

Initial Environmental Examination

July 2012

Cambodia: Flood Damage Emergency Reconstruction Project

Prepared by Ministry of Rural Development for the Asian Development Bank.

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Initial Environmental Examination

of

National, Provincial and Rural Road Restoration

Flood Damage Emergency Reconstruction Project

July 2012

ABBREVIATIONS

| | |
|----------|---|
| AADT | Annual Average Daily Traffic |
| ADB | Asian Development Bank |
| APL | Angkor Protected Landscape |
| APSARA | Authority for Protection and Management of Angkor and the Region of Siem Reap |
| BOD | Biological Oxygen Demand |
| BTB | Battambang |
| DBST | Double Bituminous Surface Treatment |
| DOE | Department of Environment |
| EA | Executing Agency |
| EARF | Environmental Assessment and Review Framework |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Plan |
| FDERP | Flood Damage Emergency Reconstruction Project |
| FS | Feasibility Study |
| GoC | Government of Cambodia |
| GPS | global positioning system |
| GRM | grievance redress mechanism |
| ha | hectare |
| HIV/AIDS | human immunodeficiency virus/acquired immune deficiency syndrome |
| IA | Implementing agency |
| IEE | Initial Environmental Examination |
| MAG | Mines Advisory Group |
| MCFA | Ministry of Culture and Fine Arts |
| MEF | Ministry of Economy and Finance |
| MOE | Ministry of Environment |
| MOWRAM | Ministry of Water Resources and Meteorology |
| MPWT | Ministry of Public Works and Transport |
| MRD | Ministry of Rural Development |
| MT | motorized transport |
| NR | National Road |
| NTFP | non-timber forest products |
| O&M | Operation and Maintenance |
| PCMU | Project Coordination and Monitoring Unit |
| PDPWT | Provincial Department of Public Works and Transport |
| PDRD | Provincial Department of Rural Development |
| PIU | Project Implementation Unit |
| PPTA | Project Preparation TA |
| RCVIS | Road Crash and Victim Information System |
| REA | Rapid Environmental Assessment |
| RI | Riel |
| ROW | right of way |
| RP | Resettlement Plan |
| SBST | Single Bituminous Surface Treatment |
| SEIA | Summary Environmental Impact Assessment |
| SEU | Social and Environmental Unit (in MRD) |
| SPS | ADB's Safeguard Policy Statement (2009) |
| TA | technical assistance |
| TSBR | Tonle Sap Biosphere Reserve |
| TSP | Total Suspended Particulates |
| UNESCO | United Nations Educational Scientific and Cultural Organization |
| US\$ | United States Dollar |
| UXO | Unexploded Ordnance |
| WB | World Bank |

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I. Executive Summary

1. The Asia Development Bank (ADB) and the Royal Government of Cambodia (RGC) has agreed to implement the Flood Damage Emergency Reconstruction Project (FDERP), which will be financed by a project loan from the ADB and grant for the Australian Government. The FDERP is being implemented through the Ministry of Economy and Finance (MEF) as the executing agency (EA). There are three implementing agencies (IAs): (i) Ministry of Public Works and Transport (MPWT) for output 1; (ii) Ministry of Rural Development (MRD) for output 2, and (iii) Ministry of Water Resource and Meteorology (MOWRAM) for output 3.

2. The purpose of this Initial Environmental Examination report (IEE) is to provide an assessment of the environmental concerns that need to be taken into account with regard to the rehabilitation of part of flood damaged national and provincial roads in four provinces. The project has been classified as Category “B” for environmental impact, and the IEE has been carried out in accordance with the procedures described in “Environmental Guidelines for Selected Infrastructure Projects” Office of the Environment, (ADB 1993). The IEE is prepared in ADB’s IEE format as outlined in the “Environmental Assessment Requirements of the Asian Development Bank” (ADB 1998).

3. The IEE provides an initial rapid screening of the activities to be carried out under the proposed project, with the intention of identifying potentially significant environmental impacts, determining appropriate mitigation measures, and identifying if any further environmental assessment is required. With limited time of the preparation of the IEE, it is assessing only through existing secondary data from the project and other similar projects.

4. Based on the study of the existing environmental and social conditions in the project areas and potential impacts from project implementation, it is found that the project will result in overall benefits to communities in terms of livelihoods and connection between community and community, especially students, pregnant women and ill people can easily gain access to school and hospitals in time.

5. During construction a series of temporary negative impacts including dust, noise, road safety, worker’s safety, wastewater, solid waste and water contamination will occur, however, those impacts are avoidable and can be reduced by environmental control measures and mitigation measures. As for operational stages, the benefit includes improving community livelihood, public health, tourist access and general amenity.

6. In order to reduce the impacts, the alternative approaches are recommended as below:

- The environmental mitigation measures and environmental monitoring plan which are presented in the IEE report should be implemented.
- Good cooperation between all stakeholders, especially IA, EA and local authorities should be undertaken.
- Consultation with the local community should be implemented that IAs can update concerns and issues during project construction and operation.
- Further investigations are needed with regard to developing a suitable design for the borrow pits so that these may provide a range of multiple uses for the farmers whose land they will be excavated on.

7. The IEE has identified a range of potential impacts and determined suitable mitigation measures together with a monitoring program. Implementation of the proposed mitigation measures, the monitoring program and recommendation will avoid/reduce the impacts to insignificant levels. Hence no detail EIA study is required.

II. Policy, Legal, and Administrative Framework

A. Policy Framework

8. In 1993 the Royal Government of Cambodia confirmed a new Constitution in which environmental considerations were included for the first time. Specifically Article 59 states: *The State shall protect the environment and balance of abundant natural resources and establish a precise plan of management of land, water, air, wind, geology, ecological system, mines, energy, petrol and gas, rock and sand, gems, forests and forestry products, wildlife, fish and aquatic resources* and it was within this constitutional context that the Ministry of Environment (MOE) was established.

9. The hierarchy of legislation in Cambodia is:

- Royal Decree signed by the King
- Sub-decree signed by the Prime Minister
- Ministerial Decision signed by a Minister
- Regulation issued by a Ministry

10. The major legislation in Cambodia is the Royal Decree which ratifies laws passed by parliament. These can be supplemented by “prakas” or ministerial decisions. These laws allow sub decrees and regulations to be passed which can stipulate procedures and standards to be met in order to ensure compliance with the law. Many of these sub-decrees and standards have been drafted but have not yet been ratified by parliament. However, contractors are still expected to make sure their operations comply with the draft regulations.

B. Legal Framework

1. Laws on Environment

11. 1996 the Law on Environmental Protection and Natural Resource Management (NS/RKM/1296/36) came into force and it requires the government to prepare national and regional environmental plans and sub-decrees concerning a wide range of environmental issues, including EIAs, pollution prevention and control, public participation and access to information.

12. Other ministries explicitly mentioned at the time were Ministry of Water Resources, Hydrology and Meteorology and Ministry of Land Use Management, Urbanization and Construction. The list was later expanded to include the Ministry of Public Works and Transport, Ministry of Agriculture, Forestry and Fisheries, Ministry of Rural Development, Ministry of Health and Ministry of Tourism.

2. Laws on Historical Monuments

13. There is a general law in Cambodia which covers all national monuments. This is the “Law on Protection of Cultural and National Heritage”, (1996). This is supplemented by the “Decision on the Definition of 3 Zones to Protect Temple Surrounding Areas in All Provinces and Municipalities Except Angkor Wat”, 1996. These laws protect small temples or ancient structures.

3. Laws on Nature Reserves

14. Royal Decree “Protected Natural Areas” issued in November 1993 gives protection to environment, land, forests, wetlands and coastal zones. This decree covers 23 locations representing 18% of Cambodia's total area and is under the jurisdiction of MoE.

4. Laws on Wildlife

15. The “Joint Prakas of the Ministry of Environment and the Ministry of Agriculture on

Prohibition of Hunting and Catching of Wildlife Animals" (1996) specifically bans hunting of animals and birds for food. A contractor's workers must observe this law.

5. Subsidiary Laws on Environmental Protection

a. Sub-decrees and Regulations

16. The "Law on Environmental Protection and Natural Resource Management" (1996) is "enabling legislation", in that it enables the Ministry of Environment to pass sub-decrees and regulations to protect the environment. This subsidiary legislation lays down quantitative standards which must be met by contractors in their operation.

17. Several sub-decrees are already laws. Others have been drafted and are expected to become law in the near future. These standards give parameters and values which must be measured to check compliance with the regulations. Even if the regulations are in draft form, the contractors are expected to comply with them.

b. Sub-Decree on Air and Noise Pollution Control (Draft)

i. Air Quality (Draft)

18. The air pollution regulations are contained in Draft Sub-Decree on Air and Noise Pollution. For dust control, there should no visible emissions from stockpiles of materials, crushers or batching plants. At sensitive receptors a standard of TSP < 0.33 mg/m³ 24 hour average should be met. All vehicles should be well maintained and comply with the air quality regulations.

ii. Noise (Draft)

19. The noise regulations are contained in Draft Sub-Decree on Air and Noise Pollution. The regulations do not stipulate a level for noise from construction sites but refer to mixed commercial / industrial and residential property. Neither do they give the measurement method. Therefore the following standards are recommended. Noise levels at the perimeter of any site should not exceed :

- Continuous Equivalent Level (Leq) = 75dB(A) 12 hours daytime (0700-1900)
- Continuous Equivalent Level (Leq) = 65dB(A) 12 hours nighttime (1900-0700)

The descriptor "Continuous Equivalent Level (Leq)" is a commonplace measurement and most noise monitoring equipment measures it directly. The measurement is made at the construction site perimeter which makes monitoring easier as it does not require one gaining access to a private residence. The level of 75dB(A) daytime / 65 dB(A) nighttime is a "good" standard and commonly used in countries such as Singapore and Malaysia.

iii. Vibration

20. There is no standard for vibration in Cambodia. Therefore the following standard is recommended. The vibration levels at any vibration sensitive property or location should be less than 1mm/second peak particle velocity (ppv). The level of 1mm/second ppv is a good "standard" and is derived from the US Bureau of Mines publications for avoidance of damage and the UK GLC (Greater London Council) standard for avoidance of nuisance.

c. Sub-Decree on Water Pollution Control (No. 27 ANRK.BK 1999) (Draft)

21. As a minimum, all discharges of liquid wastes from construction camps, work sites or operations, to streams or water courses should be: BOD ≤ 50mg/L; Turbidity < 5 NTU; SS ≤

50 mg/L; Temperature < 45°C; pH = 6-9; Oil & Grease ≤ 5 mg/L and Dissolved Oxygen > 4mg/L.

There is no legal standard for performance of septic tanks but they should be checked for correct operation: that is absence of smell; no overflowing; and no surface water logging.

d. Sub-Decree on Solid Waste Management (No. 36 ANRK.BK 1999) (Draft)

22. Under the Draft Sub-Decree on Solid Waste Management (No. 36 ANRK.BK 1999), Article 7 “the disposal of waste in public sites or anywhere that is not allowed by authorities shall be strictly prohibited”. There are no quantitative parameters given but good sensible practice is expected. Such practices would include :

- All general waste and food waste should be removed to a government approved landfill.
- All demolition waste must be removed to a government approved location.
- All waste oils and greases should be removed by a registered subcontractor. The final destination should be established.

Failure to employ sensible precautions may cause sanitation problems to workers living in camps and also may result in prosecution.

e. Hazardous Substances

23. There is no specific regulation for hazardous substances in Cambodia. This aspect is covered in the Sub-Decree on Water Pollution Control Annex 1 and Sub-Decree on Solid Waste Management, which give details of classifications of what are defined as hazardous substances. Any hazardous substances must be stored correctly and only disposed in a manner approved by the MoE.

C. Administrative Framework

1. Protected Areas

24. Cambodia has a network of 23 natural protected areas managed through the Ministry of Environment (MoE). These areas cover 2.2 million hectares or 18% of Cambodia's land area and include most of its important habitats. The Forest Administration has also designated protected forests (from cancelled logging concessions) bringing the total area under protection to around 25% which is more than twice the global average. Protected Areas are sites which are protected by Royal Decrees, Laws and Regulations. Such mandatory stipulations are promulgated in Khmer language. These have been obtained and if necessary, translated. The Khmer version takes precedence over the translated version.

25. In 2008 Cambodia introduced the Protected Area Law (No. NS/RKM/0208/007), which defines:

- (i) national parks
- (ii) wildlife sanctuaries
- (iii) protected landscapes
- (iv) multiple use areas
- (v) Ramsar sites
- (vi) biosphere reserves
- (vii) natural heritage sites and
- (viii) marine parks

Details are :

- **National Parks** (IUCN category II) – Natural and scenic area of significance for their scientific, educational and recreational values.
- **Wildlife Sanctuaries** (IUCN category IV) – Natural area where nationally significant species of flora or fauna, natural communities, or physical features require specific intervention for their perpetuation.
- **Protected Landscapes** (IUCN category V) – Nationally significant natural and semi-natural landscapes that must be maintained to provide opportunities for recreation.
- **Multiple-Use Areas** (IUCN category VIII) – Areas that provide for the sustainable use of water resources, timber, wildlife, fish, pasture, and recreation with the conservation of nature primarily oriented to support these economic activities. The Tonle Sap Multiple-Use Area was nominated as Cambodia's first Biosphere Reserve in 1997. The Boeung Chmar portion of Tonle Sap Multiple-Use Area (28,000 ha) is designated as a Ramsar site.
- **Ramsar Sites** – There are two sites in the IUCN categories IV and VIII above and one site in the middle stretches of the Mekong River between Stung Treng and the border with Laos.

26. The Law on Forestry Management prohibits the hunting of wildlife within such protected areas. As well as maintaining checkpoints and providing rangers, the Ministry of Environment (MoE) has an active community education program to promote environmental awareness especially within the rural communities.

27. This law is recent (2008) and many of the protected areas predate this by many years. Both the original legislation and the most current have been reviewed during this project.

2. Cambodian IEE Requirements

28. On 11 August 1999 a Sub-decree (72 ANRK.BK) on EIA Processes was promulgated requiring an initial EIA (IEIA) or EIA for selected projects listed in the sub-decree annex to be submitted by public or private project owners to the MOE for review. (See table below)

29. The Sub-decree No 72 ANRK.BK. Date 11, August 1999 Annex "List of the projects that require an Initial Environmental Impact Assessment" refers to "National Road Construction \geq 100 Kilometers and bridges \geq 30 tonnes". As this project is rehabilitation of existing roads, and bridges are 25 Tonnes capacity, an IEE will not be required by MoE.

Table II-1 List of Projects that require an Initial Environmental Impact Assessment

| No. | Type and activities of the projects | Size / Capacity |
|--|---------------------------------------|------------------------------------|
| A. Industrial | | |
| a) Foods, Drinks, Tobacco | | |
| 1 | Food processing and caned | ≥ 500 Tones/year |
| 2 | All fruit drinks manufacturing | ≥ 1,500 Litres / day |
| 3 | Fruit manufacturing | ≥ 500 ones/year |
| 4 | Orange Juice manufacturing | All sizes |
| 5 | Wine manufacturing | All sizes |
| 6 | Alcohol and Beer brewery | All sizes |
| 7 | Water supply | ≥ 10,000 Users |
| 8 | Tobacco manufacturing | ≥ 10,000 Boxes/day |
| 9 | Tobacco leave processing | ≥ 350 Tones/ year |
| 10 | Sugar refinery | ≥ 3,000 Tones / year |
| 11 | Rice mill and cereal grains | ≥ 3,000 Tones / year |
| 12 | Fish, soy bean, chili, tomato sources | ≥ 500,000 Litres/ year |
| b) Leather tanning, Garment and Textile | | |
| 13 | Textile and dyeing factory | All sizes |
| 14 | Garments, washing, printing, dyeing | All sizes |
| 15 | Leather tanning, and glue | All sizes |
| 16 | Sponge- rubber factory | All sizes |
| c) Wooden production | | |
| 17 | Plywood | ≥ 100,000m ³ /year(log) |
| 18 | Artificial wood | ≥ 1,000 m ³ /year (log) |
| 19 | Saw mill | ≥ 50,000m ³ /year (log) |
| d) Paper | | |
| 20 | Paper factory | All sizes |
| 21 | Pulp and paper processing | All sizes |
| e) Plastic, Rubber and Chemical | | |
| 22 | Plastic factory | All sizes |
| 23 | Tire factory | ≥ 500 Tones /year |
| 24 | Rubber factory | ≥ 1,000 Tones /year |
| 25 | Battery industry | All sizes |
| 26 | Chemical production industries | All sizes |
| 27 | Chemical fertilizer plants | ≥ 10,000 Tones /year |
| 28 | Pesticide industry | All sizes |
| 29 | Painting manufacturing | All sizes |
| 30 | Fuel chemical | All sizes |

III. Description of Project

30. The Project will restore critical public and social infrastructure assets necessary to restore livelihood, access in project provinces that will secure the social infrastructure services against future flooding.

(i) **Output 1:** National and provincial road restoration will reconstruct flood damaged national and provincial roads in four provinces. In Prey Veng, 2 kilometers (km) of ring road, which also serves as a flood protection dyke for Prey Veng City will be strengthened, and 5 bridges along National Road 11 which were severely weakened by the floods will be replaced. In Kampong Cham, Banteay Meanchey and Battambang provinces, 72 km of provincial roads will be repaired and upgraded, and one bridge replaced. The works will be carried out in 3 stages. Temporary Stage 1 work has already been completed under government funding to restore minimum function of the roads. Stage 2 is the most urgent work that needs to be fast-tracked with substantial works done during the 2012 dry season to secure functioning of the roads during the 2012 wet season. Stage 3 works will be prepared to commence after the 2012 wet season.

(ii) **Output 2:** Rural roads restoration will reconstruct about 450 km of flood damaged rural roads in five provinces of Prey Veng, Kampong Cham, Kampong Thom, Siem Reap and Banteay Meanchey. Civil works of reconstruction will be carried out in three stages of which Stage 1 has been already completed. The Stage 2 repairs will quickly restore access by re-shaping the road section and providing a 100 to 150 millimeter (mm) laterite overlay, before the rainy season in 2012. During Stage 3, the road sections will be further strengthened to protect against future flood damage with cross-drainage facilities and appropriate paving of laterite/double bituminous surface treatment (DBST).

(iii) **Output 3:** Irrigation and flood control. Under this output, about 26 flood damaged irrigation schemes covering about 25,000 hectare (ha) will be repaired in at least 5 provinces, Prey Veng, Kampong Cham, Kampong Thom, Siem Reap, and Battambang. Stage 1 works involved temporary measures completed during 2011 to restore irrigation as far as possible. It is proposed to complete relatively small scale Stage 2 works before the 2012 wet season in 19 schemes to restore most of the irrigation operation, and to secure undamaged works for the next wet season. Stage 3 covers works that require more detailed investigations, and this work will commence after the 2012 wet season.

(iv) **Project and flood management.** This output will support the EA to undertake overall oversight and management of the project and ensure that procedures are followed and that the implementation schedules are kept on track. This output will also provide consulting and capacity development inputs to link the restoration outputs under the project with support for flood management activities.

Under the output 2, the **Rural roads restoration** has to reconstruct about 450 km of flood damaged rural roads in five provinces of Prey Veng, Kampong Cham, Kampong Thom, Siem Reap and Banteay Meanchey. Civil works of reconstruction has be carried out in three stages of which Stage 1 has been already completed. The Stage 2 repairs will quickly restore access by re-shaping the road section and providing a 100 to 150 millimeter (mm) laterite overlay, before the rainy season in 2012. During Stage 3, the road sections will be further strengthened to protect against future flood damage with cross-drainage facilities and appropriate paving of laterite/double bituminous surface treatment (DBST). The Project has five packages in stage 2 that are CW1, CW2, CW3, CW4 and CW8 consisted of 26 roadlines and in stage 3, there were CW5, CW6, CW7, consisted of 12 roadlines. The following are the descriptions of packages of stage 2 and 3:

- The package CW1 consists of four roads. The first subproject (PV1) covers 15.7 km of rural

road from Kampong Popil to Chreang Totoeung in Peareang district. It connects to national road No. 8, and is one of the important rural roads in the north-west of Prey Veng province. The second subproject (PV5) is 5.6 km rural road from Plouv Phum to Po Sabang in Peareang district. The third subproject (PV6) is emergency repair of 20.5 km rural road from Boeung Kak to Lngoeun in Kanh Chriech district. The fourth subproject (PV7) is 7.7 km rural road connecting from national road No.1 to Trapeang Roka in Kampong Trabek district.

- The subproject CW2: (KC1A) covers 27.0 km of rural road from Tary Krom to Prek Tanong in Kah Sotin and Srey Santhor district. It is one of the important rural roads in the west of Kampong Cham province. The second subproject (KC2) is 13.5 km rural road from Phum Tiprampi to Spean Preak Cham in Krouch Chma district. The third subproject (KC3) is emergency repair of 7.0 km rural road from Sokorng to Reay Pay in Kang Meas district. The fourth subproject (KC7) is 14.0 km rural road from Peam Chileang to Thmorpich in Tboung Khum district. The fifth subproject (KC8) is the 12.4 km long from Phaav to Daun Dom in Cheung Prey and Batheay District, and there is a bridge construction excluding road restoration at KC1B in Srey Santhor district.
- The package CW3 consists of five roads lines. The first subproject (SR2) covers 6.0 km of rural road from Prey Toteung to Balaang in Chikreng district. The second subproject (SR3) for the package is 14.6 km rural road from Kralanh to Sambo in Kralanh district. The third subproject (SR5) is emergency repair of 9.8 km rural road from Bakorng to Kandek in Parasat Bakorng district. The fourth subproject (SR6) is 10.6 km of rural road from Khnat to Keo Poir in Puok district, and the fifth subproject (SR8) is 9.0 km rural road from Reusei to Luok in Chikreng district.
- The package CW4 consists of seven road lines. The first subproject (BMC1) covers 20.0 km of rural road from national road No.5 to Chaeng Maen through Ballangk in Malai district. The second subproject (BMC2) for the package is the 7.0 km rural road from national road No.5 to Thmasen in Poipet district. The third subproject (BMC4) is repair of 10.0 km rural road also from national road No.5 to Tasol in Mongkol Borei district. The fourth subproject (BMC5) is the 4.0 km rural road connecting from Kah Porng Svort to Kah Keo in Mongkol Borei district. The fifth subproject (BMC6) is covering 8.0 km of rural road from national road No.5 to Samroung in Ou Chrov district. The sixth subproject (BMC7) is emergency repair of 7.0 km rural road from national road No.5 to Srah Riang in Mongkol Borei district, and the seventh subproject (BMC8) is covering 9.5 km rural road from national road No.5 to Chamnom in Mongkol Borei district.
- Subproject CW5 involves the repair of 86.1 km in Kampong Cham and Prey Veng provinces, consisted of 7 roadlines, 3 roadlines in Kampong Cham province. So the subproject are dealing with the placement of subbase material along the existing roads is a method of construction that reshape damaged road surface and top up with laterite thickness of 10 or 15 cm. Replacement of Structures and Drainage Work. The bridges will be constructed at KC7 road in Kampong Cham Province. There will be two (2) lanes with an overall length of 25 meters for both of them. It will have piled foundation, reinforced concrete (RC) substructure, T-beams as superstructure. Damaged box culverts will be replaced with equivalent or bigger size. Clogged and damaged pipe culverts will also be replaced with bigger size culverts for the smooth drain.
- Subproject CW6, consisted of 4 roadlines, involves the repair of 52.6 km, one roadline in Kampong Thom province and three roadlines in Siem Reap province, the subprojects have deal with the placement of subbase material along the existing roads is a method of construction that reshape damaged road surface and top up with laterite thickness of 10 or 15 cm. Replacement of Structures and Drainage Work. There is no bridge construction in this subproject. Damaged box culverts will be replaced with equivalent or bigger size. Clogged and damaged pipe culverts will also be replaced with bigger size culverts for the smooth drain which helps minimizing the slope erosion.
- Subproject CW7, it is just one roadline, it involves the repair of 30.0 km in Banteay Mean Chey province, placement of subbase material along the existing road is a method of construction that reshape damaged road surface and top up with laterite thickness of 10 or 15 cm. Replacement of Structures and Drainage Work. There is no bridge construction in this subproject. Damaged box culverts will be replaced with equivalent or bigger size. Clogged and damaged pipe culverts will also be replaced with bigger size culverts for the smooth drain

which helps minimizing the slope erosion.

- The package CW8 consists of five road lines in Kampong Thom province. The first subproject (KT1) covers 15.0 km of rural road from Anlong Chuor to Tuol Kreul in Prasat Blang district. The second subproject (KT2) for the package is the 4.2 km rural road from Thmey to Kampeut in Prasat Blang district. The third subproject (KT3) is the emergency repair of 5.2 km rural road from Mean Chey to Chek Mouy Storg in Sandan district. The fourth subproject (KT5) is 3.5 km rural road connecting from Tuol Sangkae to Sang in Santuk district. The fifth subproject (KT6) is emergency repair from national road No.6 to Thlok in Stoung district

31. This IEE includes the preparation of environmental assessments and environmental management plans (EMPs) developed for roads (outputs 1 and 2).

IV. Description of the Environment

1. *Physical environment*

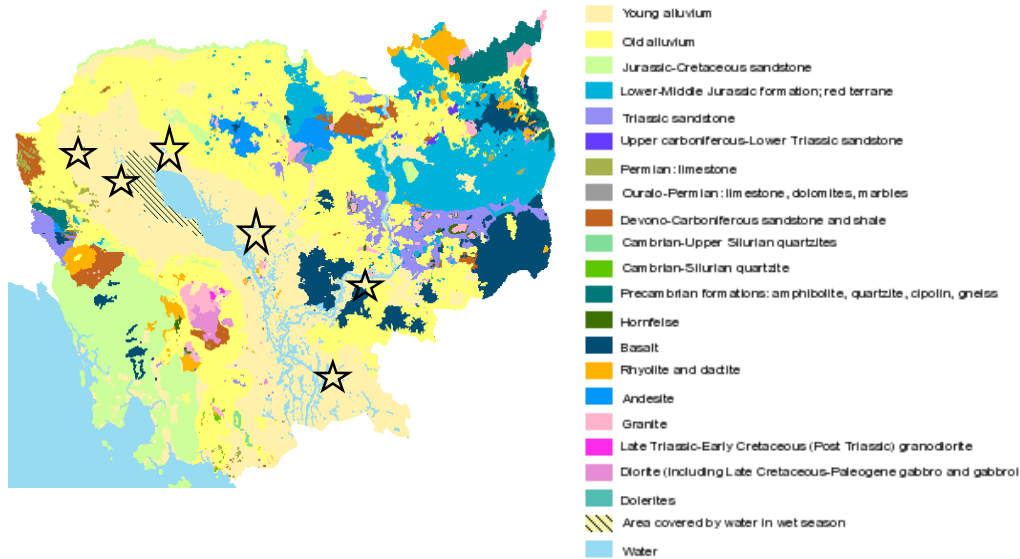
Topography, geology and soil

32. Cambodia is bordered by Thailand to the northwest, Laos to the northeast, and Vietnam to the east, and the Gulf of Thailand to the southwest. It has twenty four provinces and capital city. The selected provinces of the project are Battambang, Banteay Meanchey, Siem Reap, Kampong Cham, Preyveng and Kampongthom where located in floodplain of the lower Mekong River Basin in Cambodia.

33. Quoted from GMS (2002), the alluvium forms part of the Cambodian Central Plain that surrounds the Tonle Sap and encompasses the lower Mekong River system in Cambodia, which extends through to the Vietnam coast. The plain is featureless apart from a few scattered outcrops of Jurassic Sandstone that occur as small hills that rise steeply to about 100 m asl above the plain. The GMS (2002) also described that these hills occur at Phum Liep, Sisophon and Phnom Thom and are the only sources of rock in the area. Elsewhere, several small low north-south tending ridges that typically rise 3-5 m above the plain occur and are sought after as urban sites so as to be above the flood level.

34. The geology of the Battambang, Banteay Meanchey and Prey Veng areas is characterized by young alluvium soils (see geological map in **Figure 1** below) made up by sediment deposits from rivers and streams. These are mainly finer sediments, thus a high concentration of silt and clay is found in the ground (CTDP, 2012).

Figure 1: Geological Map



(Data source: NREM DATA TOOL BOX – Royal Danish Embassy- Danida - Phnom Penh, Cambodia, March 2007)

Climate

35. The climate of the area is characterized by distinct rainy and dry season. The project areas are effluence from the monsoon wind. The southwest monsoon starts in May and lasts till October called as the dry season, while from November to April the dry northeast monsoon occurs.

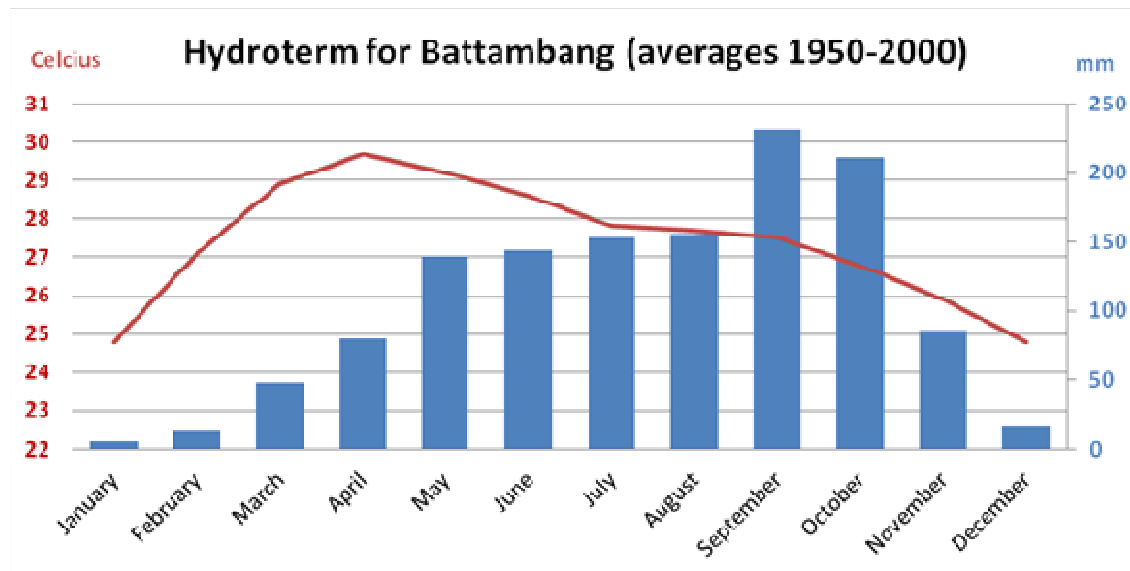
36. The average rainfall in Battambang is 1300 mm, with peak rainfall occurring in September/October and the lowest rainfall in February. As for the temperature, it is lowest in December/January with average minimum temperature of 26°C and the highest in April with average minimum of 34°C. The wind direction during the rainy season is prevalent from south-west to north-east while opposite during the dry season. **Figure 2** below illustrates the average rainfall in Battambang, as well as maximum through the past 30 years. According to the Prey Veng, Kampong Cham, Siem Reap and Banteay Meanchey, they are located in floodplain areas like Battambang thus the wind effluence, temperature and rainfall are quite similar.

Water resource

37. According to the GMS (2002), the hydrology of the project area, especially Battambang and Banteay Meanchey, is determined by three systems: (i) the hydrological conditions that prevail in the upper catchment areas of the Dangrek escarpment as modified by the nearly level plain area that surrounds the road and is evident as channelised flow in the four main drainage channels that cross the plains area, (ii) locally derived drainage that originates from the plain as overland flow. This becomes channelised below the road and then joins one of watercourses and enters the Tonle Sap via the Stueng Sangkhae, and (iii) the operation of the Tonle Sap itself. The Tonle Sap is the largest freshwater area in SE Asia and is an important regulating feature of the lower Mekong River, which by acting as storage; both moderates flood flows during the wet season and maintains low flows during the dry season.

38. As for Prey Veng and Kampong Cham, the hydrology of the area is affected by two main systems: (i) locally derived drainage from its plain and catchment, and (ii) the natural flowing and drainage from the lower Mekong River.

Figure 2: Average rainfall in BTB (1950-2000)



Source: CTD, 2012

Ground water

39. Groundwater is an important source of domestic water in the study area for both residential development and commercial development. However, it has been a problem during the dry season, both water quality and quantity, in some of the areas. However, there is no detailed data on groundwater availability in the study area is available.

2. Ecological environment

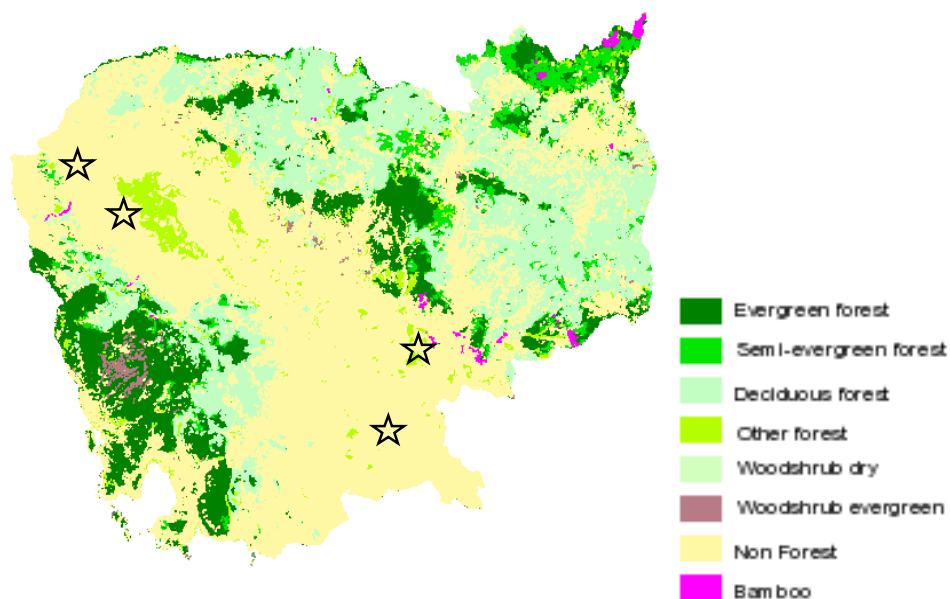
Forest and vegetation

40. The natural forest in project areas has almost completed. The land areas are dominated by agricultural land (see **Figure 3** below). Agricultural activities including rice field and vegetation are increasing in the project areas. The proposed sites of road improvement are not close to any sensitive protected areas or protected biodiversity under control by government. Only some economic trees such as coconut, mango, papaya, banana, jackfruit and others are found at some sections of the project roads will be minimally affected.

Rare or Endangered Species

41. Given the largely urban, economic developmental nature and result on land encroachment of the project area, no rare or endangered species are expected to be present now.

Figure 3: Land cover context



Source: CTD, 2012

Protected areas

42. Protected Areas in Cambodia are under control by Ministry of Environment (MOE). Twenty-three of protected and wildlife conservative areas were created in 1993, of which are located in the project province, only Battambang (**Table 1**). This law doesn't create any protected areas in Prey Veng, Banteay Meanchey and Kampong Cham yet in 1993 (Table 1). According to the GMS (2002), the protected areas in Banteay Meanchey are established additionally (**Table 2**).

43. Law of the projected areas also described that every protected area shall be protected and controlled from any negative impacts of every activity mentioned in article 41. Every development or project in the protected areas will be banned except those are approved by Minister of Ministry of Environment in terms of benefits to natural resource conservation and management purposes. Referring to the Royal Decree on the creation and designation of protected areas (1993), these protected areas cover 3,273,200 ha, approximately 18% of the country's land area. This is under the direct legal framework of the new Protected Areas Law promulgated in February 2008.

Table 1: Description of the protected areas administrated by the MOE

| Protected area | Surface area (ha) | Province |
|---|-------------------|-------------------------------|
| Natural Parks: 871,250 ha | | |
| Bokor | 140,000 | Kampot |
| Botum Sakor | 171,250 | Koh Kong |
| Kep | 5,000 | Kep |
| Kirirum | 35,000 | Kampong Speu and Koh Kong |
| Phnom Kulen | 37,500 | Siem Reap |
| Ream | 150,000 | Sihanouk-Ville |
| Virachey | 332,500 | Stueng Treng and Rattanakiri. |
| Wildlife Preserves: 2,030,000 ha | | |
| Boeng Per | 242,500 | Kampong Thom |

| Protected area | Surface area (ha) | Province |
|--|-------------------|---|
| Kulen Promtep | 402,500 | Siem Reap, Oddor Meanchey and Preah Vihear |
| Lumphat | 250,000 | Rattanakiri and Mondulhiri. |
| Peam Krasoab | 23,750 | Koh Kong |
| Phnom Namlear | 47,500 | Mondulhiri |
| Phnom Oral | 253,750 | Koh Kong, Pursat and Kampong Chhnang |
| Phnom Prich | 222,500 | Mondulhiri and Kratie |
| Phnom Samkos | 333,750 | Koh Kong and Pursat |
| Roneam Donsam | 178,750 | Battambang |
| Snoul | 75,000 | Kratie |
| Protected scenic view areas: 500,950 ha | | |
| Angkor | 10,800 | Siem Reap |
| Banteay Chmar | 81,200 | Banteay Meanchey |
| Dung Peng | 27,700 | Koh Kong |
| Preah Vihear | 5,000 | Preah Vihear |
| Samlot | 60,000 | Battambang |
| Tonle Sap | 316,250 | Kampong Chhnang, Kampong Thom, Siem Reap, Battambang and Pursat. |

Source: Royal decree on the creation and designation of protected areas (1993)

Table 2: Protected Areas in the Province of Banteay Meanchey and Battambang

| Protected Area | Province | Total Size (ha) | Characteristics |
|---|--|-----------------|---|
| Ang Trapang Thmor Sarus Crane Conservation Area | Banteay Meanchey | 12,650 | Important site for the Eastern Sarus Crane and other water fowl that have established a habitat on the reservoir. |
| Ronem Daun Sam Wildlife Sanctuary | Banteay Meanchey 30% Battambang 70% | 178,750 | Lowland evergreen and semi-evergreen forest of unknown condition – no forest exists across the Thai border. Possibly holds pileated gibbon (an endangered primate). |
| Banteay Chhmar Protected Landscape | Banteay Meanchey | 81,200 | The area contains archaeological/cultural value. Otherwise the area is reported to be badly degraded. |

(**Source:** National Environmental Action Plan, MoE, 1998, Tonle Sap Resource Management and Conservation, CNMC, 2001, Conservation Activities at Ang Trapeang Thmor Sarus Crane Conservation Area, WCS, 2001.)

Wildlife

44. As given the above forest cover land, the wildlife is very rare in the project areas. Most of the areas are converted to be agricultural and residential. No rare or endangered fauna are resident within or adjacent to the proximity of the project roads. None of the roads passes through any forested or protected areas.

Fish

45. Fish are an important vitamin of the diet of the people living in Cambodia. The roads are located in a flood plain that is linked to the Tonle Sap Lake and the Lower Mekong River where are very essential of fish production. The production of the lake is estimated about

65kg per ha per year, which is more than five times that of most tropical freshwater bodies (World Bank, 2003). According to the GMS (2002) the most common fish has been found in the Lake and flood plain areas presented in the Table 3.

Table 3: Fish commonly found in the Tonle Sap and Floodplain area

| Local Name | Scientific Name | Comments |
|------------------|-------------------------------------|-----------------------|
| Trei Ros/ Ptuok | <i>Channa striata</i> | Migrates for breeding |
| Trei Andeng Tun | <i>Clarias macrocephalus</i> | Migrates for breeding |
| Trei Chhpin | <i>Barbodes gonionotus</i> | |
| Trei Riel | <i>Henicorhynchus siamensis</i> | |
| Chhlang | <i>Mystus filamentus</i> | |
| Trei Kes | <i>Micronema bleekeri</i> | |
| Trei Kagnchruk | <i>Botia modesta</i> | |
| Trei Kamphleanh | <i>Trichogaster trichopterus</i> | Migrates for breeding |
| Trei Kamphleav | <i>Kryptopterus moorei</i> | Migrates for breeding |
| Kanh Chanh Chras | <i>Pseudambassis notatus</i> | |
| Kanh Chos | <i>Mystus mysticetus</i> | Migrates for breeding |
| Kan Trob | <i>Pristolepis fasciata</i> | |
| Khong Veng | <i>Dangila lineata</i> | Migrates for breeding |
| Kranh | <i>Anabas testudineus</i> | Migrates for breeding |
| Kros phnom | <i>Poropuntius deauratus</i> | Migrates for breeding |
| Angkat Prak | <i>Cyclocheilichthys microlepis</i> | |
| Slat | <i>Notopterus notopterus</i> | |
| Ta Aun/ Kramorm | <i>Ompok bimaculatus</i> | |
| Sraka Kdam | <i>Cyclocheilichthys repasson</i> | Migrates for breeding |

Source: GMS, 2002

3. Human and economic development

Population

46. According to the population census 2008, the population in Cambodia is 13.4 million of which 51.5 percent are female while 48.5 percent are male. The estimated growing rate is about 1.54 percent per annum. It shows that province of Battambang, Banteay Meanchey, Siem Reap, Kampong Thom, Kampong Cham and Preyveng have a population of 1,025,174; 677,872; 896,443; 631,409; 1,679,992; and 947,372 persons.

Table 4: Population and administrative statistics

| Province | District/town ¹ | Commune ¹ | Sangkat ¹ | Village ¹ | Total Population ² |
|------------------|----------------------------|----------------------|----------------------|----------------------|-------------------------------|
| Battambang | 14 | 92 | 10 | 800 | 1,025,174 |
| Banteay Meanchey | 9 | 55 | 10 | 644 | 677,872 |
| Siem Reap | 12 | 87 | 13 | 876 | 896,443 |
| Kampong Thom | 8 | 73 | 8 | 735 | 631,409 |
| Kampong Cham | 17 | 167 | 6 | 1,759 | 1,679,992 |
| Preyveng | 13 | 113 | 3 | 1,137 | 947,372 |

Sources: ¹ Population Census (2008); ² NCDD: <http://db.ncdd.gov.kh/>

Poverty

47. According to the GMS (2002) GDP per capita in 1999 was estimated at 290 \$ of which 36 percent were affected by poverty. Rural poverty is higher at 40 percent versus 30 percent in urban areas. The ADB (2007) the poverty rate in Siem Reap was 54 percent which estimated number of poor people was about 356,800 persons.

Employment

48. The economic and social development in a country depends on numbers of persons who are economically active.

49. The census (2008) shows that total population in 2008 is 13,395,682 persons of which 6,935,246 persons were employed while 118,152 persons unemployed. By comparison the numbers of un-employment in country was decreased from 273,183 persons in 1998 and 118,152 in 2008 (Table 5).

Table 5: status of employment

| Status of employment | 1998 | 2008 |
|-------------------------------------|-------------------|-------------------|
| | Persons | Persons |
| Total population in Cambodia | 11,437,656 | 13,395,682 |
| Employment | 4,845,762 | 6,935,246 |
| Unemployment | 273,183 | 118,152 |
| Urban Population | 2,095,074 | 1,299,677 |
| Employment | 761,998 | 1,233,174 |
| Unemployment | 95,235 | 58,337 |
| Rural Population | 9,342,582 | 12,096,005 |
| Employment | 4,083,764 | 5,702,072 |
| Unemployment | 177,948 | 59,815 |

Source: Population census (2008)

V. Screening of Potential Environmental Impacts and Mitigation Measures

1. *Environmental Assessment Methodology*

50. The Initial Environmental Examination (IEE) provides an analysis of possible impacts associated with restoration of highways and rural road renovation, and is prepared based only on secondary data, a review of previous reports, and EARF. The main purpose is to assess potential impacts on physical, biological and socio-economic environments and find possible measurement for mitigation or avoidance.

51. Impacts are analyzed in terms of 4 key aspects: project location; design; construction; and operation. The impacts are classified according to the degree of impacts which are defined as follows:

- Not significant (D1): No impact from the project activity
- Small impact (D2) - low probability of occurrence and low magnitude of any impact occurring on the environment.
- Moderate impact (D3) – Moderate probability of occurrence and moderate magnitude of any impact occurring on the environment.
- Major impact (D4) - high probability of occurrence and high magnitude of any impact occurring on the environment.
- (+) = beneficial impact

52. The impacts are also assessed according the duration of occurrence as follows:

- Short term = less than 1 year,
- Medium term = 1 to 5 years,
- Long term = More than 5 year.

2. *Screening of environmental impacts*

53. This section covers a preliminary screening of potential environmental impacts of the project for each of three stages as follows:

- (i) Pre-construction: Occurring during project design and during completion of detailed design and land acquisition.
- (ii) Construction: Occurring during project construction that includes the vegetation clearing, earthworks, and road construction.
- (iii) Operation: Occurring after completion of road construction.

54. The list of potential impacts identified for the Road Improvement Project is discussed in **Table 6**. Most of the works involves restoration of existing roads, so the impacts for the most part will be normal incremental in nature, and major impacts are not expected. No impacts are expected on sensitive areas such as protected areas, wildlife, and natural resources conservation and cultural and heritage sites. The majority of the impacts will only be during project construction. The related mitigation measures which are available for these limited impacts are also presented in Table 6.

Table 6: Matrix of Potential Environmental Impact and Possible Mitigation Measures: Road and Highway

| Issue | Mitigation measures | Signific- ance | Dur- ation | Who responsible? | | Monitoring/ management |
|---|--|-------------------|---------------------|---|-------------------------|--|
| | | | | Construction | Implementat- ion | |
| 1. Recommendation during project design | | | | | | |
| Loss of roadside trees | <ul style="list-style-type: none">- Tree clearing should be avoided as much as possible, and if unavoidable, the damaged trees need to be replaced by re-planting new road side trees.- Incorporate replacing damages in project costs- Consult communities in project design and public awareness. | D2 | Med- ium term | Engineer – include costs of tree planting in project design | Engineer | Environmental Specialist (ES), IA, EA, |
| Loss of natural trees /protected area for borrow pits | <ul style="list-style-type: none">- Develop alternative uses for borrow pit areas where is not negative impact on livelihood and protected areas- Incorporation of replacing damages during project design. | D2 | Med- ium term | Engineer | Engineer/ Contractor | ES, IA, EA |
| Loss of agricultural land for borrow pits | <ul style="list-style-type: none">- Develop alternative uses for borrow pit areas where is not negative impact on livelihood and protected areas.- Incorporation of replacing damages during project design. | D2 | Long term | Engineer | Engineer/ Contractor | ES, IA, EA |
| Land mine and UXO | <ul style="list-style-type: none">- Subprojects will rehabilitate existing roads without widening. Nevertheless, risks remains since there may be deep seated mines that could be exploded by heavy construction equipment, etc.- Hence consultative meetings with local communities are necessary to know clearly where there are risks of mines or UXO. Unsafe areas should be cleared before project implementation. | D3 | Med- ium term | Contractor | IA | ES, IA, EA |
| Relocation or assets affected | <ul style="list-style-type: none">- Engineer should design to avoid or reduce any impact on assets (individual or community).- Ensure compliance with the resettlement framework of the Project and Cambodian laws, policies, and regulations. | D2 | Long term | Engineer IA/ EA | Engineer IA/ EA | ES, IA, EA |
| 2. Recommendation during construction phase | | | | | | |
| Dust from road works | Water shall be sprayed during construction, particularly in towns and villages, to ensure that dust is minimized throughout the construction zone. | D3 | Short term | Contractor | Contractor | IA/EA/ES to check the site during construction |

| Issue | Mitigation measures | Significance | Duration | Who responsible? | | Monitoring/ management |
|---|---|--------------|------------|------------------|----------------|--|
| | | | | Construction | Implementation | |
| | | | | | | interview locals etc. |
| Dust, odor and dry material handling | Dry material handling and transport generate large amounts of dust thus: (a) The Contractor shall prepare a dust control program. (b) Water shall be sprayed where dry materials are handled, crushed and transported. (c) Vehicles transporting materials are to be covered to reduce spills and dust. | D2 | Short term | Contractor | Contractor | ES, IA, EA |
| Air pollution and noise | <ul style="list-style-type: none"> - vehicles and equipment are to be maintained to meet Cambodian emission and noise standards to limit emissions that cause air pollution and noise - Construction to cease within 100m of a village or town during lunch hours and night time. | D2 | Short term | Contractor | Contractor | ES, IA, EA |
| Human waste from construction | Provision of sanitary facilities (toilets, etc.) with proper waste disposal will be provided by contractors | D2 | Short term | Contractor | Contractor | ES, IA, EA |
| Solid waste generation from construction camp, work sites and workers | Sufficient garbage containers are to be provided in construction camps and at work site, and be emptied daily, the waste being disposed of in an approved landfill or site to avoid solid waste creating a nuisance and encouraging disease vectors (such as flies and rats) or blocking drainage system and hazard to human health and environment. Every camp and work site to be cleaned before moving to new sites. | D2 | Short term | Contractor | Contractor | ES, IA, EA to check & observe the construction areas and camp sites |
| Traffic and transport of equipment | Construction vehicles will comply with national speed limit and will drive at low speeds, especially at markets, schools, hospitals, and urban /populated areas. | D2 | Short term | Contractor | Contractor | ES, IA, EA |
| Traffic congestion | Keep road space or bypass for travelers to avoid traffic jams, and construction vehicles to be parked at designated safe places. | D2 | Short term | Contractor | Contractor | ES, IA, EA to check & observe trucks, pit soil piles, & other equipment at construction area |
| Traffic accidents | Put up construction signs for public, safety first signs at the construction area, and place suitable barriers around works sites | D2 | Short term | Contractor | Contractor | ES, IA, EA |

| Issue | Mitigation measures | Significance | Duration | Who responsible? | | Monitoring/management |
|--|---|--------------|------------|------------------|----------------|-----------------------|
| | | | | Construction | Implementation | |
| | to prevent people or animals going onto the site. | | | | | |
| Soil erosion | Eroded material from embankments and borrow pits can block ditches and culverts, damage adjacent land & cause deterioration in water quality. The alternative approaches should be: (1) provide adequate across drainage to avoid over flow or flooding, and (2) re-vegetation of construction area to reduce runoff and flow. | D3 | Long term | Contractor | Contractor | ES, IA, EA |
| Water contamination | The most severe water quality impact would be from bitumen, diesel or waste oil. Since these substances are toxic to living organisms, the following will observed: <ul style="list-style-type: none"> - Diesel and waste oil are to be handled and stored carefully to prevent leakage or spill. Waste oil is to be collected, stored and disposed at approved sites (according to national standard). - Storage is to be in drums, raised off the ground, covered to keep rain out and surrounded by a bund to contain any spills and simplify clean up. - The Contractor shall prepare a Spill Management Plan (including measures to be taken and equipment to be used) to ensure adequate cleanup of any spills. | D2 | Short term | Contractor | Contractor | ES, IA, EA |
| Loss of trees | Tree clearing should be avoided as much as possible and tree planting carried out where appropriate in order to enhance the environments around the road. | D2 | Long term | Contractor | Contractor | ES, IA, EA |
| Worker safety and health | <ul style="list-style-type: none"> - Workers should wear protection equipment during work time to ensure that they are safe and good health. - A contractor should develop a health and safety plan. M - Manager should educate workers on health & safety projection. | D3 | Short term | Contractor | Contractor | ES, IA, EA |
| Transmission of sexually communicable diseases | <ul style="list-style-type: none"> - Provide sanitation and portable water. - Education of workers on transmittable diseases. | D3 | Long term | Contractor | Contractor | ES, IA, EA |
| Stagnant water areas | Siting camps distant to communities and removal of still water areas | D2 | Long term | Contractor | Contractor | ES, IA, EA |

| Issue | Mitigation measures | Significance | Duration | Who responsible? | | Monitoring/management |
|---|--|--------------|-----------|--|----------------|---------------------------|
| | | | | Construction | Implementation | |
| (breeding mosquitos) | | | | | | |
| 3. Recommendation during operational phase | | | | | | |
| Traffic accident | <ul style="list-style-type: none"> - Provide traffic sign board at corner or curve road, especially at school, hospital and market areas. - Road safety device including traffic sign board (especially at corner or curve road and school, hospital and market centers) and speed bump (for reducing speed, especially at hospital, market and school areas). - Public awareness and campaign on traffic sign and national traffic regulation to educate communities to get understanding on the traffic thus the traffic accident will be reduced or avoided. | D3 | Long term | Contractor (Cost of the sign boards should be incorporated by Engineer) IA, EA | IA, EA | IA, EA, local Authorities |

Note: D1 = Not significant, D2 = small impact, D3 = moderate impact, D4 = big impact; Short term = less than 1 year, medium term = 1 to 5 years, long term = More than 3 year.

Environmental problems related to project design

a. Loss of road side tree and natural forest (D2)

55. Although the project will only restore roads that were damaged from flooding, there is still the potential for impacts on trees and natural forest if:

- (i) Trees immediately adjacent to the works are affected minimally by the reconstruction.
- (ii) Areas in primary natural forest are selected for borrow pits for sub-base material.

Mitigation: Ensure there are acceptable alternative borrow pit areas that would have an overall beneficial advantage in terms of improved livelihood and reduced environmental impact. The borrow pits will need to be re-vegetated before being handed back to the owner, or may be used for fish raising.

Monitoring: i. Detailed Design; Evolve acceptable concepts and designs in consultation with communities. Responsibility: EA/IA/Consultant.

ii. Construction: Check Contractor's work monthly. Responsibility: EA/IA/Consultant.

b. Relocation or affecting some assets (D2)

56. Some shops, private and public assets are located along road curbside.

Mitigation: The design should maximize benefits or avoid impacts on assets (individual or community) and ensure compliance with the resettlement framework of the Project and Cambodian laws, policies, and regulations.

Monitoring: i. Detailed Design; Acceptable concepts and designs will need to be further evolved together with the villagers. Responsibility: EA/IA/Consultant.
ii. Construction: Checking Contractor's work. Responsibility: EA/IA/Consultant.

c. Environmental problem related to project construction

Dust Impacts (D3)

57. Dust from transportation of construction materials to site and road works during construction will be a problem to communities who live along roads, especially during dry season. The dust will impact on aesthetics and public health through breathing and polluting water quality.

Mitigation: The Contractor will be required to have a dust abatement program that includes spraying water on roads and work areas within villages and houses that may be located close to the road.

Dry material handling and transport generate large amounts of dust thus:

- *The Contractor shall prepare a dust control program.*
- *Water shall be sprayed where dry materials are handled, crushed and transported.*
- *Vehicles transporting materials are to be covered to reduce spills and dust.*

Monitoring: IA/EA/ES Monthly (Monitor should check at the site during construction and also interview with villagers, teacher ect.)

Noise Impacts (D2)

58. Construction equipment may cause temporary and localized noise and vibration generation. Sources of noise include transportation of material, vehicle and equipment used

at the road work site. These will impact on communities close to work areas.

- Mitigation: The Contractor will need to ensure that construction within 100m of a village or town is to be limited to avoid lunch hours and night time.
- Monitoring: Contractor/IA/EA, monthly.

Human wastes from construction (D2)

59. Sources of the human waste will be generated by workers that will impact on environment and public health in the communities around the work site.

- *Mitigation: Provision of sanitary facilities (toilets, etc.) with proper waste disposal will be provided by contractors.*
- Monitoring: Contractor/IA/EA, monthly.

Solid waste (D2)

60. Solid waste includes residue from construction material and worker's eating food and drinking, generating plastic bags, white styrofoam plastic from food package, plastic bottles and glass bottles. Solid waste can create nuisance, encourage disease vectors (such as flies and rats), block drainage system and be a hazard to human health and environment.

- *Mitigation: Contractor should ensure that (i) sufficient garbage containers are to be provided in construction camps and at work site, and be emptied daily, the waste being disposed of in an approved landfill or site and (ii) every camp and work site should be cleaned up before moving to new sites.*
- Monitoring: Contractor daily, IA/EA, monthly (Monitor should check at the Camp Site during stay and after moving out).

Traffic congestion and transport of equipment (D2)

61. Traffic congestion normally occurs by illegal parking of equipment and piling of soil for road construction.

- *Mitigation: Contractor should ensure that: (i) drivers of construction vehicles will comply with national speed limit. (ii) construction vehicles will drive at low speeds, especially at market, school, hospital, urban areas. (iii) keep road space or bypass for travellers to avoid traffic jams. (iv) vehicle for construction should park at designated safe places.*

- Monitoring: Contractor daily; IA/EA, monthly.

Traffic accident (D2)

62. Traffic accidents can happen when motorists drive at night without lights. Also accidents can be caused by illegal parking, soil piled along roads with no warning signs about construction works. Accidents are also caused by careless, high speed or unprofessional driving.

- *Mitigation: Contractor should: (i) Put construction signs, for example, safety first, at the construction area and put wire fences around works sites to protect people or animals from entering the site; (ii) Construction vehicles must comply with national speed limits; (iii) Construction vehicles will drive at low speeds, especially near markets, schools, hospitals, in urban areas. (iv) Construction vehicle should park at designated safe places.*

- *Monitoring: Contractor daily; IA/EA, monthly.*

Worker's Safety and Health (D2)

63. Accidents inevitably happen and when they do the Contractor will need to have an effective Worker Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities.

Mitigation: Preparation of a Worker Health and Safety Plan

Monitoring: Contractor daily, IA/EA monthly.

Soil erosion (D3)

64. The potential for soil erosion occurs normally during clearing embankments and earthworks on excavated areas and placing new soil cover. These may cause sediment run off to a water body due to rainfall and will block ditches and culverts, damage adjacent land and cause deterioration in water quality.

- *Mitigation: The contractor will be required to implement soil and erosion controls to minimize soil erosion and sedimentation of waterways. The alternative approaches should be: (1) provide adequate cross drainage to avoid over flow or flooding and (2) re-vegetation of construction area to reduce runoff and flow.*
- *Monitoring: IA/EA monthly.*

Water contamination (D2)

65. The most severe water quality impact would be from bitumen, diesel or waste oil. These substances are toxic to living organisms.

- *Mitigation: Contractor has to ensure that: (i) Diesel and waste oil are to be handled and stored carefully to prevent leakage or spill. (ii) Waste oil is to be collected, stored and disposed at an approved site (according to national standard). (iii) Storage is to be in drums, raised off the ground, covered to keep rain out and surrounded by a bund to contain any spills and simplify clean up. (iv) The Contractor shall prepare a Spill Management Plan (including measures to be taken and equipment to be used) to ensure adequate cleanup of any spills.*
- *Monitoring: Contractor daily; IA/EA monthly.*

Loss of tree (D2)

66. The project will only improve the existing roads where damaged during flooding. Thus only some tree and branch of tree will be affected minimally.

- *Mitigation: Tree clearing should be avoided as much as possible and tree planting carried out where appropriate in order to enhance the environment around the road.*
- *Monitoring: IA/EA monthly.*

Transmission of sexually communicable diseases (D3)

67. HIV/AIDS is still prevalent in Cambodia thus it may happen through workers from various provinces.

- *Mitigation: Preparation of Health Plan and Education of workers on transmittable diseases.*
- *Monitoring: IA/EA monthly.*

Stagnant water areas (breeding mosquito vectors) (D2)

68. Stagnant water can create habitats for mosquito vectors that may remain in borrow pits, wastewater and in discarded solid waste such as old tires, plastics and containers that may be disposed by workers around worker camps. Borrow pits and other excavation areas are unlikely to be a major problem as any water that is caught in them is expected to be turbid and unsuitable for the malarial mosquito larvae to breed in.

- Mitigation: Contractor must ensure that (i) solid waste disposed into safe landfill. (ii) Siting camps distant to community's and removal of stagnant water areas, and (iii) borrow pits may be converted to ponds for fish raising or water storage for community utilization.
- Monitoring: Contractor daily; IA/EA monthly.

d. Environmental problem related to project operation

Traffic accident (D3)

69. As a result of the improved road, it will be possible for vehicle speeds to increase from an average of about 30 kph to possibly 100+ kph. This will consequently increase road accidents on a largely unskilled driver population. With higher speeds drivers, passengers, pedestrians and livestock will be increasingly involved in accidents.

- Mitigation: Some measures to improve road safety are :
 - (i) Provide traffic sign boards at corner or curved roads, especially at near school, hospital and market areas.
 - (ii) Road safety device such as speed bump (for reducing speed, especially at hospital, market and school areas).
 - (iii) Public awareness and campaign on traffic signs to educate communities to gain understanding on traffic.
- Monitoring: local authority daily; IA/EA monthly for 1 year after road completion for construction.

3. Potential positive environmental and social impacts

During project construction:

70. **Livelihood/income (+D3):** A key positive impact will be the increased opportunities for local people to be employed in construction works. The construction contractor will be encouraged to maximize the employment of local people in the construction works. However, contractor should also provide enough training to them before starting works.

During project operation:

71. **Easier Transport at Reduced Costs (+D3):** The improvement of the road surface and new bridging will reduce travel time and transport costs. It will improve access to services, especially access to medical facilities. Monitoring will not be needed.

72. **Livelihood/Income (+D3):** The improvement of the roads will reduce cost of travelling and provide access to services and transportation of local products to market. Monitoring will not be needed

73. **Improved public access (+D3):** The improved road will provide benefits by improving road access to services for local communities, especially access to hospital, governmental services and markets.
Monitoring: not needed.

VI. Information Disclosure, Consultation and Participation

74. MEF is the EA (executing agency) for the Project through its Project Coordination and Monitoring Unit (PCMU), which will be assisted by PCMU consultants. The PCMU has an Environment Focal Person to coordinate environmental and social safeguards planning and implementation, and these tasks will be assisted by Safeguards Specialist within the PCMU consultant team. The PCMU will ensure that the respective IAs properly follow the IEEs and review framework (EARF) during subproject implementation. Three Project Implementation Units (PIUs) have been formed in each of the IAs – MPWT, MRD, and MOWRAM. Each PIU has a Safeguards Focal Persons, and they in turn will be supported by an Environment Specialist within the IA's consultant team. They will have the primary responsibility for disclosing information to the public and APs – Affected Persons.

75. The PIUs will undertake screening and classification of subprojects for submission to the PCMU and ADB. PIUs will prepare safeguards documents for approved subprojects. Safeguards documents will be reviewed and approved by the PCMU and ADB. PIUs will be tasked with the day-to-day implementation and monitoring of safeguards plans. PIUs will also obtain all clearances and fulfill government requirements. The PIUs will also have provincial offices with a Safeguards Coordinator who will be responsible for consulting with other Stakeholders, obtaining data required for safeguards plan preparation, monitoring and progress reports, and coordination with relevant departments such as department of environment to consult and/or obtain endorsement if necessary.

76. A series of consultation meetings with local authorities and communities have been conducted during the project development and design related to resettlement, design, environment and social factors. Furthermore the preparation of local community consultation should be continued for every stage of project design and implementation thus realistic impacts and issues will be updated and all impacts will be mitigated timely. All such meetings encourage the full participation of the local community.

VII. Grievance Redress Mechanism

73. During site preparation and construction phases, there may be complaints related to the environmental performance of the project. To ensure that there will be a mechanism to resolve such complaints, the IAs shall undertake the following prior to start of site works:

- i) establish a grievance redress mechanism (GRM)
- ii) make public the existence of the GRM through public awareness campaigns
- iii) ensure that names and contact numbers of representatives of the IAs and contractors are placed on the notice boards outside the construction site and at local government offices (e.g., provincial and commune levels)

74. Through a Grievance Redress Committee (GRC), promptly address affected people's concerns, complaints, and grievances about the project's environmental performance at no costs to the complainant and without retribution. The GRC, which shall be established before commencement of site works, shall have members from the IAs (e.g. PDRD) commune councils, local NGO, and women's organization. Grievances can be filed in writing or verbally with any member of the GRC. The committee will have 15 days to respond with a resolution. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the Government's judicial or administrative remedies.

75. IAs shall make public the existence of this grievance redress mechanism through public awareness campaigns. They shall set-up a hotline for complaints and the hotline shall be publicized through the media and numbers placed on the notice boards outside the construction site and at local government offices (e.g., provincial, district, commune levels). Locally affected people will still be able to express grievances through the commune councils

and these would be referred through the usual channels in those committees.

76. The GRC will receive, follow-up and prepare monthly reports regarding all complaints, disputes or questions received about the Project and corresponding actions taken to resolve the issues. The GRC will also use the punitive clauses of the 1996 Law on Environmental Protection and Natural Resources Management in conjunction with MOE to prosecute offending parties.

77. Villagers and APs are encouraged to voice complaints and these are to be duly investigated and reported through the contractor to the IA and so to MEF.

78. Environmental monitoring must be carried out by the construction supervision inspectors. Response to complaints will be based on the following schedule:

- Complaint made to contractor or others
- Response by contractor or construction supervision consultants' inspectors.
- Weekly compiling of checklists by inspectors. Copies of checklists to be given to contractors as official notification of action being required, confirmation of receipt obtained by contractor signing copy, and joint inspection carried out if necessary.
- Monthly progress reports by inspectors by consolidating weekly reports.
- Corrective Action Reports (CARs) from contractors, as soon as action taken.
- Monthly progress meetings with contractors at which CARs from previous month examined and checked.
- Three monthly progress reports to ADB detailing problems and Corrective Actions taken.
- Regular checks by the Local Environmental Specialist and regular oversight checks by International Environmental Specialist.
- Checks with complainants that they are satisfied

Review of progress must be checked on a daily basis by the inspectors. Any urgent issues must be drawn to the contractors' attention immediately. Failure by the contractor to respond in a timely or adequate manner must be raised with them at the monthly progress meetings.

VIII. Environmental Management Plan

78. The General Environmental Management Plan (EMP) gives guidance on how to mitigate the environmental concerns identified in connection with this project. The EMP deals with mitigation and management measures to be taken during Project implementation to avoid, reduce, and mitigate adverse environmental impacts.

74. IAs will ensure that the EMP is included in the tender documents for civil works. It will form part of the contract between the IA and the selected contractor and the requirements of the EMP will be contractually binding on the contractor. The conformity of contractors with environmental contract procedures and specifications shall be regularly monitored by the PCMU through the Social and Environmental Office (SEO) during Project implementation. PCMU /SEO shall be assisted by the detailed design and implementation supervision consultant (DDIS) to undertake EMP monitoring and to prepare corresponding semi-annual reports for submission to ADB.

75. After appointment and mobilization the contractor must prepare his own version of the EMP known as the Contractors EMP (CEMP). This must give specific details of locations of borrow areas, borrow roads, workers camps and other facilities. This must be submitted to the Supervising Consultant for their approval before works commence.

77. The PCMU will monitor and measure the progress of EMP implementation. The monitoring activities will correspond with the project's risks and impacts and will be identified in the IEEs for subprojects. In addition to recording information of the work, deviation of work

components from original scope, the PCMU will undertake site inspections and document review to verify compliance with the EMP and progress toward the final outcome.

78. Supervision consultants will submit monthly monitoring and implementation reports to the PIUs, who will take follow-up actions, if necessary. PIUs will submit quarterly monitoring and implementation reports to the PCMU. The PCMU will submit semi-annual monitoring reports to ADB. Project budgets will reflect the costs of monitoring and reporting requirements. Monitoring reports will be posted in a location accessible to the public. An example of Environmental and Social Monitoring Report Outline is given in Appendix 1.

79. The PCMU will document monitoring results, identify the necessary corrective actions, and reflect them in a corrective action plan. Each quarter the PCMU will study the compliance with the action plan developed in the previous quarter. Compliance with loan covenants will be screened by the EA.

80. ADB will review project performance against the EA's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the Project's risks and impacts. Monitoring and supervising of environmental safeguards will be integrated into the project performance management system. ADB will monitor projects on an ongoing basis until a project completion report is issued. ADB will carry out the following monitoring actions to supervise project implementation:

- i. conduct periodic site visits for projects with adverse environmental impacts;
- ii. review the periodic monitoring reports submitted by the executing agency to ensure that adverse impacts and risks are mitigated as planned and as agreed with ADB;
- iii. work with executing agency to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the legal agreements, and exercise remedies to re-establish compliance as appropriate; and
- iv. prepare a project completion report that assesses whether the objective and desired outcomes of the safeguard plans have been achieved, taking into account the baseline conditions and the results of monitoring.

IX. Conclusion and Recommendation

81. Based on the study of the existing environmental and social conditions in the project areas and potential impacts from project implementation, it is found that the project will result in overall benefits to communities in terms of livelihoods and connection between community and community, especially students, pregnant women and ill people can easily gain access to school and hospitals in time.

82. During construction a series of temporary negative impacts including dust, noise, road safety, worker's safety, wastewater, solid waste and water contamination will occur, however, those impacts are avoidable and can be reduced by environmental control measures and mitigation measures. As for operational stages, the benefit includes improving community livelihood, public health, tourist access and general amenity.

83. In order to reduce the impacts, the alternative approaches are recommended as below:

- The environmental mitigation measures and environmental monitoring plan which are presented in the IEE report should be implemented. (A suggested draft EMP is given in Appendix 2)
- Good cooperation between all stakeholders, especially IA, EA and local authorities should be undertaken.
- Consultation with the local community should be implemented that IAs can update concerns and issues during project construction and operation.

- Further investigations are needed with regard to developing a suitable design for the borrow pits so that these may provide a range of multiple uses for the farmers whose land they will be excavated on.

84. The IEE has identified a range of potential impacts and determined suitable mitigation measures together with a monitoring program. Implementation of the proposed mitigation measures, the monitoring program and recommendation will avoid/reduce the impacts to insignificant levels. Hence no detail EIA study is required.

APPENDIX 1: Environmental and Social Monitoring Report Outline

The level of detail and comprehensiveness of a monitoring report is commensurate with the complexity and significance of social and environmental impacts. A safeguard monitoring report may include the following elements:

- (a) Background/context of the monitoring report (adequate information on the project, including physical progress of project activities, scope of monitoring report, reporting period, and the monitoring requirements including frequency of submission as agreed upon);
- (b) Changes in project scope and adjusted safeguard measures, if applicable;
- (c) Qualitative and quantitative monitoring data;
- (d) Monitoring parameters/indicators and methods based on the monitoring plan/program previously agreed upon with ADB;
- (e) Monitoring results compared against previously established benchmarks and compliance status (e.g., national environmental emission and ambient standards and/or standards set out in the Bank Group's Environmental, Health and Safety Guidelines; timeliness and adequacy of environmental mitigation measures; involuntary resettlement compensation rates and timeliness of payments, adequacy and timeliness of involuntary resettlement rehabilitation measures including serviced housing sites, house reconstruction, livelihood support measures, and training; budget for implementing environment management plan (EMP), resettlement plan, or indigenous people plan, timeliness and adequacy of capacity building, etc.);
- (f) Monitoring results compared against the objectives of safeguards or desired outcomes documented (e.g. involuntary resettlement impacts avoided or minimized; livelihood restored or enhanced; indigenous people (IP's) identity, human right, livelihood systems and cultural uniqueness fully respected; indigenous people not suffer adverse impacts, environmental impacts avoided or minimized, etc.);
- (g) If noncompliance or any major gaps identified, include a corrective action plan;
- (h) Records on disclosure of monitoring information to affected communities;
- (i) Identification of key issues, or complaints from affected people, or recommendations for improvement;
- (j) Monitoring adjustment measures recommended based on monitoring experience/trends and stakeholders response;
- (k) Information about actual institutional arrangement for implementing the monitoring program/plan provided or adjusted, as may be required;
- (l) Proposed items of focus for the next report and due date.

Appendix 2 - Draft EMP for Road Construction/Innovation

| Environmental Management Plan |
|---|
| <p>GENERAL</p> <p>The Environmental Management Plan is included as part of the Technical Specifications (section 1.10) and therefore will take precedence in any conflict with General Specifications.</p> |
| <p>MEASUREMENT</p> <p>This item will not be measured and instead will be assessed by the Engineer regarding the Contractor successfully meeting all the Specifications requirements.</p> |
| <p>PAYMENT</p> <p>No separate payment shall be made in respect of compliance with the provisions of the Environmental Management Plan. The Contractor shall be deemed to have made allowances for such compliance with these provisions in the preparation of his prices for items of work included in the Bill of Quantities and made full compensation for such compliance will be deemed to be covered by them.</p> |

The contractor has to incorporate the environmental management plan into account for high consideration to compliance with Cambodian Policy and ADB safeguard policy. The EMP below is general provision for contractor to follow as guidance.

| Issue | Mitigation measures | Significance | Duration | Who responsible? | | Monitoring ¹ /management |
|---|---|--------------|-------------|---|--|--|
| | | | | Construction | Maintenance/implementation | |
| 1. Recommendation during project design | | | | | | |
| Loss of roadside trees | <ul style="list-style-type: none"> - Tree clearing should be avoided as much as possible, and if unavoidable, the damaged trees need to be replaced by re-planting road side new trees. - Incorporation of replacing damages during project design - Consult communities in project design and public awareness. | D2 | Medium term | Contractor Engineer (Incorporate costs of tree planting in project design; lead consultations and ensure incorporation in project design.) | Contractor Engineer | Implementing Agency (IA)/Executing Agency (EA)/Environment Specialist (ES) |
| Loss of natural trees/protected area for borrow | <ul style="list-style-type: none"> - Develop alternative uses for borrow pit areas where is not negative impact on livelihood | D2 | Medium | Engineer | Engineer/Constructor | Implementing Agency (IA)/Executing Agency (EA)/Environment |

| | | | | | | |
|--|---|----|-------------|-----------------------|-----------------------|--|
| pits | <ul style="list-style-type: none"> and protected areas. - Incorporation of replacing damages during project design. | | | | | Specialist (ES) |
| Loss of agricultural land for borrow pits | <ul style="list-style-type: none"> - Develop alternative uses for borrow pit areas where is not negative impact on livelihood and protected areas. - Incorporation of replacing damages during project design. | D3 | Long term | Engineer | Engineer/Constructor | Implementing Agency (IA)/Executing Agency (EA)/Environment Specialist (ES) |
| - Land mine and UXO | <ul style="list-style-type: none"> - Subprojects will rehabilitate existing roads without widening. Nevertheless, risks remains since there may be deep seated mines that could be exploded by heavy construction equipment, etc. - Hence consultative meetings with local communities are necessary to know clearly where there are risks of mines or UXO. Unsafe areas should be cleared before project implementation. | D3 | Medium term | Contractor | IA | IA/EA/ES |
| - Relocation or affecting some assets | <ul style="list-style-type: none"> - Engineer should design to avoid or reduce any impact on assets (individual or community). - Ensure compliance with the resettlement framework of the Project and Cambodian laws, policies, and regulations. | D2 | Long Term | Engineer IA/EA | Engineer IA/EA | IA/EA/ES |
| 2. Recommendation during construction phase | | | | | | |

| | | | | | | |
|--|--|----|------------|------------|------------|---|
| - Dust from road works | - Water shall be sprayed during construction, particularly in towns and villages, to ensure that dust is minimized throughout the construction zone. | D3 | Short term | Contractor | Contractor | IA/EA/ES Investigator should check at the site during construction and also interview with villagers, teacher ect. |
| - Dust, odor and dry material handling | <ul style="list-style-type: none"> - Dry material handling and transport generate large amounts of dust thus: <ul style="list-style-type: none"> ▪ The Contractor shall prepare a dust control program. ▪ Water shall be sprayed where dry materials are handled, crushed and transported. ▪ Vehicles transporting materials are to be covered to reduce spills and dust. | D2 | Short term | Contractor | Contractor | IA/EA/ES |
| - Air pollution and noise | <ul style="list-style-type: none"> - Vehicle and equipment emissions cause air pollution and noise: Hence, vehicles and equipment are to be maintained to meet Cambodian emission and noise standards.. - Construction within 100m of a village or town is to be limited to lunch hours and night time. | D2 | Short term | Contractor | Contractor | IA/EA/ES |
| - Human wastes from construction. | - Provision of sanitary facilities (toilets, etc.) with proper waste disposal will be provided by contractors. | D2 | Short term | Contractor | Contractor | IA/EA/ES |

| | | | | | | |
|---|---|----|------------|------------|------------|--|
| - Solid waste generation from construction camp, work sites and workers | <ul style="list-style-type: none"> - Solid waste can create nuisance, encourage disease vectors (such as flies and rats), block drainage system and hazard to human health and environment. Hence, sufficient garbage containers are to be provided in construction camps and at work site, and be emptied daily, the waste being disposed of in an approved landfill or site. - Every camp and work site should be clean during stay and before moving to a new sites. | D2 | Short term | Contractor | Contractor | IA/EA/ES Investigator should check and observe at the construction areas and camp site. |
| - Traffic and transport of equipment | <ul style="list-style-type: none"> - Construction vehicles will comply with national speed limite - Construction vehicles will drive at low speeds, especially at market, school, hospital, urban areas... | D2 | Short term | Contractor | Contractor | IA/EA/ES |
| - Traffic congestion | <ul style="list-style-type: none"> - Keep road space or bypass for travellers to avoid traffic jams. - Vehicle for construction should park at designated safe places. | D2 | Short term | Contractor | Contractor | IA/EA/ES Investigator should check and observe trucks, pit soil pile and other equipment at the construction area |
| - Traffic accident | <ul style="list-style-type: none"> - Put construction signs, as example, safety first at the construction area and putting wire around works sites for protecting people or animal go | D2 | Short term | Contractor | Contractor | IA/EA/ES |

| | | | | | | |
|-----------------------|---|----|------------|------------|------------|----------|
| | <i>into the site.</i> | | | | | |
| - Soil erosion | - Eroded material from embankments and borrow pits can block ditches and culverts, damage adjacent land and cause deterioration in water quality. The alternative approaches should be: (1) provide adequate across drainage to avoid over flow or flooding and (2) re-vegetation of construction area to reduce runoff and flow. | D3 | Long term | Contractor | Contractor | IA/EA/ES |
| - Water contamination | - The most severe water quality impact would be from bitumen, diesel or waste oil. These substances are toxic to living organisms | D2 | Short term | Contractor | Contractor | IA/EA/ES |
| | - Diesel and waste oil are to be handled and stored carefully to prevent leakage or spill. Waste oil is to be collected, stored and disposed at an approved site (according to national standard). | | | | | |
| | - Storage is to be in drums, raised off the ground, covered to keep rain out and surrounded by a bund to contain any spills and simplify clean up. | | | | | |
| | - The Contractor shall prepare a Spill Management Plan | | | | | |

| | | | | | | |
|--|--|----|------------|------------|------------|---|
| - Loss of tree | (including measures to be taken and equipment to be used) to ensure adequate cleanup of any spills. - Tree clearing should be avoided as much as possible and tree planting carried out where appropriate in order to enhance the environments around the road. | D2 | ong term | Contractor | Contractor | IA/EA/ES Investigator should check and observe along the proposed road during construction |
| - Worker safety and health | - Workers should wear protection equipment during works to ensure that they are safe and good health. - A contractor should develop a health and safety plan. Manager should educate workers on health and safety projection. - Provide sanitation and portable water. | D3 | Short term | Contractor | Contractor | IA/EA/ES Investigator should check and observe at a construction site and camps during construction. |
| - transmission of sexually communicable diseases | - Education of workers on transmittable diseases. | D3 | Long term | Contractor | Contractor | IA/EA/ES |
| - Stagnant water areas (breeding mosquito victors) | - Siting camps distant to communities removal of still water areas | D2 | Short term | Contractor | Contractor | IA/EA/ES Investigator should check and observe at a camp site. |
| - | - | | | | | |

| 3. Recommendation during operational phase | | | | | | |
|--|--|----|-----------|------------|---|-------------------------|
| Traffic accident | <ul style="list-style-type: none"> - Provide traffic sign board at corner or curve road, especially at school, hospital and market areas. - Road safety device including traffic sign board (especially at corner or curve road and school, hospital and market centers) and speed bump (for reducing speed, especially at hospital, market and school areas). - Public awareness and campaign on traffic sign to educate communities to get understanding on the traffic thus the traffic accident will be reduced or avoided. | D3 | Long term | Contractor | Contractor | IA/EA/Local Authorities |
| | | | | IA/EA | (Cost of the sign boards should be incorporated by Engineer) IA/EA | IA/EA/Local Authorities |

Note: D1 = No significant, D2 = small impact, D3 = moderate impact, D4 = big impact; Short term = less than 1 year, medium term = 1 to 5 years, long term = More than 3 year.

¹ = Indicators for monitoring will be attached.

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