The environmental pledge must be printed in the respective company's letterhead and attached to the EIA report.

(b) Executive Summary of the EIA Report in Bahasa Malaysia and English.

(c) Brief Introduction to the Project, Project Proponent (address, key person and contact information), Environmental Firm (address, key person and contact information) and EIA Team Members (name, academic qualifications, areas of study, signature).

(d) Review of the policy, regulatory and legal requirements for the Project (refer to **Chapter 2** of this EIA Guideline for details).

(e) Terms of Reference (TOR) for the EIA Study as endorsed by the DOE (refer to **Chapter 3** of this EIA Guideline for details). Endorsement letter from DOE to be attached as an appendix to the EIA Report.

(f) Statement of need for the Project. Supporting arguments for the project to justify its needs and necessity shall be included as part of the report.

(g) Deliberation on the alternatives and project options.

(h) Detailed description of the project including site information, concept and breakdown of major components, material and manpower requirements, project activities (refer to **Appendix A**). Mandatory to be addressed is rehabilitation of site if the project is abandoned at any stage of project activity.

(i) Description of the baseline conditions (physical-chemical, biological and human environment) within the ZOS (or the ZOI, whichever is greater) that may be impacted by the Project (see **Chapter 4** of this EIA Guideline).

(j) Assessment of the significant impacts (positive and negative), prediction of the extent and effects on nearby sensitive receptors and proposal of P2M2 to minimise or enhance these impacts and any potential residual impacts (see **Chapter 5 and 6** of this EIA Guideline).

(k) Details of public consultation and engagement as part of EIA requirements.

(l) Environmental Management Plan (EMP) incorporating the LD-P2M2, monitoring and audit programme (see **Chapter 7** of this EIA Guideline).

(m) Appendices containing technical studies, supporting documentation, results of analysis, list of references, etc to be included.

8.2.2 Executive Summary

The Executive Summary shall be prepared in infographic format in both Bahasa Malaysia and English**,** presenting the following information:

(a) Introduction.
(b) Project Proponent & Qualified Person.
(c) Legislative requirements.
(d) Statement of need.
(e) Project location including relevant maps showing project location and sensitive receptors.
(f) Project Description – include flow diagram of main process.
(g) Project Activities:
- Pre-construction Stage.
- Construction Stage.
- Operation Stage.

(h) Existing Environment.
(i) Impact Assessment & Mitigation Measures:
- A description of performance monitoring (PM) program, compliance monitoring (CM) for pollution prevention and mitigation measure (P2M2) and tabulation of relevant PM parameter, recommended limits, monitoring, locations and frequencies.

Softcopy of the Executive Summary (in PDF format) shall be submitted to the DOE along with softcopy of the full EIA Report.

8.2.3 Data Deliverables

The Project Proponent shall make available all relevant data collected during the EIA study (in raw or processed format) along with the EIA Report, when requested by DOE.

Examples of such data include sampling results (certificates and raw data), modelling databases, baseline data (surveys, hydrographic data and climate data), metadata files, etc. This data shall also be provided to the relevant government agencies upon request.

8.2.4 Conclusion to the EIA Report

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

8.3 EIA REPORT SUBMISSION AND REVIEW PROCESS

EIA report submission shall be in line with the steps and procedures outlined in the EGIM and the current requirements by the DOE mentioned above. Since sewage project is only for First Schedule, the EIA submission and review process for First Schedule EIA is presented in **Table 8-1**.

Table 8-1 Submission and Review Process for First Schedule EIA

Components	First Schedule Activities
Submission of Report	DOE State
TOR/ESI Report Submission	• Three (3) hardcopies and one (1) softcopy in PDF format via email • Distribution of softcopy (CD) to agencies/AI/NGO for comments
EIA Report Submission	• Three (3) hardcopies and one (1) softcopy (CD) to DOE State • One (1) softcopy (CD) to DOE HQ • Distribution of softcopy (CD) to agencies/AI/NGO for comments • Softcopy of Executive Summary (ES) and Ringkasan Eksekutif (RE) in infographic
Review Timeline	Twenty-five (25) working days (5 weeks)
Public Participation in EIA Study	Required
Public Display of EIA Report	Not required
Advertisement of EIA Report	Not required

Note: The Qualified Person shall refer to the latest or updated requirements by the DOE.

REFERENCES

Bull *et al* (2018). IAQM Guidance on the assessment of odour for planning – version 1.1, Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/odour-guidance-2018.

Department of Environment (1985). Development of Water Quality Criteria and Standards for Malaysia.

Department of Environment (2015). Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order.

Department of Environment (2004). Environmental Impact Assessment Guidelines for Risk Assessment.

Department of Environment (2005). Environmental Quality (Scheduled Waste) Regulations.

Department of Environment (2007). The Planning Guidelines for Environmental

Department of Environment (2007). The Planning Guidelines for Vibration Limits and Control in the Environment. Second Edition.

Department of Environment (2009). (Environmental Quality (Sewage) Regulations. In Environmental Quality Act (1974) (Act 127).

Department of Environment (2013). Malaysian Ambient Air Quality Standards (MAAQS). Department of Environment, Malaysia.

Department of Environment (2014). Environmental Quality (Clean Air) Regulations.

Department of Environment (2015). Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order. In the Environmental Quality Act (1974) (Act 127).

Department of Environment (2015). Technical Guidance on Performance Monitoring of Air Pollution Control Systems (APCS)

Department of Environment (2016). Environmental Impact Assessment Guideline in Malaysia (EGIM).

Department of Environment (2017). Environmental Essentials for Siting of Industries In Malaysia (EESIM).

Department of Environment (2017). Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2)

Department of Environment (2017). STS Technical Guidance Document on Performance Monitoring of Sewage Treatment Systems

Department of Environment (2019). Malaysia Marine Water Quality Quality Standards and Index.

Department of Environment (2019). The Planning Guidelines for Environmental Noise Limits and Control. Third Edition.

Department of Irrigation and Drainage (2010). Guideline for Erosion and Sediment Control in Malaysia.

Department of Irrigation and Drainage (2012). Urban Stormwater Management Manual for Malaysia (MSMA). Second Edition.

Federal Department of Town and Country Planning (2016). National Urbanisation Policy 2 for 2016-2025.

Indah Water Konsortium (2011). An Overview of Malaysia's Sewerage Management. Retrieved from http://www.wepa-db.net/pdf/1203forum/20.pdf

Indah Water Konsortium (2019). Population Equivalents. Indah Water Konsortium. Retrieved from https://www.iwk.com.my/do-you-know/population-equivalents

Ministry of Energy, Green Technology and Water (2017). Green Technology Master Plan Malaysia 2017-2030.

Ministry of Health (2000). National Standard for Drinking Water Quality.

Ministry of the Environment (2003). Ontario Ambient Air Quality Criteria (OAAQC). Ministry of Environment, Ontario.

National Land Code (1965) (Act 56).

Nowak, Otto. (2006). Optimizing the Use of Sludge Treatment Facilities at Municipal WWTPs. Journal of Environmental Science and Health. Part A. 41:9. 1807-1817. DOI: 10.1080/10934520600778986

Office of Environmental Health (1999). Arizona Ambient Air Quality Guidelines. The Office of Environmental Health, Arizona Department of Environmental Quality, Air Programs Division.

Pinasseau *et al* (2018). Best Available Techniques (BAT) Reference Document for Waste treatment Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control); EUR 29362 EN; Publications Office of the European Union, Luxembourg, 2018; ISBN 978-92-79-94038-5, doi:10.2760/407967, JRC113018

Plan Malaysia (2018). Manual for Social Impact Assessment of Project Development. Second Edition.

Registration of Engineers Act (1967). Revised in 2015.

Road Transport Act (1987) (Act 333).

Solid Waste and Public Cleansing Management Act (2007).

Southeast Asian Fisheries Development Center, (SEAFDEC). Retrieved from http://www.seafdec.org/malaysia/

Standard and Industrial Research Institute of Malaysia (1991). Malaysian Standard, MS 1228 (Design & Sewerage System Installation).

Street, Drainage and Building Act (1974) (Act 133).

Suruhanjaya Perkhidmatan Air Negara (2008). Malaysian Sewerage Industry Guideline (MSIG), Vol I (Sewerage Policy for New Developments), First Edition

Suruhanjaya Perkhidmatan Air Negara (2009). Malaysian Sewerage Industry Guideline (MSIG), Vol III (Network Sewer & Pump Station). Third Edition.

Suruhanjaya Perkhidmatan Air Negara (2009). Malaysian Sewerage Industry Guideline (MSIG). Vol IV (Sewerage Treatment Plant). Third Edition.

Suruhanjaya Perkhidmatan Air Negara (2013). Malaysian Sewerage Industry Guideline (MSIG). Vol II (Sewerage Works Procedure). Second Edition.

Suruhanjaya Perkhidmatan Air Negara (2013). Water Services Industry (Planning, Design and Construction of Sewerage System and Septic Tank) Rules. Special Edition.

Town and Country Planning Act (1976) (Act 172).

United Nations (2015). Sustainable Development Goals.

United States Environmental Protection Agency (1995). Superfund Program Representative Sampling Guidance Volume 2: Air (Short-term Monitoring) Interim Final.

United States Environmental Protection Agency (2013). Emerging Technologies for Wastewater Treatment and In-Plant Wet Weather Management.

United States Environmental Protection Agency (2013). Emerging Technologies for Biosolid Management.

United States Environmental Protection Agency (2017). SESD Operating Procedure for Groundwater Sampling (SESDPROC-301-R4).

Water Services Industry Act (2006) (Act 655).

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APPENDIX A
PROJECT DESCRIPTION DETAILS

APPENDIX A – PROJECT DESCRIPTION DETAILS

Content	Description
Project Details	• Project title. • Name and contact details of the Project Proponent. • Name and contact details of EIA Team. • Location of project (coordinates, lot no, district etc.). • Relevant map of project location and accessibility.
Project Location	• General site plan including ZOS (5-km radius) and ZOI. • Project boundary and layout (with coordinates). • Description of location in relation to identifiable landmarks (i.e. city centres, main roads, towns etc.).
Project Components	Descriptions of the project components together with the complete layout plan should be given as follows: • Solid screening section (Fine and course screen) • Pumping station • Grit, oil and grease chamber • Primary treatment • Secondary treatment • Tertiary treatment • Sludge thickener area • Filter press for Sludge dewatering area • Sludge cake storage • Blower house • Odour control system • Biogas Facility (If any) • Control/SCADA room
Process Technology	• Detailed explanation on the concept of selected treatment for STPs and STFs • Process flow description from primary treatment to tertiary treatment (if any) and pollution control • Process flow diagram and mass balance.
Detailed Design for Pollution Control System	Detailed design of the pollution control system should be included in the report as follows: • sewage/air emission information. • Process flow chart including the pollution generation points and mass balance. • Flowrate and quality of sewage /air emission for each source. • Discussion of the significant sewage/air emission parameters (maximum and average concentration). • Description of the technologies proposed. • Discussion and statement that the pollution control systems are the "Best Available Technologies" or "Best Available Technologies not entailing excessive cost" or "state of the art technologies". • Working engineering drawings, P&ID, performance monitoring procedure and instruments.

Content	Description
Mass Balance Calculation	• Overall sewage and sludge flow. • Quantification of total inflow and outflow of the process (sewage stream) • Difference between inputs and outputs (waste streams).
Project Activities	• Method statement for major project activities during pre-construction, construction, and operational stages. • Manpower requirements. • Workers quarters location
Infrastructure, Utilities and Amenities Requirement	Details of the estimated demand for: • Water supply. • Electricity. • Sewerage. • Telecommunications. • Transport system. • Waste management.
Project Implementation Schedule	• Estimated timeline for phases implementation from planning to construction and operational phases. • Details of each stages of implementation.

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.

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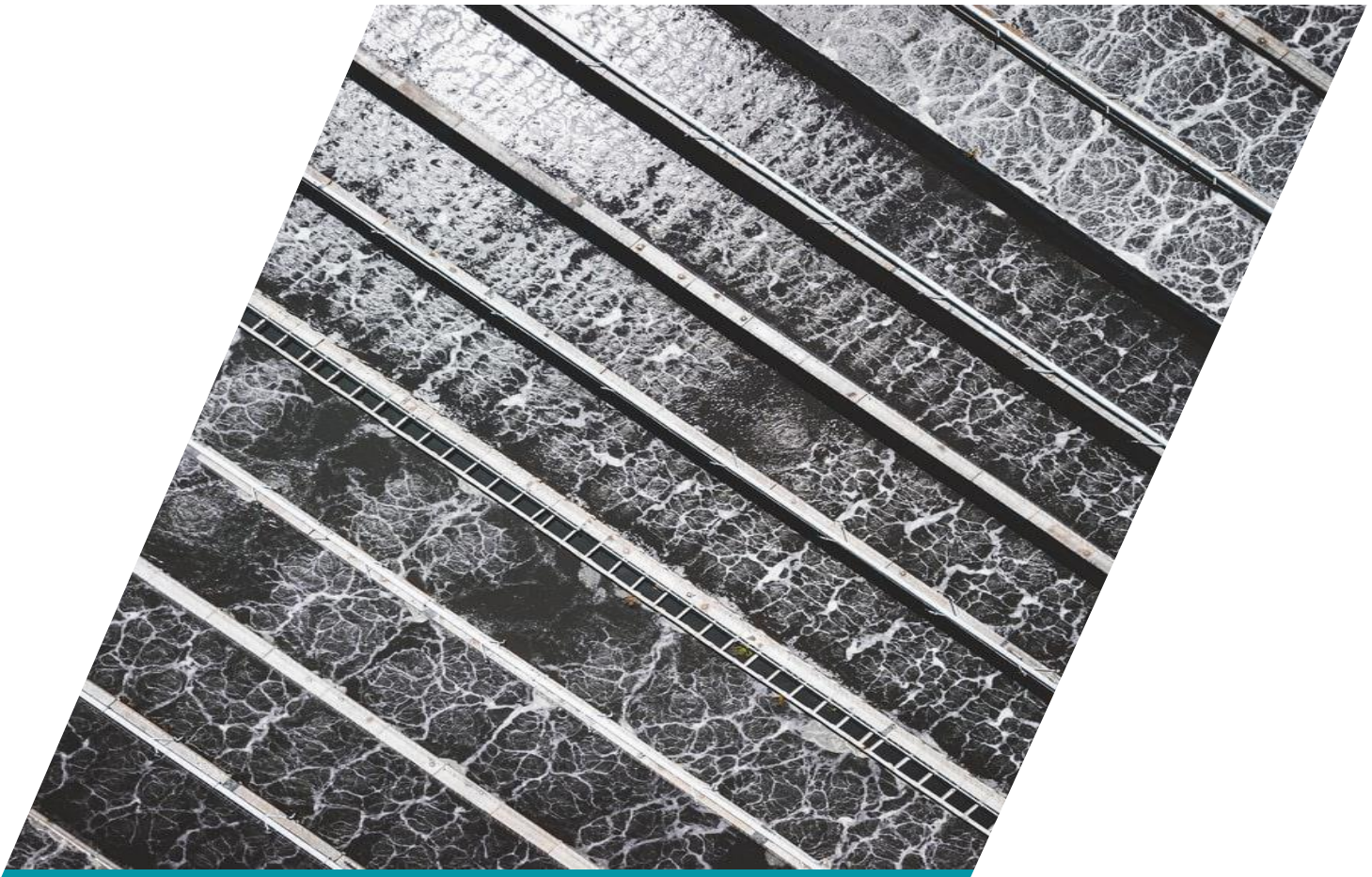

APPENDIX B
GENERAL SITE SELECTION CRITERIA

APPENDIX B – GENERAL SITE SELECTION CRITERIA

Criteria	Description
Proximity to residential areas	• All sewer and sewer appurtenances, pumping stations and treatment works should be located as far from the public right of way and habitable buildings as economically practicable. • Locate preferably downwind of human dwellings. • Secluded locations are best if feasible. If not, suitable buffers and distances from human dwellings must be ensured.
Landuse/ Planning	• The sitting of STPs and STFs should be in line with Sewage Master Plan • STPs and STFs shall be sited away from the followings: i. Existing cemeteries and gazetted reserves for cemetery. ii. Religious centres. iii. Eating places. • STPs shall be located such that sewers are easily connected/conveyed to the proposed site. • If temporary treatment plants are to be provided, they shall be located as near as possible to public trunk sewers. • For safety reasons, STPs and STFs shall be located away from children playgrounds.
Buffer requirement	• Buffer requirements for Sewage Project should comply with Malaysian Sewerage Industry Guideline (MSIG), Vol IV (Sewerage Treatment Plant), Third Edition (2009) as follows: i. Minimum distance of 30 m from the fence of the treatment plant to the nearest habitable building property line within residential and commercial development. ii. Minimum distance of 20 m from the fence of the treatment plant to the nearest property line within industrial development. iii. Minimum distance of 10 m from the fence of the treatment plant to the nearest habitable building property line if the proposed treatment plant is fully enclosed. iv. A minimum distance of 10 m from the fence of the treatment plant to the nearest habitable building property line if the proposed treatment plant is covered or buried. However, this reduction in buffer requirement does not apply if the nearby habitable buildings are of high rise type.
Local soil characteristics, geology, hydrology and topography.	• The terrain such as nature of the ground including the level and variation of the water table must suit the nature of the works to be anticipated. • Choose areas with low water table and easy to work. • Geology – Avoid areas with peat soil to avoid settlement • Topography should permit drainage by gravity into trunk sewers or treatment plants to minimise pumping.

Criteria	Description
Land area available for expansion	• Wastewater sewage treatment plants and the associated conduits for collection and conveyance of wastewater requires large tracks of land. • Land availability, the need for future expansion and associated cost of land has to be considered. • Areas of high land demand & cost, and conflicting interests in land utilisation should be avoided if possible. • Minimise costs incurred and ensure expansion opportunity.
Water pollution	• STPs should preferably be located downstream of water intake points and sensitive freshwater ecosystem area. • STPs shall be located near to a suitable watercourse that is able to receive and assimilate treated effluent from the plant without reducing beneficial uses of the water course downstream • Low flow and the highest known flood level of other watercourses to which discharge of the effluent is possible must be taken into consideration • Emergency bypass shall be provided either at the last manhole or wetwell. The bypass shall discharge to the nearest drain which shall have sufficient capacity to cater for the discharge during rainfall.
Flooding	• Sewage pumping stations should not be subject to flooding and should be located off the right of way of streets.
Solid waste disposal	• Facilities for eventual disposal of sludge and screenings should be located within easy reach of the wastewater treatment plant.

Note: The list is not exhaustive and additional criteria may be required by the relevant agencies. It is the responsibility of the Project Proponent and the Qualified Person to engage with relevant agencies on a case-by-case basis.

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APPENDIX C
BAT & BACT FOR STPs AND STFs

APPENDIX C – BAT AND BACT FOR SEWAGE TREATMENT PLANTS AND SLUDGE TREATMENT FACILITIES

A. List of BAT/BACT for STPs

Treatment Plant Classification	Type of processes
Attached Growth Processes	Tracking Filter
	Rotating Biological Contractor (RBC)
	Submerged Biological Contractor (SBC)
	Fluidised Bed
	Packed Bed Reactor
Suspended Growth Processes	Water Stabilisation Pond System
	Aerated Lagoon
	Conventional Activated Sludge
	Extended Aeration
	Oxidation Ditch
	Deep Shaft
	Sequencing Batch Reactor
Hybrid Processes	Attached Growth and Suspended Growth Processes
Tertiary treatment	Filtration system • To remove suspended solids or colloidal matter in effluent • Filters shall have automated backwash features and sized adequately to allow continuous filtration
	Adsorption (Activated Carbon) • To remove small quantities of refractory organic and inorganic compounds
	Chemical treatment • For acid-base neutralisation and precipitation of phosphorus
	Air Stripping • To remove ammonia nitrogen from effluent
	Reoxygenation • To increase dissolved oxygen levels in effluent through reoxygenation systems such as: i. Cascade From hydraulic design of structure such as weir overflows, flume, spillways, etc. ii. Reoxygenation iii. Mechanical reoxygenation From mechanical equipment such as surface aerators, jet diffusers or diffused air (coarse, fine, bubbles, etc)

Source: USEPA, (2013)

B. List of BAT/BACT for STFs

Treatment Plant Classification	Type of processes
Conditioning	Chemical Conditioning
	Heat Conditioning
	Cell Destruction • To destroy the cell membranes of microbes in waste activated sludge to increase the performance of anaerobic digestion. • Examples: i. Chemical Cell Destruction (Microsludge™) ii. Ultrasonic Cell Destruction iii. Biological Cell Destruction (BIODIET®)
	Electrocoagulation • To increase the rate at which anaerobic digestion of solids occurs.
	Enzyme Conditioning • To degrade organic material to increase the dewaterability of biosolids.
Thickening	Centrifuge
	Gravity-Belt Thickening
	Gravity Thickening
	Rotary Drum Thickening
	Floatation Thickening
	Membrane Thickening
	Recuperative Thickening
	Metal Screen Thickening
Stabilization	Aerobic Digestion • To improve denitrification and enhance aerobic digestion • Examples: i. Autothermal Thermophilic (ATAD) ii. Aerobic/Anoxic Digestion iii. Simultaneous Digestion and Metal Leaching
	Anaerobic Digestion • To increase dewaterability • To produce Class A biosolids for direct land application • To increase biogas production and to reduce odours • Examples: i. Dual Digestion ii. Two-Stage Mesophilic iii. Anaerobic Baffled Reactor iv. Columbus Biosolids Flow-Through v. Thermophilic Treatment vi. High-Rate Plug Flow (Bio Terminator 24/85) vii. Temperature Phased Anaerobic Digestion viii. Thermal Hydrolysis (CAMBI Process) ix. Thermophilic Fermentation (ThermoTech™) x. Three-Phase Anaerobic Digestion xi. Two-Phase Acid Gas Anaerobic Digestion xii. Ozone Treatment
	Alkaline Stabilisation
	Advanced Alkaline Stabilisation
	Composting
	Pasteurisation
	Solidification

Treatment Plant Classification	Type of processes
	Synax
	Vermicomposting • To achieve pathogen reduction • To produce a land application-quality compost from biosolids
	Disinfection • To stabilise and disinfect wastewater solids • Examples: i. Ferrate Addition ii. Irradiation iii. Neutraliser
Dewatering	Belt Filter Press
	Centrifuge
	Chamber Press
	Drying Beds • To dry biosolids to a higher solid percentage. • Examples: i. Auger-Assisted ii. Natural Freeze-Thaw iii. Vacuum-Assisted iv. Quick Dry Filter Beds
	Vacuum Filters
	Electrodewatering • To enhance conventional dewatering using electric current • Examples: i. Electroacoustic ii. Electroosmotic
	Metal Screen Filtration • Inclined Screw Press
	Textile Media Filtration • To increase cake solids content in biosolids with lower energy requirements • Examples: i. Bucher Hydraulic Press ii. DAB System iii. Geotube Container
	Membrane Filtration • To increase percent of solids in biosolids cake • Example - Membrane Filter Press
	Simon Moos • For on-site dewatering for septic tanks and small wastewater treatment plants • Example - Tubular Filter Press
	Thermal Conditioning and Dewatering • Increase the dewaterability of sludge without chemical additive • Example - Mechanical Freeze Thaw
Thermal Conversion	Combustion • Fluidised-Bed Furnace • Multiple-Heath Furnace

Treatment Plant Classification	Type of processes
	• Reheat and Oxidise (RHOX) • Molten Salt Oxidation • Oxygen-Enhanced Incineration
	Oxidation: • Wet Air Oxidation • Supercritical Water Oxidation • Deep-Shaft Wet Air Oxidation (VERTAD™) • Plasma Assisted Sludge Oxidation
	Vitrification • Reduce the volume of biosolids while producing potentially usable by-products • Examples: i. Minergy ii. Melting Furnace
	Fuel Production • To convert biosolids into a renewable fuel • Examples: i. Gasification ii. Sludge-to-Oil iii. SlurryCarb
Drying	Direct Drying
	Flash Drying
	Indirect Drying
	Belt Drying • For drying of biosolids to 90% or more solids
	Direct Microwave Drying • To remove excess water from waste activated sludge and reduce pathogens.
	Flash Drying • For drying of biosolids to 90% or more solids
	Fluidised Bed Drying • For drying digested/undigested municipal biosolids to Class A levels
	Chemical Drying
	Multiple Effect Drying
Other processes	Cannibal Biosolids Destruction Process • To reduce biosolids volume without digestion, thickening, dewatering or polymer addition
	Lystek Thermal/Chemical Process • To produce high solids and pathogen-free product for beneficial use
	Injection in Cement Kiln • To reduce emission of nitrogen oxides (NO_X) and/or fuel usage

Source: USEPA, (2013)

C. BACT to reduce air pollutant and odour

Technique	Description
Adsorption	To remove hydrogen sulphide, and odorous compounds by using adsorbent such as activated carbon.
Biofilter	A biofilter consists of a bed of media with immobilized microbes that biodegrade pollutants passed through in an air stream. It is able to remove ammonia, hydrogen sulphide, and odorous compounds.
Integrated Photocatalytic Ion Deodorization System	Involves physical and chemical reaction which eventually transformed the odorous gas into carbon dioxide (CO_2) and water (H_2O).

Source: Pinasseau et al, (2018)

D. BACT to reduce noise and vibration emissions

Technique	Description
Appropriate location of equipment and buildings	Noise levels can be reduced by increasing the distance between the emitter and the receiver, by using buildings as noise screens and by relocating building exits or entrances.
Operational measures	This includes techniques such as: i. Inspection and maintenance of equipment; ii. Closing of doors and windows of enclosed areas, if possible; iii. Equipment operation by experienced staff; iv. Avoidance of noisy activities at night, if possible; v. Provisions for noise control during maintenance, traffic, handling and treatment activities.
Low-noise equipment	This may include direct drive motors, compressors, pumps and flares.
Noise and vibration control equipment	This includes techniques such as: i. Noise reducers; ii. Acoustic and vibrational insulation of equipment; iii. Enclosure of noisy equipment; iv. Soundproofing of buildings.
Noise attenuation	Noise propagation can be reduced by inserting obstacles between emitters and receivers (e.g. protection walls, embankments and buildings).

Source: Pinasseau et al, (2018)

E. List of Emerging Technologies for STPs and STFs

No	Emerging Technologies
1.	Alternative Disinfectants [Peracetic Acid (PAA) and BCDMH]
2.	Ammonia Recovery
3.	Blue CAT™
4.	Salsnes Filter
5.	Membrane Biofilm Reactor (MBR)
6.	Vacuum Rotation Membrane (VRM®) System
7.	OpenCel Focused Pulse
8.	Integrated Fixed-film Activated Sludge (IFAS) Systems with Biological Phosphorus Removal
9.	Multi-Stage Activated Biological Process (MSABP™)
10.	Aerobic Granular Sludge Process (AGSP)
11.	Biological Micro-Electro-Mechanical Systems (BioMEMS)
12.	Fluorescence In Situ Hybridization (FISH) for Phosphorus Accumulating Organisms (PAOs)
13.	Handheld Advanced Nucleic Acid Analyzer (HANAA)
14.	Immunosensors and Immunoassays
15.	Photo-electro Chemical Oxygen Demand (PeCOD™)
16.	Critical Oxygen Point Control
17.	Membrane Air Scour Alternatives
18.	Ultra-fine Bubble Diffusers
19.	Automated Channel Routing for UV Disinfection
20.	Low Pressure High Output Lamps for UV Disinfection
21.	Solar Drying of Sewage Sludge

Source: USEPA, (2013)

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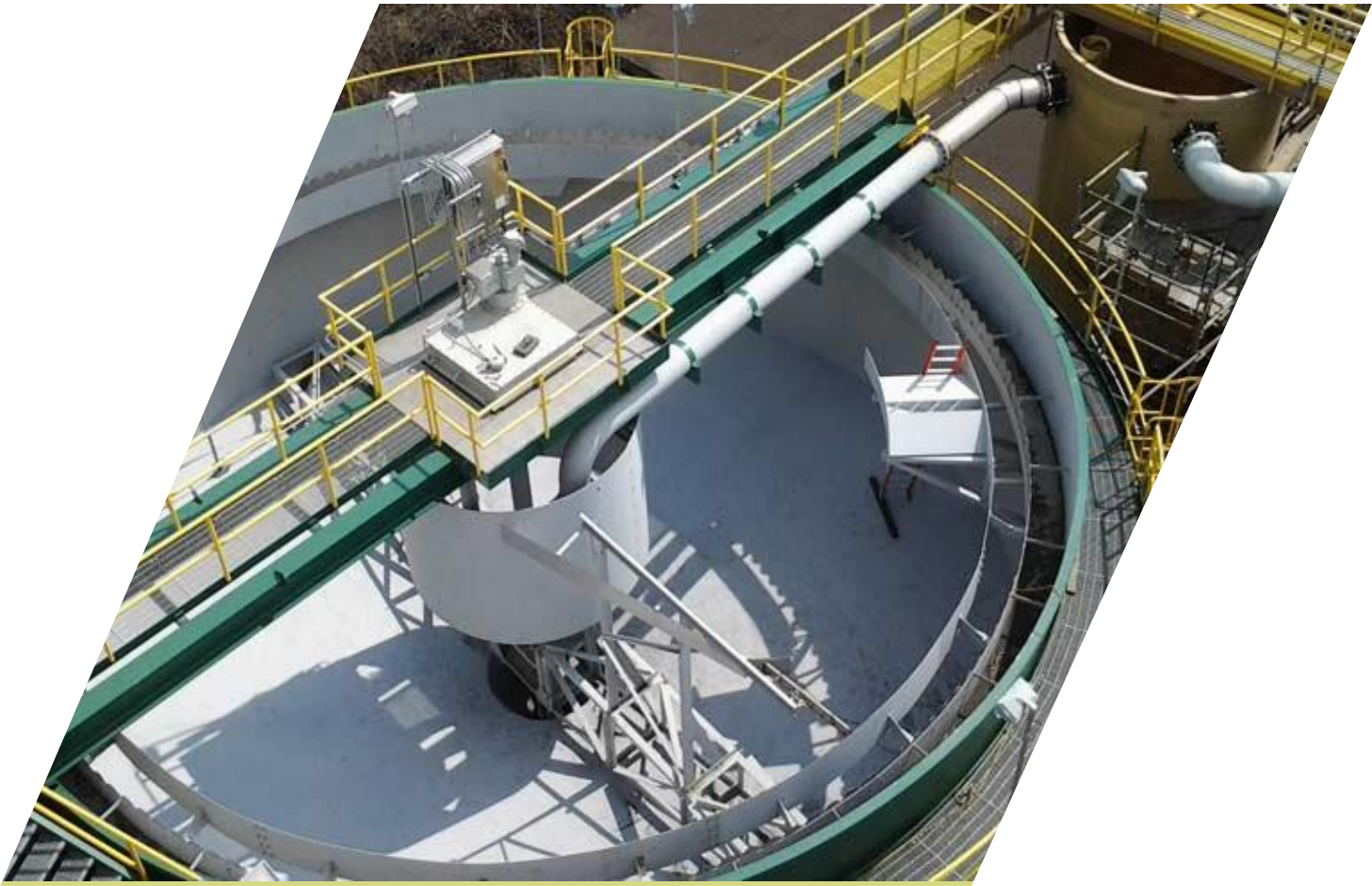

APPENDIX D
KEY PROJECT ACTIVITIES

APPENDIX D – KEY PROJECT ACTIVITIES

Prescribed Activities	Stages			
	Pre-Construction	**Construction**	**Operation**	**Abandonment**
First Schedule, Activity 14(c)(i) – Construction of sewage treatment plant with 20,000 population equivalent or more	• Access Tracks • Survey • Site Investigation • Land Acquisition	• Site Construction Facility • Site Clearance • Site Formation • Ancillary/ Infrastructural works • Excavation, trenching, tunnelling, laying of conduits, filling and resurfacing, road diversion activities • Construction of pump-houses, storage tanks, manholes and STPs • Environmental Monitoring • Environmental Audit • Event Contingency / Emergency Responses Exercises	• Conveyance of sewage to site • Preliminary, secondary and tertiary treatment. • Pumping treated water to discharge • Sludge treatment (dewatering, conditioning, digestion, thickening and drying) • Sludge management (storage, handling and transfer) • Occupational and safety measures during operation management • Environmental Monitoring • Environmental Audit • Power failure/ abnormal operating conditions	• Decommissioning, dismantling and removal of STPs and STFs • Demolition and Disposal of Building Structures • Site Restoration, rehabilitation, Post Closure Landuse Plan
First Schedule, Activity 14(c)(ii) – Sludge Treatment Facilities		• Site Construction Facility • Site Clearance • Site Formation • Ancillary/ Infrastructural works • Excavation, trenching, filling and resurfacing, road diversion activities • Construction of sludge treatment facilities • Environmental Monitoring	• Sludge receiving • Sludge treatment (dewatering, conditioning, digestion, thickening and drying) • Sludge management (storage, handling and transfer)	

Prescribed Activities	Stages			
	Pre-Construction	**Construction**	**Operation**	**Abandonment**
		• Environmental Audit • Event Contingency / Emergency Responses Exercises	• Occupational and safety measures during operation management • Environmental Monitoring • Environmental Audit • Power failure/ abnormal operating conditions	

Note: The list is not exhaustive and additional activities may be relevant depending on the scale, nature and location of the Project Site. It is the responsibility of the Project Proponent and Qualified Person to identify relevant activities based on case-by-case basis.

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Waste Treatment & Disposal
-Sewage

APPENDIX E

ENVIRONMENTAL SCOPING MATRIX

APPENDIX E – ENVIRONMENTAL SCOPING MATRIX

Key Project Activities	Environmental Components											
	Air Quality & Odour	**Surface Water Quality**	**Noise & Vibration**	**Geology & Soil**	**Groundwater Quality**	**Waste Generation**	**Terrestrial and aquatic Flora & Fauna**	**Land Use**	**Land Traffic & Transportation**	**Socio-Economic**	**Public Health**	**Risk**
Pre-Construction												
Access Tracks												
Survey												
Site Investigation												
Land Acquisition												
Construction												
Site Clearing												
Earthworks												
Ancillary/ Infrastructural works												
Construction of pump-houses, storage tanks, manholes												
Construction of buildings / machineries												
Operation												
Conveyance of sewage to site												
Preliminary Treatment												
Secondary Treatment												
Tertiary Treatment												
Pumping treated sewage to discharge												
Sludge Treatment												
Sludge Management (storage, handling and transfer)												

Key Project Activities	Environmental Components											
	Air Quality & Odour	**Surface Water Quality**	**Noise & Vibration**	**Geology & Soil**	**Groundwater Quality**	**Waste Generation**	**Terrestrial and aquatic Flora & Fauna**	**Land Use**	**Land Traffic & Transportation**	**Socio-Economic**	**Public Health**	**Risk**
Occupational and safety												
Power failure / abnormal operating condition												
Abandonment												
Decommissioning, dismantling and removal of STPs and STFs												
Demolition and Disposal of Building Structures												
Site Restoration and Rehabilitation												

Note:

Positive Impact		Negative Impact	
P1	Low	N1	Low
P2	Medium	N2	Medium
P3	High	N3	High
0	Neutral		

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Waste Treatment & Disposal
-Sewage

APPENDIX F
PARAMETER AND ANALYSIS FOR BASELINE SAMPLING

APPENDIX F – PARAMETER AND ANALYSIS FOR BASELINE SAMPLING

Environmental Components	Parameters	Unit	Criteria for Data Analysis	Remarks
Ambient Air Quality	Particulate Matter (PM_{10})	24 hours	• Malaysia Ambient Air Quality Standards (MAAQS) 2013	• Within project site and surrounding sensitive receptors(s) especially at sensitive receptor(s) located downwind to the project area. • Air quality monitoring should consider the basic parameters in MAAQS 2013. • Wind measurement (wind direction and wind velocity) at each monitoring location should be taken throughout the monitoring period (i.e. 24-hr). • The Qualified Person should consider baseline for the sensitive receptor(s) and other parameters that will be predicted/modelled in the air quality impact assessment.
	Particulate Matter ($PM_{2.5}$)	24 hours		
	Sulphur Dioxide (SO_2)	24 hours		
	Nitrogen Oxides (as NO_2)	1 hour		
	Carbon Monoxide (CO)	8 hours		
	Ground Level Ozone (O_3)	8 hours		
Odour	Perceived Odour	D/T	• Currently no standards /guidelines available.	• Within project site and surrounding sensitive receptor(s) especially at sensitive receptor(s) located downwind to the project area. • To note the wind speed, wind direction, surface temperature and relative humidity at each sampling point during sampling. • The Qualified Person should consider baseline for the sensitive receptor(s) that will be predicted/modelled in the odour impact assessment.
	Odour concentration	OU/m^3		

Environmental Components	Parameters	Unit	Criteria for Data Analysis	Remarks
Noise	LA_{eq}, LA_{max}, LA_{min}, LA_{90}, LA_{10}	24 hours	• Guidelines for Environmental Noise Limits and Control Third Edition, 2019. Schedule of Permissible Sound Levels.	• Within project site and surrounding sensitive receptor(s). • The Qualified Person should consider baseline for the sensitive receptor(s) that will be predicted/modelled in the noise impact assessment.
Vibration	Peak particle velocity be measured simultaneously in the three orthogonal x, y, z axes, computed vectorial sum	m/s	• The Planning Guidelines for Vibration Limits and Control in the Environment Second Edition, 2007. Annex A: Schedule of Recommended Vibration Limits.	• Within project site and surrounding sensitive receptor(s). • The Qualified Person should consider baseline for the sensitive receptor(s) that will be predicted/modelled in the vibration impact assessment.
Surface Water Quality	pH (in-situ reading)#	-	• National Water Quality Standards (NWQS)	• Samples should be analyzed for all parameters coherent to the Environmental Quality (Sewage) Regulations 2009. • # means parameters in the Water Quality Index (WQI) should be included the baseline sampling. • Upstream and downstream of the project point of discharge. • * means parameter to be considered if the river has a tidal effect. • Hydraulic measurement (depth, width and velocity) should be taken for modelling purposes.
	Temperature (in-situ reading)	^{o}C		
	Dissolved Oxygen (DO) (in-situ reading)#	mg/L		
	Dissolved Oxygen (DO) saturation	%		
	Colour	TCU		
	Turbidity	NTU		
	Biochemical Oxygen Demand (BOD_5)#	mg/L		
	Chemical Oxygen Demand (COD)#	mg/L		
	Total Suspended Solids (TSS)#	mg/L		
	Oil and grease (O&G)	mg/L		

Environmental Components	Parameters	Unit	Criteria for Data Analysis	Remarks
	Ammoniacal Nitrogen (NH_3-N)#	mg/L		• The Qualified Person should consider baseline for the sensitive receptor(s) that will be predicted/modelled in the water quality impact assessment.
	Faecal coliforms	Count/100 mL		
	E. coli	Count/100 mL		
	Chloride	mg/L		
	Nitrite (NO_2)	mg/L		
	Nitrate (NO_3)	mg/L		
	Phosphorus (P)	mg/L		
	Conductivity*	um		
	Salinity*	ppt		
	Water flowrate	m^3/day		
Marine Water Quality	pH	-	• Malaysian Marine Water Quality Standards (MMWQS)	• Sampling needed if the project site is located adjacent to the coast where sewage being discharged into the sea. • # Parameters in the Malaysian Marine Water Quality Index (MMWQI) should be included in the baseline sampling • Minimum 5 locations (to cater for longshore current patterns) • Sampling should be conducted at three level (surface, mid depth and bottom) • Sampling should be conducted during high and low tides; spring and neap tides
	Temperature	°C		
	Dissolved Oxygen#	mg/L		
	Colour	TCU		
	Turbidity	NTU		
	Total Suspended Solids#	mg/L		
	Biochemical Oxygen Demand (BOD_5)	mg/L		
	Chemical Oxygen Demand (COD)	mg/L		
	Phosphate (PO_4)#	mg/L		
	Nitrate (NO_3)#	mg/L		
	Ammonia#	mg/L		
	Oil & Grease	mg/L		
	Polynuclear Aromatic Hydrocarbons (PAH)	mg/L		
	Tributyltin (TBT)	µg/L		
	Conductivity	us/cm		
	Salinity	ppt		
	Faecal coliform#	Count/100 mL		

Environmental Components	Parameters	Unit	Criteria for Data Analysis	Remarks
Groundwater quality (if required)	pH value#	-	Groundwater Quality Standards for Conventional Raw Water Treatment (Drinking Water).	• Upstream and downstream of the project site in the direction of groundwater flow. • Focus on aquifer important as source of water for drinking purposes. • **#** Parameters in the National Groundwater Quality Index (NGQI) should be included in the baseline sampling.
	Turbidity	NTU		
	Temperature	°C		
	Dissolved Oxygen	mg/L		
	Conductivity	µS/cm		
	Biochemical Oxygen Demand	mg/L		
	Chemical Oxygen Demand	mg/L		
	Total Suspended Solids	mg/L		
	Total Dissolved Solids#	Mg/L		
	Iron (Fe)#	mg/L		
	Phenol#	mg/L		
	Oil and Grease	mg/L		
	Sulphate (SO_4)#	mg/L		
	Ammoniacal Nitrogen	mg/L		
	Colour	TCU		
	Faecal coliform	Count/100 mL		
	Total coliform	MPN/100 mL		
	E. coli#	Count/100 mL		
	Hardness ($CaCO_3$)	mg/L		
	Nitrite (NO2)	mg/L		
	Nitrate (NO3)#	mg/L		
	Chloride (Cl-)	mg/L		

Note: The list above is not exhaustive and represents optional sampling locations and test methods for different parameters of various environmental components, where the Qualified Persons shall be responsible for determining the relevant requirements based on the project needs

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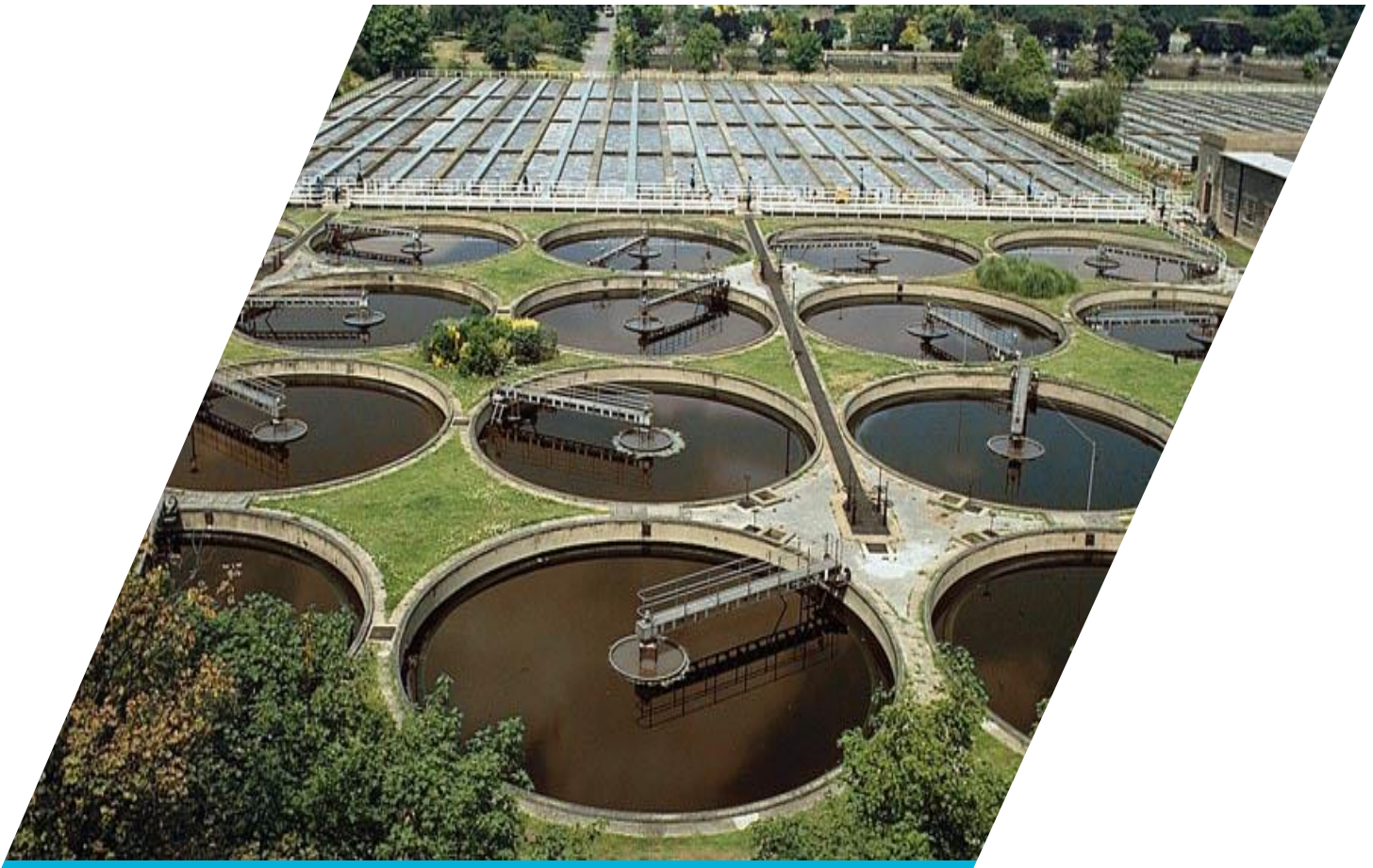


APPENDIX G
AIR QUALITY MODELLING TOOLS

APPENDIX G – EXAMPLES OF COMMON AIR QUALITY MODELLING TOOLS

Tools	SCREEN View	AERMOD View	AERSCREEN View	TSCREEN	CTSCREEN
Description	• User friendly interface for SCREEN3. • Preliminary modelling with SCREEN View can remove the need for more complicated modelling, saving time and resources.	• Complete and powerful air dispersion modelling package used extensively to assess pollution concentration and deposition from a wide variety of sources. • Incorporates building downwash algorithms, advanced depositional parameters, local terrain effects, and advanced meteorological calculations.	• User friendly interface for AERSCREEN screening-level air quality model and associated modelling programs. • Estimate worst-case impacts of ground level concentrations for a single source by interfacing with the screening mode of the AERMOD model.	• Toxics Screening Model (TSCREEN) is a Gaussian model that implements the procedures to correctly analyse toxic emissions and their subsequent dispersion from one of many different types of possible releases for superfund sites.	• CTSCREEN is a Gaussian plume dispersion model designed as a screening technique for regulatory application to plume impaction assessments in complex terrain. CTSCREEN is a screening version of the CTDMPLUS model.
Input Required	• Source type • Source parameters (emission rate, stack height and diameter, stack gas exit velocity and temperature, ambient air temperature)	• Source type • Source parameters (GPS coordinate, emission rate, stack height and diameter, stack gas exit velocity and temperature)	• Source type • Source parameters (emission rate, stack height and diameter, stack gas exit velocity and temperature, air temperature) • Building data	• Particulate matter emission type • Source parameters (emission rate, stack height and diameter, stack gas exit velocity and temperature) • Building parameters	• Terrain data • Wind speed • Terrain height • Wind directions

Tools	SCREEN View	AERMOD View	AERSCREEN View	TSCREEN	CTSCREEN
	• Dispersion coefficient • Receptor data (height above ground)		• Meteorological data • Terrain data • Receptors' distances	• Terrain type • Averaging time	
Output	• Distance vs concentration graph	• Maximum concentration by distances • 3D visualization of emission concentration	• Final maximum concentration and maximum concentration at the minimum ambient distance • Fumigation results • Maximum concentrations by distance • Meteorology associated with the maximum concentration	• Maximum concentration and the distance to the maximum • Dispersion characteristics and pollutant • Concentrations of the resulting plume	• Worst-case 1hour concentration
Price	Free	Paid (inquire from developer)	Paid (inquire from developer)	Free	Free

Source: Environmental Essential for Siting of Industries in Malaysia, (2017).

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 suitable assessment tools to assess the impacts. Proposed assessment models shall be well established, acceptable to DOE and that newer predictive models can be used if the models are more robust.

EIA GUIDELINES

Waste Treatment & Disposal
-Sewage

APPENDIX H
QRA MODELLING TOOLS

APPENDIX H – EXAMPLES OF COMMON QRA MODELLING TOOLS

Name	ALOHA™	PHAST™	EFFECTS	TEREX	WHAZAN
Application	➢ Rapid prediction of source strength and dispersion during emergency response ➢ Generates a variety of scenario-specific output, including threat zone pictures, threats at specific locations, and source strength graphs. ➢ Calculates how quickly chemicals are escaping from tanks, puddles, and gas pipelines – and predicts how those release rates change over time. ➢ Models many release scenarios: toxic gas clouds, BLEVEs, jet fires, vapor cloud explosions, and pool fires. ➢ Evaluates different types of hazard (depending on the release scenario):	➢ PHAST is the industry standard tool for process hazard analysis. ➢ It is used to estimate, understand and visualize the effects from loss of containment scenarios. ➢ Comprehensive hazard analysis facilities to examine the progress of a potential incident from the initial release to its far-field effects. ➢ Predict all possible complex	➢ Assess the physical effects of accidental releases of toxic or flammable chemicals. ➢ Detailed modelling and quantitative assessment of release rate pool evaporation, atmospheric dispersion, Vapour Cloud Explosion, Combustion, heat radiation effects from fires etc.	➢ Simulating concrete risk sources in industrial processes ➢ Civil crisis planning where the main threat is a terrorist attack ➢ Army modelling for an attack with hazardous substances, chemical and combat weapons for determining the area struck ➢ The rapid determination of the extent of the threat and the realization of subsequent measures for population	➢ Explore the consequences of a set of release scenarios (outflow of chemical, behaviour immediately after release, dispersion in the atmosphere, fires and explosion, indoor gas build up etc.)

Name	ALOHA™	PHAST™	EFFECTS	TEREX	WHAZAN
	toxicity, flammability, thermal radiation, and overpressure. ➢ Models the atmospheric dispersion of chemical spills on water.	consequences from possible release of hazardous material. ➢ PHAST includes a wide range of models for discharge and dispersion as well as flammable, explosive and toxic effects.		protection, especially the area struck and the necessary evacuation. ➢ Basic modules to assess accident events: -Dangerous chemical substances (TOXI, UVCE, FLASH FIRE) -Explosive systems (TEROR) -Toxic agents (POISON)	
Limitation	➢ ALOHA's concentration estimates (Gaussian assumption) can be less accurate when any condition exists that reduces mixing in the atmosphere. ➢ Concentration patchiness, particularly	➢ PHAST has limitations on the source term for maximum temperature and cannot deal with temperatures above 600°C.			➢ Only 30 chemicals are available in the supplied database. ➢ Software does not produce consequence data for all situations (e.g. dust explosion)

Name	ALOHA™	PHAST™	EFFECTS	TEREX	WHAZAN
	near the source makes the estimate unreliable. ➢ ALOHA does not account for some effects such as: - Byproducts from fires, explosions, or chemical reactions - Particulates - Chemical mixtures - Wind shifts and terrain steering effects - Terrain - Hazardous fragments				➢ The program does not make estimates of the frequency of the scenarios or risk.
Input	➢ Scenario information (e.g. chemical, weather conditions, and the type of release)	➢ Basic information about storage or process conditions and material properties			➢ Quantities of hazardous substances and site conditions ➢ Physical and chemical Data from built in chemical database
Output	➢ Graphical outputs ➢ GIS-Compatible output (ALOHA's threat zones can be displayed on maps)	➢ Graphical or report outputs ➢ GIS-Compatible	➢ Graphical outputs ➢ Reports ➢ Contours on map (incorporated GIS tool)	➢ Situation of modelling ➢ Characteristics of a danger ➢ Marking out a	➢ Consequence calculation in both graphical and tabular form

Name	ALOHA™	PHAST™	EFFECTS	TEREX	WHAZAN
		output		danger zone ➢ GIS-compatible	
Special Feature	➢ A part of CAMEO® software suite. ➢ Large chemical library (approximately 1,000 common hazardous chemicals) ➢ Pre-accident modelling	➢ Integrated material property database containing more than 1,600 pre-defined pure component chemicals	➢ Complete and industry standard chemical database, containing over 2200 toxic and flammable values and all thermodynamic properties. ➢ Pre accident modelling ➢ Modelling the effects of accidental release of hazardous substances	➢ Post-accident modelling	➢ Process hazard screening tool

Source: Environmental. Essential for Siting of Industries in Malaysia, (2017).

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 suitable assessment tools to assess the impacts. Proposed assessment models shall be well established, acceptable to DOE and that newer predictive models can be used if the models are more robust.

EIA GUIDELINES

Waste Treatment & Disposal
-Sewage

APPENDIX I

EXAMPLES OF POLLUTION PREVENTION AND MITIGATION MEASURES

APPENDIX I – EXAMPLES OF POLLUTION PREVENTION AND MITIGATION MEASURES

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
Pre-Construction		
• Soil Investigation • Site Survey • Land Acquisition	• Soil erosion and sedimentation	• Project Proponent shall avoid conducting soil investigation and site survey during rainy day or wet season.
	• Socio-economic impact if relocation of local community	• Site survey to clearly establish the boundary of the acquired land shall be conducted before any land clearing work starts to avoid disputes. Areas to be acquired / developed and areas to be preserved (buffer zone) must be clearly defined and agreed upon by all parties. • Any relocation, Project Proponent shall ensure the relocation is planned and carried out in a proper manner, provide some compensation for the affected community.
Construction		
• Site Clearance • Establishment of Access Road • Pipeline Installation Works • Mobilisation of Machinery and Equipment • Civil and Structural Work	• Soil erosion and sedimentation	• Project Proponent shall conduct Land-Disturbing Pollution Prevention and Mitigation Measures LD-P2M2 (refer to **Section 6.4**). • Preparation of ESCP (construction of temporary silt fence, temporary silt trap, stockpile area, sandbag, wash trough and temporary earth drain). • Earthworks to carry out in phases. • Schedule to avoid rainy day or wet season. • Vegetated buffer strip recommended to be established. • Turf all bare grounds immediately. • Planning and implementation of BMP.
• Mechanical and Electrical Installation	• Generation of dust and deterioration in air quality	• Provision of temporary wash trough for wheel washing facility to clean tyres of vehicles from dirt and mud. • Cover trucks carrying earth or other materials with canvas. • Spray Project site with water by using water bowser especially during dry weather.

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
		• Store and cover the construction raw materials such as sand, gravel and cement in a proper and neat manner. • Prohibition of open burning.
	• Deterioration in water quality	• Provision of proper internal or temporary drainage system at Project site. • Construction of check dam, silt traps or sediment basins for temporary retention of runoff from disturbance areas. • Construction of silt fence. • De-silted of sediment basin and check dam should be performed regularly to ensure it function effectively. • Use of active treatment systems (if needed) such as flocculants, anionic polymers, etc. in constrained areas to accelerate entrapment and settlement of fine sediments. • Provision of proper toilet facility for construction workers and maintenance in accordance to the National Water Services Commission (NWSC) requirements. • Sewage discharge from toilet facility should comply with the limits stipulated in the Environmental Quality (Sewage) Regulations, 2009. • Periodical de-sludging of sewage treatment system to ensure that the treatment systems are effective at all times
	• Groundwater contamination due to spillage	• Ensure that chemicals are stored in proper storage • Ensure that storage diesel fuel is bunded. • Regular inspection for construction machineries and vehicles • Prepare and follow ERP and SOP to handle any spillage of chemicals or diesel fuel
	• Noise and vibration	• Erection of hoarding along the perimeter of the Project Site. • Periodical maintenance of all equipment and machinery. • Restrict speed limit of vehicles. • Schedule piling works during day time and week days. • Limit hours of construction activities to reduce noise disturbance.

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
		• Workers at construction site should be provided with proper Personal Protective Equipment (PPE) (i.e. earmuff, earplug, safety helmet, safety shoes, etc.).
	• Solid waste generation (biomass, excess soil and domestic wastes)	• Proper management of waste by implementing 4R (Reduce, Reuse, Recover and Recycle). • Transport and dispose waste at approved landfill. • Strictly prohibit waste from being discharged into waterways. • Provide adequate number of waste bins at strategic locations around the site office and work areas. • Practice good housekeeping.
	• Scheduled waste generation	• Store and dispose scheduled waste by following the Environmental Quality (Scheduled Waste) Regulations 2005 as follows: i. Provision of suitable and adequate temporary scheduled waste storage area with containment facility and security. Containment facility shall be designed to contain 110% of the largest inventory of liquid scheduled waste. Containment facility shall be made from impermeable materials with spill recovery facility. ii. Competent person must conduct scheduled waste notification, labelling, inventory, and consignment to track and control movement of scheduled wastes. iii. Scheduled waste management and disposal at licensed facilities using licensed transporters.
	• Socio-economic impact if relocation of local community	• Any relocation, Project Proponent shall ensure the relocation is planned and carried out in a proper manner, provide some compensation for the affected community.
	• Possible criminal case increment	• Contractor must ensure all legal requirements for construction workers are fulfilled.

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
	• Possible social conflict between local community and workers.	
	• Health risks to local residents and construction workers	• Implementation of safe work practises among the construction workers • Ensure Project site is always clean and not being a potentially surface water holding area that can be mosquito breeding ground. • Hoarding should be constructed along site perimeter to avoid trespassing • Fogging at construction site should be conducted regularly. • Ensure all wastes including construction waste and solid waste are collected and stored in a closed container. • All workers at construction site should undergo health screening and necessary vaccination in accordance to relevant requirement (i.e. MOH) to avoid infectious disease epidemic. • Any cases involving infectious disease at site must be immediately reported to local District Health Office.
	• Traffic increment	• Restrict movement of vehicles and machinery. • Vehicular movements for transportation purposes and other associated activities, particularly heavy, slow- moving vehicles, should be avoided during peak traffic hours. • Provision of road signage and traffic cones. • Establish a Traffic Management Plan.
Operation and Maintenance		
Treatment Process and Treated Sewage Discharge	• Poor treated sewage quality causing health risk and deterioration in receiving water quality.	• The treated sewage discharge should comply with Environmental Quality (Sewage) Regulation, 2009. • In some cases where the treated sewage discharge has complied with Environmental Quality (Sewage) Regulation, 2009 but still causing pollution to the receiving rivers, Project Proponent should comply the pollution load carrying capacity based on impact assessment conducted.

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
		• Apply suitable Best Available Techniques (BAT) and Best Available Control Technology (BACT) of STP by selecting energy saving equipment, energy efficiency equipment, and water recycling technology for internal use. • Appoint competent person to operate plant or facility. • Full process monitoring system by using SCADA. • Conduct regular maintenance evaluation of STP components (performance monitoring). • Conduct Planned Preventive Maintenance (PPM) for major equipment. • Conduct monthly monitoring of water quality at sewage discharge point and receiving river. • The operator should follow operating manual and Standard Operating Procedure (SOP) if major mechanical breakdown occurs. • Provision of adequate standby generator(s) or dual supply to serve as backup system. • Implement zero waste approach (if possible) by recycling the treated sewage for non-portable usage in construction site and industrial usage.
	• Equipment noise	• Provision of high wall fencing as buffer surrounding the STP and STF. • Provision of proper enclosure for noisy equipment such as pump and blower. • Provision of proper silencers to noisy equipment such as blower. • Regular service and maintenance of equipment and machineries. • Proper plant layout consideration and buffer zones. Tree planting surrounding the STP and STF area, if necessary (i.e. close proximity to sensitive receptor).
	• Toxic gas contamination, fire hazard from hydrogen sulphide /ammonia gas and flooding (if any)	• Establish standard operating procedures for working in high risk area. • Prepare ERP to address risk of toxic gas contamination, fire, flooding, etc on in STP and STF.
	• Odour generation	• Proper plant layout consideration and buffer zones. Tree planting surrounding the STP area, if necessary (i.e. close proximity to sensitive receptor).

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
		• Fully covered openings to reduce foul smell. • Odour treatment facility (if required) should be incorporated as part of the overall process in the STP. • Provision of high perimeter wall.
	• Health and safety	• Provision of proper ventilation system, leak detection and alarm system in STP and STF. • Provision of proper Personal Protective Equipment (PPE) to the workers. • Workers should follow Standard Operating Procedure (SOP) and Industry Code of Practice: Safe Working in a Confined Spaces. • Project Proponent must be equipped with emergency preparedness and response procedures to ensure the safe evacuation of workers in the event of an accidental release. • Regular training of plant operators on the safe handling procedures for chemicals as well as emergency drills among workers. • Provide appropriate warning signs at each of the process modules which are potentially hazardous. • Provide adequate safety measures within STP and STF such as protection against falling using handrail, kick plate, etc. • Restricted area should always be locked to avoid trespassing.
	• Dried sludge/biosolids generation	• Storage of dried sludge should not exceed its sludge storage capacity. • Proper disposal of sludge at sites which are approved by the Local Authority. • Minimum technical and safety standards for vehicles transporting sludges shall be specified. • Cover trucks transporting sludge with canvas. • The schedule for sludge transportation should be planned to avoid using main access road during morning and evening peak hours.

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
		• Implement zero waste management approach (if possible) by recycling the sludge as fertilizer of non-food crop agriculture, energy production and raw materials for other green technology products. • Establish Emergency Response Plan (ERP) to address any spillage during handling and transporting of dried sludge/biosolids
	• Domestic wastes generation	• Proper management of waste by implementing 4R (Reduce, Reuse, Recover and Recycle). • Provision of a recycling area to encourage recovery of reusable portions of domestic waste. • Placement of enough garbage bins at strategic locations within STP and STF area. • Waste disposal must be transported to approved landfill. • Periodic waste collection and transported to approved landfill. • Strictly prohibit waste from being discharged into waterways. • Practice good housekeeping.
Maintenance of Plant Equipment	• Deterioration in water quality	• The STP equipment must be periodically maintained to avoid breakdowns. • Spare parts must be readily available for replacement. • Availability of competent person to operate and maintain the STP and STF. • Full process monitoring system using SCADA. • Conduct regular testing for the treated effluent (as per regulatory requirement) in order to maintain and improve the STP performance. • All Planned Preventive Maintenance (PPM) work shall be carried out during off-peak period.
	• Traffic noise increment	• Restrict speed limit of vehicles.
	• Solid wastes generation (packaging wastes, domestic wastes)	• Proper management of waste by implementing 4R (Reduce, Reuse, Recover and Recycle).

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
		• Provision of a recycling area to encourage recovery of reusable portions of packaging and domestic waste. • Placement of enough garbage bins.
	• Scheduled waste generation	• Scheduled waste must be safely stored and disposed following the Environmental Quality (Scheduled Waste) Regulations 2005 as follows: i. Provision of suitable and adequate temporary scheduled waste storage area with containment facility and security. Containment facility shall be designed to contain 110% of the largest inventory of liquid scheduled waste. Containment facility shall be made from impermeable materials with spill recovery facility. ii. Competent person must conduct scheduled waste notification, labelling, inventory and consignment to track and control movement of scheduled wastes. iii. Scheduled waste management and disposal at licensed facilities using licensed transporters.
Sludge Treatment and Disposal	• Deterioration of water and groundwater quality	• Proper handling, collection, transportation and treatment of sludge. • Provide well-designed sludge dewatering facilities. • Proper handling, collection and treatment of filtrate / wastewater from dewatering facilities. • Wet sludge storage area should be lined to avoid groundwater contamination. • The sludge should be dewatered to the desired dryness, an average of 20% dry solid. • Prepare and follow ERP and SOP to handle any spillage of wet sludge.
	• Particulate matter emission from spilled dried sludge	• Proper handling, collection, transportation, and treatment of sludge. • Place dried sludge in a closed container. • Prepare and follow ERP and SOP to handle any spillage of dried sludge.
	• Traffic noise increment	• Restrict speed limit of vehicles. • The schedule for sludge transportation should be planned to avoid using the main access road during morning peak and evening peak hours.

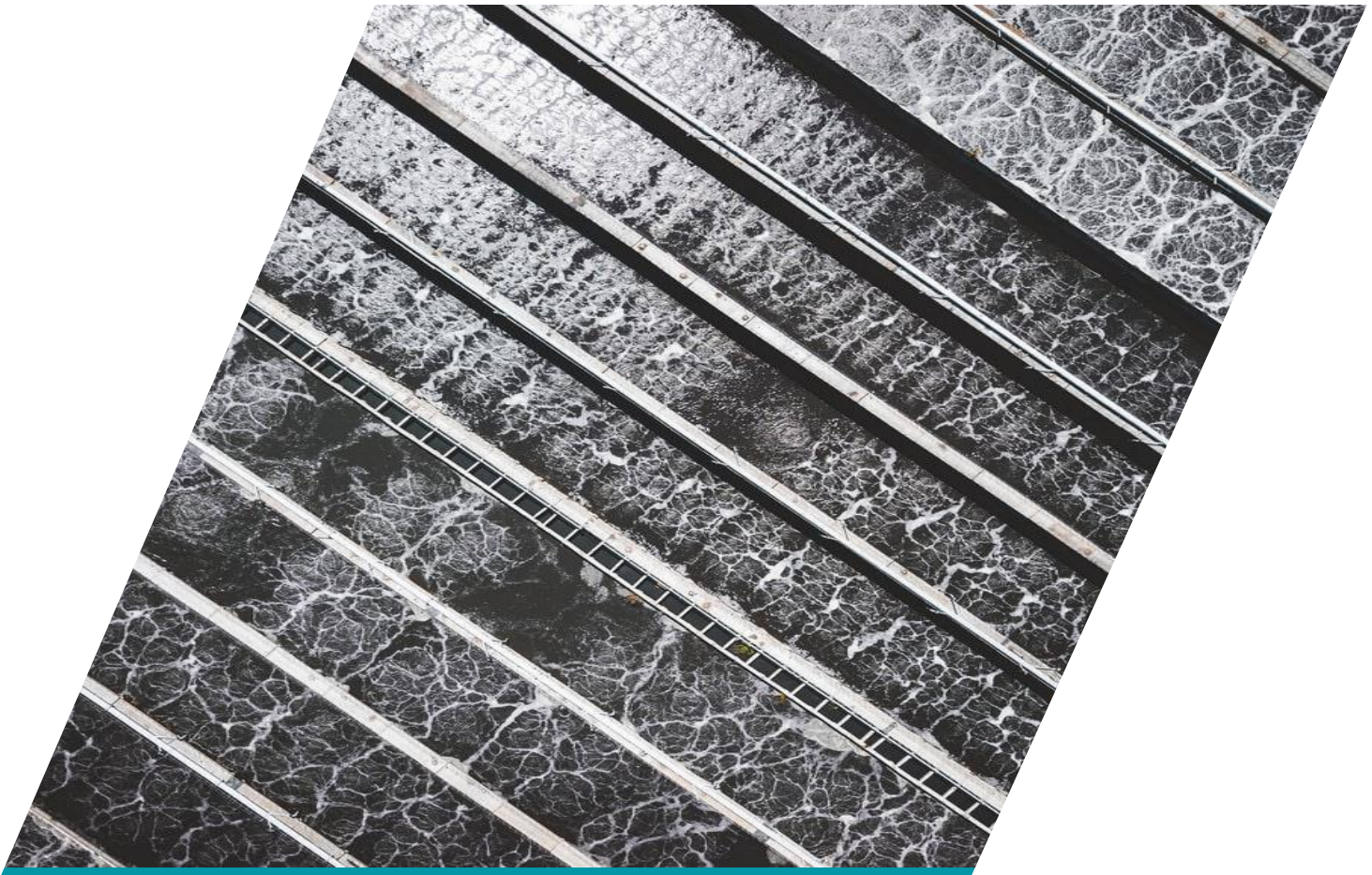
Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
	• Health risk due to wet sludge leakage and leaching	• Provide well-designed sludge dewatering facilities. • Proper handling, collection and treatment.
	• Odour generation from dewatered sewage sludge	• Provide well-designed sludge dewatering facilities. • Adequate ventilation system at sludge dewatering area. • Ensure that large quantities of sludge are not stored within the STP and STF for a long period of time. • Proper plant layout consideration and buffer zones. • Provision of high perimeter wall. • Setting up odour masking spray system by using any of the following examples (masking agents, counteractants, neutralisers and surfactant enhanced absorption agents).
	• Dried sludge / biosolids generation	• Storage of dried sludge should not exceed its sludge storage capacity. • Proper disposal of sludge at sites which are approved by the Local Authorities and DOE. • Minimum technical and safety standards for vehicles transporting sludges shall be specified. • The schedule for sludge transportation should be planned to avoid using the main access road during morning peak and evening peak hours. • Cover trucks transporting sludge with canvas. • Practice good housekeeping.
Abandonment / Post Closure		
Abandonment of Site	• Erosion and sedimentation • Dust, particulate emission • Health risk due to possible breeding ground for vermin	• Preparation of abandonment plan. • An abandonment plan shall be submitted to DOE at least three (3) months prior to project abandonment. In the event of abandonment, this plan is shall be followed closely to allow for a systematic and proper abandonment.

Project Activity	Potential Significant Environmental Impact	Proposed Mitigation Measures
	• Undisposed solid wastes	• Ample time should be allowed for the demolishing and removal of on-site equipment, machinery and building structure • Disconnection of any incoming sewage / sludge. • Proper removal and disposal of sludge and solid waste from the site. • Proper disposal of all scheduled wastes to a licensed disposal facility upon Project abandonment. • Structures that are hazardous and pose safety issues to the public must be taken apart. • Hoarding should be constructed along site perimeter to avoid trespassing. • Land restored to its original land use where possible. • Notify relevant authorities of intention of project abandonment.
	• Undisposed scheduled wastes	
Abandonment of Plant / Facility	• Deterioration of water and groundwater quality	
	• Fire hazard from sewage gas	
	• Health risk due to possible breeding ground for vermin	
	• Odour generation	
	• Damaged equipment / structures	
	• Undisposed solid waste and sludge	
	• Undisposed scheduled wastes	

Note: The list of recommended mitigation measures is not exhaustive and more effective mitigation measures through advanced technologies may be available. It is the responsibility of the Qualified person to detail out the mitigation measures in the EIA report.

EIA GUIDELINES

Waste Treatment & Disposal
-Sewage



APPENDIX J
PROPOSED MONITORING PROGRAMME

APPENDIX J – PROPOSED MONITORING PROGRAMME

A. PERFORMANCE MONITORING

Aspect	Phase	Location of Sampling Stations	Parameters	Proposed Monitoring Frequency	Proposed Reporting Frequency	Compliance Limit	Reference
Water Quality (Soil Erosion & Sedimentation)	Construction	All P2M2 on-site: • Earth drains • Silt fence • Silt trap	Structural integrity, functionality, practicality and frequency of maintenance for all P2M2	Weekly After heavy rain event (12.5 mm measured by rain gauge)	Quarterly	Design of P2M2 to comply with MSMA 2nd Edition specifications.	Urban Stormwater Management Manual Malaysia (MSMA 2nd Edition), 2012
Water Quality	Operational	Sewage Treatment Plant (STP) and Sludge Treatment Facility (STF)	Mixed Liquor Volatile Suspended Solids (MLVSS)	Weekly	Quarterly	Design specification	STS Technical Guidance Document on Performance Monitoring of Sewage Treatment Systems, 2017
			Oxygen Uptake Rate	Weekly			
			Microscopic examination	Weekly			
			Mixed Liquor Suspended Solids (MLSS)	Daily			
			Sludge Volume Index (SVI)	Daily			
			DO, pH, Turbidity, Pressure, Flowrate	Daily			
			Settleability Test	Daily			
Air Quality	Operation	Odour Scrubber Stack Outlet (if any)	Gas flow, Pressure	Daily	Quarterly	Design specification	Technical Guidance on Performance Monitoring of Air Pollution Control Systems (APCS), 2015
			Temperature	Daily			
			pH of liquor	Daily			
			Opacity/stack condition	Daily			

Note: The list is not exhaustive and not all the above may be relevant to the project. The number of sampling stations will increase if there are more sensitive receptors. The proposed monitoring frequency is subject to the significance of the impact

B. COMPLIANCE MONITORING

Aspect	Phase	Location of Sampling Stations	Parameters	Proposed Monitoring Frequency	Proposed Reporting Frequency	Compliance Limit	Reference
Water Quality	Construction	For each sediment basin/silt trap discharge points	Total Suspended Solids (TSS)	After every heavy rain event (12.5 mm measured by rain gauge)	Quarterly	50 mg/l	-
			Turbidity			250 NTU	
		Septic tank discharge point	Temperature	Monthly	Quarterly	Limit values depends on the location of the project (upstream or downstream of the water intake point)	Environmental Quality (Sewage) Regulations, 2009
			pH				
			Biochemical Oxygen Demand (BOD)				
			Chemical Oxygen Demand (COD)				
			Total Suspended Solids (TSS)				
			Oil & Grease				
			Ammoniacal Nitrogen (NH_3-N)				
			Nitrate				
			Phosphorous				
			E-coli			-	-
			Faecal Coliform			-	-
	Operation	Sewage discharge point from STP	Temperature	Monthly	Quarterly	Limit values depends on the location of the project (upstream or downstream of the water intake point)	Environmental Quality (Sewage) Regulations, 2009
			pH				
			Biochemical Oxygen Demand (BOD)				
			Chemical Oxygen Demand (COD)				
			Total Suspended Solids (TSS)				
			Oil & Grease				
			Ammoniacal Nitrogen (NH_3-N)				
			Nitrate				

Aspect	Phase	Location of Sampling Stations	Parameters	Proposed Monitoring Frequency	Proposed Reporting Frequency	Compliance Limit	Reference
			Phosphorous				
			E-coli			-	-
			Faecal Coliform			-	-
Noise	Operation	Plant Boundary	L_{Aeq}	Monthly/ Quarterly	Quarterly	70 dBA (daytime) 65 dBA (evening)	Guidelines for Environmental Noise Limits and Control Third Edition, 2019.
Air Quality	Operation	Odour Scrubber Stack Outlet (if any)	Hydrogen Sulphide	Monthly/ Quarterly	Quarterly	In the case of an untreated mass flow of 50 grams/hour or more for each substance an emission standard of 5.0 mg/m^3 applies	Fifth Schedule (Regulation 15), Environmental Quality (Clean Air) Regulations 2014
			Ammonia			In the case of an untreated mass flow of 300 grams/hour or more for each substance an emission standard of 30 mg/m^3 applies	

Note: The list is not exhaustive and not all the above may be relevant to the project. The number of sampling stations will increase if there are more sensitive receptors. The proposed monitoring frequency is subject to the significance of the impact

C. IMPACT MONITORING

Aspect	Phase	Location of Sampling Stations	Parameters	Proposed Monitoring Frequency	Proposed Reporting Frequency	Compliance Limit	Reference
Water Quality	Construction and Operation	Upstream and downstream of waterways from Project Site	Temperature	Monthly	Quarterly	Limit values based on the beneficial uses downstream	National Water Quality Standards (NWQS)
			pH				
			Biochemical Oxygen Demand (BOD)				
			Chemical Oxygen Demand (COD)				
			Total Suspended Solids (TSS)				
			Oil & Grease				
			Ammoniacal Nitrogen (NH_3-N)				
			Nitrate				
			Phosphorous				
			Faecal coliform				
			E-coli			-	-
Air Quality	Construction	Project site and nearest sensitive receptors within ZOI	Particulate Matter < 10µm (PM_{10})	Monthly/ Quarterly	Quarterly	100 µg/m^3 (24-hr)	Standard 2020 of the Malaysia Ambient Air Quality Standard (MAAQS), 2013
	Operation	Project site and nearest sensitive receptors within ZOI	Odour	Monthly/ Quarterly	Quarterly	-	-
			Particulate Matter < 10µm (PM_{10})			100 µg/m^3 (24-hr)	Standard 2020 of the Malaysia Ambient Air Quality Standard (MAAQS), 2013
			Particulate Matter < 2.5µm ($PM_{2.5}$)			35 µg/m^3 (24-hr)	

Aspect	Phase	Location of Sampling Stations	Parameters	Proposed Monitoring Frequency	Proposed Reporting Frequency	Compliance Limit	Reference
			Sulphur Dioxide (SO_2)			80 µg/m^3 (24-hr	
			Nitrogen Dioxide (NO_2)			70 µg/m^3 (24-hr	
			Ground Level Ozone (O_3)			180 µg/m^3 (1-hr)	
			Carbon Monoxide (CO)			30 mg/m^3 (1-hr)	
Noise	Construction	Project site and nearest sensitive receptors within ZOI	L_{10} (Day time 12-hr)	Monthly/ Quarterly	Quarterly	75 dBA (daytime) 70 dBA (evening)	Guidelines for Environmental Noise Limits and Control Third Edition, 2019
	Operation		L_{Aeq}	Monthly/ Quarterly	Quarterly	Limits is based on the receiving land use category in the guideline	
Vibration	Construction	Project site and nearest sensitive receptors within ZOI	Peak particle velocity (measured in three orthogonal x, y, z axes)	Monthly/ Quarterly	Quarterly	Limits based on the receiving land use category in the guideline	The Planning Guidelines For Vibration Limits and Control in the Environment, 2007

Note: The list is not exhaustive and not all the above may be relevant to the project. The number of sampling stations will increase if there are more sensitive receptors. The proposed monitoring frequency is subject to the significance of the impact.

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