

Annex 4 Environmental Monitoring/Management Plan for the Design, Construction and Decommissioning Phases

Activities	Expected Negative Impacts	Recommended Mitigation Measures	Monitoring Indicator	Capacity Building Required	Responsibility	Time Frame	Cost (USD\$)
Project Design	-Inadequate designs -Inefficient operation of system	-Incorporate environmental management components in the project design such as waste handling sites, non-porous septic tanks	Design input is constructed	-Design implementation	Design Engineer and Architect	Continuous during construction	As per contract
Site Preparation	-Demolition of structures - Evolution of emissions dust, noise -Construction waste in water bodies	-Resettle those affected before demolition -Develop reporting and grievance address system	-Affected people are resettled -No complaints/legal cases from affected people -Localised grievance address mechanism in place	-Implementation of Resettlement Action Plan/Compensation Framework	Project Proponent, Contractor , Environmental Officers and Resettlement Officer	Before project commencement	4.9Million

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		<ul style="list-style-type: none"> -Fence off project area -Prohibit dumping in water bodies -Develop a disaster and emergency rescue plan -Train on first aid 	<ul style="list-style-type: none"> No visible particles in air No complains of respiratory problems -Clean water body and no complaints for other users -Vegetation covers not covered in dust -Disaster and emergency plan in place 	<ul style="list-style-type: none"> -Implementation of emissions control mitigation -Construction waste, liquid and solid Waste management -Water Quality monitoring -Emergency response and disaster management plan -First aid training and emergency drills 	Project Proponent, Contractor , Environmental Officers and Resettlement Officer	Continuous during site preparation/construction	2,000 per site
Construction excavation	<ul style="list-style-type: none"> -Destruction of Physical Environment - Soil erosion and compaction -Obstruction of natural water courses 	<ol style="list-style-type: none"> 1.Develop soil erosion management measures 2. Limit the circulation of heavy machinery to minimal areas 3. Plan work in sections to avoid opening up areas that are left undeveloped 	<ul style="list-style-type: none"> -Absent loose materials -Visual clear water with low turbidity -Low sediments and siltation -No solid waste is deposited in the 	<ul style="list-style-type: none"> -Train on soil conservation measures -Transport vehicle management -Work planning for environmental conservation -Landscaping, tree 	Design Engineer, Architect and Resident Engineer	Continuous during development and operation	500 per site

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		4. Develop solid waste trapping structures to trap any solid waste before waste water is dumped	sewer system and neighbouring land -Number of surviving trees or mature trees	planting and management			
		5. Conserve available trees as much as possible or replant trees harvested to pave way for development	-Number of shade or fruit trees				
Water Supply	-Increased Water Demand/Supply -Reduced Water Quality -Reduced water quality due increased release of raw sewer	1. Evaluate the water requirements of the construction <i>visa vis</i> available water	-Records on amount of water used -Changes in areas water quality	- Public consultation -Shared resources record keeping -Water Quality analysis -Rain Water Harvesting	Design Team, Resident Architect, Engineer and Contractor	-During construction	2,000 per site
		2. Construct non-porous septic tank	-Development of roof gutter, storage tanks		Resident Architect, Engineer and Contractor	-During construction and operation	
		3. Develop rain water collection systems to help supplement water shortage	-Frequency of emptying septic tank		Resident Architect, Engineer & Contractor	-During construction	
		4. Conduct water quality monitoring			Resident Architect, Engineer & Contractor	-During construction and operation	

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		5. Install water saving supply and outlet systems like water saving taps, flashing systems etc			Resident Architect, Engineer & Contractor	-During construction and operation	
Construction and Maintenance	Waste Generation/High Demand of Raw material -Effluent Generation	1. Source durable project materials from local suppliers who use environmentally friendly processes in their operations.	-Clear and clean site -Absence of fugitive materials	-Bulk Budgeting -Pollution Control, Environmental Conservation and Management	Resident Architect, Engineer & Contractor	-Project Budgeting period -Throughout construction period	1,000 per site
		2. Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered; conduct appropriate storage of material to reduce impacts of weather elements such as water runoff, wind among others	-Absence of offensive environment -Absence of disease vectors and rodents		Resident Architect, Engineer & Contractor		
		3. Ensure that damage or loss of materials at the project site is kept at minimal through proper storage; leftover/waste materials should be refurbished or used in other projects or donated to community members rather than being disposed of					

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Construction and Maintenance		4. Provide sanitary waste handling facilities in form of skips, bins, mobile toilet facilities; control aquatic and soil pollution			Resident Architect, Engineer & Contractor		As per project budget
		5. Construction liquid waste should be channeled through sedimentation pools and the clean water generated be reused			Resident Architect, Engineer & Contractor		As per project budget
		6. Use of an integrated solid waste management system hierarchy of options: 1. Source reduction 2. Recycling 3. Composting and reuse 4. Combustion 5. Sanitary land filling; and conduct training among workers on the same		Bulk Budgeting- Pollution Control, Environmental Conservation and Management Waste Management Strategy -Waste Management Regulations, Polices or Guidelines	Resident Architect, Engineer & Contractor	-Throughout construction period	As per project budget
		7. Engage registered waste disposal company to handle sanitary and solid waste			Resident Architect, Engineer & Contractor	As required	As per project budget

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Construction and maintenance	-Degradation of air quality and ambient noise due to excavations operations -Degradation of air quality by vehicles emissions and dust during excavation operations -Interference with neighbours due to excessive and destructive noise -Increased impact on global warming,	1. Operate equipments equipped with air pollution control gadgets and those maintained periodically to minimize exhaust emissions and noise.	-No public complaints -Clean ambient air -Absence of evolved dust vegetation	Driving techniques to reduce emissions such as noise, dust and exhaust fumes Noise abatement techniques for machines and equipments	Resident Architect, Engineer & Contractor	-Throughout construction period	As per project budget
		2. Insulate noisy machines as work and other related construction activities will be undertaken in public areas with high human movement and other sensitive areas like dispensaries, schools etc			Resident Architect, Engineer & Contractor	-Throughout construction period	As per project budget
		3. Conduct dust palliation especially on the motorized tracks					

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	ozone depletion and acid rain	4. Develop mechanism of calculating project carbon prints/equivalents and programmes of balancing the impacts like tree planting, use of cleaner fuels like solar, wind, biodiesel in order to reduce impact on global warming	-Clean ambient air -Improved micro-climate	Carbon sequestration	Environmental Officer (EO), Resident Architect, Engineer & Contractor	As required by project	As per project budget
Construction and maintenance	-Social and Economic Concerns -Migration -Communicable diseases -Resources competition -Loss of cultural heritage -Accidental destruction of private property mainly neighbouring houses -Gender equity	1. Conduct continuous public awareness and encourage participation throughout the project lifespan to discuss contentious issues 2. Communicate project progress to community members and alert on sections to be develop to reduce destruction and interference	-No public complaints/positive remarks on project -Number of accidents -Changes in living standards. -Number of new residents -Number of	-Public awareness- Information Education and Communication (IEC) programmes on the projects social impacts	EO and Social Expert	Continuously during construction and operation period	As per project budget

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	-Interference with traffic flow along roads	3. Functional rerouting of traffic coupled with shortened period of disturbance. Micro-tunneling for major road crossings 4. Accord local community employment and business opportunity as a priority; Where possible offer women equal employment opportunities as men	contaminated diseases -Number of women participating in the project -Presence of social workers in the project area				
		5. Implement HIV/AIDS and other communicable diseases programmes in conjunction with the relevant ministries		-Public awareness- Information Education and Communication (IEC) programmes on the projects social impacts	EO and Social Expert	Continuously during construction and operation period	As per project budget
		6. Establish labour camps at reasonable distance from villages.			RE, Contractor, EO and Social Expert	Inception of construction	
Construction and	-Occupation/public Health & Safety Concerns Injuries and	1. Complying with work place legal requirements of competent work force	-Number of accidents -Number of sick	OHS Training	Resident Engineer , Contractor OHSO and EO	Continuously during construction and operation period(maintenance)	As per project budget

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maintenance	accidents to workers -Communicable diseases -Suffocation Poisoning -Disease Vectors	2.Develop appropriate structures that meet recommended standards	offs -Complaints of particular diseases	Resident Engineer	Resident Engineer & Contractor		
		3.Provision of Protective Professional Equipments Employment			OHSO and EO		
		4.Instituting Safety drills, disaster preparedness and management programmes			OHSO and EO		
Operation Phase	-Poor solid waste management -Oil spills -Sewerage leakage/overflows -Hazardous waste	1. Develop and implement emergency and disaster management plan e.g drills 2. Post environmental management procedure on solid waste management and provide disposal facilities 3.Conduct continuous maintenance of sewerage/effluent facilities 4. Monitor movement of goods and penalise those transporting hazardous waste as required by law.	-Effectiveness of drills -Posters on environmental management -Existence of garages -Comprehensive check of cargos	-Environmental Laws both local and international -Disaster Management, First Aid, Drills Response	Immigration and Customs Officers	Continuously during operation	-As per salary and border post maintenance costs

