Environmental and Social Management Plan (ESMP)

"Bhutan Waste Bank"

Greener Way

Environmental and social risks and impacts are strongly linked to subproject location and scope of activities. As much as ESMP is attempted to customize with each specific subproject location and activities. Some subproject activities of this **"Bhutan Waste Bank (BWB)"** project are clustered in one space, at one location, to be implemented at one time by one contractor, e.g., the Recycling plant establishment at Memelakha. As such, subproject activity, establishment of recycling plant, comprising of construction of; an 90 meters access road construction, construction of an Eco-pole production unit, a PET Flakes production unit, PET washing unit, an office, two blocks of staff quarters (one block one unit and one block two units) are considered in one ESMP as one subproject activity.

1. Subproject Activity Information

Subproject Activity Title:	Upscaling and Relocation of Eco-pole plant and Establishment and operation of PET Washing and Shredding Plant at Memelakha.
Estimated Cost:	689,874 USD
Start/Completion Date:	June 17, 2024 - December 31, 2024.

2. Site/Location Description

The proposed 1.64-acre site for the recycling plant is located at Memelakha, approximately 2,415 meters above sea level (masl). This land has been allocated by Thimphu Thromde from a larger 48-acre area designated for integrated waste management at Memelakha. The Memelakha landfill for Thimphu Municipality lies downhill from the proposed site, while a storage ground for a private trash dealer is located on the western slope. The site is accessible via a 4.5-meter-wide landfill access road. An additional 90 by 4.5 meters of road will be constructed to connect the site to the existing landfill road.

The allocated site features rough terrain, characterized by sparsely distributed degraded blue pine trees (*Pinus wallichiana*) and scattered shrubs of Common Himalayan Red Rhododendron (*Rhododendron arboreum*). Rainfall patterns and seasons are consistent throughout Thimphu Dzongkhag, including Memelakha. The region experiences dry months from December to March, with monthly rainfall averaging as low as 20 mm (0.79 inches), while the monsoon season, from July to September, brings rainfall of up to 220 mm (8.7 inches) per month. The average annual rainfall is approximately 650 mm (25.6 inches). Though exact figures are unavailable, light snowfall typically occurs during the winter months. Winter temperatures show significant fluctuations, with nighttime lows dropping to -10°C and daytime highs ranging between 15°C and 20°C. The soil has a compact red texture with partial rocky areas, providing stability. Land surface erosion is minimal, indicating a stable geographical condition with low risk of soil erosion or landslides. There are no surface water bodies in or near the plant establishment site.
Power supply in the area will be provided by Bhutan Power Corporation (BPC) once the plant is operational. Water supply will need to be sourced from streams in the Yusipang area, located approximately 3 kilometers upstream along the Thimphu-Wangdue Phodrang highway.

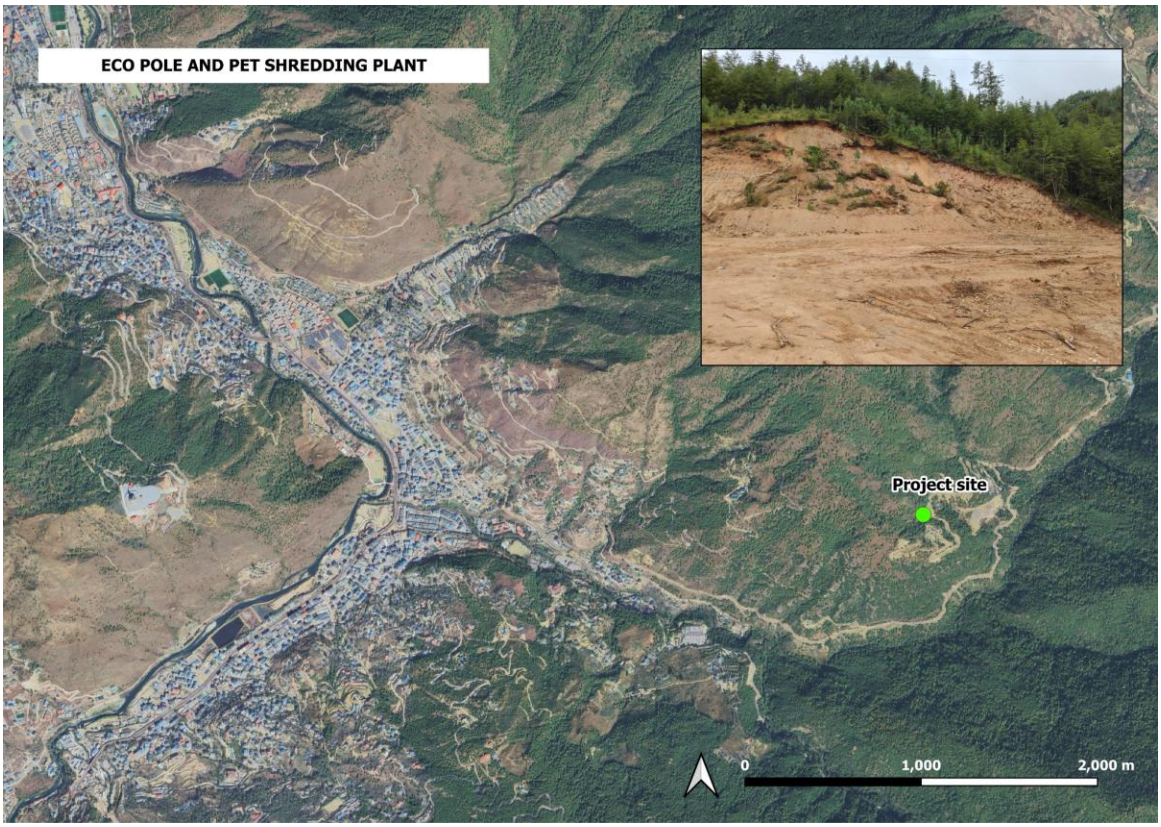

Fig. Location of project site
Map _ (https://maps.app.goo.gl/Lwj7SWcNE4Krcqap8)

3. Subproject Description and Activities

The primary function of the Plastic Recycling Facility is to produce recycled Eco-poles and PET flakes, meeting the national, regional, and global demand for recycled products and raw materials.

2.1 Construction phase

The construction phase includes the development of an Eco-pole plant with a processing capacity of 3 tonnes of plastic (LDPE & HDPE) waste daily, establishment of a PET flake production facility with the processing capacity of 5 tonnes of PET waste daily with an integrated PET washing facility with a water footprint of 2000 liters daily, and the construction of an office building and two staff quarters blocks; Block A with one unit and Block B with two units. All constructions are within one fenced area of 1.64 acres of space allocated by the Thimphu Thromde.

2.1.1 Ground preparation

Vegetation clearing, ground preparation for the recycling plant and access road will begin in the initial phase. Approximately 75 pole-sized Blue Pine trees (girth less than 10 cm) and some common Himalayan Red *Rhododendron* shrubs will be removed, with the poles repurposed for the construction of labor camps and storage sheds. To compensate for the cut trees, over 100 saplings will be planted. Ground preparation will involve removing topsoil, cutting, and leveling the slope to create a flat surface for the recycling plant infrastructure. The dry gorge on the right-hand side of the site will be filled with excavated material to extend the construction area, avoiding the need for off-site disposal.

2.1.2 Construction of roads and retaining walls.

Two retaining walls, constructed in consecutive spans, will ensure stability and protection for both the access road and the plant infrastructure.

Wall 1 dimensions: 32m (L) x [(5m + 0.45m)/2] (B) x [(0m + 9.4m)/2] (H)

Wall 2 dimensions: 17m (L) x [(0.7m + 2m)/2] (B) x 4.5m (H)

A 90m x 4.5m (LxB) access road will be constructed, involving slope cutting and backfilling of the retaining walls to maintain a gradient of 1:8. The road was built with a stone base course to ensure all-season usability.

To control silt flow from the disposed excavated materials onto the landfill access road, the construction of a Random Rubble Masonry (RRM) toe wall, measuring 10m (L) x 1m (B) x 2m (H), in the gully below the excavated material disposal slope is recommended.

Additionally, benching with a maximum height of 2m and a 70-75 degree slope will be implemented across the height of the slope above the plant site after site development. Native species of plants and grass will be planted to stabilize the area.

2.1.3 Construction of structures

Following the excavation of foundation trenches, stone soling will be laid, followed by plain cement concrete and the construction of a stone masonry (RRM) in cement mortar up to the plinth level, and the earth filling for leveling the floors will be common for all kinds of structure. The office and staff quarters will have brick walls with cement mortars and plastering, followed by white washing of the super-structures with wooden ceiling, roof trusses and pre-painted corrugated sheets for roofing.

The factory units of Eco-pole and PET Washing and Shredding plant will have PPGI walls with steel columns, Steel truss, and PPGI roofing in super-structure. The interior will have PCC flooring over stone soling, along with RCC machine foundation blocks, constructed according to the specific design requirements of the machinery.

PVC pipes and joints fittings will be used for sanitary and water supply facilities. Insulated power supply cable, wirings, and PVC electrical fittings will be used for the electrifications of factory, office, and the staff quarters.

2.2 Operational phase

2.2.1 Production of Eco-pole (500 poles))

Greener Way currently produces 150 eco poles daily at its MRF below Ngabirongchu bridge. Shifting the factory to Memelakha Recycling Plant is designed to upscale the ecopole production to 500 poles daily consuming at least 3000 kg plastic wastes.

Specifications and price::

Dimensions	Round/Diameter	Round/Diameter	Square (	Suare
Length/Height (ft)	5.5	7.0	7.0	7.0
Across size (mm)	75	50	60	80
Weight (approx/kg)	6.5	3.7	7	12.5
Cost Nu. (Green color)	450	320	490	680
Cost Nu.(Black color)	420	290	450	650z

The production of Eco-poles involves several key steps.;

1) Initially, Low-Density Polyethylene (LDPE) and High-Density Polyethylene (HDPE) are shredded using an Anglo machine and a dedicated HDPE shredder, respectively.
2) The shredded materials are then mixed in equal parts.
3) This mixture is processed through an extruder machine at high temperatures, where it is shaped into plastic posts using a mold.
4) After extrusion, the posts are cooled in a cold water bath to solidify before being separated from the mold.
5) The final step involves cutting the posts into various lengths according to customer requirements.
6) The finished poles are then stacked and stored in preparation for marketing and distribution

2.2.2. Production of plastic Flakes.

The plastic wastes recycling plant at Memelkaha will also produce PET Flakes. It is anticipated to produce approximately 5000 kg/ PET flakes from the factory.

The production of plastic flakes involves following key steps;

1) The process begins with the segregation of PET plastic, which is then directed into the shredding phase.
2) After shredding, the PET undergoes thorough washing and drying. Once cleaned and dried, the materials are collected, packed, and stored, making them ready for marketing and distribution

4. Table 1: ESMP Matrix: Risk and Impacts, Mitigation, Monitoring: [1]Construction Phase

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and Monitoring cost in USD
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Loss of biodiversity, increased soil erosion, and disruption to the local ecosystem due to loss of Blue Pine trees and Rhododendron shrubs during land preparation for access road construction and plant site development for the establishment of Eco-Pole and PET plants.	An initial vegetation survey will be conducted to identify the existing plant species. A compensation plan will be developed based on the survey result. Vegetation clearance will be minimized and native species will be introduced based on the compensation plan. In consultation with Green Bhutan Corporation Limited, more than 100 saplings will be replanted in a different location to compensate for the trees removed, with Greener Way overseeing their maintenance post-project. In the next spring season, native plant species (particularly Rhododendron) with higher quality saplings and grass species will be planted after construction is completed to ensure land stabilization. Hedgerow method plantation (with native species flowering plants (commonly planted in residential premises) also is recommended to establish vegetation belt/fencing for the plant compound.	At the site throughout the project cycle, (during land clearing, after construction and after project period)	Greener Way (Project Director during project period and the CEO post project period) and Contractor	Availability of compensation plan No. of trees cut. Diversity of plants removed Number of trees and shrubs planted Area cleared vs. replanted Sign of solid erosions	Weekly visual inspection at site	Env Consultant Greenerway Env Technical Specialist UNOPS	The cost of Reforestation is 20 USD for 110 trees.(0.179 per sabling)

[1] Overall monitoring will be done by the PIU (By the Environmental and Social Development Specialist SACEP PIU and Environmental specialist, UNOPS)

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and Monitoring cost in USD
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
The removal of topsoil during excavation, particularly in the rainy season, may lead to soil erosion and land degradation, and the risk of minor landslips	To prevent erosion, soil stabilization measures will be implemented, including benching and sloping on the uphill side of the plant site. Native species plants and grasses, primarily Rhododendron (using high-quality saplings), will be planted. Construction of retaining wall in two serial spans necessary for retaining the access road and the entire plant site To control silt flow from the disposed excavated materials onto the landfill access road, a Random Rubble Masonry (RRM) toe wall will be constructed Side drains will be constructed at all required areas to control surface runoff and prevent soil erosions	At the site during land clearing phase, and during the construction activities	Greener Way Project Director and Contractor	Signs of erosion and sediment deposition in and around the construction site.	Bi-weekly inspection to monitor during construction activities	Env Consultant GW Env Technical Specialist UNOPS	16000 USD For the construction of retaining wall
Accumulation of construction solid waste	Waste will be segregates and stored in a proper designated shred prior to disposal Reuse of materials as much as possible. The poles from the removed Blue pine trees will be reused in the construction of the labor camps and storage sheds The excavated material will be used for ground preparation in the dry gorge on the right-hand side of the site	At the plant site during construction phase	Greener Way site engineer/Contractor	Amount of waste accumulated Amount of waste reused, recycled and dispose waste Waste segregation and storing practice	During and at the end of the construction phase by weekly	Env Consultant GW Env Technical Specialist UNOPS	Cost included in the Contract for construction.

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and Monitoring cost in USD
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
	Selling of the recyclable wastes to the scrap dealers. Plastic wastes to be stored for recycling when the plan is in operation. Other waste will be handover to the municipality for disposal						
Dust generated during dry weather conditions may affect air quality, while mud during wet conditions could hinder work progress and site accessibility.	Spraying of water from time to time to supress dust generation during dry weather. Construction material will be properly covered during storage Provision of proper PPEs for the construction workers Construction of proper drainage systems to prevent excessive mud accumulation in the construction area	On daily working mode at the construction site	Contractor and GW Project Director	Air quality Use of PPEs during work	Monthly air quality testing Weekly inspection on the site	Env Consultant GW Env Technical Specialist UNOPS	Cost included in the Contract for construction.
Emissions from construction machinery and potential oil spillage could contribute to air and soil pollution.	Usage of machinery in good working conditions. Machines to be maintained in optimal condition to minimize emissions and leakages. Provision of appropriate PPEs for the Operators and helpers Usage of spill kits for spillage control and cleaning. All trucks carrying the construction materials will be covered during the transportation.	At the site during construction period (03 months)	Contractor/Project Director, Greenerway	Regular documentation of maintenance activities and checks for leakages or faults Use of PPEs such as gloves, goggles, and masks. By workers and operators Number and severity of reported spills and the response time for cleanup.	Weekly inspections of the perimeter of the site	Env Consultant GW Env Technical Specialist UNOPS	Cost included in the Contract for construction.

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and Monitoring cost in USD
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Vehicular traffic congestion due to vehicular movement	A schedule for material transportation will be introduced.	During construction period	Contractor/Project Director, Greenerway	Incidents of traffic congestion	Gather feedback from drivers and workers during site visits	Env Consultant GW Env Technical Specialist UNOPS	
Excessive noise and vibration from machinery leading to hearing loss, increased stress levels, and other health issues for workers and public nuisance	Selection of less noisy equipments for construction and maintenance of machinery at optimum conditions Use of appropriate PPEs Limiting construction activities to the day time	During construction at site.	Contractor and GW Project Director	Noise level Use of PPEs Complain due to construction activities	Site visit Monthly noise level monitoring using sound level meters in the areas with heavy machinery.	Env Consultant GW Env Technical Specialist UNOPS	Cost included in the Contract for construction.
Increased risk of accidents due to construction activities and machinery operation.	Safety briefing to workers every morning before the start of the work for the day. Cautionary reminders with fixed sign boards at the site and monitoring use of OHS PPEs from time to time throughout the day Readily available first aid facilities	At the site during construction period (03 months)	Contractor/Project Director, Greenerway	Occurrence of accident cases Use of PPEs Availability of first aid kit Availability of sign boards	Accident registry will be maintained Site visit to ensure that PPEs are worn and procedures are followed.	Env Consultant GW Env Technical Specialist UNOPS	Cost included in the Contract for construction.
Heavy Load Handling and Machinery Accidents during transport and installation of machinery	Usage of mechanical/hydraulic lifting aids and employment of trained engineers/technicians. Provision of appropriate PPEs Readily available first aid facilities	Continuous monitoring during the transport and installation phases. (03 months)	Contractor/GW Project Director	Proper usage of mechanical lifting aids, Accident report Availability of first aid facility	Weekly inspection of areas where heavy lifting is conducted to ensure mechanical lifting aids are in good working condition. Accident registry	Env Consultant GW Env Technical Specialist UNOPS	2000 USD

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and Monitoring cost in USD
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Electrical Hazards and Water Contamination during Electric Wiring/Plumbing	Proper insulation and grounding of electrical systems Usage of certified materials and standard procedures for plumbing and sanitary fittings Use of appropriate PPEs	At the site during construction period (03 months)	Contractor/GW Project Director	Compliance with electrical codes Condition and effectiveness of insulation materials around electrical wiring. Use of PPEs	Weekly inspections of areas with electrical wiring right after installations and before systems are energized to ensure proper insulation, grounding, and safe installation of electrical systems, with monthly follow-up inspections	Env Consultant GW Env Technical Specialist UNOPS	1800 USD
Complain during construction phase	Establish the Project's Grievance Redress Mechanism (GRM), actions and implementation measures to GRM Publicize the existence of the Project's GRM through campaigns, websites, billboards, etc. Ensure that the contact details are placed on notice boards and/or websites	During construction phase	GW project director	Number of complained received	Reviewing GRM, Complaint log and implementation measures on received complains monthly	Env Consultant GW Env Technical Specialist UNOPS	A total of USD 15,000 has been allocated for gender-related expenses, including the Grievance Redressal Mechanism . This budget will cover the resolution of all complaints received. .

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and Monitoring cost in USD
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Occupational Health and Safety	Provision of PPE, and safety briefing programs Provision of proper sanitary facilities, and safe drinking water Provision of workers with adequate and well-ventilated camps, clean eating areas, and separate sleeping	During construction phase	GW project director	Number of accident, Verification of health and safety plan and records	Weekly site visit Visual inspection and interviewing workers, reviewing accident registry	Env Consultant GW Env Technical Specialist UNOPS	PPE Cost included in the Contract for construction. Regarding the visual inspections, two vehicles have been hired for the project at a rate of USD 1,300 per month.

Table 2: ESMP Matrix: Risk and Impacts, Mitigation, Monitoring - Operation phase

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and monitoring cost
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Dust generation while loading,unloading, and transfer process of the raw materials and shredding leading to respiratory issues.	Enforcement of Personal Protection Equipments (PPEs)	Inside the site throughout the operation time.	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Workers sickness cases Air quality. Use of PPEs	Site visit Monthly health checkups. Quarterly Air quality testing.	Env Consultant GW Env Technical Specialist UNOPS	1000 USD
Excessive noise and vibration from machinery leading to hearing loss, increased stress levels, and other health issues for workers.	Specifying low noise emissions as a requirement for machinery selection Regular maintenance of machinery to reduce noise levels use of PPEs such as earplugs or earmuffs; Implementation of vibration control measures,like securing foundation with concreting, reinforced cement concreting (RCC) wherever necessary, ensuring adequate tightening of fixtures and joints, and proper lubrications in the joints, bearings and shaft movement areas. sound level meters in the areas with heavy machinery. Noise level will be maintained at 75dB(A) at Day-time and 65dB(A) at night-time	Areas with heavy machinery during operations phase	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Noise level Use of PPEs Scheduled maintenance of machineries	Weekly Site visits Reviewing records related to the maintenance of machinery	Env Consultant GW Env Technical Specialist UNOPS	500 USD

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and monitoring cost
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Heat generation from melting and molding of Eco-poles and potential fire risks due to leakages in electrical wiring and fittings and discomfort for workers exposed to high temperatures.	Adequate ventilation and provision of appropriate PPEs. Bi-weekly monitoring of temperature during production hours to ensure temperatures remain within safe limits Fire fighting facilities in place including extinguishers/fire hydrants Emergency evacuation plan will be introduced to the facility with trainings Fire and safety drills will be conducted	Inside the factory and throughout operation phase	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Airflow rates and effectiveness of ventilation systems (fans, exhausts) to manage heat levels. Temperature inside the factory Availability and functionality of fire extinguishers, fire hydrants, and other fire fighting facilities Effectiveness Of fire safety drills and training sessions conducted for workers.	Weekly site visit for inspections Reviewing documents	Env Consultant GW Env Technical Specialist UNOPS	500 USD
Improper handling or disposal of solid waste leading to soil, water contamination and affecting the visual appeal of the hub.	waste generated during operations and domestic waste will be separately collected and will be managed separately Proper segregation and disposal of solid waste; recycling and reusing where possible and Non-recyclable waste will be handover to the municipality Regular waste audits and adherence to waste management protocols.	At the site during the whole operation period	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Quantity and type of solid waste produced.	Waste audit records Waste handover and disposal records	Env Consultant GW Env Technical Specialist UNOPS	200 USD

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and monitoring cost
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Potential Water Pollution due to Wastewater generation from the operation activities and toilets, Washing, and PET Waste washing	Use closed-loop water systems and proper treatment of wastewater including primary and secondary treatment options. Bio- microbics technology will be integrated to the treatment process. Oil and grease trapping pits will screen the wastewater prior to release of the water into the open drain. Collection of screened solids will be disposed of in the landfill site. Quarterly waste water quality testing for release of screened waste water into the environment. A 30 m buffer zone will be maintained from the water resource at all times.	Wastewater will be continuously treated and tested at the site (Monthly)	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Chemical composition, presence of contaminants (as per the lab tests).	Quarterly sampling and laboratory analysis from the discharge points	Env Consultant GW Env Technical Specialist UNOPS	32000 USD
Potential for worker health issues, accidents, due to unhygienic conditions and bad sanitation practices.	Health and safety management plans will be introduced including cleaning schedule Provision of safe drinking water, dining facility and sanitary facility Solid waste and waste water will be manage properly and good housekeeping practices will be introduced	Throughout the facility during operations phase	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Implementation o Health and safety management plans and cleaning schedule Availability of drinking water, dining facility and sanitary facility	Quarterly health and safety audits	Env Consultant GW Env Technical Specialist UNOPS	500 USD

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and monitoring cost
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Potential for fluid/grease leakages leading to burns, infections, water and soil contamination.	Strict enforcement of the use of PPEs Usage of spill kits for spillage control and cleaning Installation of proper flooring in the factory to prevent fluids or grease from coming into contact with the ground.	Inside the factory and throughout machines in operation phase	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Workers injury cases. Air quality. Soil quality testing. Cleanliness in the workplace	Weekly Site visits Reviewing Quarterly workers health checkup Soil testing after major spillage accident	Env Consultant GW Env Technical Specialist UNOPS	1000 USD
Workers may experience injuries from various hazards including moving machinery parts, heavy lifting, sharp edges, and slip-and-fall accidents. Common injuries include cuts, bruises, sprains, and fractures.	Comprehensive safety training programs for all employees Ensuring proper use of PPEs Inspection of equipment to prevent malfunctions Emergency response procedures in place including first aid training and readily available first aid facilities	Inside the factory and throughout machines in operation phase	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Workers injury records Use of PPEs Training session conducted	Weekly site visit for inspections Reviewing records of accident registry, Injury/health treatment cases, costing recording and training records	Env Consultant GW Env Technical Specialist UNOPS	500 USD
Potential breakdowns and failures of machinery lead to operational disruptions, safety hazards, and delays.	Keep detailed maintenance records and perform routine inspections to identify and address potential issues before they lead to breakdowns. Ensure that all equipment is operated by trained personnel.	Inside the factory and throughout machines in operation phase	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Functionality/efficiency of machines Competency level of operators	Weekly site visit for inspections Reviewing breakdown records, maintenance records and competency level of personals	Env Consultant GW Env Technical Specialist UNOPS	200 USD

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and monitoring cost
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Potential for community disruption and negative impacts on local quality of life due to project operations and activities.	Although direct and immediate neighboring community impact is not expected as there are No resident settlements in the nearby vicinity. However, indirect impacts to communities especially from use of Eco Poles is possible. Therefore, community engagement represented by local government leaders and the relevant govt regulatory stakeholders is necessary for consultation in any changes of design of the products, renovation of equipment or production plans and training programs is necessary for awareness and acceptance by the beneficiary/recipient communiities.	Intermittently every 1-2 months during construction and operations phase	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager and communication officer	Number of complaints and community feedback.	Quarterly community surveys within the neighboring community areas and facility perimeter.	Env Consultant GW Env Technical Specialist UNOPS	12000 USD
Potential for environmental contamination and health impacts due to the release of microplastics from the recycling process.	Consistent vacuum cleaning of the floors. Provision of PPEs for workers and visitors. Regular ambient air quality testing. Proper ventilation such as provision of turbo ventilators and opening to ensure that the workers aren't affected. Collected micro plastics, if any, to be disposed of at landfill sites.	Daily in areas where PET Flakes are processed, stored and handled.	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Contaminant levels, adherence to Environmental standards, 2020.	Quality control tests, laboratory analysis	Env Consultant GW Env Technical Specialist UNOPS	400 USD Per Test for air quality testing

Anticipated E&S Risks and Impacts	Risk Mitigation and Management Measures	Impact Mitigation		Impact/Mitigation Monitoring			Mitigation and monitoring cost
		Location/Timing/ Frequency	Responsibility	Parameter to be monitored	Methodology, including Location and Frequency	Responsibility	
Risk of emotional, physical, and social harm due to sexual exploitation, abuse (SEA), and sexual harassment (SH), potentially leading to a toxic work environment and long-term psychological effects on affected workers.	A secure and confidential complaint box and working grievance mechanism. Appointment of a designated point representing both gender of contact for handling complaints an effective referral mechanism Regular training on preventing SEA and SH, will be conducted The GRM committee has been established with PSEA policy as a toolbox to ensure a harassment-free workplace. The gender expert with the help of the GRM committee will advocate on PSEA matters monthly to minimize such risks.	At site during operational phase	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Complaint received vs actions taken in response to Complaints Number of trainings conducted Nominated focal point in contact with workers	Monthly inspection of the site and employee surveys	Gender Expert, Env Consultant GW Env Technical Specialist UNOPS	A total of USD 15,000 has been allocated for gender-related expenses, and all matters concerning SEA and SH will be addressed within this budget.
Energy over consumption due to in- efficiency of machines, leading to increased environmental footprint and resource depletion.	Conduct an energy efficiency assessment before starting the operations Incorporate energy-efficient technologies Practices to reduce overall consumption Regular maintenance of the machinery to keep them in optimum conditions	During installation and through out the operations at site	Greener Way (Project Director during project period and the CEO post project period)/Plant Manager	Consumption levels. Schedule maintenance of machineries	Quarterly energy efficiency assessments of the entire facility, focusing on high-energy-consuming equipment.	Env Consultant GW Env Technical Specialist UNOPSS	Automatically captured in the monthly electricity bills. **Operational cost**: Total budget for Power and Electricity and: USD 17,325

5. Capacity Development & Training

Capacity development and training for the Recycling Plant workers on Occupational Health and Social safety, especially to the new recruitments, for an effective construction and operation of the plant will include;

1) Training on recognizing, preventing and responding to state of emergencies, risks to occupational health safety, social disgruntlement/complains from the community, workplace disharmony,
2) Training on use of PPEs and safeguards, first aid, emergency preparedness, fire drills, etc
3) Awareness and understanding of gender based violence and discrimination,
4) Training on machine operations and time to time updating the technological know-how capacities, especially whenever there is changes or updating of machineries, equipments and facilities; Standard operational procedures, process steps (receiving plastic raw materials at the plant site to shredding, to washing, to production of ecopole or PET flakes, cooling, drying, packing, stacking, storing, to marketing)
5) Training on workplace compounding, quality controls, housekeeping, ES protection and monitoring and very importantly on waste management within the plant and the wastewater treatment needs and processes, prior to disposal to the open environment.
6) Training on Initial Environment and Social Assessment (IESA) of the recycling plant and framing of Standard Operating Procedures (SOP) for monitoring and responses will be an added value and have sustainable impact not only in the ES impacts responses but also in maintaining the quality of the products.

6. Implementation Schedule and Cost Estimates

Access road construction and retaining wall construction is in progress. Site development and infrastructure construction awarded to the same contractor in the same contract package. Implementation of this subproject activity will continue. Scheduled to complete all construction by Nov '24, in order to start operating the plant for a few months within the project period.

Table 03 Environmental & Social Cost for Eco-Pole and PET Washing and Shredding Plant

Sl. No	Description	Timeline	Cost (USD)
1	**Construction Phase:** 1. Implement revegetation using native species. Re-plantation of more than 100 saplings will be undertaken in a different location for substitution of the trees removed. The saplings planted will be monitored/maintained by Greener Way's environment officer post project period. 2. Minimize topsoil removal; store and reuse for post-construction landscaping. 3. Comply to the Environmental Standards, especially the workplace air quality, ambient air quality, emissions, and noise pollution. 4. Enforce usage of PPEs by workers/supervisors/site visitors. 5. Proper stacking and storage of raw materials to minimize spillage of materials and contamination from construction materials.	March, 2024 - December, 2024	1. The cost of Reforestation is 20 USD for 110 trees.(0.179 per sapling) 2. 16000 USD for the construction of retaining walls. 3. Mitigation costs are integrated into the awarded contract
2	**Procurement and Installation of machines:** 1. Procure machines with sustainability certifications. 2. Enforce strict use of OHS safety gear and PPEs during installation and operation. 3. Ensure compliance with environmental and safety standards during installation.	August 2024-December 2024	1. For the PPE and training cost during installation 2000USD 2. 1800 USD for proper electrical and inspections

3	**Operational Phase:** 1. Provide high-quality safety gear (e.g., boots, gloves, masks, PPE) and health and safety training. 2. Install first aid kits for immediate medical assistance. 3. Ensure compliance with environmental standards (air quality, emissions, noise) for worker health and community harmony. 4. Health insurance is not required due to free government health services (per Constitution Articles 9.21 and 9.22). 5. Maintenance and repair of the machines 6. GW has conducted full health checks for all employees	November, 2024 - January 2025	1. PPEs, ear plug and fire extinguisher: USD 2000 2. 1900 USD to ensure safe working environment(safe drinking water, cleanliness and safety training) 3. Health check-up: USD 500 4. 400 USD Per Test for air quality testing
5	**Reforestation:** 1. Of 75 trees cut, 16 no of trees planted at the site itself as of now . 11 saplings were bought from local nurseries and 5 were given free to GW by the nursery owner. 2. Furthermore, re-plantation of more than 100 saplings undertaken in a different location for substitution of the trees removed. The saplings planted will be monitored/maintained by Greener Way's environment officer post project period.		Cost incorporated in the construction phase (Row 1).
6	**Environmental clearance**	June 20	USD 365
7	**Gender related expenses + GRM**	February, 2024 - January, 2025	USD 15,000
8	**Power and Electricity**	May, 2024 - January, 2025	USD 17,325
9	**Human Resource**: Existing Greener Way workers, representing vulnerable, informal waste workers with low education, have been hired for the eco-pole and PET plant. This project has increased their remuneration and provided formal employment opportunities, uplifting the socio-economic status of waste workers and attracting others in need of jobs.	May, 2024 - January, 2025	USD 105,050
10	**Housing:** Staff quarters are being constructed with a capacity to accommodate 25-30 people. This will provide free housing for employees who cannot afford high-cost homes, reducing their expenses and enabling more savings and investment opportunities for low-income families.	November 2024 - January 2025	USD 100,000`
11	**Water treatment**: During Eco-Pole production, water is used to cool the mold to be able to separate the plastic from the mold. Thus, the water used will be discarded as waste water. Likewise, in the PET Washing and Shredding Plant, caustic soda will be used to wash the PET. Thus, that will be discharged as waste water.	November, 2024 - January 2025	USD 32000

	GW will make use of *Bio-microbics technology* to treat the wastewater. This technology does not use any chemicals to treat the wastewater. However, during the last stage of the water treatment, if the water is found to have unsafe PH balance then sodium chloride will be used to balance it out.		
12	**Environmental Expert Fee:** Covers costs for an environmental expert to identify improvement areas and monitor construction activities.	une, 2024 - December, 2024J	USD 23,333.73

***Note**: *Since the costs for HR, housing, and environmental experts have not been included in the matrices for Sections 3 and 4, the total mitigation costs in these sections may appear lower than those in Table 3 of the Environmental & Social Cost for the Eco-Pole and PET Washing and Shredding Plant under Section 6.*

7. Attachments

Annex 1: MoU/Rental Land Agreement for the establishment of Eco-Pole and PET plant at Memelakha.

MOU_Rental Land agreement_Eco-pole_PET_BWB_DECC_GW.pdf

Annex 2: Environmental clearance for upscaling and relocating Eco-pole plant

Environmental Clearnace_ Eco-Pole Plant_ESMP.pdf

Annex 3: Environmental clearance for PET Washing and Shredding Plant

Environmental Clearnace_ PET Plant_ESMP.pdf

Annex 4: Drawing of Eco pole plant and PET plant

Architectural Drawings for Eco-Pole and PET plant

Review & Approval

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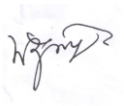
<tr><td colspan="2"> 

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Date: Aug 11, 2024</td></tr>
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 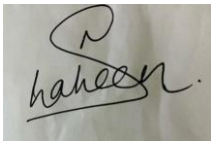

Position: Technical Specialist Environment Bhutan
Date: 15th Aug 2024</td><td>Approved By:
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