Kingdom of Cambodia
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CAMBODIA: - POWER DISTRIBUTION GMS TRANSMISSION PROJECT
- RURAL ELECTRIFICATION AND TRANSMISSION PROJECT

DETAILED ENVIRONMENTAL MANAGEMENT PLAN

January 2007

Ministry of Industry Mines and Energy
Electricité du Cambodge
Phnom Penh, February 08, 2007

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Subject: Detailed Environmental Management Plan (Draft) for Power Distribution and Greater Mekong Sub-Region Transmission Project and Rural Electrification and Transmission Project.

Dear Mr. Sir/Madam,

We have pleasure to enclosing the draft Detailed Environmental Management Plan (DEMP) for your kind review and approval. The DEMP is prepared by incorporation with the Initial Environmental Examination (IEE) and Environmental Management Plan (EMP) which were approved by ADB and Ministry of Environment of Cambodia.

The DEMP shall be applied incorporated to Construction Environmental Management Plan (CEMP) which will be prepared by contractor.

Sincerely yours,

Chan Sokphath
Senior Director
Corporate Planning and Projects

CC: - Mr. Yasuhiko HINO
    - Mr. Praing Chulasa
    - Mr. Sok Sovann
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APPENDIXES

Appendix Summary of Mitigation Measures and Implementation Responsibility
ABBREVIATION

ADB -- Asian Development Bank
CEMP -- Construction Environmental Management Plan
DCC -- Design and Construction Contractor
DEMP -- Detail Environmental Management Plan
EDC -- Électricité du Cambodge
EIA -- Environmental Impact Assessment
EMP -- Environmental Management Plan
ESD -- Environmental and Social Division
IEE -- Initial Environmental Examination
MIME -- Ministry of Industry, Mines and Energy
MOE -- Ministry of Environment
O&M -- Operation and Maintenance
PIC -- Project Implementation Consultant
PMU -- Project Management Unit
RGC -- Royal Government of Cambodia
WB -- World Bank
SEO -- Social and Environment Office
1. INTRODUCTION

Eléctricité du Cambodge (EDC) intends to provide additional power to Phnom Penh to improve electricity supply and reduce costs to the consumer under the Power Distribution and Greater Mekong Sub-region (PDGMS) Project and Rural Electrification and Transmission Project. EDC also plans to improve power supply and distribution in a number of provincial towns under this Project with assistance from the ADB and the World Bank.

The components of the proposed Project are as follows;

<ADB fund>
- 230 kV main transmission line from the WPP substation site to the Vietnam border
- Construction of substations at WPP and Takeo.
- Medium voltage distribution lines to villages

<WB fund>
- 115 kV transmission lines from West Phnom Penh connecting to the existing ring line in Phnom Penh, Construction of National Control Center (NCC).
- Grid extension expanding the existing 22kV around Phnom Penh, Sihanoukville, Kampot, Takeo, Kampong Speu and Battambang.
- Updating equipment in the existing Phnom Penh Substation at GS1, GS2 and GS3.

The transmission line incorporates a 30 m right-of-way (ROW), covering 15 m either side of the centerline, where settlement and structures will not be permitted and vegetation height restrictions will apply.

Initial Environmental Examination (IEE) for the Project was carried out as part of ADB Technical Assistance (TA) 4078 – CAM in July 2003. This project has been categorized as Environmental Category B by the ADB based on the prediction of relatively minor adverse impacts from project construction and operation. Accordingly, the preparation of an IEE is required in accordance with ADB environmental assessment requirements. Project is still at the detailed feasibility design stage. The final design of infrastructure will be undertaken by the selected Design and Construction Contractor (DCC).

The IEE contained the part of environmental impacts and mitigation measures, and the environmental management plan including monitoring plan. The IEE report was submitted to the Ministry of Environment (MOE) in November 2003. The MOE approved the Report “in principle” in November 2003, however the MOE requested to MIME to prepare in both version of English and Khmer in order to examine in detail. While the Environmental Management Plan (EMP) was prepared by EDC in November 2003. The MOE again requested to prepare in both version of English and Khmer for IEE report and EMP. EDC prepared them and submitted to MOE in April 2006. MOE fully approved above document in May 2006.

In the meantime, the ADB requires the RGC that a Detailed Environmental Management
Plan (DEMP) be prepared at the beginning of the implementation stage.

The objective of the DEMP is to determine the necessary practical mitigation measures for avoiding, and/or minimizing negative impacts caused by the Project. The Project has various aspects of construction activities such as establishment of transmission line and construction of substation. Therefore, the DEMP has been developed so as to cover every aspect of the Project components.

2. METHODOLOGY

The DEMP has been developed through the activities below.

- Reviewing the IEE Report prepared in July 2003;
- Reviewing the Environmental Management Plan (EMP) prepared in November 2003;
- Site investigating to identifying additional negative impacts to be considered in the DEMP;
- Clarifying the institutional aspect that necessary for the implementation of DEMP;
- Consulting on the mitigation measures proposed in the DEMP with the engineers of the PICs (ADB/WB);
- Consulting on DEMP with related agencies: MOE, and ADB/WB advisers

3. SUMMARY OF POTENTIAL NEGATIVE IMPACTS

Project is in beginning stage of construction. The final design of infrastructure will be undertaken by the selected Design and Construction Contractor (DCC). In this chapter, potential negative impacts caused by the Project are considered based on the results of the IEE.

3.1 LAND ACQUISITION AND LAND USE CHANGE

Land acquisition is required to establish the transmission line towers and substations. In the IEE, land acquisition at each of the estimated 350 tower sites for the 230 kV transmission line will be between 100-225 m², totaling about 4 ha, depending upon final design. Land acquisition at each of the estimated 200 tower sites for the 115 kV line will be 4 m², totaling less than 0.1 ha. Land to be acquired at the two substation sites will total about 8.0 ha, including the area for the access roads leading to these sites. Accordingly, total land acquisition is estimated to 12.1 ha, to be confirmed during the final design. The land for 230 kV transmission line construction will be acquired from an estimated 140 households. Permanent land use change will only occur on approximately 8.6 ha as cropping will be permitted beneath the towers but land use will change on each tower footing. Cropping
crops will also be unaffected as they are generally less than 3 m high (e.g. cassava grows to around 3 m).

3.5 CROP AND LAND DISTURBANCE

Disruption of farming activities and the disturbance of crops, bunds, canals and drains will occur during construction and some line maintenance activities where machinery access has to be gained and no permanent roads exist. Crop disturbance during construction will result from the establishment of a temporary 3-4 m wide access way to each tower site, the construction of each tower site and conductor stringing. Short sections of paddy bunds and drain/canal embankments will be temporarily removed and drains/canals may be temporarily filled to establish access, to be reinstated by the contractor once construction has been completed.

3.6 WILDLIFE IMPACT

Wildlife will be affected by transmission line construction and operation through the loss of habitat from ROW vegetation clearing, and from the deaths of individuals caused by electrocution or flight impact.

3.7 AIR QUALITY

Exhaust emissions from machinery used for tower and substation construction will be minor, localized and of short duration. Dust may be generated on construction sites.

3.8 SOIL EROSION

Soils along the ROW are generally erodible due to high dispersibility, therefore ground disturbance has the potential to create an erosion hazard. Reduced vegetative cover from ROW clearing and general ground disturbance from machinery operation during construction will only create a low erosion hazard as ground slopes rarely exceed 2%. Exceptions to this will be on riverbanks and on the batters of canals and drains where vegetation removal and ground disturbance on these steeper slopes may create a moderate to high erosion hazard on these specific sites. A moderate erosion hazard will also be created on embankment batters at the substation sites during and following landfilling.

3.9 WATER QUALITY AND SOIL CONTAMINATION

Water sources are susceptible to pollution from accidental spills of construction materials, oils and chemicals, and from human contamination from defecation. Appropriate facilities will be provided and controls placed on construction and workforce activities.

The WPP and Takeo substation sites are located on flood prone land. Soil and water contamination may occur at the substations from the accidental release of transformer oil or
3.13 HEALTH AND SAFETY

Health hazards may be created by the temporary influx of construction workers into the project area, from construction activities and from the operation of the transmission and distribution lines.

Workforce Influx
A considerable number of people are likely to be employed as management staff, skilled/unskilled workers on the transmission line construction. They will mainly come from outside the immediate project area, including from Phnom Penh, elsewhere in Cambodia and outside Cambodia. The staff come from outside the transmission line area, predominantly men, will temporarily reside in the project area during the construction period. This period of residence has the potential to raise the number of cases of sexually transmitted disease (STD) in predominantly rural communities in the project area.

Construction Hazards
Health hazards from construction activities will occur from heavy machinery operation, the handling of hazardous materials and general construction activities. Unexploded ordinance (UXO) is known to occur within the ROW and thus poses a significant hazard at these locations.

Electrostatic Induction and Electromagnetic Induction
A health hazard caused by electrostatic and electromagnetic induction may occur. The induction will occur in the area surrounding conductors and other electrical devices, but rapidly reduce with distance from the source.

Electrocution
Electrocution can occur from contact with the live conductors, flashover from the conductor to a tower and conductor breakage. Contact with live conductors or flashover to a person or object near a live line is highly unlikely to occur given that a safe minimum vertical clearance from ground level of 7 m and 6 m will be provided to the 230 kV and 115 kV lines respectively. The accidental failure of the transmission line involving a conductor breaking is also highly unlikely to result in people being electrocuted. Very sensitive and 100% redundant transmission line protection will be adopted for the line. This protection will detect any fault, including the conductor snapping, and cause the line to be de-energised within three cycles, thus largely avoiding the potential for electrocution from a breakage.

Hazardous Materials
Since Poly chlorinated biphenyls (PCBs) has carcinogenicity, it is not used as an insulated medium of transformers and capacitors.

Aviation Hazard
The installed transmission line will pose a very minor general aviation hazard. The volume of air traffic in the project area is low, apart from adjacent to the northern end of the northern
other hazardous substances. Both substations will be bunded in accordance with standards to prevent the loss of oil off site.

Turbidity created by minor erosion and sedimentation resulting from construction will have a negligible impact on water quality.

### 3.10 NOISE

Tower foundation construction will be undertaken by boring machines and pile drivers, depending upon site conditions. This equipment will generate noise levels in the range of 90-105 dBA at source. If helicopters are used to construct towers or string lines, the noise range may be slightly higher near the source.

Given the relatively short duration of excavation activities and helicopter operations that will occur at any particular site along the transmission line route, and the predominantly rural location of these activities, the resulting noise impact is classified as relatively minor.

### 3.11 HISTORIC, CULTURAL AND RELIGIOUS SITES

The transmission line route avoids crossing or running within close proximity of historic, cultural and religious sites and no graves are crossed by the ROW. The line will not be visible from Tonle Bati and Angkor Borei historic sites, and will be a distant feature below the horizon when viewed from Phnom Chisou, therefore the cultural landscape of these sites will be unaffected.

The nearest religious site to the proposed route is Wat Svay Ampea, a locally significant site located approximately 800 m southwest of the WPP substation site, 500 m north of the 230 kV ROW. Despite this close proximity, the 230 kV route does not cross the main approach view of the temple, which is gained from the east along the access road off NR3. However, the northern 115 kV line is proposed to cross the approach road approximately 800m to the north of the other temple, Wat Sleng.

### 3.12 RADIO AND TV INTERFERENCE

High voltage transmission lines can develop a “corona effect” caused by the ionisation of air around the conductors, insulators and hardware due to a constant electric charge. This effect occurs when the stress on the air surrounding the conductor and associated hardware exceeds the breakdown strength of air. It results in power loss and electromagnetic interference to radio and television signals, producing low level noise, but does not pose a health hazard. The corona effect is generally low in dry weather and rises as moisture levels increase. Conductor size is a significant determinant of corona effect. The selection of a sufficiently large conductor prevents the onset of corona.
beneath towers is a safe practice in terms of electrical field exposure and line clearance from crops and people working these areas.

3.2 BUILDING REPLACEMENT AND HOUSEHOLD RELOCATION

The transmission line ROW has been located to avoid settlements, but 135 houses and a chicken shed could not be avoided and require relocation to establish the required line clearance distances. These buildings will be relocated to nearby sites acceptable to the relocating household, in accordance with the conditions set out in the Resettlement Action Plan (RAP). An estimated approximately 20% of structures will be relocated on the same parcel of land, while the remaining 80% of structures will require a new block of land and the replacement of associated infrastructure due to insufficient space and/or topography restrictions on the existing parcel.

New house site land will generally be acquired in the same village where the existing dwelling is located. No impact will occur to "host" communities where land is acquired for relocating households as these households will be relocated within their own communities.

3.3 LOSS OF TREE RESOURCES

Private and communal trees and plants above 3 m height within the 30m wide ROW will be either removed or pruned to provide the necessary conductor clearance distance. Trees up to 3 m height will be permitted within the ROW, such as banana palms.

In addition, large trees within 30 m of the base of towers and poles will be selectively removed or pruning to remove or reduce the height of trees that have the potential to fall and strike these structures. Tree removal or pruning will also be undertaken immediately outside the ROW to prevent trees from falling and striking the lowest conductor.

Tree removal and pruning will mainly occur in settlement areas, where the majority of trees occur. Scattered trees such as sugar palms and coconut palms that are grown on paddy land, canal embankments, riverbanks and roadsides comprise the remaining trees to be removed or pruned.

3.4 LAND USE RESTRICTION

Land use restrictions will be placed on all land within the ROW, owned by 3,198 PAFs. Vegetation will be restricted to 3 m height, whilst no structures will be permitted to be constructed within the easement. On rural land, this will reduce the agricultural capability of land by denying the growing of most trees in the ROW. On urban or industrial land, land use capability will be reduced by prohibiting structures.

Immediately outside the ROW tree height restrictions will also be applied. Cereal cropping within the ROW will be permitted as this vegetation is less than 1 m high, whilst garden
115 kV line where the route passes approximately 3.3 km south of Pochentong Airport, the main international and domestic airport in Cambodia. Given the setback of the line from the airport and a maximum height of line of around 21 m, a hazard will not be created to general air traffic using this airport.

4. MITIGATION MEASURES

Mitigation measures for potential negative impacts will be adopted in each stage of the Project, namely design and pre-construction stage, construction stage and operation stage. Different mitigating approach could be considered for the same negative impact, depending on the timing of the Project.

Followings are the mitigation measures for each project stage. Summarized potential negative impact and the mitigation measures are given in Appendix.

4.1 DESIGN AND PRE-CONSTRUCTION STAGE

4.1.1 LAND ACQUISITION AND LAND USE CHANGE

- Fair compensation will be paid for acquired land based on current market rates, taking into account land capability.
- Design to minimize tower/pole footprint

4.1.2 BUILDING REPLACEMENT AND HOUSEHOLD RELOCATION

- Replacement houses, other buildings and facilities will be constructed to a similar standard to the existing structures
- Replaced structures will, in order of preference, be located on the existing landholding outside the ROW, on a replacement block of land in the vicinity of the original building or at a similar site agreed to with the owner.
- Relocated households will retain title over their existing ROW land (except tower and substation sites) despite being compensated with a house block and an adjacent tree and garden area, thereby gaining additional land for garden production or similar.
- Relocation expenses and allowances will be paid to affected households to cover the cost of moving possessions and the cost of living and disturbance during relocation.
- Building materials from structures removed from the ROW will be made available to the relocating household for its use. Materials that are not wanted by the household will be disposed of by the design and construct engineer.

4.1.3 LOSS OF TREE RESOURCES

- Compensation for removed or pruned trees will be paid at fair market value based on tree type and age.
4.1.4  LAND USE RESTRICTION

- A one-off compensation payment may be paid to affected landowners to offset the devaluation of land within the ROW due to reduced land capability as a result of building prohibition. This payment would be based on current or future land capability, depending upon the site. No compensation will be paid for vegetation height restrictions applied to land adjoining the ROW.

4.1.5  CROP AND LAND DISTURBANCE

- Tower footing design should minimize permanent land use requirement, and should allow access for farming in and around footing area.

4.1.6  WILDLIFE IMPACT

Habitat Loss
- At the freshwater swamp area special precautions are to be taken to avoid fish spawning and waterfowl habitat areas.

4.1.7  WATER QUALITY AND SOIL CONTAMINATION

- Substations will be constructed above at least the 1:10 year flood level by creating a filled pad.
- Substation transformers will be located within secure and impervious bunded areas with a storage capacity of at least 110% of the capacity of oil in transformers and associated reserve tanks. Drainage flame traps with oil/water separators will also be installed.

4.1.8  HISTORIC, CULTURAL AND RELIGIOUS SITES

- Alignment should be designed to avoid areas of cultural significance.
- Chance find procedures should be established and incorporated into construction contract bidding documents.

4.1.9  RADIO AND TV INTERFERENCE

- Transmission line design will comply with the “General Requirements of Electric Power Technical Standards of the Kingdom of Cambodia (hereinafter, referred to as Technical Standards), Clause 47”, and equivalent international standards.
- A single conductor with the size of more than 400 mm² or bundle conductors will be used for a phase of the 230 kV line to mitigate the corona effect.
- The design of all line conductor fittings, vibration dampers, tension clamps and other line components will avoid sharp corners or projections that would produce
high electrical stresses in normal working conditions. The design of adjacent metal parts and mating surfaces will prevent corrosion of the contact surfaces and maintain good electrical contact under service conditions. Care will be taken during manufacture of conductors and fittings and during subsequent handling to ensure smooth surfaces free from abrasion.

4.1.10 HEALTH AND SAFETY

- Proper design to limit ground level exposure to electrostatic and electromagnetic induction in compliance with “Technical Standards, Clause 47”
- Proper design to limit lightning strike in compliance with “Technical Standards, Clause 42”
- Wherever towers are located close to settlements, proper countermeasures must be taken in compliance with “Technical Standards, Clause 32”
- PCBs will not be used in transformers or any other project facilities or equipment.
- The use of marker balls on conductors will be considered in the detailed design of 115 kV lines to make the conductors more visible. Specific sites considered will include where air traffic is more likely (i.e. near Phnom Penh Airport or above main roads, where an emergency landing may be attempted) or where longer spans occur (e.g. crossing watercourses).

4.2 CONSTRUCTION STAGE

4.2.1 LOSS OF TREE RESOURCES

- Trees that can survive pruning to less than 3 m height will be pruned to provide the required line clearance distances, not cleared (Transmission line component)
- Vegetation to be cleared will be marked prior to clearance to ensure that minimal clearance occurs.
- Trees that have mature heights in excess of the required clearances will be clearly marked, and only these trees will be felled or trimmed to meet the clearance requirements.
- Vegetation to be removed manually, no pesticides to be used
- Felled trees and other cleared or pruned vegetation (wood, branches and foliage) will be made available/retained by the owner of that vegetation for his/her use, or will be removed if requested by the owner (Transmission line component)

4.2.2 CROP AND LAND DISTURBANCE

- The selection of construction techniques and machinery will consider minimization of ground disturbance
- Construction activities on cropping land will be timed to avoid disturbance of field crops within one month of harvest wherever possible.
- Established roads and tracks will be used for construction and maintenance access
to the line wherever possible.

- Where access is required off existing roads and tracks, access will be restricted to a single carriageway width within the ROW unless more direct and lower impact access can be gained.

- The temporary placement of fill in drains/canals will not be permitted where impeded drainage could cause flooding or damage.

- Compensation for lost production will be paid for crops disturbed prior to harvest based on area of disturbed crop, market price and agreed yield.

- Spoil excavated from tower footings will be disposed of by placement along roadsides, or at nearby houseblocks if requested by landowners, to improve these features.

- Procuring of fill for the substation foundations by creating or improving local ponds or drains, undertaken with the agreement of local communities.

4.2.3 WILDLIFE IMPACT

Habitat Loss

- Trees that can survive pruning to less than 3 m height will be pruned to provide the required line clearance distances, not cleared (Transmission line component)

- Transmission line construction workers will be prohibited from harvesting or collecting fuelwood or other tree products in the project area during their employment, apart from the current activities of locally employed staff.

4.2.4 AIR QUALITY

- Wet surfaces during hot, dry and/or windy conditions

4.2.5 EROSION

- Construction activities involving significant ground disturbance (i.e. substation landforming) will not be undertaken during the dry season (mid May to October)

- Groundcover to be left undisturbed as much as possible

- Tree clearance to enable line construction and establish the ROW will seek to leave ground cover (i.e. grass and low shrubs) undisturbed as far as possible.

- Tree clearing will only involve the cutting of trees to ground level or pruning as appropriate, with tree stumps and roots retained.

- Substation embankments will be topsoiled and planted with a cover crop and perennial ground cover species immediately following final landforming to provide rapid and long-term ground stabilization.

- Borrow pits to be rehabilitated and revegetated

- The fenced substation compounds will include the embankments to ensure that ground cover is protected from over grazing or harvesting.

- Excess fill from tower foundation excavation will be disposed of by landforming next to roads or around houses, in agreement with the local community or
landowner. All landformed areas will be seeded with a cover crop and perennial grass mix.
- Where fill is obtained from specific sites for the construction of the substation foundations, these sites will be rehabilitated by seeding with a cover crop and perennial grass mix.

4.2.6 WATER QUALITY AND SOIL CONTAMINATION

- Fuel and other hazardous materials used during project construction will be stored in a secure manner above flood level and at least 20 m from any waterbody, watercourse, canal or storage pond.
- Proper wastewater treatment, water supply and waste disposal facilities for workforce

4.2.7 NOISE

- Construction activities will only be undertaken during the day and local communities will be informed of the construction schedule.
- If nighttime construction is necessary, local population will be notified in advance

4.2.8 HEALTH AND SAFETY

- All sites certified clear of UXO by Cambodian Mine Clearance Authority (CMAC) prior to construction
- The Design and Construction Contractor will prepare an Occupational Health and Safety Plan and provide related training and instructions to all staff before each person commences duties.
- The construction workforce facilities provided by the Design and Construction Contractor will include proper sanitation, water supply and waste disposal facilities.
- Public health information will be provided by the Design and Construction Contractor to the construction workforce prior to the commencement of on-site work, primarily covering the prevention of sexually transmitted diseases (including HIV/AIDS).

4.3 OPERATION STAGE

4.3.1 LAND ACQUISITION AND LAND USE CHANGE

- Owners of land acquired for 230 kV towers will be permitted to grow cereal crops under the towers.

4.3.2 WILDLIFE IMPACT

Habitat Loss

- Trees up to 3 m height will be retained within the ROW (Transmission line component)
Flight Deaths and Electrocution

Birds
In accordance with results of O&M, where particular attention should be given, measures to minimize bird deaths associated with transmission lines will be considered, including:
- silhouettes of birds of prey attached to conductors to frighten birds;
- markers attached to wires, such as colored balls, to improve line visibility for birds; and
- modifications to mitigate electrocution, such as perch guards and conductor insulation (Helland-Hansen et al, 1995).

Mammals
In accordance with results of O&M, where particular attention should be given, measures to minimize fauna deaths associated with transmission lines will be considered, including:
- Installation of screens to prevent monkeys and other arboreal mammals climbing towers will be considered in the design of the towers.
- A monitoring program will be undertaken to determine the occurrence of fauna deaths associated with the transmission line. Additional mitigation measures will be considered if implemented measures are unsuccessful.

5. ENVIRONMENTAL MONITORING PROGRAM

5.1 RESPONSIBILITIES

Social and Environmental Division SED under Project Management Offices (PMO1 & 2) of EDC, with assistance of the PIC, will carry out Compliance Monitoring, which is the monitoring activities on the compliance with proposed mitigation measures, to ensure mitigation measures are implemented to meet environmental requirements.

The Contractors, under the supervision of the PIC, will prepare and carry out the Construction Environmental Management Plan (CEMP) based on DEMP prepared by the SED with assistance of the PIC, to implement the mitigation measures. Also, the Contractors will conduct self-monitoring to ensure the effectiveness of the compliance on the mitigation measures.

5.2 FRAMEWORK FOR THE ENVIRONMENTAL MONITORING

Fig-1 shows procedure and relationship in carrying out Environmental Monitoring Procedure.
Fig 1  Environmental Monitoring Procedure
5.3. MONITORING ITEMS

Monitoring items have been determined based on the potential negative impacts identified in each project stage. Monitoring items for each project stage are given below. Monitoring activities are summarized in Table 1.

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5.4. REPORTING FOR MONITORING PROGRAM

SED, with the assistance of the Environmentalists of the PICs, will submit Monthly Reports on Environmental Monitoring Program to the concerning organization. The content of the Report will consist of:

- Summary of the environmental effects of the Project that have been predicted during project planning.
- Summary of environmental effects which have been observed to date
- Unpredicted effects and the nature of observations, if any
- Project’s compliance on the EMP
6. PUBLIC CONSULTATION

Public consultation is an important element for carrying out Environmental Monitoring Program. Providing local people participation in the Project will assist in finding out impacts caused by the Project and their solution. Also this will improve environmental governance mechanism to influence decision about the use and management of natural resources.

All phases of the Project will include structure for consultation and for information disclosure to affected people, appropriate government agencies, and other stakeholders, for a sound environmental management. The following information will be disclosed to local people and other stakeholders.

6.1. NOTIFICATION ON THE COMMENCEMENT OF THE CONSTRUCTION

Meeting for notification on the commencement of the construction to local communities will be held. The meeting will include representatives from (i) villages affected by the Project; (ii) EDC, (iii) province affected by the Project; and (iv) Inter-Ministry Resettlement Committee (IRC). The meeting will be held at each Project Provincial Office, at least one month before the commencement of construction.

6.2. FEEDBACK OF LOCAL GRIEVANCE TO THE DEMP

During the construction stage, in order to ensure that mitigation measures (DEMP) is properly implemented, it is important to maintain effective procedure for absorbing grievances from stakeholders, to identify any environmental and social impacts occurred from incompliance of mitigation measures.

Local people in the Project area, through public meeting, will be instructed on how to make grievances on social and environmental issues to the Project when be impacted. At the Meeting, Grievance Forms provided by the Project will be given to Village Chief for grievance registration.

During construction stage, the local people can make their grievances to the Project through their Village Chief. SED will conduct periodically visit to Village Chiefs to collect Grievance Forms. SED, in collaboration with the Environmentalist of PIC, will carry out solution for the grievances.

Procedure on absorbing and solving grievances is shown in Fig-2.
Fig-2  Procedure on Grievance Absorption and Solution

7. RESPONSIBILITIES FOR IMPLEMENTATION OF DEMP

7.1. INTRODUCTION

MIME does not have an environmental or social unit at present. EDC currently undertakes environmental and social functions on a project-by-project basis as necessary, performing this work as a secondary role to their primary work as engineers or managers. In order to carry out DEMP project base, establishing Social and Environmental Office (SEO) for the Project is considered to be critical.

7.2. ESTABLISHMENT OF THE SEO

The following persons, under the agreement of EDC, have been appointed as the staffs of the SEO. They will cover the both Project components funded by ADB and WB.

1. Mr. Mao VISAL, Head of SEO working on regular basis with the PIC
2. Mr. Chen SOPHANNA, Deputy head of SEO working on regular basis with the PIC

The number of staff of SEO will be expanded to four before commencement of construction activities.

7.3. RESPONSIBILITY OF THE SEO

The SEO, with assistance of the Environmentalist of the PIC, will
• Carry out Compliance Monitoring: the day-to-day inspection on compliance of mitigation measures of the contractors;
• Prepare reports on Compliance Monitoring.
• Address grievances from affected people
## Appendix 1 Summary of Mitigation Measures and Implementation Responsibility

<table>
<thead>
<tr>
<th>Environmental Issue</th>
<th>Mitigating Measure</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Design &amp; Pre-construction Stage&gt;</td>
<td></td>
<td>EDC/DCC</td>
</tr>
<tr>
<td>Land Acquisition and Land Use Change</td>
<td>- Fair compensation will be paid for acquired land based on current market rates, taking into account land capability.</td>
<td>EDC/DCC</td>
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<tr>
<td></td>
<td>- Design to minimize pole footprint</td>
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<tr>
<td>Building Replacement and Household Relocation</td>
<td>- Replacement houses, other buildings and facilities will be constructed to a similar standard to the existing structures</td>
<td>EDC/DCC</td>
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<td></td>
<td>- Replaced structures will, in order of preference, be located on the existing landholding outside the ROW, on a replacement block of land in the vicinity of the original building or at a similar site agreed to with the owner.</td>
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<td>- Relocated households will retain title over their existing ROW land (except tower and substation sites) despite being compensated with a house block and an adjacent tree and garden area, thereby gaining additional land for garden production or similar.</td>
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<td>- Relocation expenses and allowances will be paid to affected households to cover the cost of moving possessions and the cost of living and disturbance during relocation.</td>
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<td>- Building materials from structures removed from the ROW will be made available to the relocating household for its use. Materials that are not wanted by the household will be disposed of by the design and construct engineer.</td>
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</tr>
<tr>
<td>Loss of Tree Resources</td>
<td>- Compensation for removed or pruned trees will be paid at fair market value based on tree type and age</td>
<td>EDC/DCC</td>
</tr>
<tr>
<td>Environmental Issue</td>
<td>Mitigating Measure</td>
<td>Responsibility</td>
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<tr>
<td>Land Use Restriction</td>
<td>- A one-off compensation payment may be paid to affected landowners to offset the devaluation of land within the ROW due to reduced land capability as a result of building prohibition. This payment would be based on current or future land capability, depending upon the site. No compensation will be paid for vegetation height restrictions applied to land adjoining the ROW.</td>
<td>EDC</td>
</tr>
<tr>
<td>Crop and Land Disturbance</td>
<td>- Tower footing design should minimize permanent land use requirement, and should allow access for farming in and around footing area</td>
<td>DCC</td>
</tr>
<tr>
<td>Wildlife Impact</td>
<td><strong>Habitat Loss</strong></td>
<td>DCC</td>
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<td>- At the freshwater swamp area special precautions are to be taken to avoid fish spawning and waterfowl habitat areas.</td>
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<tr>
<td>Water Quality and Soil Contamination</td>
<td>- Substations will be constructed above at least the 1:10 year flood level by creating a filled pad.</td>
<td>DCC</td>
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<td></td>
<td>- Substation transformers will be located within secure and impervious bunded areas with a storage capacity of at least 110% of the capacity of oil in transformers and associated reserve tanks. Drainage flame traps with oil/water separators will also be installed.</td>
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<tr>
<td>Noise</td>
<td>- Setback of housing in accordance with Cambodian and World Bank noise standards/guidelines</td>
<td>DCC</td>
</tr>
<tr>
<td>Historic, Cultural and Religious Sites</td>
<td>- Alignment should be designed to avoid areas of cultural significance</td>
<td>DCC</td>
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<td></td>
<td>- Chance find procedures should be established and incorporated into construction</td>
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<tr>
<td>Environmental Issue</td>
<td>Mitigating Measure</td>
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<tr>
<td>Radio and TV Interference</td>
<td>Transmission line design will comply with the “General Requirements of Electric Power Technical Standards of the Kingdom of Cambodia (hereinafter, referred to as Technical Standards), Clause 47”, and equivalent international standards.</td>
<td>DCC</td>
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<td>A single conductor with the size of more than 400 mm² or bundle conductors will be used for a phase of the 230 kV line to mitigate the corona effect.</td>
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<td>The design of all line conductor fittings, vibration dampers, tension clamps and other line components will avoid sharp corners or projections that would produce high electrical stresses in normal working conditions. The design of adjacent metal parts and mating surfaces will prevent corrosion of the contact surfaces and maintain good electrical contact under service conditions. Care will be taken during manufacture of conductors and fittings and during subsequent handling to ensure smooth surfaces free from abrasion.</td>
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</tr>
<tr>
<td>Health and Safety</td>
<td>Proper design to limit ground level exposure to electrostatic and electromagnetic induction in compliance with “Technical Standards, Clause 47”</td>
<td>DCC</td>
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<tr>
<td></td>
<td>Proper design to limit lightning strike in compliance with “Technical Standards, Clause 42”</td>
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<td></td>
<td>Wherever towers are located close to settlements, proper countermeasures must be taken in compliance with “Technical Standards, Clause 32”</td>
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<td>PCBs will not be used in transformers or any other project facilities or equipment.</td>
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<tr>
<td>Environmental Issue</td>
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<td>Responsibility</td>
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<tr>
<td>Loss of Tree Resources</td>
<td>- The use of marker balls on conductors will be considered in the detailed design of 115 kV lines to make the conductors more visible. Specific sites considered will include where air traffic is more likely (i.e. near Phnom Penh Airport or above main roads, where an emergency landing may be attempted) or where longer spans occur (e.g. crossing watercourses).&lt;br&gt;&lt;br&gt;- Trees that can survive pruning to less than 3 m height will be pruned to provide the required line clearance distances, not cleared (Transmission component)&lt;br&gt;- Vegetation to be cleared will be marked prior to clearance to ensure that minimal clearance occurs.&lt;br&gt;- Trees that have mature heights in excess of the required clearances will be clearly marked, and only these trees will be felled or trimmed to meet the clearance requirements.&lt;br&gt;- Vegetation to be removed manually, no pesticides to be used&lt;br&gt;- Felled trees and other cleared or pruned vegetation (wood, branches and foliage) will be made available/retained by the owner of that vegetation for his/her use, or will be removed if requested by the owner (Transmission component).</td>
<td>DCC</td>
</tr>
<tr>
<td>Crop and Land Disturbance</td>
<td>- The selection of construction techniques and machinery will consider minimization of ground disturbance&lt;br&gt;- Construction activities on cropping land will be timed to avoid disturbance of field crops</td>
<td>DCC</td>
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<td>Environmental Issue</td>
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<tr>
<td>Habitat Loss</td>
<td>Trees that can survive pruning to less than 3m height will be pruned to provide the required line clearance distances, not cleared (Transmission line component)</td>
<td>DCC</td>
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<td>Transmission line construction workers will be prohibited from harvesting or collecting fuelwood or other tree products in the project area during their employment, apart from the current activities of locally employed staff.</td>
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<td>Environmental Issue</td>
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<tr>
<td>Air quality</td>
<td>- Wet surfaces during hot, dry and/or windy conditions</td>
<td>DCC</td>
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</table>
| Erosion             | - Construction activities involving significant ground disturbance (i.e. substation landforming) will not be undertaken during the dry season (mid May to October).  
- Groundcover to be left undisturbed as much as possible  
- Tree clearance to enable line construction and establish the ROW will seek to leave ground cover (i.e. grass and low shrubs) undisturbed as far as possible.  
- Tree clearing will only involve the cutting of trees to ground level or pruning as appropriate, with tree stumps and roots retained.  
- Substation embankments will be topsoiled and planted with a cover crop and perennial ground cover species immediately following final landforming to provide rapid and long-term ground stabilization.  
- Borrow pits to be rehabilitated and revegetated  
- The fenced substation compounds will include the embankments to ensure that ground cover is protected from over grazing or harvesting.  
- Excess fill from tower foundation excavation will be disposed of by landforming next to roads or around houses, in agreement with the local community or landowner. All landformed areas will be seeded with a cover crop and perennial grass mix.  
- Where fill is obtained from specific sites for the construction of the substation foundations, these sites will be rehabilitated by seeding with a cover crop and perennial grass mix. | DCC            |
<table>
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</table>
| Water Quality and Soil Contamination      | - Fuel and other hazardous materials used during project construction will be stored in a secure manner above flood level and at least 20 m from any waterbody, watercourse, canal or storage pond.  
- Proper wastewater treatment, water supply and waste disposal facilities for workforce | DCC            |
| Noise                                     | - Construction activities will only be undertaken during the day and local communities will be informed of the construction schedule.  
- If nighttime construction is necessary, local population will be notified in advance | DCC            |
| Health and Safety                         | - All sites certified clear of UXO by Cambodian Mine Clearance Authority (CMAC) prior to construction  
- The Design and Construction Contractor will prepare an Occupational Health and Safety Plan and provide related training and instructions to all staff before each person commences duties.  
- The construction workforce facilities provided by the Design and Construction Contractor will include proper sanitation, water supply and waste disposal facilities.  
- Public health information will be provided by the Design and Construction Contractor to the construction workforce prior to the commencement of on-site work, primarily covering the prevention of sexually transmitted diseases (including HIV/AIDS). | DCC            |
<p>| <strong>&lt;Operation Phase&gt;</strong>                     |                                                                                                                                                                                                                      |                 |
| Land Acquisition and Land                 | - Owners of land acquired for 230 kV towers will be permitted to grow cereal crops under                                                                                                                                | EDC            |</p>
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<tr>
<th>Environmental Issue</th>
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<tr>
<td>Use Change</td>
<td>the towers</td>
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<tr>
<td>WILDLIFE IMPACT</td>
<td><strong>Habitat Loss</strong></td>
<td>EDC</td>
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<td>- Trees up to 3 m height will be retained within the ROW (Transmission line component)</td>
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<tr>
<td>Flight Deaths and Electrocution</td>
<td><strong>Birds</strong></td>
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<td>In accordance with results of O&amp;M, where particular attention should be given, measures to minimize bird deaths associated with transmission lines will be considered, including:</td>
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<td>- silhouettes of birds of prey attached to conductors to frighten birds;</td>
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<td></td>
<td>- markers attached to wires, such as colored balls, to improve line visibility for birds; and</td>
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<td>- modifications to mitigate electrocution, such as perch guards and conductor insulation (Helland-Hansen et al, 1995).</td>
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<tr>
<td>Mammals</td>
<td>In accordance with results of O&amp;M, where particular attention should be given, measures to minimize fauna deaths associated with transmission lines will be considered, including:</td>
<td>EDC</td>
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<td>- Installation of screens to prevent monkeys and other arboreal mammals climbing towers will be considered in the design of the towers.</td>
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<td>- A monitoring program will be undertaken to determine the occurrence of fauna deaths associated with the transmission line. Additional mitigation measures will be considered if implemented measures are unsuccessful</td>
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