

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

Environment and Social Management Plan

**For Blue Flag Beach Certification of Ariyamaan
Beach, Ramanathapuram, Tamil Nadu**

July 2024

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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, Kushi Beach 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.

Kushi Beach, located along the coast of Ramanathapuram district in Tamil Nadu. The Government of Tamil Nadu, in its commitment to sustainable development and environmental conservation, has initiated a project to achieve the prestigious Blue Flag certification for Kushi Beach under the Beach Environment & Aesthetics Management Services (BEAMS) program. This certification represents the highest international standards of water quality, environmental management, safety, and educational services, thereby enhancing the beach's global appeal and promoting eco-tourism.

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. Project Overview and Findings of ESDD

1.1. Project overview

The Government of Tamil Nadu has launched a project entitled Tamil Nadu - Sustainably Harnessing Ocean Resources and Blue Economy (TN – SHORE) with funding from the World Bank. The project aims to enhance the resilience and sustainable utilization of coastal resources through a multi-pronged approach. It envisions a holistic integration of various sectors to drive a resilient and circular blue economy, empower local livelihoods, and enhance capacities for a greener future. One of the sub-projects identified is obtaining Blue Flag Programme for Kushi Beach, in Ramanathapuram district.

The Blue Flag Programme, an esteemed international eco-label, is dedicated to promoting sustainable development in freshwater and marine areas. It has garnered recognition for its rigorous standards that integrate environmental management, water quality, safety, and environmental education. This holistic approach has been instrumental in promoting synergy between the tourism and environmental sectors at various levels, from local to national.

In alignment with its commitment to environmental sustainability and tourism development, the Government of Tamil Nadu has embarked on an ambitious initiative to attain Blue Flag certification for ten select beaches under the Beach Environment & Aesthetics Management Services (BEAMS) programme. Kushi Beach in Ramanathapuram, a highlight of the state's coastal beauty, is one of the selected beaches for this esteemed certification.

1.2. Objective and context of ESMP

The main objective of an ESMP is to list out the mitigation measures for potential negative impacts of various sub-project activities and designate responsible entities for the same.

An ESDD to understand the likely environmental and social impacts and risks has been prepared. Based on the outcome of the ESDD, an ESMP to deal with issues and appropriate mitigation measures to address the impacts is prepared for each of the sub-project activities.

The perspective of a management plan is the outcome of the ESDD exercise carried out for the sub-project activities. The ESDD indicated potential effects on the baseline social and environmental nature of the project area. Although targeted at achieving environmental management, water quality, safety, and environmental education through sustainable development, the project includes various construction activities to create permanent fixtures in the zone. A separate ESMP is therefore required for each of the sub-project activities.

An Environmental and Social Management Plan (ESMP) for an eco-labelled beach is a document that specifies the actions that will be taken to reduce the environmental and social effects of a project. It is a crucial tool for making sure that beach development is sustainable and that the requirements of the neighbourhood are taken into account.

The potential environmental and social impacts of the beach development project should be assessed, and subsequent mitigation strategies should be defined in this management plan. To achieve this, a monitoring and evaluation plan is necessary to track the effectiveness of the mitigation measures. This plan should also consider engaging the local community and addressing their concerns related to the Kushi Beach development activities.

The following environmental and social impacts should be considered in an ESMP for the blue flag beach development:

1. **Impacts on water quality:** Beach development can pollute water through the discharge of sewage, storm water runoff, and other pollutants. This can harm marine life and make the water unsafe for swimming and other activities.
2. **Impacts on coastal erosion:** Beach development can accelerate coastal erosion by removing sand from the beach and by disrupting the natural processes that help to protect the coast from storms.
3. **Impacts on wildlife and beach vegetation:** Beach development can disturb or destroy beach vegetation and associated habitat, including nesting areas for sea turtles and shorebirds etc.
4. **Impacts on the local community:** Beach development can displace local residents and businesses, and it can increase traffic and noise levels.

1.3. Sub-Project Description

Kushi is located at 24 Km distance, 37 minutes travel time from Rameswaram and located in Palk bay. It is a part of the larger Ariyaman Beach that is in close proximity to Rameswaram and Danushkodi. The sandy stretches of the area already popular among daily visitors and tourists alike. It is in close distance from various popular destinations of Ramanathapuram district. There are facility of guesthouse cottage homestay, modern outdoor fresh water swimming pool, children park and eco-friendly cottages available for visitors. The GPS coordinates of the beach are from Lat-Long: 9°17'55.00"N and 79°4'10.02"E. The total beach area is 0.01 sq. km (11,781 sq. m.). Of this, the proposed infrastructure is to be established in 2400 sq. m.

The beach attracts an average of 3,000 visitors per day on weekdays and 4,500 visitors per day on weekends and public holidays. During the summer months, around 2,000-2,500 people visit the beach every day.

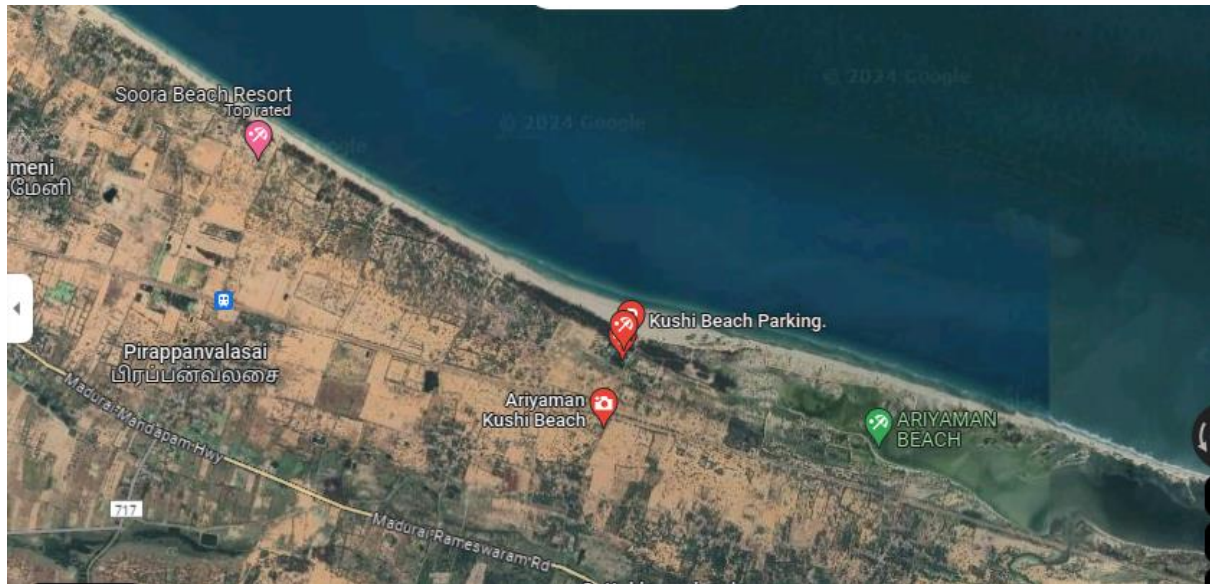


Fig. 1: Location of Kushi Beach, Ramanathapuram, Tamil Nadu for Proposed Blue Flag Beach Development



Fig.2 Proposed zonation for Blue Flag Certification area

1.4. Proposed Interventions/ Activities and Intended Outcomes

The Kushi Beach Blue Flag project encompasses a comprehensive suite of interventions and activities aimed at enhancing the environmental, social, and economic aspects of the beach. These are designed to meet the stringent criteria required for Blue Flag certification, thereby ensuring the sustainable development of the beach area. The proposed interventions are categorised into the following areas:

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 Kushi 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 impacts 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 Kushi 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 Kushi Beach has identified few environmental and social risks and impacts that need to be addressed. These are summarised below:

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. Leakage from the Bio-digester unit can caused ground water pollution and release of Gas can harm the person maintaining the unit.
- ii. Leakage from the Bio-digester unit can cause ground water pollution and release of Gas can harm the person maintaining the unit.

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.
- ii. **Labour, OHS & HS:** The migration of labour during construction should be managed to ensure fair working conditions and minimize social disruptions.

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 ensures 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

1. **Environmental and Social Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts;
2. **Environmental and Social Standard 2:** Labour and Working Conditions;
3. **Environmental and Social Standard 3:** Resource Efficiency and Pollution Prevention and Management;
4. **Environmental and Social Standard 4:** Community Health and Safety;
5. **Environmental and Social Standard 5:** Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
6. **Environmental and Social Standard 6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources;
7. **Environmental and Social Standard 7:** Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities;
8. **Environmental and Social Standard 8:** Cultural Heritage;
9. **Environmental and Social Standard 9:** Financial Intermediaries; and
10. **Environmental and Social Standard 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	Precautionary steps to avoid environmental damages while carrying out all the activities and briefing the people involved	Applicable (Included in the ESMP)

ESS	Recommended Management Plans	Applicability
Social Risks and Impacts	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.	
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	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.	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 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. To avoid cutting trees or removing vegetation, the layout plans and designs for all the activities should avoid areas with vegetation. In case felling of any tree is absolutely unavoidable due to site-specific conditions, permission of the Forest Dept. will be	Not Applicable

ESS	Recommended Management Plans	Applicability
	secured and compensatory plantation undertaken as per the instructions.	
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)

2. Environmental and Social Management Plan (ESMP)

Sub-project activities for ESMP

The plan on the following sub-project activities for the identified stretch of Kushi Beach have been provided in this section:

1. Plan for Development Activities: Focuses on integrating environmental sustainability and community safety standards right from the design and pre-construction phases through to construction. This plan ensures all developmental activities align with established environmental and safety protocols.
2. Plan for pollution management: 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. Plan for Human Health and Safety: 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. Plan for Monitoring and Evaluation: 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. Plan for 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.

2.1. Plan for Development Activities

Table 2.1 summarizes the plan for developmental activities

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 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.

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	Design Team and operator	To be included in ToR and bid documents.

			storage and treatment solutions to handle system breakdowns without environmental contamination. Establish protocols for the segregation, handling, and proper disposal of waste.		
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	Sufficient space is required to keep the solar batteries so that access becomes easy for maintenance work without any hazard	Facility Operator	To be included in ToR and bid documents.
		Water required to clean solar panels	Minimal water should be used to clean the solar panels while in operation because of the accumulation of dust and bird droppings		
		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.
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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.

2.2. Pollution Management Plan

The component wise plans for Kushi Beach are given below

2.2.1. Grey Water Treatment Plan

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

Potential negative impacts	Mitigation measures	Responsible agency	Monitoring agency
Inadequate attention to legal and regulatory clearances required for operation.	All clearances required from other departments shall be ensured and made available before start of operation. This includes consent for operation for the GWTP from the state Pollution Control Board (including approval of the attached quality testing lab).	Facility Operator	TNDOE
Treated water reuse may lead to contamination in case of inappropriate use or in case of reduction in efficiency of GWTP or non-working of GWTP.	The treated water may be used for gardening, flushing, etc. The quality parameters for recycling and reuse applications must be BOD/TSS less than 10 mg/L and Total Coliform less than 230 MPN/100 ml in treated water. The treated water quality needs to be tested at prescribed regular intervals. The treated water quality needs to comply with the latest standards prescribed by the SPCB/CPCB.	Facility Operator	TNDOE
Treated water disposal into the sea or any other water bodies may lead to pollution of the water body receiving GWTP discharges in case of reduction in efficiency of GWTP or non-working of GWTP.	The treated water quality needs to be tested at prescribed regular intervals. The treated water quality needs to comply with the latest standards prescribed by the SPCB.	Facility Operator	TNDOE
Improper disposal of sludge leading to contamination of land and water.	The sub-project does not envisage any such production of sludge as all waste water from toilets and shower area goes to grey water treatment plant.	Facility Operator	TNDOE
Inadequate monitoring of GWTP operation may lead to unchecked deterioration in performance over time.	Operations log shall be maintained with details on quantity of inflow effluent and outflow treated water; quality of inflow effluent and outflow treated water, quantity and quality of sludge generation, etc., at every step in the process.	Facility Operator	TNDOE
Untrained staff may cause inefficient functioning of GWTP.	Staff will be trained in the operation and maintenance of the GWTP. SOPs to be displayed near GWTP including emergency procedures.	GWTP supplier	TNDOE
Safety hazards	Fire extinguisher to be provided. Workers shall use required PPEs. All cleaning agents & detergents are made of biodegradable ingredients and will be stored at proper raised platforms and in secured store room.	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 Kushi Beach. The detailed responsibilities and measures are structured to provide clear guidance for the operation of the GWTP, ensuring environmental compliance and safety.

2.2.2. Plan for Bio-digester

Table 2.3 summarizes the ESMP for operation of Bio-digester at the identified stretch of Kushi Beach

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

<i>Potential negative impacts</i>	<i>Mitigation measures</i>	<i>Responsible agency</i>	<i>Monitoring agency</i>
Inadequate attention to legal and regulatory clearances required for operation.	Only authorized and well-researched & established technology (DRDO) will be used for bio digesters. Being an approved technology from Government of India, no clearances will be required from departments before start of operation.	Facility Operator	TNDOE

Potential negative impacts	Mitigation measures	Responsible agency	Monitoring agency
Poor quality of the biogas bag (gas holder) can lead to gas leaks due to wear and tear.	The bag should be made from fiber-reinforced PVC of at least 850 g/m ³ .	Facility Operator	TNDOE
Improper selection of site can reduce performance efficiency.	The site should be large enough for the digester bag, the inlet and outlet of the digester, and some additional space to walk around the installation (for periodic checks and maintenance tasks). It should be as close as possible to the place where the gas is going to be used, in order to avoid long gas lines. The ground should be flat.	Facility Operator	TNDOE
Gas leaks can pose a safety risk.	Each day the whole biogas system should be checked for irregularities (tears or cracks in the bag or hoses, tightness of hose clamps). All connections should be sprayed with soap water mixture so that any leaks can be detected by the presence of bubbles. Make provision for a 'flame arrestor' device in the gas pipe. In case of fire, it will prevent the flame from travelling down the gas pipe into the gas storage bag and causing an explosion. No smoking or open flames should be allowed near biogas digesters, especially when checking for gas leaks.	Facility Operator	TNDOE
Negative pressure in the biogas plant can pose a safety risk.	Ensure that in normal operations the pressure inside the biogas system is always greater than the outside pressure.	Facility Operator	TNDOE
Improper management of digester effluent (sludge) can create pollution.	The digester effluent (sludge) needs to be partially dried and then composted at the location.	Facility Operator	TNDOE
Inefficient utilization of the biogas generated.	Biogas utilizing devices such as stove or lamps will be procured, based on the likely amount of gas to be generated, and utilized.	Facility Operator	TNDOE
Safety risks in case of floods	In case of floods, safety measures must be taken in advance so that the gas can escape in case the digester and/or the gas storage tank are flooded. An upside-down 'T' pipe should be placed at the highest	Facility Operator	TNDOE

Potential negative impacts	Mitigation measures	Responsible agency	Monitoring agency
	vertical point in the gas pipe line above the gas outlet from the digester. A vertical pipe and a gate valve should be joined to the stem of the upside-down 'T' pipe. The gate valve can then be opened to release the biogas if a flood threatens to cover either the digester or the gas storage tank.		

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.

2.2.3. Plan for Solid Waste Treatment

Table 2.4 summarizes the ESMP for operation of Solid Waste Treatment Plant at the identified stretch of Kushi Beach

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

Potential negative impacts	Mitigation measures	Responsible agency	Monitoring agency
Inadequate attention to legal and regulatory clearances required for operation.	All clearances required from other departments shall be ensured and made available before start of operation.	Facility Operator	TNDOE
Contamination of beach and water body from leachates and spillage of waste	Regular maintenance of the waste management unit, leachate tank	Facility Operator	TNDOE
	Sampling and testing of surrounding soil and water		
	Identification of the leakage source and address the issue. Transfer the leachates to nearby WTP		
Deterioration of air quality by dust during the operation / transport of the waste to the plant	Though minimal , but can be further minimized by water spray on operation site	Facility Operator	TNDOE
	Implement preventive maintenance program for hand carts and other transport vehicle		
	Strict application of personnel protective equipment and wear by		

Potential negative impacts	Mitigation measures	Responsible agency	Monitoring agency
Odours caused by the stored and transported waste	the workers using operation and transport	Facility Operator	TNDOE
	Planting Trees and plants along buffer zone		
	Wash of the tipping area and the solid waste vehicles		
Noise impacts during operation	Covering of the transported waste and immediate processing	Facility Operator	TNDOE
	The remaining waste (if any, during non-operation period) should be put in roll on/off container and covered		
	Limiting operation works to daytime for minimizing adverse impact on coastal biota		
Workers Health and Safety	Regular maintenance of vehicles, generator and waste processing plant	Facility Operator	TNDOE
	Schedule the movement of vehicles for collection (comber) and transport of carefully with minimal disturbance to tourist and biota		
	Provision and use of the PPE by workers		
Inconvenience of community (visiting, and local)	Provide First Aid kits	Facility Operator	TNDOE
	Periodic check-up for health		
	Information sharing with the community		
	Grievance uptake Channels for any coming complaints during operation (social media, website, email and telephone number)		
	Acknowledge and address the complaints		
	Monitor, evaluate and provide feedback	Facility Operator	TNDOE
	Ensure documentation for any received complaint		

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 Kushi Beach are conducted in an environmentally responsible and socially sensitive manner, adhering to regulatory requirements and best practices for sustainable management.

2.3. Human health and safety Plan.

2.3.1. Potential Impact on Occupational Health and Safety

Positive Impacts: By adopting the majority of pre-fabricated structures and environment friendly materials, modern equipment & tools, and operation methods and facilities, the treatment plants will ensure safe working conditions. Disaster mitigation elements will be built into the design and operation of the treatment plants and other facilities, making it a safe working environment.

Negative Impacts: Construction related safety risks to Labour could be due to unrestricted access, improper use of machinery, lack of protective gear, lack of access to first aid, improper storage of materials, etc. Improper waste disposal and sanitation practices by construction workers will pollute the coastal environment; inadequate attention to ventilation in design will result in poor air circulation and lighting; poor attention to disaster mitigation in design and operation of the facility can aggravate damage risk. Uncontrolled disposal of wastes close to the site is associated with resident populations of vermin, which are factors for increasing nuisances to humans and the spread of disease, and disrupting the natural ecosystem. These might lead to pests, rodents and snakes that occupy the solid waste disposed. Project components are designed in such a manner that it encompass all such features of occupational health & safety. Provision of personal protective gear for staff, skilled, qualified & trained manpower for using plant & machinery, provisions of tools and tackles, first aid station comprising of kit & attendant and scientific handling & management of both liquid & solid waste are some of the features of the project and therefore no such impact is envisaged.

2.3.2. Potential Impact on Community Health & Safety

Positive Impacts: The beach facilities are designed around sustainable development goals and will not only contribute to a cleaner beach environment and community health (wastewater & sanitation) but also improve livelihood. The design features of the project facilities, equipment & plants are also an education for local community to adopt in their respective household processes and therefore improve their living standards.

Negative Impacts:

During Construction: Inadequate attention to Labour and community safety in design (for example, poor design of sanitation facilities and drainage can lead to higher risk of contamination, poor choice of materials can lead to fire risks, etc.); Unrestricted access to the work site could pose construction related safety risks to community. No such impact is envisaged in this project.

During Operation: The use of contaminated raw materials will compromise product quality and people's health; Unhygienic handling during the production process may lead to contamination. Poor sanitation practices, contaminated water sources, and inadequate food handling can contribute to the spread of waterborne and foodborne illnesses among beach tourists and local communities. Bacterial infections, such as *E. coli* and norovirus, are common risks associated with swimming in polluted waters or consuming contaminated food. Additionally, Activities such as swimming, surfing, and boating carry inherent risks, including drowning, injuries, and fatalities. Lack of proper safety measures, inadequate lifeguard coverage, and insufficient signage can increase the likelihood of accidents, especially for inexperienced or unaware visitors.

The use of plastic is completely avoided in the design features of the sub-projects. The use of biodegradable materials and cleaning agents is promoted in the project interventions, so therefore no negative impact is envisaged on the health of the community and local environment. Regular monitoring of environmental parameters, preparedness, response, and recovery measures tailored to the specific risks and vulnerabilities ensures safe community health.

2.4. Infrastructure Management Plan

2.4.1.ESMP for Operation of Solar Energy Plant

Table 2.5 summarizes the ESMP for operation of Solar Energy Plant at the identified stretch of Kushi Beach

Table 2.5: Environmental and Social Management Plan for operation of Solar Energy Plant

Potential negative impacts	Mitigation measures	Responsible agency	Monitoring agency
Storage of batteries in closed rooms may cause occupational dangers	Sufficient well ventilated space is required to keep the solar batteries so that access becomes easy for maintenance work without any hazard	Facility Operator	TNDOE
Water required to clean solar panels	Minimal water should be used to clean the solar panels while in operation because of the accumulation of dust and bird droppings	Facility Operator	TNDOE
Disposal of electrical equipment	Switchgears, transformers, Cables, batteries, Trays etc.	Facility Operator	TNDOE

Potential negative impacts	Mitigation measures	Responsible agency	Monitoring agency
	wear and tear should be disposed of scientifically.		
Disposal of electronic equipment	Control panels, Electronic hardware, and solar panels etc. wear and tear should be disposed of scientifically.	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 TNDOE 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 Kushi Beach and its surrounding community.

2.5. Plan for Physical forces

2.5.1. Disaster Management Plan (DMP)

The objective of the DMP for the identified stretch of Kushi Beach is to ensure safety of life, protection of the environment, and safety of the installation. Regular review and update of the plan is essential to reflect changes in the environment, infrastructure, and local regulations.

The disaster preparation, response/mitigation are listed below

Hazard	Actions for Disaster Preparedness	Actions for Disaster Response
All hazards	- Ensure provision of complete personal protective equipment for all workers. - Establish an emergency response team comprising relevant stakeholders, including local	- Maintain log of all accidents and near-miss incidents. - Implement a robust communication system to disseminate timely alerts and

Hazard	Actions for Disaster Preparedness	Actions for Disaster Response
	government officials, emergency services (police, fire, medical), lifeguards, tourism operators, and community representatives. • Designate roles and responsibilities for each team member, ensuring clear lines of communication and coordination during emergencies. • Ensure clear display of emergency contact numbers in the premises. • Ensure accident insurance coverage for all staff and workers.	updates to beach tourists, workers, and businesses in case of emergencies.
Natural Hazards		
Cyclones and Storm surges	• Ensure integration of cyclone resistant elements in building design. • Ensure completion of all civil works prior to the onset of the monsoon season. • Follow instructions of district administration regarding prior evacuation of the area. • Keep the material storage inventory at a minimum during the cyclone and storm surge season.	• Immediate Relief action will be initiated in the department level
Earthquake	• Ensure integration of earthquake resistant elements in facility design. • Include earthquake preparedness actions in staff training on disaster preparedness.	• Shut off electricity, gas, water supply. • Evacuate building after shaking has stopped. Move all staff to safe, clear area.
Anthropogenic hazards		
Accidents related to use of machinery	• Keep first-aid kit readily available and updated. • Train all staff in first aid.	• Safety measures will be taken in advance, even then if the accident happens, medical attention will be provided
Fires and explosions	• Keep fire extinguisher readily available and updated. • Conduct periodic and regular fire evacuation drills.	• In case of earthquakes, cyclones, etc., turn off electricity and gas supply. • Safety measures must be taken in advance so that the

Hazard	Actions for Disaster Preparedness	Actions for Disaster Response
	• Train all staff in first aid for burns. • Ensure periodic checks and maintenance of bio-digester and solid waste treatment plant.	gas in the bio-digester can escape in case the digester and/or the gas storage tank are flooded. Refer to ESMP for Biogas Plants.
Electric shocks	• Ensure that all wiring, circuit breakers, appliances are safe and in good condition. • Train all staff on electrical safety. • Make sure all employees know how to switch off the electrical mains in an emergency.	• Safety measures will be taken in advance, even then if the accident happens, medical attention will be provided
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 Kushi Beach, ensuring preparedness and a rapid, coordinated response to emergencies.

2.6. Monitoring and evaluation of ESMP implementation

For the Environmental and Social Management Plan to be successfully implemented, monitoring and evaluation (M&E) are crucial. It contributes to ensuring that the ESMP is implemented in accordance with its objectives, that it is successful in reducing environmental and social consequences, and that it is responsive to stakeholders' requirements. M&E should be conducted throughout the life cycle of the project, from the planning stage to the implementation stage to the post-project stage. This will help to ensure that the ESMP is effective in mitigating environmental and social impacts throughout the project.

Objective of Monitoring and evaluation

The objective of environmental monitoring is:

- To check the effectiveness of implementation of the mitigation measures in the ESMP.
- To check the implementation of capacity building programs on the ESMP.

Regular environmental monitoring will help in timely identification of residual issues so that required mitigation action can be taken promptly.

a. Regulatory requirements for monitoring

Waste treatment plants are required to monitor the quality of effluent discharged and emissions made. The result of such monitoring is to be submitted to the State Pollution Control Board (SPCB) at stipulated intervals. The monitoring and analysis are to be performed in laboratories approved by the board. In addition, the SPCB may undertake periodic inspections of the treatment plants to evaluate the progress and efficiency of consent conditions and to ascertain the water and ambient air quality.

b. Monitoring Schedule

The monitoring plan for the Environmental and Social safeguards is given in Table .

Table 2.6: Environmental and social safeguards monitoring plan

<i>Key aspect</i>	<i>Locations, Parameters, Indicators</i>	<i>Frequency of monitoring</i>	<i>Responsibility</i>
Monitoring at Construction Stage			
Biodiversity	No. of trees felled, saplings planted and survival rate of saplings raised for compensatory plantation	Six-monthly	Contractor (during construction)

Key aspect	Locations, Parameters, Indicators	Frequency of monitoring	Responsibility
	Chance finding of turtle nesting in the project area and near vicinity	From December to March	TNDOE
Construction safety	No. and nature of worksite accidents and near-miss incidents	Monthly	Contractor
		Quarterly	TNDOE
		Six-monthly	
	No. of community grievances raised and addressed	Monthly Quarterly Six-monthly	Contractor TNDOE
Capacity building on environmental and social safeguards	No. of awareness programs organized for workers, local community	Monthly Quarterly Six-monthly	Contractor TNDOE
Monitoring at Operation and Maintenance Stage			
Water quality of treated grey water in treatment plant	Percentage of samples that are in compliance with the prescribed general standards for discharge of effluents: pH, TDS, DO, Salinity, Total Hardness, Fluoride, Chloride, MPN, Heavy Metals	Weekly Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Emissions from solid waste management plant	Percentage of samples that are in compliance with the prescribed standards	Daily Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Quantity of treated and untreated solid waste	Type, Volume/Weight and Details of treatment of each type of solid waste	Daily Monthly Six-monthly Annual	Beach Facility Operator TNDOE
Quality of treated sludge from bio-digester	Volume	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 raised and addressed	Monthly Quarterly Six-monthly	Beach Facility Operator TNDOE

2.7. Implementation and Supervision arrangements

The project implementation agency, i.e., Tamil Nadu Department of Environment (TNDOE) is the sole agency to implement the ESMP under the guidance of TN SHORE project management authorities. It needs to follow the mitigation arrangements specified in the ESMP and also work out the modalities to implement the biodiversity management plan suggested in the ESMP, which, if needed, should be expanded based on the field conditions. It will work out a budget to implement the plan and reflect it separately in the overall budget of the project.

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.

2.8. Reporting

The implementing agency shall prepare a report after the establishment of each project component, indicating compliance with the measures suggested in ESMP, and submit it to the TN SHORE project authorities. The report also needs to contain information to be disclosed to the stakeholders on the activities undertaken and the rate of progress. This transparency is vital for maintaining stakeholder engagement and ensuring accountability throughout the project's lifecycle.