ENVIRONMENTAL MITIGATION AND MONITORING PLAN (EMMP) TABLE

EMMP for Project BAIDP(Overall LGED responsible person is the LGD PDO, he designates and EO or EIP for oversight)

A major method of avoidance and impact minimization in the G2G agreement is the development of Standardized Designs. USAID has provided technical capacity building through their partner the ACE. ACE is responsible to build capacity within LGED in establishing infrastructure designs that follow established international best practices as standard designs. For example; culverts and U drains construction is governed by the road standard design; e.g. structures extend the road embankment and measures to with stand erosion. In addition, sanitation facilities specified in the standard designs meet or exceed guidelines found in the Small Scale guidelines for waste water. Another example is the standard road designs follow established international standards for road design including proper sloping, embankment protections, silt prevention, surface water routing, erosion and sediment controland retaining walls.

Another method of reducing environmental impact is proper planning (as detailed above); avoidance whenever possible (e.g. avoiding damaging trees); use of non-hazardous materials wherever possible (e.g. all paint will be lead free, water based latex paint); and recycle of used construction material. The latter is an industry practice here in Bangladesh. Paint and asphalt not used on specific projects are returned to contractors premises for use on other projects. This also includes drums and paint containers; they are reused or recycled by returning to contractors premises. Contractors will be required to keep a log of material returned to site.

For these road and infrastructure projects, little heavy equipment-or even mechanical equipment is used. Most of the "heavy" work is done with pick and shovels. Only trucks that bring equipment to site and a power roller will be used for the roads. Refueling will normally be done off site; if not measures will be taken to prevent spills. No maintenance work will be done on equipment on site. This equipment will not be washed on site; for the market centers/collection centers, concrete mixers are the hand type. At the end of the day a Concrete Washout device, appropriate size for of a hand mixer, will be used to clean out the left over cement. If mixers require refueling, spill prevention measures will also be used.

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
1	Improper design of project activities will lead to environmental degradation	• Rural Roads, Market and Collection Centers will have Standard Design approved by the Bangladesh Planning Commission and US Army Corps of Engineers	During design	Design team: Field Eng./Contractor / U.S. Army Corps of Engineers
2	Survey teams damage or clear vegetation in conducting their survey	• Avoidance; where practical, avoid damaging or removing vegetation to conduct survey. • Minimize tree-branches trimming. • Trees and vegetation will be replanted and maintained according to LGED "Tree Plantation Manual."	During survey; re-vegetation work will begin within 5 days of noticeable damage, or when construction work allows access.	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
		• Select healthy local native species and, where practical, income producing trees will be used.		
3	Soil Borings cause degradation of terrestrial and aquatic habitat; noise may generated during drilling operation (short-term)	• Soil borings are only anticipated for geotechnical investigations, an auger will be used. Soil samples will be taken as needed for the investigation; all other material will be returned filling the bore hole to original condition. We do not anticipate needing to do this on most road projects. • Erosion control measures will be used to prevent and reduce erosion. Contractor will provide ear protection for workers if drillingis conducted; will be done during daylight hours avoiding community disruption.	During boring and after completion area returned to pre-boring condition.	LGED-EO/Contractor /Contractor
4	Trees maybe damaged or destroyedduring construction activities	• Avoidance; where practical, avoid damaging or removing trees during construction activities. • Trees and vegetation will be replanted and maintained according to LGED “Tree Plantation Manual” • Contractor’s defect liability period is one year; responsible for 100% replacement and caring for one year. • After one year, LGED is responsible for tree maintenance and replacement • Select healthy local native species and where practical income producing trees will be used.	During construction; daily check to ensure environmental protections are in place. Re-planting takes place immediately after construction or earlier if allowed by construction. Must be completed prior to final payment.	LGED-EO/Contractor
5	Vegetation on road bed and market construction areas removed, damaged or destroyed in the process of construction resulting in degradation of the environment including increased erosion and loss of	• Re-vegetate areas using appropriate ground cover and in a manner that will reduce soil erosion and increase sedimentation. Vegetation should be consistent with vegetation removed or destroyed during construction. • Provide vegetation (grass, grass and trees) strips within parking lot including shade trees. • Trees and vegetation will be replanted according to LGED “Tree Plantation Manual” Contractor’s	Immediately at the end of the construction work and prior to final payment. Within 5 days of ending of contract the re-vegetation plan will start.	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
	native vegetation for wildlife and community	defect liability period is one year; responsible for 100% replacement and caring for one year. • After one year, LGED is responsible for tree maintenance and replacement.		
6	Earthwork (Excavation and Fill)causes degradation of terrestrial and aquatic habitat due to removal of vegetation within the project boundary Increasing soil erosion; possible degradation of water quality	• Collect soil from dry land avoiding vegetation removal or disturbance. • At ditch or pond sites add erosion control protection, e.g. sand sacks, will be given which will also control sedimentation. • Aquatic habitat will not be disturbed during earth collection; barriers and silt traps will be employed to prevent discharge into ponds. • To avoid loss of soil fertility, stockpile the topsoil of 15 cm depth for latter rehabilitation of soil collecting area. Soil will not be stockpiled for more than 7 to 14 days. If soil is stockpiled more than 7 to 14 days, will be covered with tarp and barriers placed around pile. Pile will be covered during rain, with barriers placed around pile to prevent runoff. • Soil will be compacted to reduce soil erosion and runoff. • When necessary soil will be collected from road site borrow pits.	During earth work; daily evaluation of work area to ensure EMMP compliance.	LGED-EO/Contractor
7	Roadbed constructionmay temporarily cause degradation of terrestrial and aquatic habitat; sedimentation of streams and surface water; social impact of citizens being affected by construction activities	• Contractor will recover all construction related waste and return back to premises for reuse. • Rubbish (trash) will be sent to government Upazila disposal site. • Control roadbed dust by spraying water on a daily basis, and more if onsite engineer deems conditions warrant. • Compacted road bed as required to minimize materials runoff and erosion • At the ditch or pond site protection will be implemented which will also control sedimentation by using standard erosion control measures	During construction; recycle material as material is used; daily ensure work site is clean and environmental mitigations are in place and good repair.	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
		such as straw, jute and silt barriers. • Stabilize disturbed roadbed as work proceeds. • Avoidance; storm water issues will be avoided or reduced by scheduling road construction activities normally in dry season. Individual road designs where potential storm water or sediment issues might be a factor will have specific mitigation measures built into the individual designs by LGED and approved by ACE. If necessary will be temporary mitigations required (e.g. silt fence); and if required permanent mitigations included (e.g. retaining wall around pond). • If required by conditions, contractor will prepare a storm water management plan and erosion and sediment control plan in conjunction with the ACE approved road design mitigations included in the road or infrastructure design. Plan will be approved by LGED project manager before the beginning of the job. • Traffic control measures at sites where needed will be employed to minimize community disruption.		
8	Construction activities: dust generation from construction sites and material stock piles may present a health hazard and degrade the environment	• Most of the construction work would be manual labor based which will reduce the amount of dust generating present on site. • Minimize the extent and period of exposure of the bare surfaces. • Trucks carrying material to site will employ tarps or other control measures to reduce spillage and control dust construction site • Reschedule earthwork activities when practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site. • Dirt stockpiles will be covered during windy conditions. • Establish adequate locations for storage, mixing and loading of	During Construction; as required by climate or environmental conditions, immediately when conditions warrant.	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
		construction materials, in a way that dust dispersion is minimized because of such operations. • Water will be sprayed around material stockpiles (especially sand & boulder/brick chips), access roads and bare soils as required to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high winds and dry periods		
9	Construction vehicles and machinery exhaust emissions can reduce air quality and present a temporary health hazard	• Most of the construction work would be manual labor based and little pollution generating equipment will be used. • Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites. • Contractor will be required to maintain vehicles and construction equipment in good working condition including regular off site servicing and inspection • Operate the vehicles in a fuel efficient manner	During Construction; weekly review of equipment or as needed. (LGED to review records)	LGED-EO/Contractor
10	Temporary noise pollution from construction vehicular traffic and machinery causing an impact on people, property, fauna, livestock and the natural environment	• Most of the construction work would be labor based and little noise generating equipment will be used. • The contractor will provide ear protection to all laborers • Maintain all vehicles in good working order to minimize noise production. • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site • Appropriately site all noise generating activities to avoid noise pollution to local residents • Notify adjacent landholders prior any typical noise events outside of daylight hours	During day time and whenever any complains are received and routine check on maintenance (LGED to review records)	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
11	Relocating of electric pole from road alignment	• Prior to start of construction, the electric pole will be shifted to the road shoulder in consultation and assistance of Rural Electrical Board.	Once during construction	Contractor/LGED/REB
12	Lack of proper sanitation facilities may create health hazards for workers.	• LGED approved hygienic sanitary facilities (e.g. latrines) will be provided by contractor. • Facilities will not be located within 50 meters (next) of residences • Separate latrines for both males and females will be provided. One toilet facility for every 10 employees. • Wastewater will be discharged into the soak pit located away from streams and ponds; e.g. 15 meters or more if deemed necessary. • Contractor will inspect facilities daily to ensure they are kept clean • If domestic wastewater is an issue, it will also be discharged into the soak pit. • Where necessary, erosion control measures such as sand bags, silt fences, or re-vegetation will be employed.	Approval by LGED; daily cleaning and when needed.	LGED-EO/Contractor
13	Human Health and Worker Safety	• Provide safety/health training to workers prior to construction. Training will include safe work practices, proper use of personal protective equipment and abide by Bangladeshi safety rules. Training will be documented by Contractor. • Implement appropriate human health and worker's safety measures during construction, including providing a first aid kit and at least one worker on site who knows how to apply basic first aid. • Provide workers with appropriate safety equipment. For example provide safety googles, hard hats where flying debris may be present, ensure proper footwear is worn (not foam flip flops), hearing protection is available.	Training prior to start of construction; daily inspections. Log will be kept of training with sign in sheet.	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
		• Potable water will be provided for crew including hand washing station. • Keep camp size small and low profile. • Provide temporary sanitation on construction sites for male and female workers. Use guidelines provided by USAID small scale construction and sanitation guidelines. • Ensure workers all have tetanus vaccinations. • Smoking is restricted to designated smoking areas, away from flammable materials.		
14	Construction vehicular traffic: increased traffic use in narrow access road by construction vehicles will affect the movement of normal road traffic and the safety of the road-users.	• Provide clear signage at strategic road locations. LGED will provide feedback if additional signage is required. Restrict truck deliveries to daytime working hours (as common practice in Bangladesh) to avoid road accidents and to reduce inconveniences to the road users. • Restrict overloaded vehicles • Operate construction vehicles to non-peak periods (night) to minimize traffic disruptions. Enforce on-site and access road speed limits.	Daily, weekly or additionally as conditions warrant. LGED will visit site at least once/week and verify compliance. Log will be checked.	LGED-EO/Contractor
15	Loss of soil fertility due to topsoil removal during constructionlowers plant and agriculture productivity	• Removed or disturbed topsoil will be collected and safeguarded in a designated area within the construction zone. • Duration of stockpilewill be kept to a minimum (normally less than 7 days but no longer than 14);in addition, sand bags or other devices will be provided around the stockpile in rainy conditions.Soil mounds kept longer than 14 days will be covered with tarp.	Daily, or more as conditions warrant. LGED will visit site at least once/week and verify compliance.	LGED-EO/Contractor
16	Soil and land erosion due to construction activities	• Soil/ land erosion problem will be mitigated by following the correct design procedures including phased construction and adequate compaction. • Follow LGED, USACE, and recognized	Advanced planning of ACE approved road design. Daily inspection, apply mitigations immediately when	LGED-EO/Contractor /ACE

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
		international best practice guidelines to prevent soil erosion. This includes conservation methods including proper terracing, water diversions, vegetation cover and restoration, and similar techniques to reduce soil erosion and increase sedimentation of eroded materials. • Use guidelines outlined in the USAID IEE and recommended USAID guidance documents; e.g. reduce vertical terracing and minimize slopes used. • Erosion and sedimentation plans built into the design phase call for best engineering practices that use soil conservation techniques, culverts and appropriately designed and constructed roadside drains to capture and route surface water run-off in to stabile areas such as fields and forests, etc. • Tree plantations on road slopes followed by addition ground-cover vegetation as needed and effective maintenance procedures. • Protective measures like providing ground cover and walls along slopes and pond embankments to prevent land erosion of slopes next to the road in cases where the road is adjacent to any type of water body. • Initiate specific site plans that reduce the effects of scour where water scour potential is an issue (i.e. addition of culverts and U-drains).	warranted.	
17	Local drainage system may get clogged due to improper management of solid waste (construction	• Monitor and clean drainsdaily and as needed. • Solid wastes should not be dumped into drains. • Blocked drains will be cleaned properly and debris will be sent to	Daily monitoring, and when additionally needed.	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
	debris and refuse), and other materials especially at construction sites	government controlled Upazila disposal site. • Solid wastes will not be dumped into the drain.		
18	Construction waste can degrade the environment, and reduce aesthetic value of an area	• Prohibit burning of solid waste. • Contractor will use best practices to minimize the amount of material left over and whenever possible recycle excess material in other projects. In Bangladesh, almost all construction material/waste will be recycled for other projects. • Wherever possible, Contractor will use non-hazardous material substitute for material considered hazardous. • Training will be provided to construction workers on safety best practices and rules; handling of solid waste and any hazardous material. Training will also be given on proper fueling of vehicle when that vehicle is on construction site and how to follow fuel spill guidelines. • Clear construction waste and rubbish from site on daily basis or as needed basis. • Contractor will recover all construction related waste and return back to their premises for reuse. Any material returned back to premises will be disposed of according to Bangladesh laws. • Rubbish (trash) will be sent to government controlled Upazila disposal site on a daily basis. • Locate any temporary garbage or refuse collection site away from residences. • Remove disabled equipment, including vehicles and machinery from the area within 24hours. • Fuel, solvents, petroleum based products, oil-contaminated materials, and other potentially or hazardous material/waste will be stored at contractors premises and	During and after completion with close out of work area. Work sites must be certified as clean and restored to LGED standards prior to final payment.	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
		not on site. Asphalt, as described elsewhere, will be stored according to listed procedures. • Construction equipment is minimal on these projects; mostly hand labor. Equipment will not be cleaned on construction sites; any large equipment such as hand cement mixers, cleaning will be returned to contractor premises and recorded in daily log. • Left over waste drums such as asphalt or paint will be returned to contractor's premises. While on site all containers will be labeled, and stored on impervious surface such as plastic tarps. • Any unused paint (e.g. market centers) and/or asphalt will be returned to contractor's site to be used elsewhere. Empty paint/asphalt drums/containers will be returned to contractor's site. Contractor will maintain records documenting return of containers to their site. Contractor will render containers, e.g. paint, safe by recycling and/or cleaning at contractor's site according to Bangladesh laws, manufactures instructions and best safety practices. NOTE: It is not contractor best practices in Bangladesh to waste left over material by dumping it; but returning to their premises for other projects.		
19	Hazardous materials andpetroleum productsused in construction activities could contaminate soiland water, environment in general impacting human, aquatic	• Preventative; small quantitiesof hazardous material or minimal amounts of construction material will be used for these activities. Contractor will recover all construction related material and return back to their premises for reuse or proper disposal. • Rubbish (trash) will be sent to government controlled Upazila disposal construction site.	Daily check by contractor; and records kept verified by LGED at least weekly.	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
	and terrestrial life.	• If hazardous material will be used on sites, it will be used and stored on impervious surface to prevent spills. Workers will be trained in the implementation of the spill plan. The plan in case there is a spill is the following: Three types of hazardous waste being used for these projects; asphalt, gasoline and paint (e.g. at market centers). Any spills not contained by the impervious surface will be mitigated on site. If asphalt comes in contact with non-road soil will be put back into asphalt mixer. If paint spills on site it will volatilize leaving solid waste, rendering harmless. If fuel spills, soil contacted by the fuel will be collected and put on a tarp and allowed to volatilize. This soil will then be transported to the approved Upazila landfill. • Paints: if used will be water based latex paint. • If present, unused materials such as paints will be returned back to contractor's premises. Contractor will document the amount of material brought to the site and amount returned to their premises. • For example; drums with unused asphalt will be returned to contractor premises for recycling and/or proper disposal according to Manufactures recommendations, industry best practices and Bangladesh laws. Contractor will acknowledge proper disposal in writing. • Contractor will state they will use best industry practices, handle the material in a manner consistent with the MSDS and manufacturers recommendations, and assume all liability for proper handling and disposal of material and any waste.		
20	Surface water and soil contamination	• No bitumen mixing will be done at site; asphalt is ready to use.	Daily check and records kept	LGED-EO/Contractor

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
	from bitumen/asphalt mixing at road sites	• Drums with bitumen mixture will be stored on impervious surface on site; checked daily at least once to ensure no leaks are occurring. • Drums will not be stored, processed nor opened next to ponds or other water bodies. • Amount of bitumen mixture on site will be kept to just enough material to complete project. • Contractor will return used drums and unused material to their premises for recycling. This is the major practice of Bangladesh contractors; used drums have high reuse value. Drums with unused asphalt will be returned to contractor premises for recycling and/or proper disposal according to Manufactures recommendations, international best practices and Bangladesh laws. Contractor will acknowledge proper disposal in writing. • Contractor will state they will use best industry practices, handle the material in a manner consistent with the MSDS and manufacturers recommendations, and assume all liability for proper handling and disposal of material and any waste.		
21	Lack of public involvement in construction process can cause social problems and damage the human environment	• Public consultation will be taken during project design and before construction start. • No relocation of people will be needed or made.	Throughout construction period	Contractor/LGED
22	Soil erosion can reduce topsoil, leach vital nutrients and cause sedimentation into nearby water bodies	• Preventative measures; removal oftopsoiland soil vegetation cover will be kept at minimum. • Construction areas, especially roads, will be inspected daily during rainy seasonand weekly in normal dry period. Immediate corrected activities will be taken when erosion	During construction; daily check. Immediately as environmental mitigations are needed.	Contractor/LGED will be notified and oversee.

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
		issues are found. • Re-vegetation of bare areas or areas showing signs of erosion will take place immediately as construction activity allows in the area. • Sedimentation barriers such as jute bags or cover will be used until soil is stabilized. • Barriers will be used to prevent surface water from running into ponds during heavy rains. • Follow LGED best practice guidelines to prevent soil erosion. This includesconservation methods including: terracing, water diversions, vegetation cover and restoration, and similar techniques to reduce soil erosion and increase sedimentation of eroded materials. • Erosion and sedimentation plans call for best engineering practices that use soil conservation techniques, culverts and appropriately designed and constructed roadside drains to capture and route surface water run-off in to stabile areas such as fields and forests, etc. • Trees and ground cover re-vegetation will be used as the primary long-term measures as a needed and effective maintenance procedure. Contractor will follow guidelines mentioned elsewhere concerning maintenance and replacement of vegetation. Protective measures like providing ground cover and walls along slopes and pond embankments to prevent land erosion of slopes next to the road in cases where the road is adjacent to any type of water body.		
23	Silting from open earth construction mound/piling/other places	• Deposit excess soil in a designated area away from ponds or drains. • Cover during rainy periods or high winds with barriers or tarps over soil mound. • If the soil will be not be used within	During construction; as it occurs	Contractor/LGED will be notified and oversee.

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
		2 weeks, establish a good grass cover or cover with cloth/plastic.		
24	Fuel/oil spillage from operational equipment may contaminate soil and/or surrounding surface water	• The project will use very little equipment requiring petroleum products. Only the truck bringing supplies, small power roller, hand concrete mixer, and possibly water pump will require refueling. The truck will not be refueled on site. The use of heavy equipment on rural roads isnot practicein Bangladesh.Any equipment used will be cleaned at contractors' premises. • Fuel will not be stored on site. • If stored, only short time, then daily monitoring will be done for leakage, and product will be stored on impervious surface. • Lubricants and other similar petroleum products will not be stored on site • Bitumen is ready made, and will be stored on an impervious surface • Contractor will haveLGED approved spill prevention and control plan and provide training to employees on how to prevent spills and what to do if a spill occurs. • Vehicles will not be serviced on site; if fuelling is necessary, drip pan or other device to catch spill or over flow will be used. • Vehicles will be inspected daily prior to going to site for leaks and damage, and log maintained by contractor. • Asphalt compactor or roller will be inspected daily for leakage and removed off site for repair or placed on impervious service for emergency repairs. • The key is prevention and minimal usage of hazardous material on site.	During construction; as it occurs	Contractor/LGED will be notified and oversee.
25	Surface water could be affected by the disposal of construction	• Equipment is not washed on site; no mitigation measures are required. • See previous section for spill and safety plans. Workers will be trained	Contractor responsible to insure equipment is washed off site	Contractor/LGED will be notified and oversee.

Sl. No.	Environmental Impact/ Issue	Mitigation Measures	Timing	Responsible Organization
	wastes or water used for washing equipment.	to abide by all work plans.		