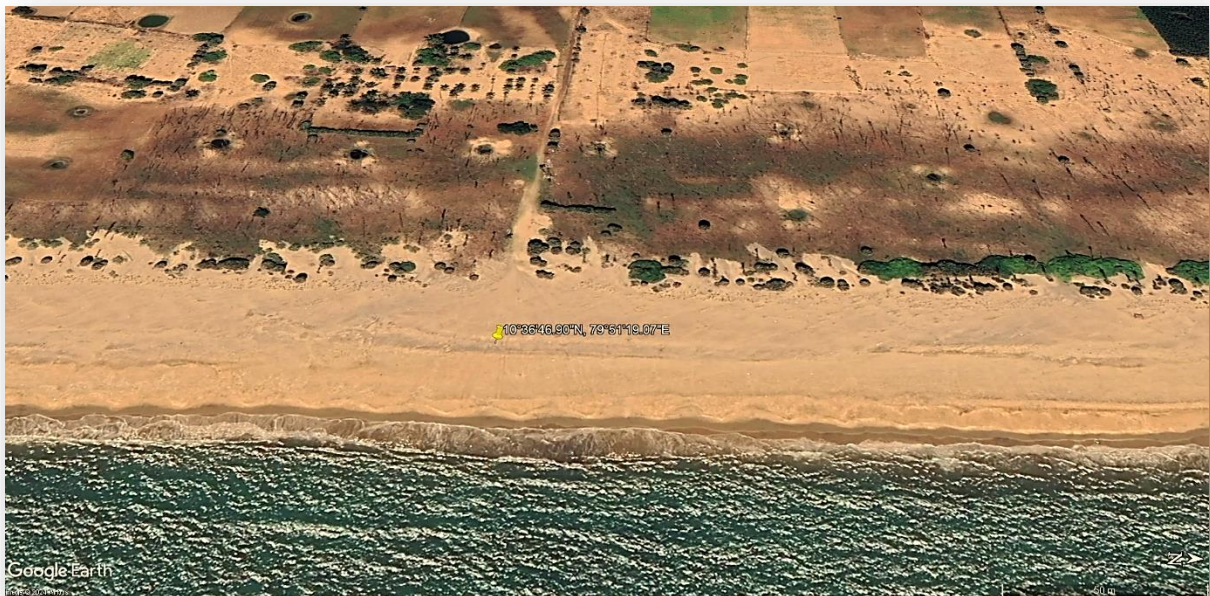


Tamil Nadu Sustainably Harnessing Ocean Resources and Blue Economy (TN-SHORE)

Environment and Social Management Plan

for

Blue Flag Beach Certification of Kameswaram Beach, Nagapattinam



**National Centre for Sustainable Coastal Management
Chennai**

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Environmental and Social Management Plan Kameswaram Beach, Nagapattinam

Executive Summary

The Tamil Nadu - Sustainably Harnessing Ocean Resources and Blue Economy (TN-SHORE) project, supported by the World Bank, aims to enhance the sustainable utilization and resilience of coastal resources. As part of this initiative, Kameswaram Beach in Nagapattinam has been selected for Blue Flag certification, a prestigious eco-label promoting sustainable development in marine and freshwater areas. This certification requires rigorous standards in environmental management, water quality, safety, and education.

The ESMP outlines mitigation measures for potential environmental and social impacts identified through an Environmental and Social Due Diligence (ESDD). The plan ensures sustainable development by addressing impacts with appropriate strategies, benefiting both the environment and the local community.

Kameswaram Beach, located in the Kaduvaiyar and Vedaranyam Canal Basin in Nagapattinam district, covers an area of 0.06 sq. km. The beach attracts thousands of visitors daily and is known for Olive Ridley turtle nesting. The proposed development includes infrastructure to enhance visitor experience and environmental management.

The project interventions focus on pollution abatement, infrastructure development, environmental education, and data collection. Key activities include mechanized beach cleaning, wastewater management, solid waste management, eco-friendly facilities, safety and information infrastructure, and environmental education events. These measures aim to enhance cleanliness, conserve biodiversity, reduce marine litter, improve water quality, and boost tourism, contributing to local economic development.

The ESMP implementation, led by the Tamil Nadu Department of Environment (TNDOE), involves rigorous monitoring and evaluation to ensure compliance with the World Bank's Environmental and Social Standards (ESS). Regular reporting and stakeholder engagement are essential to the supervision process. Through meticulous planning, monitoring, and community engagement, the project aims to achieve sustainable coastal tourism, setting a benchmark for other regions.

1.0 Project Overview and Findings of ESDD

1.1 Project overview

The Government of Tamil Nadu, with funding support from the World Bank, has initiated the Tamil Nadu - Sustainably Harnessing Ocean Resources and Blue Economy (TN-SHORE) project. This project aims to enhance the resilience and sustainable utilization of coastal resources through a comprehensive approach that integrates various sectors to promote a resilient and circular blue economy, empower local livelihoods, and build capacities for a sustainable future. One of the key activities identified is achieving Blue Flag certification for Kameswaram Beach in Nagapattinam.

The Blue Flag Programme is a prestigious international eco-label that promotes sustainable development in freshwater and marine areas. It is known for its rigorous standards encompassing environmental management, water quality, safety, and environmental education. This holistic approach has effectively fostered synergy between tourism and environmental sectors at local and national levels.

In line with its commitment to environmental sustainability and tourism development, the Government of Tamil Nadu has embarked on an ambitious initiative to obtain Blue Flag certification for ten selected beaches under the Beach Environment & Aesthetics Management Services (BEAMS) programme. Kameswaram Beach in Nagapattinam, a gem of the state's coastline, is among the selected beaches for this prestigious certification.

1.2 Objective and context of ESMP

The primary objective of an ESMP is to outline mitigation measures for the potential negative impacts of various sub-project activities and designate responsible entities for their implementation. An Environmental and Social Due Diligence (ESDD) has been conducted to understand the likely environmental and social impacts and risks. Based on the ESDD findings, an ESMP has been developed to address these impacts with appropriate mitigation strategies for each sub-project activity.

The perspective of a management plan is derived from the ESDD exercise carried out for the sub-project activities. The ESDD highlighted potential effects on the baseline social and environmental conditions of the project area. While the

project aims to achieve environmental management, water quality, safety, and environmental education through sustainable development, it includes various construction activities to create permanent fixtures in the zone. Therefore, a separate ESMP is required for each sub-project activity.

An ESMP for an eco-labelled beach is a critical document that specifies actions to mitigate the environmental and social impacts of the project. It ensures that beach development is sustainable and takes into account the needs of the local community. The potential environmental and social impacts of the beach development project are assessed, and subsequent mitigation strategies are defined in the ESMP. Additionally, a monitoring and evaluation plan is necessary to track the effectiveness of these mitigation measures. This plan should also engage the local community and address their concerns related to the Kameswaram Beach development activities.

The ESMP for Blue Flag beach development considers the following environmental and social impacts:

- a) Impacts on Water Quality: Beach development can lead to water pollution through the discharge of sewage, stormwater runoff, and other pollutants. This can harm marine life and make the water unsafe for swimming and other activities.
- b) Impacts on Coastal Erosion: Beach development can accelerate coastal erosion by removing sand from the beach and disrupting the natural processes that protect the coast from storms.
- c) Impacts on Wildlife and Beach Vegetation: Beach development can disturb or destroy beach vegetation and associated habitats, including nesting areas for sea turtles and shorebirds.
- d) Impacts on the Local Community: Beach development can displace local residents and businesses, increase traffic and noise levels, and alter the socio-economic dynamics of the area.

By addressing these impacts through a well-structured ESMP, the project can ensure sustainable development that benefits both the environment and the local community.

1.3 Sub-Project Description

Kameswaram is situated within the Kaduvaiyar and Vedaranyam Canal Basin in Nagapattinam district, Tamil Nadu (Figure 1). The Kaduvaiyar and Vedaranyam Canal is one of the six major river basins in the district, encompassing areas such as Nagapattinam, Karappidagai South, and Kovilpathu. The Nagapattinam River is a significant watercourse in this region. Additionally, the Kollidam River and its tributaries—including Odampokki, Mullaiyar, Vallapar, Adappar, Thirumalairajanaru, Arasalar, Manjalar, Harichandranadhi, Veeracholanaru, Ayyapanaru, Cauvery, and Vikramanaru—play a crucial role in the hydrology of this area. Cauvery is one of the major rivers in South India, traversing Tamil Nadu and the Union Territory of Puducherry. The total area of the basin is 4,498.5 sq. km.

The Nagapattinam coast is renowned for Olive Ridley turtle nesting, with efforts underway to establish a dedicated turtle conservation and education centre in the district. The GPS coordinates of Kameswaram Beach are 10°36'46.90"N latitude and 79°51'19.07"E longitude. The total beach area is 0.06 sq. km (11,781 sq. m.), with 430 sq. m. designated for the proposed infrastructure development. (Figure 2)

Kameswaram Beach attracts an average of 2,300 visitors per day on weekdays and 3,500 visitors per day on weekends and public holidays. During the summer months, the daily footfall ranges from 2,500 to 3,000.

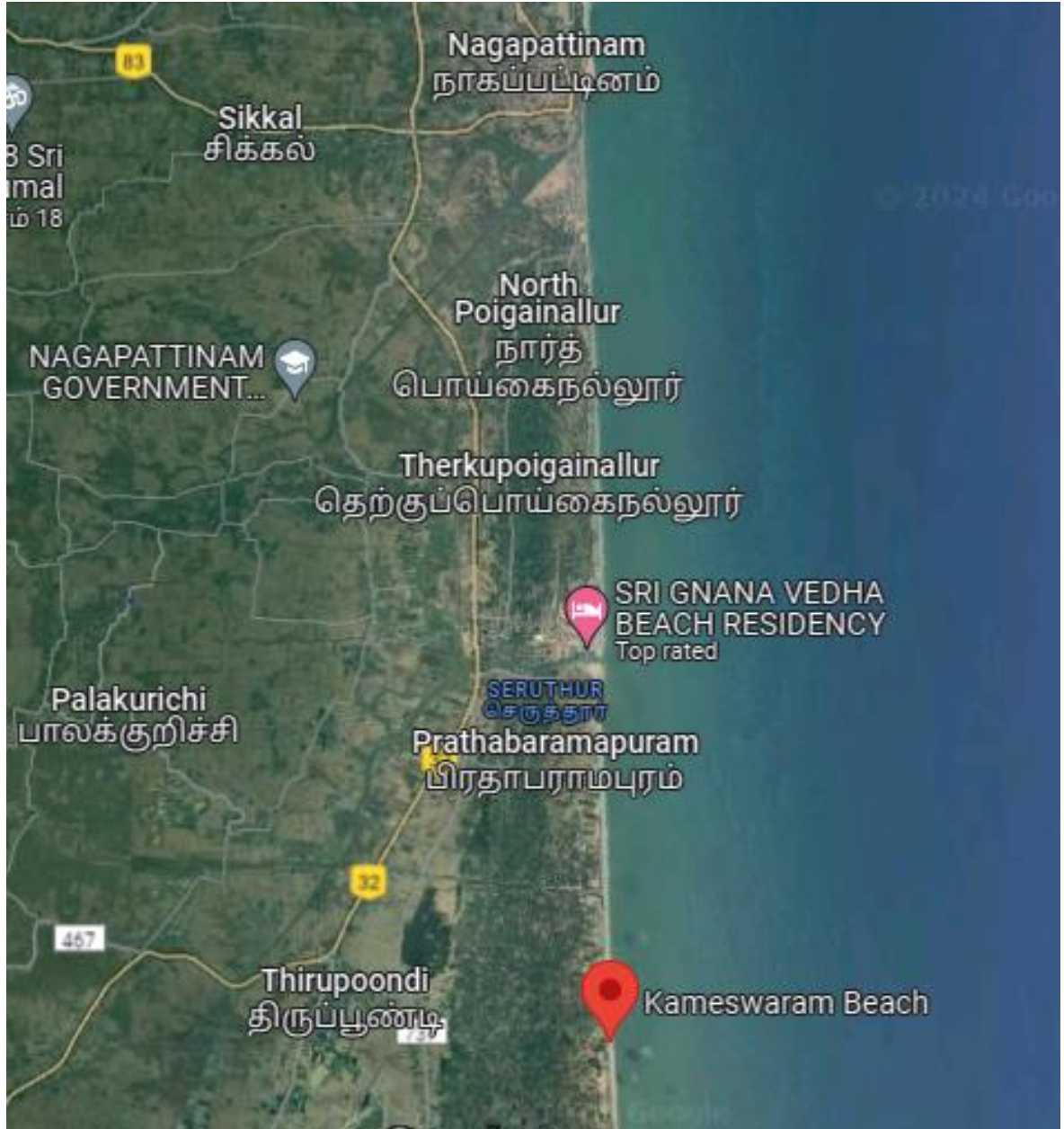


Fig. 1: Location of Kameswaram Beach, Nagapattinam, Tamil Nadu for Proposed Blue Flag Beach Development

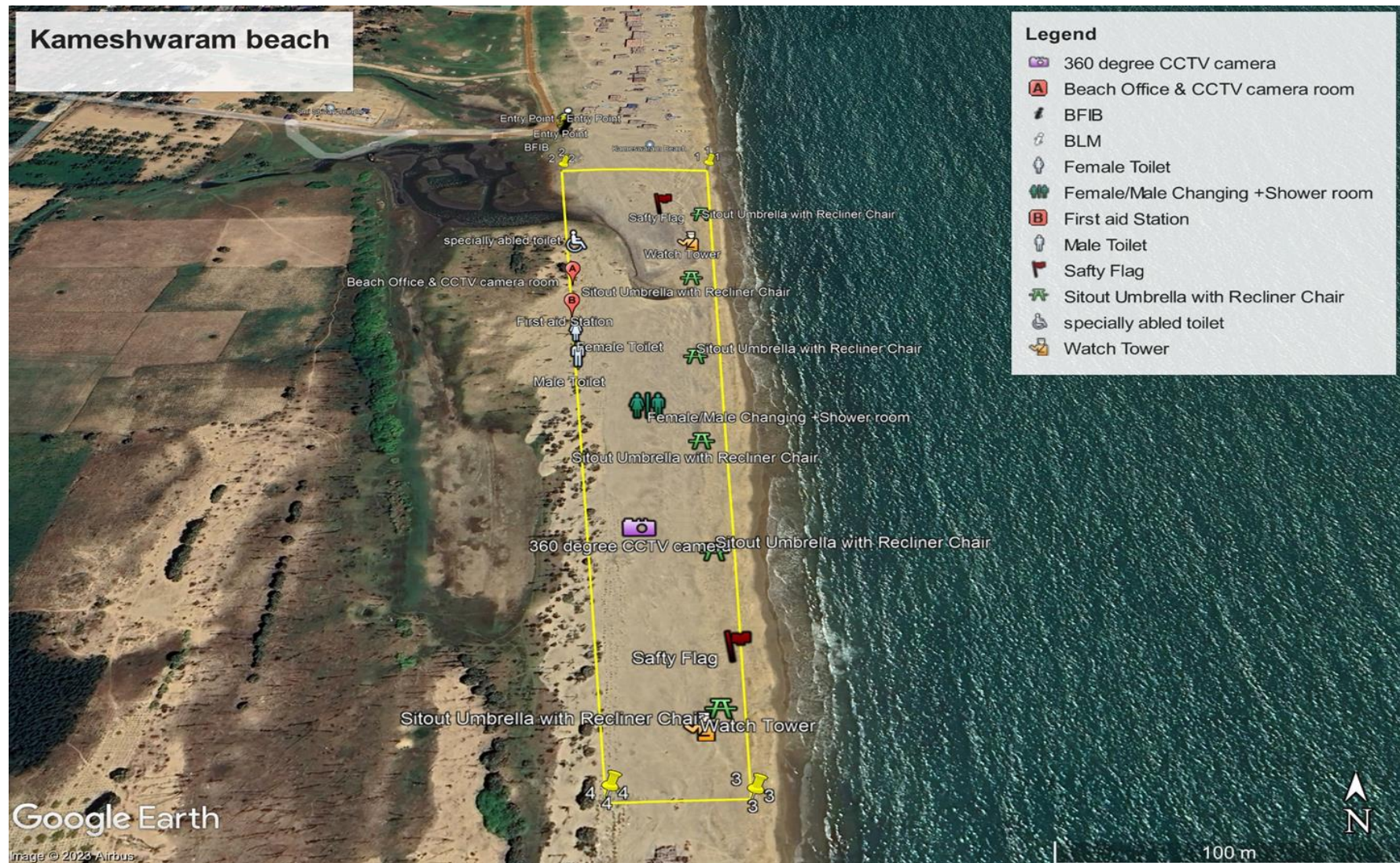


Fig.2 Proposed zonation for Blue Flag Certification area

1.4 Proposed Interventions/ Activities and Intended Outcomes

The Kameswaram Beach Blue Flag project includes a robust array of interventions and activities strategically designed to enhance the environmental, social, and economic facets of the beach. These measures are meticulously crafted to satisfy the rigorous standards of the Blue Flag certification, promoting sustainable development across the designated beach area. The proposed interventions are organized into distinct categories, each targeting specific improvements:

I. Pollution Abatement Services:

- a. **Site-Specific Interventions:** Implementation of targeted measures to address and mitigate pollution sources, including beach litter, debris, plastics, solid waste, and wastewater.
- b. **Mechanized Beach Cleaning:** Utilization of walk-behind machines for efficient and regular cleaning of the beach to maintain high cleanliness standards.
- c. **Wastewater Management:** Installation of BIO-Digester/BIO-Tank Units, including Grey Water Treatment Plants and Fluidized Aerobic Bio-Reactors, to treat and manage wastewater effectively.
- d. **Solid Waste Management Plan:** Development and execution of a comprehensive plan for the collection, segregation, recycling, and disposal of solid waste generated on the beach.

II. Infrastructure Facilities Development:

- a. **Beach Planning and Zoning:** Strategic planning and zoning of Marina beach area to optimize usage and minimize environmental impact.
- b. **Infrastructure Development:** Construction of essential facilities such as toilet blocks, changing rooms with shower panels, bamboo-made items and structures (e.g., seating benches, umbrellas), a 40 KW solar power plant, purified drinking water facilities, LED landscape lighting, beach access pathways, and an amphibious wheelchair.
- c. **Safety and Information Infrastructure:** Installation of beach safety and information flags, a CCTV system, a control room, a site office, water rescue equipment, first aid and safety equipment, environment

education displays, do's and don'ts kiosks, and a beach layout map and information board.

III. Environmental Education Events:

Organization of events and activities aimed at raising awareness and educating visitors and the local community about environmental conservation and sustainable practices.

IV. Data Collection for Blue Flag Criteria Compliance:

- a. **Pre-Field Screening:** Initial assessment to identify potential environmental and social issues.
- b. **Beach Suitability Assessment Survey (BSAS):** Comprehensive survey covering parameters such as geology, geomorphology, ecosystem, pollution, socio-economic factors, facilities, and other relevant issues.
- c. **Preparation of Geomorphological & CRZ Maps:** Creation of detailed maps to understand and manage the coastal zone effectively.
- d. **Ecology/Environmental Evaluation and Impact Assessment:** Assessment of the ecological and environmental impacts of the proposed interventions.
- e. **Safety & Risk Assessment:** Analysis of bathymetry, wave studies, currents, and biodiversity impact to ensure the safety of beachgoers.
- f. **Beach Water Quality Testing (BWQT):** Regular monitoring of beach water quality for physical, chemical, and biological contamination.

V. Obtaining Blue Flag Beach Certification:

Completion of all necessary steps and fulfilment of the 33 criteria stipulated for Blue Flag certification. The implementation of these interventions is expected to result in the following outcomes:

- a. **Enhanced Cleanliness:** Achieving an "A++ Category (Outstanding)" cleanliness level for the newly developed Blue Flag beach.
- b. **Biodiversity Conservation:** Effective mechanisms to be in place to protect and conserve beach vegetation and associated biodiversity.

- c. **Marine Litter Reduction:** Reduction of marine litter by 80% to 85% from existing levels, with conversion/safe disposal mechanisms for marine litter.
- d. **Water Quality Monitoring:** Regular monitoring and maintenance of bathing water quality to ensure safety and hygiene.
- e. **Safe Recreational Areas:** Clear demarcation of safe areas for bathing, swimming, and other recreational activities.
- f. **Economic Development:** Income generation and livelihood development for local communities through enhanced tourism and the development of eco-labelled beach recreational facilities of international standards.
- g. **Increased Visitor Numbers:** Over 200% increase in visitors for beach recreational activities, leading to revenue generation and alternate livelihoods for local fishermen communities.

These interventions and outcomes are aligned with the SDGs and are aimed at establishing Kameswaram Beach as a model of sustainable and responsible coastal tourism

1.5 ESDD findings and key impacts to be addressed

ESDD provides details on screening carried out to assess the environmental and social impacts likely to occur. The ESDD has analysed the E & S impacts arising due to the planned activities and it was found that the activities lead to low to moderate E&S impacts. The screening of potential activities associated with the Blue Flag certification of Kameswaram Beach has identified few environmental and social risks and impacts that need to be addressed. These are summarised below:

1. Environmental Risks and Impacts:

- i. **Pollution and Hazards Due to Storage and Wastes:** The management of waste and storage of materials during construction may pose environmental hazards if not properly handled.
- ii. Leakage from the Bio-digester unit can cause ground water pollution and release of Gas can harm the person maintaining the unit.

2. Social Risks and Impacts:

- i. **Gender:** The project should consider the gender-specific impacts and ensure equitable participation and benefits for both men and women. It would strictly ensure non-prevalence of Gender based violations
- ii. **Labour, OHS and HS:** The influx of labour during construction should be managed to ensure fair working conditions and minimize social disruptions.

3. Environmental and Social Standards:

These are a set of ten benchmarks set by the World Bank for achieving a minimal social and environmental standard during project execution. They ensure inclusion of good management practices of international/national standard to achieve sustainability, good governance, accountability, inclusiveness and transparency. These Environmental and Social Standard (ESS) are

- ESS 1:** Assessment and Management of Environmental and Social Risks and Impacts;
- ESS 2:** Labour and Working Conditions;
- ESS 3:** Resource Efficiency and Pollution Prevention and Management;
- ESS 4:** Community Health and Safety;
- ESS 5:** Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- ESS 6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- ESS 7:** Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities;
- ESS 8:** Cultural Heritage;
- ESS 9:** Financial Intermediaries; and
- ESS 10:** Stakeholder Engagement and Information Disclosure.

The following ESS categories are relevant and suggested mitigation measures

Table: ESS Applicability analysis and recommended management measures/ plans

ESS	Recommended Management Plans	Applicability
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	Precautionary steps to avoid environmental damages while carrying out all the activities and briefing the people involved on non-engagement of Gender-based violence or Harassment Safety from waves: Warning boards for occasional freak waves. Signage for rip currents, uneven terrain. Watch towers and trained lifeguards stationed across the designated area. The safe bathing zone is demarcated well with the aid of visible lines and buoys. First-aid kit, safety gears for swimming.	Applicable (Included in the ESMP)
ESS2: Labour and Working Conditions	Adopting labour management rules and instructions to prevent Occupational Health issues and adopting safety norms especially to avoid injuries while using manual or electric tools; Promoting gender equality and also preventing GBV	Applicable (Included in the ESMP)
ESS3: Resource Efficiency, Pollution Prevention and Management	Adopting prescribed solid waste management practices including disposing of solid wastes at designated places Polluted seawater: Regular water quality monitoring and display of results in the beach information board. Managing waste from beachgoers, as well as potential runoff from nearby sources of pollution. Gas and Liquid leakage from Bio-digester unit to be checked and arrested at the earliest. Use of solar-based power to improve energy conservation	Applicable (Included in the ESMP)
ESS 4: Community Health and Safety	Cultural and social environment is included in the baseline details, for proper monitoring and assessment in the DPR document (Environmental and Social Safeguards Monitoring Plan)	Applicable (Include in the ESMP)

ESS	Recommended Management Plans	Applicability
ESS 5: Land Acquisition, Restrictions on Land use and Involuntary Resettlement	The project is in area that is under the control of the Government and land acquisition is not involved. There is no resettlement required for execution of the project. To regulate a few tourist activities within the Eco-labelled beach protective barrier such as a fence or vegetation (Engineering control) may be used	Not Applicable
ESS 6: Biodiversity conservation and Sustainable Management of Living Natural resources	The project area does not fall within any Environmentally Sensitive Area.	Not Applicable
ESS 7: Indigenous Peoples Historically Underserved Tradition Local Communities	No indigenous people or tribal live in the area	Not Applicable
ESS 8: Cultural Heritage	Cultural sites are located far away from the mangrove areas	Not Applicable
ESS 9: Financial Intermediaries	No financial compensation etc., involved	Not Applicable
ESS 10: Stakeholder Engagement and Information Disclosure	A stakeholder consultation was carried out during site screening. A feedback mechanism is in place to address any grievances of the stakeholders (including beach goers).	Applicable (Included in the ESDDR)

The comprehensive assessment and analysis conducted through the ESDD have been pivotal in identifying and categorizing the potential environmental and social risks associated with the Kameswaram Beach project. The subsequent development and implementation of the ESMP based on these findings will ensure that all necessary precautions and mitigation measures are effectively addressed. By adhering to the World Bank's ESS, the project commits to upholding high standards of sustainability, governance, and community engagement. This commitment ensures that the development of Kameswaram Beach not only meets international environmental criteria but also enhances the socio-economic conditions of the local community while conserving its natural heritage.

2.0 Environmental and Social Management Plan (ESMP)

2.1 Sub-project activities for ESMP

The ESMP outlines a comprehensive strategy for managing and mitigating environmental and social impacts associated with the designated projects along Kameswaram Beach. The plan is structured to address specific aspects of the project through detailed sub-plans, each tailored to meet the stringent requirements of environmental sustainability and social responsibility. The sub-project activities encompassed in this plan include:

- 1. Development Activities Plan:** Focuses on integrating environmental sustainability and community safety standards right from the design and pre-construction phases through construction. This plan ensures all developmental activities align with established environmental and safety protocols.
- 2. Pollution Management Plan:** Specifies measures for the prevention, control, and management of pollution throughout the construction and operational phases. This includes detailed strategies for managing waste, treating greywater, and handling bio-digestion outputs effectively.
- 3. Human Health and Safety Plan:** Addresses potential health and safety risks to workers and the community, detailing preventive measures and emergency response strategies to maintain safety at all times.
- 4. Monitoring and Evaluation Plan:** Essential for ensuring that all ESMP activities are carried out as planned and are effective in mitigating environmental and social impacts throughout the project lifecycle.
- 5. Implementation and Supervision Arrangements:** Defines the roles and responsibilities of the implementing agencies and supervisory mechanisms to ensure adherence to the ESMP.
- 6. Reporting:** Outlines the requirements for documentation and reporting on the ESMP's implementation, ensuring transparency and accountability in meeting the environmental and social governance standards.

Each component of the ESMP is designed to comprehensively address the specific risks and impacts associated with the project, ensuring effective management and mitigation across all phases of project development and operation.

2.2 Development Activities Plan

This section outlines the proactive measures to mitigate potential negative impacts during the design, pre-construction, and construction stages of the Kameswaram Beach project. These measures are detailed in Table 2.1, which summarizes the ESMP for development activities, ensuring compliance with environmental, safety, and community standards.

Table 2.1: Environmental and Social Management Plan for developmental activities

Activity	Applicable ESS category	Potential Negative Impacts	Mitigation Measures	Responsible Entity	Inclusion in ToR and Bid Documents
Mechanized cleaning of Beaches with walk behind machine	ESS2: Labour and Working Conditions	Accidental injury to the operator and/or to other workers	Implement strict safety protocols, including the use of personal protective equipment (PPE), regular safety drills, and on-site safety signage in multiple languages. Provide adequate worker facilities as per labour laws.	Contract or Direct	To be included in ToR and bid documents.
Bio-Digester/ Bio-Tank Unit	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS2: Labour and Working Conditions ESS3: Resource Efficiency, Pollution Prevention and Management	1. Construction Safety and Worker Welfare 2. Waste Management 3. Sewage and Water Management 4. Inadequate Safety Measures.	- Implement strict safety protocols, including the use of personal protective equipment (PPE), regular safety drills, and on-site safety signage in multiple languages. Provide adequate worker facilities as per labour laws. - Include fail-safe sewage	Design Team and operator	To be included in ToR and bid documents.

	ESS 4: Community Health and Safety		storage and treatment solutions to handle system breakdowns without environmental contamination. ▪ Establish protocols for the segregation, handling, and proper disposal of waste. Include measures for hazardous waste.		
Solid Waste Management Plant	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS2: Labour and Working Conditions ESS3: Resource Efficiency, Pollution Prevention and Management ESS 4: Community Health and Safety	1. Construction Safety and Worker Welfare 2. Waste Management 3. Sewage and Water Management 4. Inadequate Safety Measures.	▪ Implement strict safety protocols, including the use of personal protective equipment (PPE), regular safety drills, and on-site safety signage in multiple languages. Provide adequate worker facilities as per labour laws. ▪ Include fail-safe sewage storage and treatment solutions to handle system breakdowns without environmental contamination. ▪ Establish protocols for the segregation, handling, and proper disposal of waste. Include measures for hazardous waste.	Design Team and operator	To be included in ToR and bid documents.

Toilet Blocks Facilities	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS2: Labour and Working Conditions	1. Construction Safety and Worker Welfare 2. Waste Management 3. Sewage and Water Management 4. Inadequate Safety Measures.	- Implement strict safety protocols, including the use of personal protective equipment (PPE), regular safety drills, and on-site safety signage in multiple languages. Provide adequate worker facilities as per labour laws. - Include fail-safe sewage storage and treatment solutions to handle system breakdowns without environmental contamination. - Establish protocols for the segregation, handling, and proper disposal of waste.	Design Team and operator	To be included in ToR and bid documents.
Solar power plant facility (40 KW)	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS2: Labour and Working Conditions	Storage of batteries in closed rooms may cause occupational dangers Water required to clean solar panels	Sufficient space is required to keep the solar batteries so that access becomes easy for maintenance work without any hazard Minimal water should be used to clean the solar panels while in operation because of the accumulation of dust and bird droppings	Facility Operator	To be included in ToR and bid documents.

		Disposal of electrical equipment	Switchgears, transformers, Cables, batteries, Trays etc. wear and tear should be disposed of properly		
		Disposal of electronic equipment	Control panels, Electronic hardware, and solar panels etc. wear and tear should be disposed of properly		
Site development and components construction/ installation	ESS1: Assessment and Management of Environmental and Social Risks and Impacts ESS 6: Biodiversity conservation and Sustainable Management of Living Natural resources	▪ Loss of trees, biodiversity ▪ Access route or nesting/ feeding grounds	▪ No. of trees felled, saplings planted and survival rate of saplings raised for compensatory plantation should be strictly monitored and recorded. ▪ There are no records of turtle nesting or any other ecologically sensitive areas (ESA) in the selected location, but any chance finding should be reported to the relevant authority and area marked.	Contract or and Facility Operator	To be included in ToR and bid documents.

The Table 2.1 provides detailed mitigation strategies and clear responsibilities, ensuring that the ESMP is effectively integrated into the bid documents. These comprehensive entries help ensure that all potential environmental and social

impacts are addressed pre-emptively, and the contractors are well informed of their obligations and the standards they must meet.

2.3 Pollution Management Plan

The comprehensive strategies and measures to be implemented to manage and mitigate pollution at Kameswaram Beach, ensuring adherence to both environmental standards and Blue Flag certification requirements are provided in this section. The plan is organized by components, each addressing specific pollution concerns associated with the operational and construction phases of the beach's development. Here, we detail the respective approaches for grey water treatment, bio-digestion, and solid waste management to safeguard the coastal ecosystem and public health.

2.3.1 Grey Water Treatment Plant

The ESMP details including the operational guidelines and management measures for the Grey Water Treatment Plant (GWTP) to ensure its efficient functioning and compliance with environmental standards (Table 2.2) are provided in this section.

Table 2.2: Environmental and Social Management Plan for operation of Grey Water Treatment Plant

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Legal and Regulatory Clearances	Ensure all necessary clearances from relevant departments, including the State Pollution Control Board consent for GWTP operation and quality testing lab approval.	Facility Operator	TNDOE
Treated Water Reuse	Use treated water for non-potable purposes such as gardening and flushing, adhering to strict quality parameters (BOD/TSS < 10 mg/L, Total Coliform < 230 MPN/100 mL). Regular testing to comply with SPCB/CPCB standards.	Facility Operator	TNDOE
Treated Water Disposal	Regularly test treated water quality and ensure compliance with SPCB standards to prevent pollution of receiving water bodies.	Facility Operator	TNDOE
Sludge Disposal			TNDOE

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
	Implement measures to prevent sludge production. Ensure that wastewater is directed to the GWTP without generating sludge	Facility Operator	
Monitoring GWTP Operation	Maintain detailed operations logs, including data on inflow and outflow quantities and qualities, and sludge characteristics, if any.	Facility Operator	TNDOE
Training for Staff	Provide thorough training for staff in GWTP operations and maintenance. Display Standard Operating Procedures (SOPs) and emergency procedures onsite.	GWTP supplier	TNDOE
Safety Hazards	Equip the facility with fire extinguishers and appropriate personal protective equipment (PPE). Ensure storage of biodegradable cleaning agents and detergents in secured and raised platforms.	Facility Operator	TNDOE

Key Aspects of the Pollution Management Plan:

- i. **Comprehensive Compliance:** Ensures all operations meet legal and regulatory requirements to prevent environmental impacts.
- ii. **Quality Control:** Regular testing and adherence to strict water quality standards for reuse and disposal safeguard the environment.
- iii. **Operational Integrity:** Detailed monitoring and logs help maintain high operational standards and detect any deviations early.
- iv. **Staff Proficiency:** Continuous training and clear procedures ensure the staff operate the plant efficiently and respond effectively in emergencies.
- v. **Safety and Storage:** Implements safety measures and proper storage protocols to mitigate any potential hazards associated with the GWTP operations.

This plan is designed to minimize environmental impacts associated with grey water treatment and ensure sustainable water management practices at Kameswaram Beach. The detailed responsibilities and measures are structured

to provide clear guidance for the operation of the GWTP, ensuring environmental compliance and safety.

2.3.2 Plan for Bio-digester

This plan outlines the ESMP for the operation of the Bio-digester at Kameswaram Beach (Table 2.3).

Table 2.3: Environmental and Social Management Plan for Bio-digester Operation

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Legal and Regulatory Compliance	Use only authorized and established technology (DRDO) which requires no additional clearances.	Facility Operator	TNDOE
Quality of Biogas Bag	Use fiber-reinforced PVC bags with a minimum density of 850 g/m ³ to prevent gas leaks	Facility Operator	TNDOE
Site Selection	Ensure the site is large, flat, and proximal to gas use points to optimize biogas plant efficiency and facilitate maintenance.	Facility Operator	TNDOE
Gas Leak Risks	Conduct daily inspections for system integrity. Use soap water for leak detection and install flame arrestors to mitigate fire risks. Prohibit smoking and open flames near the system.	Facility Operator	TNDOE
Pressure Management	Maintain a higher internal pressure in the biogas system than the external environment to prevent negative pressure risks.	Facility Operator	TNDOE
Management of Digester Effluent	Compost the partially dried sludge on-site to avoid pollution.	Facility Operator	TNDOE

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Biogas Utilization	Ensure appropriate biogas-using devices are procured and utilized efficiently.	Facility Operator	TNDOE
Flood Risk Management	Implement flood safety measures, including the installation of an upside-down 'T' pipe with a gate valve to safely release biogas in flood scenarios.	Facility Operator	TNDOE

Each mitigation measure is designed to address specific operational risks associated with the bio-digester, ensuring that the system operates safely, efficiently, and in compliance with environmental standards. The Facility Operator, in collaboration with TNDOE, will oversee and monitor the implementation of these measures to adapt and respond to any operational challenges promptly.

2.3.3 Plan for Solid Waste Treatment

The details of the operational strategies and environmental management practices for the Solid Waste Treatment Plant at the identified stretch of Kameswaram Beach, designed to minimize environmental and social impacts. The management plan (Table 2.4) integrates advanced waste processing technologies and rigorous monitoring protocols to ensure compliance with environmental regulations and sustainability goals.

Table 2.4: Environmental and Social Management Plan for operation of Solid Waste Treatment Plant

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Legal and Regulatory Compliance	Secure all necessary clearances prior to operation commencement.	Facility Operator	TNDOE
Leachates and Waste Spillage	Perform regular maintenance and monitor leachate tanks. Identify and rectify any leakage sources promptly.	Facility Operator	TNDOE

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Air Quality	Minimize dust by water spraying and enforce strict maintenance of transport vehicles. Implement vegetation buffers.	Facility Operator	TNDOE
Odor Management	Maintain cleanliness in waste handling areas and ensure waste is covered during transport and when stored temporarily.	Facility Operator	TNDOE
Noise Control	Restrict noisy operations to daytime and maintain equipment to reduce sound emission. Schedule vehicle movements to minimize disruption.	Facility Operator	TNDOE
Worker Health and Safety	Provide proper personal protective (PPE) equipment, First Aid kits, and regular health check-ups for all personnel.	Facility Operator	TNDOE
Community inconvenience	Implement effective communication and grievance handling mechanisms. Engage with the community proactively to address concerns.		TNDOE

Key Aspects of Solid Waste Treatment Plan:

- i. **Comprehensive Management:** Ensures operational compliance with environmental standards and safety protocols.
- ii. **Community and Environmental Protection:** Implements strategies to minimize adverse impacts from waste management activities.
- iii. **Operational Excellence:** Maintains high standards of operation through regular monitoring and updates to the management strategies.

These plans ensure that both bio-digester and solid waste treatment operations at Kameswaram Beach are conducted in an environmentally

responsible and socially sensitive manner, adhering to regulatory requirements and best practices for sustainable management.

2.4 Human Health and Safety Plan

The Human Health and Safety Plan outlines the strategic measures designed to safeguard occupational and community health throughout the development and operational phases of the project. This plan addresses both potential positive and negative impacts, ensuring that comprehensive safety protocols are followed.

2.4.1 Potential Impact on Occupational Health and Safety

Positive Impacts:

The use of pre-fabricated structures, eco-friendly materials, modern equipment, and advanced operational methods will significantly enhance safety at the treatment plants. Design and operational strategies incorporate disaster mitigation measures to ensure a secure working environment.

Negative Impacts:

Potential occupational hazards include construction-related risks such as unrestricted site access, improper use of machinery, and inadequate use of protective gear. Additional concerns include insufficient first aid resources, improper material storage, and poor waste disposal practices by construction workers, which could lead to environmental pollution. Inadequate ventilation and lighting in facility design could affect air quality and visibility, increasing the risk of accidents and health issues. The presence of waste near the site could attract vermin, leading to increased human nuisance, disease transmission, and ecosystem disruption. However, the project design integrates comprehensive occupational health and safety features, including:

- Provision of personal protective equipment.
- Employment of skilled and trained personnel for equipment and machinery operation.
- Availability of appropriate tools and tackles.
- Well-equipped first aid stations with trained attendants.
- Scientific management of liquid and solid waste.

These measures are expected to mitigate such risks effectively, ensuring a safe occupational environment.

2.4.2 Potential Impact on Community Health & Safety

Positive Impacts:

The project's alignment with sustainable development goals will enhance community health and environmental quality. Improved waste management and sanitation facilities contribute to cleaner living conditions, which in turn can boost local livelihoods. The project's design and facilities also serve as educational resources for the community, encouraging the adoption of similar practices in household settings to elevate living standards.

Negative Impacts:

During Construction, potential risks include inadequate safety considerations in design and construction, such as poorly designed sanitation facilities and drainage, which could increase contamination risks. The choice of construction materials may also pose fire hazards. However, stringent design and operational protocols are anticipated to prevent such impacts.

During Operation, the use of contaminated raw materials, unhygienic handling during production, and inadequate sanitation practices could contribute to the spread of waterborne and foodborne diseases. Activities like swimming and boating also present risks such as drowning and injuries. However, the project has adopted several preventive measures:

- Avoidance of plastic and promotion of biodegradable materials.
- Comprehensive environmental monitoring and regular safety audits.
- Implementation of detailed preparedness, response, and recovery strategies tailored to specific risks and community vulnerabilities.

These proactive measures ensure that the project will not adversely affect community health and safety, nurturing a safe and sustainable environment for both residents and visitors to Kameswaram Beach.

2.5 Plan for Infrastructure Management

The ESMP focuses on the management of infrastructure related to the Solar Energy Plant at Kameswaram Beach. Effective management is critical to ensuring that infrastructure supports the project's sustainability goals while minimizing environmental and social impacts.

2.5.1 ESMP for Operation of Solar Energy Plant

The following Table 2.5, outlines the ESMP for the operation of the Solar Energy Plant at Kameswaram Beach. It details potential negative impacts and their corresponding mitigation measures, along with designating responsibility and oversight to appropriate agencies.

Table 2.5: ESMP for Operation of Solar Energy Plant

Potential Negative Impacts	Mitigation Measures	Responsible Agency	Monitoring Agency
Battery Storage Hazards	Ensure batteries are stored in well-ventilated areas to facilitate safe maintenance and prevent occupational hazards.	Facility Operator	TNDOE
Water Use for Cleaning Panels	Use minimal water for cleaning solar panels to remove dust and bird droppings, optimizing water use efficiency.	Facility Operator	TNDOE
Disposal of Electrical Equipment	Employ scientific disposal methods for worn-out switchgears, transformers, cables, batteries, and trays to minimize environmental impact.	Facility Operator	TNDOE
Disposal of Electronic Equipment	Ensure scientific disposal practices for control panels, electronic hardware, and worn-out solar panels to prevent environmental pollution.	Facility Operator	TNDOE

Key Aspects of the Solar Energy Plant ESMP:

- i. **Safety and Efficiency:** The plan emphasizes safe storage practices for batteries and efficient use of resources, such as water for maintenance of solar panels.

- ii. **Environmental Responsibility:** Focuses on the scientific disposal of both electrical and electronic equipment, ensuring compliance with environmental standards to mitigate pollution.
- iii. **Regular Monitoring:** The TND OE is tasked with overseeing the implementation of these mitigation measures to ensure ongoing compliance and to address any emerging issues promptly.

This management plan is designed to ensure that the operation of the Solar Energy Plant is conducted in an environmentally responsible and socially considerate manner, aligning with both local regulations and sustainable practices. It prioritizes safety, resource efficiency, and environmental protection to minimize the impact on Kameswaram Beach and its surrounding community.

2.6 Plan for Physical forces

2.6.1 Disaster Management Plan (DMP)

The Disaster Management Plan aims to ensure the safety of life, protect the environment, and safeguard infrastructure along the stretch of Kameswaram Beach. It incorporates regular updates to adapt to changes in environmental conditions, infrastructure developments, and regulatory frameworks. Some of the Key Elements of the Disaster Management Plan is given in Table 2.6

Table 2.6: Disaster Preparedness and Response Actions

Hazard Category	Preparedness Actions	Response Actions
All Hazards	• Ensure all workers are equipped with personal protective equipment • Formulate an emergency response team involving local government, emergency services, and community representatives. • Designate clear roles and ensure effective communication channels. • Display emergency contact numbers prominently. • Provide accident insurance for all staff and workers.	○ Maintain a detailed log of all accidents and near-miss incidents. ○ Implement a communication system for timely alerts and updates during emergencies.

Hazard Category	Preparedness Actions	Response Actions
Natural Hazards (Cyclones, Storm Surges, Earthquakes)	• Integrate cyclone-resistant features in structures • Complete all civil works before monsoon • Follow local administration's evacuation guidelines. • Minimize material storage during high-risk seasons. • Incorporate earthquake-resistant design and train staff in earthquake preparedness.	○ Activate immediate relief actions as directed by local authorities ○ Shut off utilities in the event of an earthquake and evacuate to safe areas.
Anthropogenic Hazards (Accidents, Fires, Electric Shocks)	• Maintain updated first-aid kits • Train staff in handling machinery safely and providing first aid • Keep fire extinguishers accessible and conduct regular fire drills • Ensure all electrical systems meet safety standards and train staff in electrical safety.	○ Provide immediate medical attention as needed. ○ Implement safety measures to prevent fire spread or electrical hazards, especially in flood scenarios. ○ Ensure biogas and waste treatment facilities have emergency protocols to handle gas leaks and explosions.
Specific Hazards (Drowning)	• Station lifeguards and safety equipment at strategic locations along the beach • Regularly inspect and maintain safety and rescue gear.	○ Ensure readiness of rescue operations to respond to incidents of drowning or sea-related accidents efficiently.

Key Elements of the DMP:

- i. **Comprehensive Coverage:** The plan addresses a wide range of hazards, both natural and anthropogenic, ensuring thorough preparedness and effective response strategies.

- ii. **Stakeholder Involvement:** Involves various local stakeholders, including government officials, emergency services, and community representatives, ensuring a coordinated and efficient emergency response.
- iii. **Regular Updates and Training:** Emphasizes the importance of regular plan updates and continuous training for staff to handle emergency situations effectively.
- iv. **Infrastructure Resilience:** Focuses on incorporating disaster-resilient features in facility design and infrastructure to mitigate the impact of disasters.

This management plan is designed to enhance disaster resilience for the community and the environment around Kameswaram Beach, ensuring preparedness and a rapid, coordinated response to emergencies.

2.7 Monitoring and evaluation of ESMP implementation

Effective implementation of the ESMP is essential to achieving the project's sustainability goals. Monitoring and Evaluation (M&E) play a pivotal role in this process by ensuring that the ESMP adheres to its objectives, successfully mitigates environmental and social impacts, and remains responsive to the needs and expectations of stakeholders. Continuous M&E activities are integrated throughout the project lifecycle, from planning through to post-implementation, facilitating timely adjustments and ensuring the long-term effectiveness of the ESMP.

Objectives of Monitoring and Evaluation:

- Evaluate the efficiency of implemented mitigation measures to ensure they effectively reduce environmental and social impacts.
- Monitor the progress of capacity-building initiatives designed to enhance understanding and compliance with the ESMP among all project participants.

a. Regulatory requirements for monitoring:

Waste treatment facilities are mandated to regularly monitor the quality of their effluent and emissions. This data must be reported to the State Pollution Control Board (SPCB) at designated intervals. These reports are crucial for the SPCB to oversee compliance with environmental standards and to conduct

periodic inspections to assess the operational efficacy and environmental impact of the facilities.

b. Monitoring Schedule:

The comprehensive monitoring plan for the ESMP is detailed in Table 2.6, which outlines the frequency and responsibility for monitoring various environmental and social parameters.

Table 2.6: Environmental and Social Safeguards Monitoring Plan

Key aspect	Locations, Parameters, Indicators	Frequency of Monitoring	Responsibility
Monitoring at Construction Stage			
Biodiversity	No. of trees felled, saplings planted, survival rate of saplings	Six-monthly	TNDOE
Construction safety/ Community Grievances	No. and nature of worksite accidents and near-miss incidents	Monthly Quarterly Six-monthly	Contractor, TNDOE
	No. of community grievances raised and addressed	Monthly Quarterly Six-monthly	Contractor TNDOE
Capacity Building	No. of awareness programs for workers, community	Monthly Quarterly Six-monthly	Contractor TNDOE
Monitoring at Operation and Maintenance Stage			
Water Quality	Compliance with standards for pH, TDS, DO, Salinity, etc.	Weekly Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Emissions (Solid Waste)	Compliance with emissions standards	Daily Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Solid Waste Management	Type, Volume/Weight, treatment details of solid waste	Daily Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Sludge Quality (Bio-digester)	Volume and quality of treated sludge	Weekly Monthly Six-monthly Annual	Beach Facility Operator TNDOE

Key aspect	Locations, Parameters, Indicators	Frequency of Monitoring	Responsibility
Occupational Safety and Health	No. and nature of worksite accidents and near-miss incidents	Weekly Monthly Quarterly Six-monthly	Beach Facility Operator TNDOE
Public Safety and Health	No. of community grievances, drowning incidents, fatalities	Monthly Quarterly Six-monthly	Beach Facility Operator TNDOE

This structured approach to M&E ensures that all potential impacts at Kameswaram beach are carefully monitored and managed, contributing to the project's overall success and sustainability.

2.8 Implementation and Supervision Arrangements

The Tamil Nadu Department of Environment (TNDOE) serves as the primary implementing agency responsible for executing the ESMP under the oversight of the TN SHORE project management authorities. It is mandated to adhere strictly to the mitigation measures outlined in the ESMP, along with developing operational strategies to effectively implement the biodiversity management plan as proposed. Adjustments to the biodiversity management plan, if required, will be made based on on-site conditions, ensuring its alignment with project objectives.

Moreover, a dedicated budget specifically allocated for the implementation of the ESMP and other blue flag beach activities are recommended in the DPR (**Chapter 5 Infrastructure Development & Budget**). Section 5.3 of the DPR provided the budgets for various Infrastructures (including bio-digester, grey water treatment plant, Solid Waste Management, shelterbelt plantation etc.) required for the implementation of the ESMP and other blue flag beach activities. Table for the Beach Monitoring and Maintenance is also provided in the section 5.5. This budgetary allocation will be clearly delineated within the overall project budget, reflecting the commitment towards environmental and social safeguards.

By entrusting TNDOE with the implementation of the ESMP, supported by robust supervision mechanisms, the project ensures diligent execution of mitigation measures and adopts environmental sustainability in line with project objectives.

2.9 Reporting

Following the establishment of each project component, the implementing agency is required to prepare a comprehensive report detailing adherence to the measures outlined in the ESMP. This report will be submitted to the TN SHORE

project authorities for review and assessment. Additionally, the reports should include detailed disclosures to stakeholders regarding the progress of the activities undertaken. This transparency is vital for maintaining stakeholder engagement and ensuring accountability throughout the project's lifecycle.