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ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងបរិស្ថាន
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សូមគោរពជូន
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យោង ៖ - ព្រះរាជក្រមលេខ នស/រកម/១២៩៦/៣៦ ចុះថ្ងៃទី២៤ ខែធ្នូ ឆ្នាំ១៩៩៦ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីកិច្ចការពារបរិស្ថាន និងការគ្រប់គ្រងធនធានធម្មជាតិ
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- លិខិតលេខ ៣០៩១ សក ចុះថ្ងៃទី១៥ ខែសីហា ឆ្នាំ២០១៤ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- លិខិតលេខ ៧២១ សជណ ប.ស្ថ ចុះថ្ងៃទី០៣ ខែតុលា ឆ្នាំ២០១៤ របស់ក្រសួងបរិស្ថាន
- លិខិតលេខ ៣៨០២ សក ចុះថ្ងៃទី០៧ ខែតុលា ឆ្នាំ២០១៤ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន

សេចក្តីដូចមានចែងក្នុងកម្មវត្ថុ និងយោងខាងលើ ខ្ញុំសូមគោរពជម្រាបជូន **ឯកឧត្តមរដ្ឋមន្ត្រី** មេត្តាជ្រាបថា ក្រសួងបរិស្ថានឯកភាពលើរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមពេញលេញ (ESIA) សម្រាប់គម្រោងធ្វើឱ្យប្រសើរឡើងវិញនូវកំណាត់ផ្លូវជាតិលេខ៥ ចាប់ពីឆ្នាមួម-បាត់ដំបង និង សិរីសោភ័ណ-ប៉ោយប៉ែត ដែលមានទីតាំងស្ថិតនៅក្នុងភូមិសាស្ត្រខេត្តពោធិ៍សាត់ ខេត្តបាត់ដំបង និង ខេត្តបន្ទាយមានជ័យ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន (ម្ចាស់គម្រោង) ដោយម្ចាស់គម្រោងត្រូវគោរពតាមកិច្ចសន្យាការពារបរិស្ថានលេខ ៣៩០៩ សក ចុះថ្ងៃទី១៦ ខែតុលា ឆ្នាំ២០១៤ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន។

អាស្រ័យដូចបានគោរពជម្រាបជូនខាងលើ សូម **ឯកឧត្តមរដ្ឋមន្ត្រី** មេត្តាទទួលអនុវត្ត និងចាត់ចែងតាមការគួរ។

សូម **ឯកឧត្តមរដ្ឋមន្ត្រី** មេត្តាទទួលនូវសេចក្តីគោរពពីខ្ញុំបាទ។

រដ្ឋមន្ត្រី

សាយ សំអាល់

ចម្លងជូន៖
- ទីស្តីការគណៈរដ្ឋមន្ត្រី
- ក្រសួងសេដ្ឋកិច្ច និងហិរញ្ញវត្ថុ
- ក្រសួងរៀបចំដែនដី នគរូបនីយកម្ម និងសំណង់
- សាលាខេត្តពោធិ៍សាត់ ខេត្តបាត់ដំបង និងខេត្តបន្ទាយមានជ័យ
- មន្ទីរបរិស្ថានខេត្តពោធិ៍សាត់ ខេត្តបាត់ដំបង និងខេត្តបន្ទាយមានជ័យ
- ឯកសារ កាលប្បវត្តិ

Kingdom of Cambodia

Nation Religion King

ꕥ

Ministry of Environment

Ref. No.778 MoE

Phnom Penh, 17 October 2014

Attention to

H.E Minister of Public Works and Transport

Subject: Response to the request for review and comments on the full Environmental and Social Impact Assessment (ESIA) for the National Road No.5 Improvement Project: Prek Kdam – Thlea Ma'am Section and Sri Sophorn – Poipet

Reference:
- Royal Krom with Ref. No. NS.RKM 1296/36 dated December 24, 1996 to issue the Law on Environment and Natural Resource Protection
- Sub Decree with Ref. No. 72 ONKr.BK dated August 11, 1999 to issue the Environmental Impact Assessment
- MPWT's letter with Ref.No.3091 dated August 15, 2014
- MPWT's letter with Ref.No.721 dated October 3, 2014
- MPWT's letter with Ref.No.3802 SK dated October 7, 2014

With the above captioned subject and reference, I would like to inform **Your Excellency** that the Ministry of Environment (MoE) has no objection on the full ESIA for the National Road No.5 Improvement Project: Prek Kdam – Thlea Ma'am Section and Sri Sophorn – Poipet. The Project is geographically located in Pursat, Battambang and Bantey Meanchey. The MPWT, who is the Executing Agency, must respect the MPWT's Pledge on environmental protection with Ref. No. 3909 SK dated October 16, 2014.

Please, Your Excellency, take action and proceed your works with the above contents properly.
Please, Your Excellency, accept my best regard.

Minister of Environment

(Signed & Sealed)

Say Sam Al

cc:
- Ministers of Council
- Ministry of Economy and Finance
- Ministry of Land Management, Urban Planning and Construction
- Provincial Hall of Pursat, Battambang and Bantey Meanchey
- Provincial Department of Environment of Pursat, Battambang and Bantey Meanchey
- Archives

Unofficial Translation

KINGDOM OF CAMBODIA
Nation Religion King

Ministry of Public Works and Transport

Report on Environmental and Social Impact Assessment (ESIA)

NATIONAL ROAD No. 5 IMPROVEMENT PROJECT
(SECTION: THLEA MA'AM TO BATTAMBANG)
VOLUME 1



With assistance of:
Katahira & Engineers International
Central East Building, 1-14-1, Shintomi, Chuo-ku, Tokyo
and
SAWAC Consultants (Cambodia) Co.,Ltd
#36c, Street 476, Toul Tumpong II, Chamcamon, Phnom Penh

Under Sponsorship of:
Japan International Cooperation Agency

JULY 2014

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Executive Summary

1..INTRODUCTION

The National Road No.5 (NR5) is an important National economic road among other roads of Cambodia. At the present, this road is connected from Phnom Penh City to Bangkok, Thailand which assigned Asian Highway A-1 or it is a gate of Souther Economic Corridor of GNS. Therefore, the Royal Government is decided to improve the NR5 to be wide with four traffic lines; it is two traffic lines go and two traffic lines back included rural area and Town or City, vehicle parking, right of way for pedestrian and for bycicle of bothsides.

2...METHODOLOGY OF THE STUDY

The main points of methodology for the ESIA study on the NR5 improvement project of MoPWT has a mechanical methodology to study 3 Environmental resources: (1) Physical Environment, (2) Biological Environment and (3) Social Environment, are described below:

- Collect data and information related to the project concerning with Institution and Stakeholder in Phnom Penh, such as Ministry of Agriculture Forestry and Fishery (MAFF), Ministry of Environment (MoE), Ministry of Water Resource and Meteorology (MoWRAM), Ministry of Public Works and Transport (MoPWT), Ministry of Planning (MoP), NGOs and other concerned Institutions;
- Collect data in the project area and organize public consultation meeting with local people and Local authorities: (Villager, village Chief, Commune Chief, District Governor/Town, Provincial Cabinet) and institutional linkaged such as: (Provincial Department of Public Works and Transport (PDoPWT), Provincial Department of Agriculture (PDoA), Provincial Department of Environment (PDoE), Provincial Department of Water Resources and Meteorology (PDoWRAM), Provincial Department of Land Urban Management Planing and Construction (PDoLUMPC), Provincial Department of Industry, Mines Energy (PDoIME), Khan of Forestry Administration, Khan of Fishery Administration and other NGOs (see Chapter-6);
- Field investigation on natural environment at project area such as: Hydrology, Soil, Geology, Forest, Wildlife, Fish ect., by mention from villagers who lived in/around project area;
- Field investigation on people's land use in the project area;
- Meet the affected and non-affected people in the project area in order to interview and understanding on their living condition before the project development; and also looking for a common idea and others suggestions which concerned to the project in order to guide the project is running smoothly;
- Taking water samplings and test of water quality sources: Surface water in order to identify of water quality before the project development;
- Taking samplings and test of Air quality, Noise and Vibration in the field (see table of Air, Noise and Vibration tested at the field in order to identify these qualities before the project development;
- Study on Ecology system (dry ans wet season) in the project area;
- Study on fishery in Steung Pursat (dry and wet season);
- Analysis all data that collected from the field and related institutions, and to describe on existing natural and social environment situation, and then predict the environmental impact may/will be happened before project Operation (in project design and project construction phases), operation and maintenance phase and disclosure phase;
- Review and modify the project master plan/relevant document;
- Determine negative and positive affected caused by project activities. Develop mitigation measure for reducing negative impact to minimum degree and increasing positive impact to maximum degree, by quoted from public consultation meeting with people and other suggestions from people, local authority, Institutional linkage in the project area;

- Prepare Environmental Management Plan (EMP) and Monitoring Program for project construction phase, project Operation and Maintenance phase. The floowing detail of methodology studies: Physical Environment resources, Biological and Socio-economic Environmental resources.

3. RELEVANT LAW AND REGULATIONS

To have well development project the 11 relevant laws, 1 Royal Decrees, 6 Sub-decrees and 3 Policy Guidelines below have to be studied and implemented.

Relevant Law:

1. Law on Constitution of Kingdom of Cambodia, 1993;
2. Law on Environmental Protection and Natural Resources Management, 1996;
3. Law on Road, 2014;
4. Law on Expropriation, 2010;
5. Law on Water Resource Management of Kingdom of Cambodia, 2007;
6. Law on Fishery, 2006;
7. Law on Cambodia Traffic, 2006
8. Law on Land, 2001;
9. Law on Labor, 1997;
10. Law on the Protection of Cultural Heritage, 1996;
11. Law on Land Management, Urban Planning and Constructions, 1994

Relevant Royal-Decree:

1. Royal-Decree on establishment and management of Tonle Sap Biosphere Reserve, 2001

Relevant Sub-Decree:

1. Sub-Decrees on the Management the Reserved Land along the National Road and Railroad of the Kingdom of Cambodia;
2. Sub-Decrees on the Air Pollution and Noise Disturbance Control, 2000;
3. Sub-Decrees on Environmental Impact Assessment Process, 1999;
4. Sub-Decrees on Water Pollution Control, 1999;
5. Sub-Decrees on Solid Waste Management, 1999;
6. Sub-Decrees on Endangerous Fisheries Resources, 2009.

Relevant Policy Guidelines:

1. General Guideline for Conducting Initial and Full Environmental Impact Assessment, 2009
2. National Policy on Green Growth, 2013
3. JICA's Guideline for Environmental and Social Considerations, April 2010

4..DESCRIPTION OF THE PROJECT

This project is the rehabilitation project for NR5 of Ministry of Public Works &Transport under loan project from Japan Government.

In the Town area, the total road width is 22m paving with asphalt consisted of 4 lanes, with each 2 lanes of opposite direction. There is vehicle parking and bike and motorbike lane width is 2.5m, excluding sidewalks width is 3m for both sides. The total road surface width is 28m which each lane's width of road is 3.5m x 4 for median central line is 3m and excluding sidewalks and lanes for bike at both sides is 2.5m X 2 and sidewalks width is 3m X 2 as well.

The rehabilitation project for portion of NR5 from Pursat to Battambang is located in two different provinces, Pursat and Battambang. It started from Kilometer Post KP171 in Pursat province to Kilometer

Post KP282+200 next to the bypass of Battambang City in Battambang province. It located in the latitude 12º29' and 13º07' at north and longitude 103º15' and 104º05' at East.

5...EXISTING ENVIRONMENT DESCRIPTION

The average rainfall in Pursat province for 13 years of return period, from 2000 to 2012, is 1,372.9mm. Perennial maximum temperature of return period year 2010 is 39.8 degree Celsius and Perennial minimum temperature of return is 17.0 degree Celsius in year 2011. The average of humidity and sunlight in Pursat for 12-years return period (2001-2012) is **81%**. The evaporation for 5 years return period the average of annual evaporation is 1430.18 mm.

The average rainfall in Battambang province for 10 years of return period, from 2003 to 2012, is 1,291.6mm. Perennial maximum temperature of return period 2010 is 39.6 degree Celsius and Perennial minimum temperature of return is 16.2 degree Celsius in year 2011. The wind speed and wind direction in dry season, from November to April, wind blew from North to Northeast. In wet season is from May to October, wind blew from Southwest to Northeast. The average of wind speed for 10-years return period (2003-2012) is 8 m/s. The average of humidity and sunlight for 10-years return period (2003-2012) is 78**%**.

For air quality measurement and analysis, the survey team did cooperation with laboratory working team of Ministry of Environment (MoE) in order to conduct the survey 24 hours of working days (not holiday or weekends), total was 6 sites. For noise and vibration tests will have conducted only at road sites. Based on the result is shown that air quality in the project area still in good condition, it was low than standard of the MoE. For the results of three survey locations for noise measurement, in the morning and evening was not over the standard, excepted only at night it was over a bit of MoE's standard. For vibration in the project area, it was still lower than standard of Ministry of Environment.

Hydrology data of Pursat River which located at the point of Veal Commune, Kandieang Reay district, downstream of Kbal Hong Dam that it is far about 3.7m from Spean Thmar of Pursat River shown that in year 1999 (it is yaer very big flooded), the water level was raised up to 6.2m and water yield in maximum was 415m3/s and the maximum water level was 0.92m and maximum water flow was 5.21m^3/s. In 1962 and 1963, the maximum water level was 4.35m and maximum water flow was 350m^3/s; then the minimum water level was 0.22 m and the minimum water flow was 0.93m/s. The catchment area of Pursat River at the point of Veal commune is 4,480Km^2. The maximum water flow of Svay Doun Keo river is 41 m^3/s and the maximum water level is 4.4 m; then the minimum water flow is 0 meter and the minimum water level is also 0 m^3/s (in dry season, this river has no water flow; it was drought mostly, but there was some water in the small pond of river bed only).

The COI: 20m (total: 40m), it illustrated that the affected Riverside vegetation, 10.13 ha, along the national road No 5 for a portion from Thlea Ma'am in Pursat to Battambang province. it illustrated that the total 30 species affected planted trees along the road were 5,210 trees, included 2,589 trees at the left side and 2,621 trees at the right side with the direction from Thlea Ma'am in Pursat to Battambang province. The most of trees at the right side is Acacias, 1,053 trees and Acacias is 903 trees at the left side.

The main animals which found in project area such as mammals is **5** speciies, birds is **34** species, Reptile and Frogs is **29** species and fish is **95** species which found in 3 areas of Steung Pursat. It is 56 species in Svay Doun Koe river, 54 species in Maung river, 61 species in Chak river and 57 species in Sandas stream that were found. So, there were 114 species of fish in total finding in project area.

According to field study along the NR5, a portion from Tlear Ma'am in Pursat to Battambang province, there was no protected area or protected forest that was habitat of vital wildlife. The bird habitats are on planted trees in villages, at the rice fields and some trees in density area. Furthermore, there were little regrowth Riverside vegetations along rivers, streams and ditches that are the habitats for aquatic species and fishes only. Riverside vegetations, when flooding occurred most commonly from heavy rainfall and an overflow of water from the Mekong River to Tonle Sap Lake in the wet season. Then, the overflow of water flowed into creeks connecting with rivers, streams and ditches. It helped the aquatic species such as: fish and water reptiles to migrate into the project area (name of vital rivers, streams. Some birds are Lesser Whistling Duck *(Dendrocygna javanica)* Asian Openbill *(Anastomus oscitans)* Barn Owl *(Tyto alba)* Grey Nightjar *(Caprimulgus indicus)* Large-billed Crow *(Corvus macrohynchos), Great Egretta (Egretta alble)* etc. They do not sleep and find food by the roads and just fly across the road.

The project is affected to families that they are living along bothside of the road, started from the middle of road of 20m of bothside (0-20m); the affected families that they are living along the Pursat bypass.

The total affected people are 1,860 families, among of these 1,636 families are affected by the project road enlarges and other 224 families affected by the Pursat bypass project. Among of the total 1,860 families there are vulnerable families (old people, disable people, widow, poor people who are earning income less than 20$/M and landless people) they are 312 families (16.8%).

6...PUBLIC CONSULTATION AND DISCUSSIONS IN THE PROJECT AREA

Objective of public consultation and discussion as below:

- To announce to the public people and all related people to understand about the purpose and implementation stage of this project;
- To find criticism idea, suggestion, argument problem, and correct method to improve project successful;
- To solve complexes by doing a meeting and discussion with concerned people and will have participation from local Authorities in the project area.

RECORD OF PUBLIC CONSULTATION

Phnom Penh:

- The representative of Tonle Sap Authority, Ministry of Water Resources and Meteorology

Pursat and Battambang Provinces:

- The representative of Provincial Cabinet, Pursat and Battambang provinces
- The representative of Provincial Department of Agriculture (PDoA), Pursat and Battambang provinces
- The representative of Khan Fishery Administration, Pursat and Battambang provinces
- The representative of Khan Forestry Administration, Pursat and Battambang provinces
- The representative of Tele-Communication Company, Pursat province
- The representative of Provincial Department of Land Urban Management Planning and Construction (PDoLUMPC), Pursat and Battambang provinces
- The representative of Provincial Department of Public Works and Transportation (PDoPWT), Pursat and Battambang provinces
- The representative of Provincial Department of Tourism (PDoT), Pursat and Battambang provinces
- The representative of Entity of Water Supply, Pursat province
- The representative of Provincial Department of Water Resource and Meteorology (PDoWRAM), Pursat and Battambang provinces
- The representative of Provincial Department of Industry Mines and Energy (PDoIME), Pursat and Battambang provinces
- The representative of "Nareth Electricity Development Co.,Ltd", Pursat province
- The representative of City Hall, Pursat and Battambang provinces
- The representative of Provincial Department of Environment (PDoE), Pursat and Battambang provinces
- The representative of Provincial Department of Culture, Fine and Arts (PDoCFA), Pursat province
- The representative of SINTRY Company, Battambang province
- The representative of Provincial Department of Tele-Communication and Post (PDoTP), Battambang province
- The representative of Cambodia Electricity Authority, Battambang province
- The representative of Krakor, Bakan and Kandieang Districts, Pursat province;
- The representative of Moung Russei, Sangkae and Thmor Kol Districts, Battambang province
- The representative of 13 Communes, 51 Villages and villagers participations which located along the NR5 of the project, Pursat province.
- The representative of 10 Communes, 35 Villages and villagers participations which located along the NR5 of the project, Battambang province.

7...POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES OF PROJECT

PROJECT DESIGN PHASE

Negative impacts

- In between PK-247 to PK-248 of this road there is no any culvert. Moreover, the drainage canal along the road was filled up by the people without concrete pipes installed. It causes flooded in this village in wet season when it was heavy rain;
- The project design for Pursat bypass is not deeply consider, it might affects on Tonle Sap biosphere reserve zone, because when the road project is completed and there is increasing households due to un-expected further to create a Town. There is no plan in advance for waste water system and other infrastructures, it causes to affect to ecology zone and lead to pollution in Buffer zone which is located nearby;
- Along this road of COI in between KP177+177 to KP177+263, PK178+484 to PK255+121 is river side vegetation (creek, canal, and pond) about 10.13ha. This vegetation will do clearance for extending road. At both sides along the road there are 30 types of crops, total is 5,210 trees (diameter from 10Cm to 130Cm) which planted by the people and provincial Khan Forest Administration. There are fruit trees planted by the people of 4,817 trees and these trees will be affected by the project;
- There is some people lived on this road about 1,860 families, 307 HHs, 195 business stalls, 8 Restaurants, 676 other small stalls and other constructions (well, fence, gate, funeral, grave, washing car place, Toilet, paddy store, drainage, Corola place, platform ect.,) total is 137 that need to demolish by this project. The new Town by-pass construction is affected on rice field of 269,026.85m^2, residential land in total is 21,079.67m^2 and commercial land is 5,962.56m^2 (belong to 224 people's families);
- There are vulnerable head housholds (the family that get income less than 20$/M, landless family, old head household, disable people, widow) totally is 312 families. The NR5 improvement project will affect on these people, it causes to them become poor and poor;
- There are social infrastructures such as: electricity Towers, Cable poles, Optic cable Towers, Optic cable underground, electric cable underground, waste water drainages, water pipes underground such as water supply pipes in Pursat Town on the COI area that started from KP183+940 to KP190+855; for Trapaing Choung and Boeung Khna communes started from KP200+600 to KP212+958; for Moung and Kea communes started from KP243+430 to KP245+939; these water pipes are affected by this road extended;
- There are two old constructions: (1) it is brick fence and (2) it is an ancient gateway of Royal Palace of Preah Bat Monivong; it was constructed in Colonial of French. Both are located on front of Bakan district and Office of Social Affairs Labor Vocational Training and Youth Rehabilitation, Bakan district, Pursat province. It will affect by the project road extended. Moreover, there are some gateways and fences along the road will be affected also.

Mitigation measures

- The detail project design of this road improvement has to consider for additional concrete rings installation at between PK247 – KP248 of this road. It plans to dig canal on both sides to regulate water flow of flood out from the village and agriculture land use along the road;
- The project design for Pursat bypass are six options: bypass at South of road (up road) and by-Pass at North of road (down road) that located in Tonle Sap biosphere reserve zone then, to do comparison of cost economic included also cost environment, and identify N-1 located at North of road is the best;
- Need to study, investigation on impact of crops, trees, households that located in COI, and including resettlement plan by insert fund to solve these impacts and fund to re-plant trees along the road. The project owner should do cooperation with relevant Ministries for successful of project plan implementation;
- Need to study, investigation on impacts: crops, fruit trees, households that located in COI, and including all things suitable registration that affected by the project. Deadline of registration on impacts such as houses, buildings, crops is 2 September 2013; for existing road and Pursat by-pass is dated on 30 December 2013, and resettlement plan is prepared fund for compensation, support to vulnerable people (Old head household, disable people, widow, poor people that they get income less than 20$/M), support to the people landless (people live in COI), support to affected people land use of family is over 20%, there is reserve fund for new program of temporary income and fund for tree planting along the road as well. The total budget for social impact resolution is USD 8,059,913.55 (included resettlement for 2 sites in Bakan district and

Moung Russei district for these sections and other one O-Chrov district for road section of Sri Sophorn to Poipet, see detail resettlement plan of NR5 improvement road project from Thlea Ma' am to Battambang and other section from Sri Sophorn to Poipet;

- Should prepare resettlement plan due to do compensation on houses, buildings, crops and fruit trees affected based on market price, including supplementation fund to these families such as money supports for impacts, money supports for transportations, money supports for family who loaned land, money supports for vulnerable Head households and money supports for new program of temporary income to affected people land use of family is over 20%. For the landless of 53 families the project owner will look for land and do resettlement them, this resettlement has to construct social infrastructures look like existing they lived or better than there.
- Should inform to these infrastructures owners in advance and should do cooperation relevant institutions to demolish and move its to new locations where are safe places, to avoid re-demolish again in the future that it is costly.
- Should discuss with Provincial Authority, Provincial Department of Culture, Fine and Acts in advance, whether need to move ancient gateway of Preah Bat Monivong from COI of road or another option that can be solved before construction project. For other gateway and Pagoda fence, the project owner should discuss with Provincial Authority, Provincial Department of Religions and Cults and relevant Pagoda Committees to do compensation; all these need to be solved whatever is far from the reserved land to avoid impact again for the future.

PROJECT CONSTRUCTION PHASE

Negative impacts

- It may change the morphology and topography in the COI area, borrow pit and quarry sites of the project due to land clearing and earth work activities for base road arranging/constructing. Moreover, there will be changed in the by-Pass due to land clearance and earth work activities, filling up soil of road surface, earth excavation for culvert and bridge construction in all places that road passed ect.,
- The water discharge of Creek and Steung might be affected due they close waterway for road extending or new construction of bridge, culvert that it will block waterway in wet season;
- Soil filling on road in the field in wet season, it leads to soil erosion to cover of rice field and it will lose soil quality in there;
- It will affect for water pollution by making turbid water due to construction activity works such as earth works (poor management works on borrow pit, quarry site), concrete works, foundation works ect., it may affect to surface water in the project area;
- Air pollution is creating due to dusty and exhausting gas from vehicles which its are constructing; its will impact to the travelers and the people living in/around the project area;
- In case lack of well wastes management in the staff-workers houses, workshop, warehouse that it causes soil pollution in the project area;
- it might disturb to the people living in/around project area because of sound, noise and vibration from construction machineries are operating on earth works, concrete works, base works, transport works and repairing works ect.;
- Fishes and other aquatic life might be affected to water sources (Creek, Prek or Steung) because of turbidity of water from cleaning rock and project construction including solid and liquid wastes and other case from infrastructures of the project such as constructions: bridge, culvert crossing Steung Pursat, Steung Svay Daun Keo, Steung Moung Russei, Steung Chork and Steung O-Samdan ect.,.
- May be required some lands for small resettlement such as land for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect.,
- The by-Pass of Pursat Town will be changed of land use such as agriculture land can change to residential house along the road or become to Town ect.,.

Mitigation measures

- There is technical Expert for monitoring of this construction such as earth compacting, concrete bed bridge and culvert making, slope of borrow pit and quarry site making, grass planting along road slope ect.,
- The project construction activity such as big earth works, it will work in dry season in order to avoid soil erosion and water polluted reduction. Moreover, at the site of road extending, culvert, bridge constructions, should do by-Pass and install concrete rings to lead water flow out from the construction site with suitable dimension to drain water to downstream as normal flow in wet season; do this in order to avoid inundated water at upstream or it occurs to break the dam by water pressure into the construction site. For big bridge constructions such as Steug Pursat, Steung Svay Daun Keo ect., should use steel pipe as suitable technical condition to encircle of bridge base in the water which it can protect water flow or water pollution;
- Most activities of the project road extending are implementing in dry season that there will less impact;
- Should observe regularly the contractor for slope road based on contract document works and should order to excavate straight at quarry site and should plant grass along slope road and shoulder also. Should control concrete mixing site, stone cleaning site to ensure that in the project area is no water quality pollution;
- In the project construction phase, the project owner should use good quality of vehicles and machines with lowest air pollution will be used to assure air quality in the project area. Especially, new vehicles and Engines are useful because its exhaust low gas and strong for works;
- Educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. Should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. For oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle. Should well manage on solid and liquid wastes, do not let its polluted into the water sources;
- Machineries and transport vehicles which are low noise shall be used in the project area;
- Should look to buy gravel to avoid for gravel cleaning in the concrete mixing site; Bridge and culvert construction should construct in dry season and should use steel mould for bridge column, do not make a dam cross the River. During doing extend culvert on existing culvert, should look for by-Pass and install concrete rings depend on dimension of water flow of Creek, and these canals to avoid block and low flow especially may impact on fish movement in wet season;
- Should do cooperation with IRC to look for land rental for temporary for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect. due to there is not affect serious to resettlement site;
- Should do cooperation with MoLUMPC to do master plan for by-Pass development, doing plan before of infrastructures such as in/out site, drainage water waste system, waste water storage site, especially waste water treatment plant site before outlet to the Steung ect., there should install signboard show development site as well;

PROJECT OPERATION AND MAINTENANCE PHASE

Negative impacts

- It might have blocked by garbage and algae at/in the canal on front of culvert which it makes low water discharge from upstream. Other hand, it blocks by illegal garbage disposing along the road;
- The water surface and groundwater polluted by serious accident of traffic from oil/fuel leakages on the ground and it floes to the shallow water sources and further flows to surface water in the project area;
- It might affects on Aquatic life and fishes by illegal garbage disposed along the road that it causes water pollution of creek, natural small stream, Prek, Steung and affects to fishes and Aquatic life of road;
- Due to have good road, there will be changed by using over from the local resources that can be affected to local economic such as increasing of rice products because the peole use chemical fertilizer, insecticide to kill crab, rat etc., that it is affected to fishery resources;

- There will be changed of type land use around this bypass project, such as agriculture land can change to the big Town or become to the Town ect.., that it causes on environmental pollution by solid and liquid wastes outlet in there.

Mitigation measures

- The MoPWT through the PDoPWT should responsible for maintain and rehabilitation of culverts along the road, do not to have garbage or soil filling up on front of culverts, to do announcement to local Authorities: Commune and village about soil filling up that caused to block water discharge of culvert and drainage system along the road. Moreover, the project owner should do cooperation with MoE through the PDoE to install environment signboards: to prohibit for garbage disposed along the road and should look for violable people and to do penalize to them, do not let them to dispose wastes everywhere again;
- In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources;
- To do cooperation with MoE trough PDoE to install many signboards: prohibit garbage disposing and should do cooperation with local Authority: commune, village hard management to violated people;
- Should do cooperation with all local Authorities especially relevant Provincial Department to control and check balance of local economic in the future, to identify that either resource economic use is not exceed;
- Should do cooperation with MDoLUMPC through PDoLUMPC to do master plan for development zone of this by-Pass in advance including waste water drainage system, especially water treatment plant to treat it first before let out to Steung ect., and should install big Architecture design signboard about zone development as well.

PROJECT CLOSURE PHASE

In project closure phase, it is after MoPWT planned for NR5 improvement project. Therefore, within this phase, it is not any affects to Social environment.

7.1 POSITIVE ENVIRONMENTAL IMPACTS

Physical and Ecological Resources

✓ **Air Pollution**

If they do comparison of air pollution before the project improvement, they will see that the air pollution by dust is much more than after the project improvement because after the project improvement, the road is width 20.5m, paved road is Asphalt Concrete (AC), strong and less of maintenance (before the project improvement width road was 9m to 10m, paved road is DBST, it is easy to damage by weight and busy of traffic).

✓ **Forest Resource**

Although, the NR5 improvement project a part from Thlea Ma' am to Battambang is affected on some river side vegetation and trees along the road, the project is planned budget for trees planting along the road in order to change this location to green environment and good view for additional on part of this road, expected to plant these trees will be better than before the project improvement.

Socio-Economic Resources

✓ **Road and Transportation**

If we have the road, we will have hope for developing local community and in country because road is the blood vessel to bring economic based. People can transport their agricultural production or crops to markets easily and fast to avoid spoiling.

✓ **National Economic Development**

The NR improvement project, it will give services such as: agriculture, tourism, especially handicraft and industry which are the important base to develop national economy.

✓ **Land Use/Land Cost and Tourism**

Due to paved road and extended, it can attract to International Tourists come from Thailand to visit tourism places in Cambodia in the future, it will help people along the road to get more income from tourism services as well.

- ✓ **Employment and Increase Living Standard**

The project will provide jobs to Cambodia people especially the people in the project site during the project construction phase trough staff-workers recruitment.

8. ENVIRONMENTAL MANAGEMENT PLAN

The implementation EMP is a task of project owner under control of integrated team that participated from relevant offices, department, and Ministries which will be organized by the project owner with MoE. This team will monitor the environmental protection measures under monitoring and following up regularly by the Ministry of Environment (MoE) and direct cooperation from the project owner.

Note: the budget estimation for EMP is US$172,550.00 (one hundred seventy two thousand and five hundred fifty dollars).

9. ECONOMIC ANALYSIS

A sensitivity analysis is conducted to see the influence of fluctuation of benefit and construction cost. Sensitivity analysis is made on the cases with +10% in the cost and -10% in the cost and benefit, respectively. These changes in cost and benefit are supposed to represent favorable and unfavorable scenarios.

As the results of sensitivity analysis, even if the worst case which the benefits are decreased in 10 % and the project costs are increased in 10 % is occurred, the project EIRR of the all cases exceeds the opportunity of capital in Cambodia of 12 %. The implementation of the project is economically feasible from view point of national economy.

10. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- Total land requirement is 451.2ha for project road construction (40m width x 112.8m length), the land both sides from the central road are 40m (COI: 20m for one side);
- According to inventory forest in project area by trees counting on the slope road from Thlea Ma' am to Battambang is 5,210 trees; it is 2,621 trees on the right hand and it is 2,589 trees on the left hand; its were 30 species which affected by the project. Moreover, there are 4,817 of economic trees people's that will be affected by this project;
- The NR5 improvement project from Thlea Ma' am to Battambang will be less affect on River side vegetation that re-grows along the road located in few communes: Boeung Kantaout, Prey Nhy, Boeung Khna, Snam Preah, Ko Koh, and Kear in totally 10.13ha in totally with 36 species;
- Polluting in surface water such as (Stream, Creek) in the project area (in wet and dry seasons) by human activities is not seriously. Base on water quality tested of 5 parameters which collected from Steung Pursat, Steung O-Tapaong, Steung Svay Daun Keo, Steung Moung, Steung Chork and Steung Sangkea shown that it is only Total Coliform which is a little bit high the standard of water drinking of MIME; and as well as TSS in 6 water sources above is high the water quality in public resources for maintaining of biodiversity of MoE. For pH in Steung O-Tapaong, Steung Moung and Steung Chork is also high standard of both Ministries. Therefore, the result of water quality test that collected from 6 water sources we can concluded that these water sources cannot use for purposed of drinking, if the people are not trying to boil it or to treat it or to use chemical treatment;
- Air quality in the project area that tested for 6 locations and road site and further far more than 100m for the road site, before the project construction found that there are two parameters: NO_2 and SO_2 were low than standard of MoE in wet and dry seasons;
- Noise quality in the project area that tested for 3 locations and road site, before the project construction, started from 6:00am to 11:00pm was low than standard of MoE in wet and dry seasons. But started from 11:00pm to 6:00am was a little high than standard of MoE in between 9.9dB to 11.6dB;

- The same as Noise, vibration quality in the project area that tested for 3 locations and road site, before the project construction found that there was low than standard of MoE in wet and dry seasons;
- There are 1,860 families, 307 HHs, 195 business stalls, 8 Restaurants, 676 other small stalls and other immovable property of 137 in the COI area of this project, these things will impact by the NR5 improvement from Thlea Ma' am to Battambang. This project has planned to establish two resettlement sites for 53 families from affected area to Bakan and Moung Russei districts (39 families to Bakan and other 14 families to Moung Russei). The total budget for social impact resolution and resettlement plan implementation is USD 8,059,913.55 for both projects; it is thisproject and other road improvement of section from Sri Sophorn to Poipet. .

RECOMMENDATIONS

- The project owner should study on project design of whole elements project's which to be sure better according to the technical highway, to avoid occuring damages by accident to the people life and animal; it is also damage on environment in/around the prject area; should do additional calculation for local earthquake. The detail project design of whole elements project's should do whatever to consider for new culverts construction for all crossing road in between PK247 to KP248 including canal digging to drain water out along this road;
- The project owner should solve for compesation to affected people that affect by the project in advance before the project starts to construct, the land required for this project is 451.2ha in the COI area.
- The project owner should require to business enterprises for sand and soil selling, concrete mixing factory, place trasferring cargos or big stores ect,..which there are big trucks in/out, they should spend their own money to connstruct a strong road on front of their locations to avoid road damaged that it was laoned from ODA of Japan for the Nation and then it destroyed by the private sector (merchant).

CHAPTER-1
INTRODUCTION

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1.1 INTRODUCTION

Cambodia has rehabilitated and reformed of economic and its sequence improvement after civil war over 30 years is completed including there was a stable of political situation.

At present situation, all kinds of investments are very important to develop Cambodia, for instance, investment in product cargos for export, investment in the construction of infrastructures, agricultural or industrial, agro-industrial sector, be in the search attractive source of tourism, services and road construction, all fields are very important potential for socio-economic development of Cambodia.

The transpotation of cargos and other materials peopole's are utilizing road, especially roadway is more than waterway and airway. The roadways in Cambodia were most whole destroyed during the war in decade of 70 to 80. Presently, the Royal Government is trying hard to rehabilitate and construct road (roadway, railway) waterway and airway due to look for assistance and loan from friendlship countries such as Japan, China United State, Australia, Asian Development Bank (ADB) and World Bank ect., in order to rehabilitate and re-develop of road systems.

The National Road No.5(NR5) is an important National economic road among other roads of Cambodia. At the present, this road is connected from Phnom Penh City to Bangkok, Thailand which assigned Asian Highway A-1 or it is a gate of Souther Economic Corridor of GNS. Therefore, the Royal Government is decided to improve the NR5 to be wide with four traffic lines; it is two traffic lines go and two traffic lines back included rural area and Town or City, vehicle parking, right of way for pedestrian and for bycicle of bothsides.

According to master plan which prepared by JICA in 2006 of Cambodia road networks development shows that the NR5 is Double Bituminous Surface Treatment (DBST) road which surface paved road of bituminous, it is not for long life utility, easy to damage and it also includes faster increasing of traffics on this road. Therefore, the Ministry of Public Works and Transport (MoPWT) has discussed with relevant Institutions especially JICA furhter to achieve an agreement of study on this road improvement since November 2010. To respond on time, JICA has assigned Technician team to study on: data and information collection, researching, investigation, topography survey on this road, in that year.

The study of NR5 improvement project is a study looking for data and information collection which it is important to determine and estimate on loan from Japan. This study are: initial project design, cost estimation of project plan implementation and it will do on Environmental and Social Impact Assessement (ESIA) included cost estimation of compensation to affected people by the project as well. In order to facilitate for this study JICA team has devided this study as portions following:

- Portion road from Prek Kdam bridge to Thlea Ma' am Pursat (ESIA studied);
- Portion road from Thlea Ma' am Pursat to Battambang Province (it is this ESIA report);
- Portion road from Battambang Province to Serey Sophorn Town (ESIA studied);
- Portion road Serey Sophorn Town to Poi Pet Town (it is Studying ESIA).

1.2 OBJECTIVES OF STUDY AND EVALUATION

In contribution of sustainable development of the country under the Royal Government of Cambodia Rectangular strategy including Water, Road, Electricity, and Human resources are main factors for Cambodia in a new stage.

Road is blood vessel of economic network of Cambodia and the Cambodia is also neccessary needed to serve on country developemnt sector. Therefore, Cambodia is trying hard to collect for National finance, looks for assistant and loan included to open for companies to invest on infrastructure of roads construction sector.But, all development projects must be conducted Environmental and Social Impact Assessment (ESIA) first and then they will be reached to project implementation base on Law on Environmental Protection and Natural Resource Management included Sub-Decree on Environmental Impact Assessment of Ministry of Environment of Kingdom of Cambodia. The study on ESIA of the project has following objectives:

- Detailed study , understand and determine the existing environmental resources in the area;
- Detailed study on Socio-Economic of project area, evaluate project development area and surrounding area that may be directly or indirectly affected by the project activities, included assembly of common affected with other projects if neccessary;
- Screen and determine potential environmental impact, both negative and positive, caused by project activities, using checklist sheet of JICA and MoE of Cambodia;
- Cite the useful recommendations and receive suggestions from project stakeholders including local people, local authority and NGOs whom live and working in the project area to find out the properly way for minimize the environment impact;
- Evaluate and predict the degree of impact on natural and social resources caused by project design, construction, operation, maintenance, and closure;
- Analyze Cost Economic on negative impact of the project, to identify that cost environment rehabilitation is enough, loose or get benefit in the operation and maintenance phase; especially it make forestry and fishery resources is rehabilitated for in any period or the project owner has to increase additional environmental cost;
- Analyze Cost Economic of the project included all damages of natural resources environment, biological and Social in order to find for project benefit;
- Minimally determine/set mitigation measures to negative environmental impacts, especially on natural and social resources;
- Determine of environmental protection plan of the project in the future;
- Conclude and make main recommendations to the project owner and other institution which is responsible has smoothly and sustainable for project implementation.

The Environmental and Social Impact Assessement (ESIA) report on the NR5improvement project is prepare reffer to Prakas on guideline in the ESIA No.376 ប្រ.ក.ប.ស្ដ dated on 2 September 2009 of MoE and guideline of JICA, dated on April 2002. This ESIA report consisted 10 Chapters:

(1).General, (2) Methodology of Study, (3) Relevant Law and Regulations, (4) Project Description, (5) Contest of Existing Environment in the project, (6) Public Consultations and Discussions in the Project Area, (7) Potential Environmental Impact and Mitigation Measures, (8) Environmental Management Plan, (9) Economic Analysis and Environmental Cost, (10) Recommendations and Conclusions.

CHAPTER-2
METHODOLOGY OF THE STUDY

CHAPTER-2

METHODOLOGY OF THE STUDY

2.1 INTRODUCTION

The main points of methodology for the ESIA study on the NR5 improvement project of MoPWT has a mechanical methodology to study 3 Environmental resources: (1) Physical Environment, (2) Biological Environment and (3) Social Environment, are described below:

- Collect data and information related to the project concerning with Institution and Stakeholder in Phnom Penh, such as Ministry of Agriculture Forestry and Fishery (MAFF), Ministry of Environment (MoE), Ministry of Water Resource and Meteorology (MoWRAM), Ministry of Public Works and Transport (MoPWT), Ministry of Planning (MoP), NGOs and other concerned Institutions;
- Collect data in the project area and organize public consultation meeting with local people and Local authorities: (Villager, village Chief, Commune Chief, District Governor/Town, Provincial Cabinet) and institutional linkaged such as: (Provincial Department of Public Works and Transport (PDoPWT), Provincial Department of Agriculture (PDoA), Provincial Department of Environment (PDoE), Provincial Department of Water Resources and Meteorology (PDoWRAM), Provincial Department of Land Urban Management Planing and Construction (PDoLUMPC), Provincial Department of Industry, Mines Energy (PDoIME), Khan of Forestry Administration, Khan of Fishery Administration and other NGOs (see Chapter-6);
- Field investigation on natural environment at project area such as: Hydrology, Soil, Geology, Forest, Wildlife, Fish ect., by mention from villagers who lived in/around project area;
- Field investigation on people's land use in the project area;
- Meet the affected and non-affected people in the project area in order to interview and understanding on their living condition before the project development; and also looking for a common idea and others suggestions which concerned to the project in order to guide the project is running smoothly;
- Taking water samplings and test of water quality sources: Surface water (see table of water quality tested at the field in order to identify of water quality before the project development;
- Taking samplings and test of Air quality, Noise and Vibration in the field (see table of Air, Noise and Vibration tested at the field in annex-3) in order to identify these qualities before the project development;
- Study on Ecology system (dry ans wet season) in the project area;
- Study on fishery in Steung Pursat (dry and wet season);
- Analysis all data that collected from the field and related institutions, and to describe on existing natural and social environment situation, and then predict the environmental impact may/will be happened before project Operation (in project design and project construction phases), operation and maintenance phase and disclosure phase;
- Review and modify the project master plan/relevant document;
- Determine negative and positive affected caused by project activities. Develop mitigation measure for reducing negative impact to minimum degree and increasing positive impact to maximum degree, by quoted from public consultation meeting with people and other suggestions from people, local authority, Institutional linkage in the project area;
- Prepare Environmental Management Plan (EMP) and Monitoring Program for project construction phase, project Operation and Maintenance phase. The floowing detail of methodology studies: Physical Environment resources, Biological and Socio-economic Environmental resources as below:

2.2 ENVIRONMENT RESOURCE STUDY

2.2.1 Meteorology and Hydrogeology Study

2.2.1.1 Meteorology Study

This study is very important in order to analyze on data base to calculating dimension of project infrastructure such as Culvert, Bridge ect.,

The study team has contacted to the Director of Department Meteorology of MoWRAM and the Director of PDoWRAM to collect data on Meteorology that concerned in the these provinces such as: Rainfall, Temperature, Wind speed and Wind direction, Humidity, Sunshine, Evaporation ect., to analyze in order to determine data base as described in Chapter-5. Moreover, if data of Meteorology is not available in the province of the project area, then data of Meteorology is closely that province, can be analyzed for data base of the project as well. Other hand, data of meteorology is not available in the country or in the region; then data of meteorology is closely that country can be analyzed for data base to calculate dimension of infrastructure of the project as well. To analyze this data the team will operate Excel in the Microsoft Office program of computer.

2.2.1.2 Hydrogeology Study

The working Team has devided in 3 main parts for this study:

(1) <u>River and Drainage Systems in the project area:</u>

It is description about water sources name which passed on this road by using map of Department of Geography that produced by JICA in 2003. It takes Themes: River 99 to use in ArcMap 10 program then doing Overlay with map of the project location and then it creates Themes: River in the project area which it is clear with the name of each Creek and Steung. In additional, study team has shown this map to local Authorities (District, Commune and Village) in order to clarify name these water sources. Moreover, study team went to field to meet the people are living in permanent along the road in the project area asked them to identify these water sources names that they use in the project area. Some names of water sources that the people used and it is diffident from the map name, the team has noted and wrote down on the map as well (see map No.1).

<u>Note:</u> *GPS has been used and marked on waterways that recorded and inserted these points into the computer and operated with MapSource program, Excel and ArcMap 10.*

(2) <u>Hydrology of Steung:</u>

The Irrigation Engineer is the person implemented of this study; this point is collected from final report of Northwest Irrigation system project in annexes of hydrology calculation (discharge in Steung Pursat, Steung Svay At, Steung Svay Daun Keo, Steung Moung Russei) This calculation they have to do probability of rainfall and modeling in SWAT computer program that they used for the project (TA ADB No.3758-CAM), (see result in Chapter-5).

Moreover, the study team has measured profile of Pursat Steung, Svay Daunkeo Steung, O-Tapaong Steung and Moung Steung by using Digital Nikon LASER 1200 and Garmin Echo-300C equipments to draw all profiles of Steung (the result shown in Chapter-5). For these equipments which measured in the field see the picture below:



(3) Surface Water Quality Test:

JICA working team has selected for 6 locations of water surface sources to study: (1) Steung Pursat, (2) Steung O-Tapaong, (3) Steung Svay Daun Keo, (4) Steung Moung Russei, (5) Steung Chork, (6) Steung Sangkae. The study on water quality is twice, once is in wet season in July and second is in dry season in December 2013. The water supply Engineer is the person in charge of this study. He sent water samplings to Laboratory, MoE to test its. The water sampling is important thing; it is not for every person can be done for this. The result of water quality test we have to see table of water test in the field attached in annex-2. The result both seasons of water quality study will be done by Water supply and Environment Engineer to analyze and conclude in Chapter-5. The tools and equipment of water quality test in the field is shown photo below.



Photo of Water Quality Test Equipments

2.2.2 Topography, Soil Type and Geology Study

2.2.2.1 Soil Study

Study team has determined on soil study by using map of Department of Geography that produced by JICA in 2003. It takes Themes: Soil type of Mr. Crocker, 1963, scale 1:1,000,000 to use in ArcMap 10 program then doing Overlay with map of the project locations and then it creates Themes Soil type which it has clear area in each of soil type. The study team leader has determined the study locations and made detail study. According to analyzing by program computer and then transferred Attribute data of coordination X and Y by UTM systems using Datum Indian 1960 to Excel file. The file is transferred to Dbase file then using DNR program computer and insert the file into Dbase in GPS Garmin 76CSX in order to look for all locations that we need to study in the field. The team has used tools and equipment and document in the field study as below:

- GPS Garmin 76CSX;
- Hand Auger (3m), drilling tools;
- Tape meter (10m and 50m);
- Shovel, Hoe, Spanner, Knife, Axe, digging hoe ect.;
- Red paint spray;
- Canon and Olympus Cameras;
- Map which has prepared and notebook;
- Book of soil type for paddy crop in Cambodia, 1997;
- Book of soil symbol of Mr. Crocker, 1963: Les sols du Cambodge et Leur potentialite TRAN CANH, 1997.

The Civil Construction Engineer has recorded data of soil element that drilled or dug at depth of 1m - 1.3m and re-marked in GPS where location of the study; and then he also noted on notebook, took a picture as well. The soil interpretation is described in Chapter-5.



Photo of Tools and Equipment Soil Test

2.2.2.2 Geology and Mine Study

Study team has determined on Geology study using map of Department of Geography that produced by JICA in 2003. It takes Themes: Geology to use in ArcMap 10 program then doing Overlay with map of the project location and then it creates Themes: Geology in the project area which it is clear area according to each occasion of rock and soil formation created.

2.2.3 Biological Resources Study

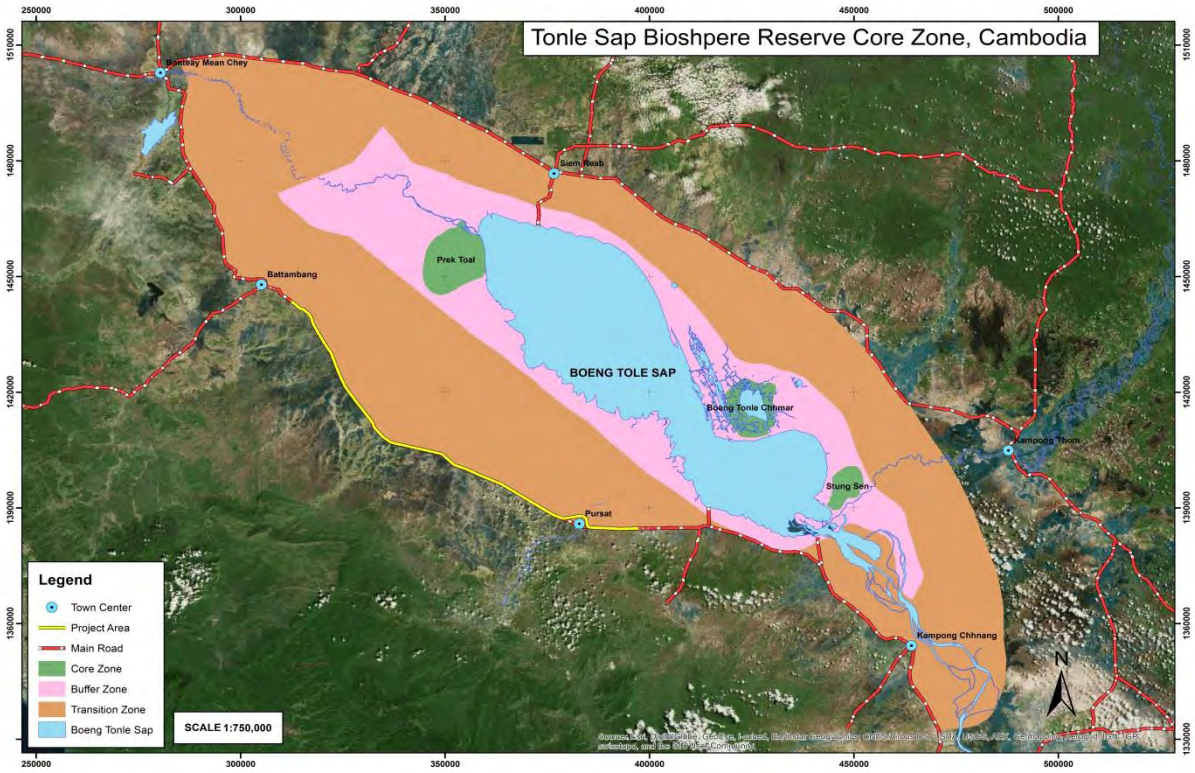
2.2.3.1 Ecology System Study

A. <u>Map creating of Land use type in the project area</u>

Study team has determined on study area for 150m both sides of road (width of 30m), at point started from KP-171 to KP-281+200 which it area sized is 3,384ha (to be provided by JICA Staudy Team) according to map of forest Administration (GIS Datasets FA 2002 and 2006, scale 1:1,000,000). It found that in the project area is not forest or protected area. But on the right side of the project area is located in the inter-area of Tonle Sap Biosphere Reserve. Moreover, this study is taken air photo which it is resolution 1m to 3m year 2008 to identify clearly location on land use map. Land uses in this project area are:

- Residential area is normal household which it is not Town;
- Residential area of 50% is Town;
- Residential area is Town;
- Rice field area;
- Riverside vegetation which it is re-grow in inundated are along the road;
- Water area such as Lake, pond, Creek, Steung ect.,

Study on Ecology system in the project area will be done twice: (1) in wet season in July and (2) in dry season in December 2013. The result this study is described in Chapter-5, point 5.1.2.4.



B. Wildlife, Mammal, Bird, Reptile and Fish

Wildlife studying (mammal, bird, reptile and fish) is applied by using photos of Checklist in the Cambodia extracts from wildlife book identification for strengthening Law practices by Department of forestry, 2002. Bird book of Cambodia published by MoE, 1999 to some people and concerned Authorities in Pursat and Battambang provinces.

At field study, along the road for some communes, study team selected people representative 1 to 2 person and 1 Commune Councilor which they clearly known wildlife in and surrounding the project area. They are: Mr. **Teng Sokha**, 45 year old, he is a Svay Daun Keo Commune Councilor; Mr. **Seth Seu**, 54 year old, he is a Village Chief of Svay Daun Keo-1 (recruited for Group-1). The Group-2 consisted: Mr. **Keut Chheun**, 73 year old, he is a Village Vice-Chief of Moung Russei; Mr. **Yem Yen**, 65 year old, he is a Village Councilor of Moung Russei and Mr. **Per Ngin**, 42 year old, he is a Village Chief of Kansaeng Banteay. The Group-3 is consisted: Mr. **Theat Bun** Chai, 60 year old and Mr. **Bun Lour**, 59 year old, they are commune councilor of Prey Touch.

Later then, working Team had guided them on how to define by showing the photos of wildlife and how to put a tick, each group can be put a tick only one mammal/fish species. Later than, working Team had collected result from each Group in order to do analyzing to count number of wildlife or fish according to method 2/3 of chosen picture of wildlife was ticked by these 3 Groups (it means that we had to check for each picture, for example, Group-1 ticked one species of wildlife in the project site and the third Group also ticked this species, but the second Group did not tick; all of these showed that this area has this species. This process was done still completed). However, the team had went to the field and doing investigation of wildlife and took some pictures wildlife and died wildlifes.

C. Wildlife threatened species and Rare species

- According to document of Cites;
- According to Sub-Decree No.123 ANK-BK, dated on 12 August 2009 on species results, fisheries products which is suffering dangerous (for fish and reptile);
- Actual study in the project area.

2.2.3.2 Fishery Resources Study in the project Area

Fish study in the project area, the JICA study team has determined for detail study in Steung Pursat. The study on fish in this Steung, it started from Damnak Ampil Dam to Cha Reuk Irrigation building which it is

far about 34Km, both season of study in wet season (July and August) and in dry season (November and December) in year 2013.

A. Objective of the study

- Household number of fisherman (professional fishing and non-professional fishing), type and number of fishing tools;
- Technical information fishing;
- Quantity of fish catchment base on type of fishing tools which they doing fishing part upstream of project area, in the project area and part downstream of project area before the project implementation phase;
- Vary of quantity fish catchment before the project implementation phase;
- Type of fish catchment part of upstream project area, in the project area and part of downstream project area before the project implementation phase;
- Fish movement in the study area in Steung Pursat.

B. Methodology of the Study

Method of this study is an actual practice by using interview with the Fisherman selected random of 13.8% (based on condition of n/N ≥ 0.1, (n) is number of family need to be interviewed, (N) is total number of fisherman in the study area) for 2013 and selected 4 person are recorders, they are fishermen that in the study area permanently. To say that: 1 person is in the project area, 1 person is downstream the project area, he is at Kbal Hong of Chareuk. Other 2 person are upstream of the project area, they are in Koh Village and at Kbal Hong of Damnak Ampil, all of them have to fill on checklist, data recording for 2 months (1 month in dry season and other 1 month in wet season) and later then the fishery specialist has interviewed and doing analysis this data as below:

- Introduce about objective of study;
- Meeting and interview with fisherman for 223HHs equal 14.75% of total fisherman of 1,612 HHs, in order to collect about technical fishing information and notice type of fish in these 3 project areas;
- Fish product is recorded on the day of number fisherman that selected, and also recorded on number day fisherman's which they were in the site pointed, and calculation daily for total fish catchment following to formula below:

$$Y = \sum_{i=1}^{b} Ybi \times \frac{B}{b}$$

Y	Total fish catchment quantity per day;
Ybi	Total fish catchment quantity of fisherman recorded per day;
B	Total number of fisherman at port boat or in village;
b	Each number of fisherman which recorded per day.

Total fish catchment quantity per month calculation following the formula

$$Y' = \sum_{i=1}^{d} Yi \times \frac{D}{d}$$

Y	Total fish catchment quantity per month;
Ybi	Total fish catchment quantity of fisherman recorded per day;
D	Number of day for fishing per month;
d	Number of day that recorded;

Yearly fish catchment quantity is monthly fish catchment quantity plus together.

2.2.4 Socio-Economic Environment Resources Study

Interviewer sampling is selected by method Participatory Rural Appraisal (PRA), diagram and SWOT (Strengths Weaknesses Opportunities and Threats). This method will use during the meeting and discussion with the local Authorities: District, Commune and Village. First, the working team has to make appointment with above local Authority, due to showing map and project location to District representative Authority. After then, the team has introduced and shown each commune location in the project area. Later on, the team is done the same that is the team has made appointment to meet relevant commune Authority in order to look for any villages that located in the project area. In the relevant villages, the village Chief or his representative or community representative has to be interviewed and consulted. Next day, the working team has asked to the village/commune representatives that they know well project locations and the people are living along the NR5 for interviewing with our team.

For measurement, investigation and information collecting from affected people's by the project, JICA study team has organized a new team (working group-B) to determine for Corridor of Impact (COI) by the project. It is 20m from the central line of road, totally is 40m width. This team has cooperated with Facilitator of MoPWT included Office of Complex Resolutions of MoFE. They went to field for meeting to delivery information and opening for public consultation in Pursat province on 7 August 2013. The message in the meeting is determination for immovable property registration and crops and trees which affected by the project, it will start on 2 September 2013. It means that, if anybody to do construction or growing the trees on Corridor of Impact (COI) after the date (2 September 2013), there is unable to registration as people affected by the project. This team has organized meeting to delivery information and public consultation at the provincial level in Battambang province on 8 August 2013. The meeting is determinate for date of immovable property registration and crops and trees which affected by the project. It counted from 2 September 2013 as Pursat province as well. The deadline of immovable property registration and crops and trees which affected by the pursat bypass dated on 30 December 2014.

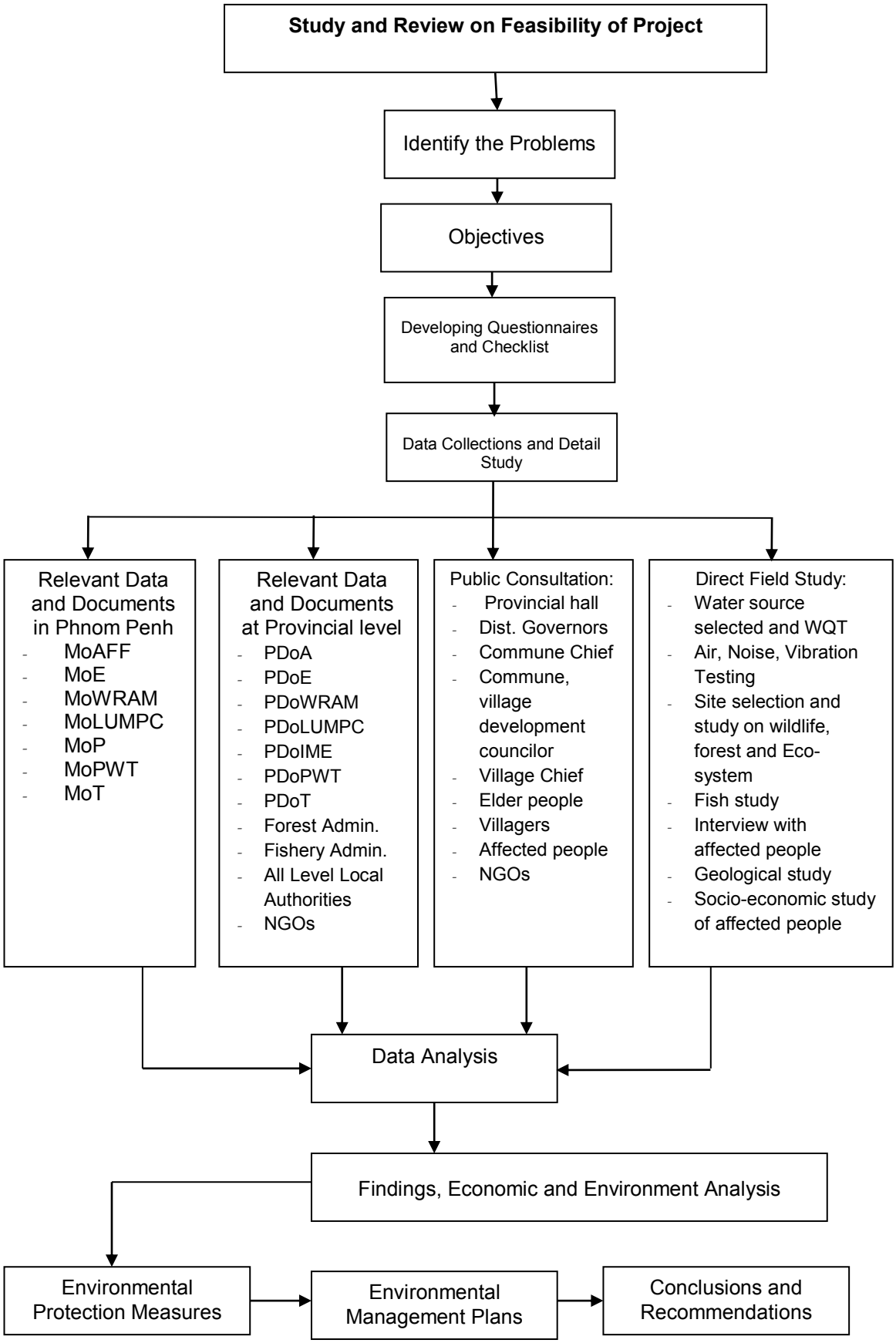
Based on introduction from the village representative and these immovable property owner's, it shown that the house owner's name, immovable property owner's (house, business stall, paddy store, fence ect.,), people/public crops in the project area, the team had interviewed them at their households. In case they are not house in the village (it is far or in others area) of the project area, the team will ask them to meet at the village Chief house for interviewing. When the study team was in the field for data collection and interviewing there were also village/commune Authorities had participated as well. The study team has used checklist and questionnaires to ask to the people in the field. The team found some affects it will be occurred by this project development. The team has recorded these affects for documentation and doing socio-economic analysis as well.

Moreover, the meeting with the people that they are not affected by the project (who are living both sides along the road), it made to introducing about project's objective, result expectation of the project activity, especially, to find out number supporter of the project and criticism ideas for environmental mitigation measures, due to they have opportunity to participate in the meeting for question and answer with the study team. In general, sampling for the people interviewing is at least 10% to 20% selected, it depend on number of the people more or less. Example, if in one village, there are people lives along the road from 1 HH to 150 HHs, it has to select 20% for interviewing. If in other one village, there are people lives along the road more than 150HHs, it has to select 25 HHs for interviewing based on condition of $n/N \geq 0.1$, (n) is number family need to be interviewed and (N) is total number family living along the road.

The Environment and Social Impact Assessment (ESIA) of the NR5 improvement project, it is implemented in the real field from July to December 2013. The result of interviewing with the people is shown in detail in Chapter-5, point 5.2 of Social Status and in Chapter-6 of Public consultation and Discussions in/around the project area.

Data analysis has been done by Socio-economic Expert of working team. Data collected from the field interviewing has inserted to Excel program computer, then doing analysis graphs and Pivot Table.

DIAGRAM OF METHODOLOGY OF ESIA PROJECT STUDY



CHAPTER-3
RELEVANT LAW AND REGULATIONS

CHAPTER-3
RELEVANT LAW AND REGULATIONS

3.1 LAW ON CONSTITUTION OF THE KINGDOM OF CAMBODIA, 1993

This law was adopted by the Charter of National Assembly of the Kingdom of Cambodia, and promulgated on September 21, 1993 related to the project as follow:

- ***Article 2:*** The territorial integrity of the Kingdom of Cambodia shall be absolutely inviolable within its borders as defined in the 1/100,000 scale map made between the years 1933-1953, and internationally recognized between the years 1963 - 1969.
- ***Article 4:*** The Kingdom of Cambodia is an indivisible State.
- ***Article 5:*** The official language and script are those in Khmer.
- ***Article 58:*** State property notably consists of land, underground, mountains, sea, sea-bed, undersea-bed, coastline, airspace, islands, rivers, canals, streams, lakes, forests, natural resources, economic and cultural centers, national defense bases, other building facilities belonging to the State.

  The administration, the utilization and the assignment of State's properties shall be determined by the law.
- ***Article 59:*** The State shall preserve and protect the environment and the balance of natural resources, by organizing a precise planning for the management, especially of the land, water, atmosphere, air, geology, ecological systems, mines, energy, petroleum and gas, rocks, sand, gems, forests and forest by-products, wildlife, fish and aquatic resources.

3.2 LAW ON ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES MANAGEMENT, 1996

Law on environmental protection and natural resource management was adopted by national assembly and declared to use a Preah Reach -1296/36 Enacted on December 24, 1996. This law has an objective as following:

- To protect and upgrade the environment quality and public health by means of prevention, mitigation and Control of pollution;
- To assess the environmental impacts of all proposed projects prior to the issuance of decision by the Royal Government;
- To ensure the rational and sustainable preservation, development, management and the use of the natural Resources of the Kingdom of Cambodia;
- To encourage, and provide possibility to public to participate in the protection of environment and- the management of the natural resources; and
- To suppress any acts this may affect to environment.

Relevant to law on natural resource management that it has required to all the firms have to prepare the report on initiative environmental impact assessment (IEIA) or the report environmental impact assessment (EIA). Rely on this law is showing that in article 6 and 7 of chapter 3 as following:

- ***Article 6:*** An environmental impacts assessment shall be carried out on every project and activity of either private or public and shall be examined and evaluated by the Ministry of Environment before it is submitted to the Royal Government for decision. This assessment shall also be applicable for those existing activities and those which are being under process and which their environmental impacts have yet not been assessed. Procedure for the environmental impact assessment shall be determined by Sub-decree following a proposal of the Ministry of Environment. Nature and size of the proposed projects as well as the existing activities and activities under process of both private and public which are subject to assessment of their environmental impacts, shall be determined by Sub-decree following a proposal of the Ministry of Environment.
- ***Article 7:*** Every Investment Project Application and proposed project which are submitted by the State, shall enclose with them a preliminary environmental impact assessment (IEIA) or

environmental impact assessment (EIA) as stated the article 6 of this law. The Ministry of Environment shall consider and make recommendations on the preliminary Environmental Impact Assessment or Environmental Impact Assessment to relevant competent bodies within a period as determined in the Law on Investment of the Kingdom of Cambodia

3.3 LAW ON ROAD, 2014

The Law on Road adopted by the National Assembly on 3 April 2014 at the second ordinary session of the five legislatures and approved by the Senate to its entire form and legality on 11 April 2014 at its extraordinary session of legislature and includes the following provisions:

- ***Article-1:*** This law has objective to management, development of roads infrastructure sector and to ensure the road traffic safety in the Kingdom of Cambodia.
- ***Article-2:*** This law has the following aims:
  - To protection of public property, protection and enhance of roads quality, maintaining orders, facilitate of the roads traffic and roads transportation.
  - To determine the policy, strategy, and developing plan for the construction, repair, and maintenance of roads infrastructure including to set up measures and technical regulations
  - To promoted and encourage the private sector to participant in the construction, repair, maintenance, and developing of roads infrastructure
  - To promoted cooperation and integrations of the nation, region, sub-region, and worlds on the roads infrastructure sector
  - To encourage for conduct research program on roads technique and to transfer of new technique for the roads infrastructure development in the Kingdom of Cambodia
  - To development of human resources in roads infrastructure sector in the Kingdom of Cambodia.

- ***Article-3:*** The scope of this law shall be applied to all the activities relevant with roads infrastructure sector in the Kingdom of Cambodia.

- ***Article-10:*** The competent authorities of road management shall develop a road master plan development, project design and prioritize projects for road construction, rehabilitation, improvement, upgrading, expansion, and maintenance as well as for other roads infrastructure development activities to propose the approval from the Royal Government.

Formalities and methodology for the road development planning, project designing and project prioritization shall be determined by a Join-Prakas of the Minister of the Ministry of Public Works and Transport and the Minister of the Ministry of Rural Development.

- ***Article-11:*** All the road construction, road expansion, interchange, intersection, overlap roads, bridges, overhead space above, overpass bridges, underground or tunnels, culverts, ground water, road ground or overhead railroad, and particularly road within daily traffic congestion, a public dissemination and draft construction project plan shall be made available to relevant competent authorities. In this case, if the legal ownerships are affected by the planned road construction or expansion project, owners may receive fair and just compensation as provide for in the law on expropriation.

3.4 LAW ON EXPROPRIATION, 2010

The Law on Expropriation adopted by the National Assembly on 29 December 2009 at the third ordinary session of the four legislatures and approved by the Senate to its entire form and legality on 12 March 2010 at its extraordinary session of legislature and includes the following provisions:

- ***Article-1:*** This law aims to define an expropriation in the kingdom of Cambodia by defining the principle, mechanism, procedures of expropriation and fair and just compensation for any construction and rehabilitation, and public physical infrastructure expansion project for the public and national interest and development of Cambodia.
- ***Article-2:*** This law primarily aims to:

- Ensure just and fair deprivation of legal right to private property,
- Ensure a fair and just compensation in advance,
- Serve the nation and public interest, and
- Develop public physical infrastructures.

- ***Article-7:*** The state is the only party who carries out expropriation for public and national interest purpose. The expropriation is applied to complete the requirements for public interests, and for national, economic, and social development.

  The expropriation can be carried out only if it is for implementing a project as set out in Article 5 of this law.

- ***Article-9:*** The expropriated immovable property shall be used for the anticipated purposes as declared on expropriation for public interest or for the requirements for national interests only, and shall not be left unused without reasons or transferred to a third party for private interest purposes.

  The owner or rightful owner shall be given priority to buy the rest of the required

  immovable property with the compensation rate. If the owner or rightful owner refuses to accept the rest of the required immovable property, it shall be kept as state property.

- ***Article-11:*** Before exercising any expropriation, the government shall prepare enough annual budgets, and grant credit fully and timely to the Expropriation Committee in according to the proposal submitted by Ministry of Economy and Finance for payment of compensation to the immovable property's owner or rightful owner affected by the expropriation.

3.5 WATER RESOURCE MANAGEMENT LAW OF KINGDOM OF CAMBODIA, 2007

This law was adopted on May22, 2007 by the National Assembly of the Kingdom of Cambodia during the 6th session of its third legislature, and promulgated on June 29, 2007:

- ***Article 1:*** The general purpose of this Law shall be to foster the effective management of the water resources of the Kingdom of Cambodia to attain socio-economic development and the welfare of the people,

This law shall determine:

- The rights and obligations of water users,
- The fundamental principles of water resources management,
- The participation of users and their associations in the sustainable development of water resources.

- ***Article 2:*** In this Law, unless the context otherwise requires,
  - **"Water" and "water resources,"** means surface, underground and atmospheric water;
  - "**Water resources**" means sea, river, tributary, stream, waterfalls, canal, lake and swamp, pond, reservoirs or storage.
  - **"Groundwater"** means water held within a saturated soil, rock medium, fractures or other cavities within the ground;
  - **"Aquifer"** means a geological formation where underground water accumulates;
  - **"Basin"** means a geographical area determined by the watershed limits of the system of waters, including surface and underground waters;
  - **"Sub-basin"** means part of a basin;
  - **"International rivers"** means rivers geographically situated in the territory of two or more states;
  - **"Banks"** of a river, stream, canal, lake and reservoir shall mean the land normally inundated by the water contained in such river, stream, canal, lake or reservoir, together with such soil, rock or any other material immediately adjacent thereto, but does not include any land

beyond that land, soil, rock or other materials, which" is occasionally inundated by such water;

- **"Shore"** of sea, river, tributaries means the land covered with sand or soil, and declining towards the water in a body of water, occasionally inundated by such water;
- **"Beds"** means the portion of land delimited by the banks of a river, stream, lake, canal or reservoir, and normally covered by water;
- **"Public purpose"** refers to urban and rural water supply, food production, hydro-power generation, navigation, industrial development and the maintenance of minimum flows for ecological, cultural and religious purposes and the preservation of aquatic life;
- **"Waterworks"** means dams, weirs, canals, drains, reservoirs, tanks, cisterns, intakes, dykes, embankments, wells, boreholes, tunnels, conduits, pipes, sluices, plants, pumps, and such other structures or installations as are constructed, or used for the purpose of diverting, storing, conveying, abstracting, using, conserving and protecting water resources, for land drainage purposes, or for the prevention and mitigation of the effects of floods, and of other water-related emergency situations.
- **"license"** means the permit document which confers to a person the right to use water and water resources;
- **"Person"** means any physical or juridical person, whether private or public

- ***Article 3:*** All water and water resources are owned by the State.
- ***Article 4:*** Water and water resources shall be managed and developed based on an integrated water resources management (IWRM).

  The IWRM shall take into account:

  - all aspects of water resources;
  - linkages between water resources and other components of the natural environment;
  - Requirement for an effective and sustainable water use for human being, environment and other sectors.

The implementation of the IWRM shall be carried out jointly and within a cooperation framework of all relevant agencies.

- ***Article 5:*** The MOWRAM is mandated to manage, lead and supervise the implementation of the present law. The MOWRAM shall conduct consultation with other concerned ministries. In case of need, the Royal Government of Cambodia shall set up a joint commission for addressing and coordinating works and activities among the Ministries concerned.
- ***Article 11:*** Every person has the right to use water resources for his/her vital human need including drinking, washing, bathing and other domestic purposes including watering for animal husbandry, fishing and the irrigation of domestic gardens and orchards, in a manner that will not affect other legal right of others. Amount not exceeding that necessary to the fore-mentioned uses are not subject to the licensing.
- ***Article 12:*** The diversion, abstraction and use of water resources for purposes other than those mentioned in Article 11, and the construction of the waterworks relating thereto, are subject to a license or permit.

The formality for license application shall be provided for by the Government sub-decree.

The extraction of sand, soil, stones, gravel, petroleum and gas from the beds and banks of watercourses, lakes, canals and reservoirs is also subject to licensing. The technical hydrological formality shall be detailed in the Government sub-decree. .

The filling of river, tributary, stream, natural lakes, canal, and reservoirs shall subject to license or written authorization. Its formality shall be provided for in the Government sub-decree.

The diversion of water from the Kingdom of Cambodia territory shall be permitted and agreed by the Royal Government of Cambodia with due ratification by the legislative bodies.

- ***Article 14:*** Prior to granting water use license to any person, the MOWRAM shall consult with the other agencies and the local authorities concerned on the water utilization and the construction of waterworks proposed by the applicant.
- ***Article 22:*** The discharge, disposal or deposit of polluting substances which are likely to deteriorate the quality of water and to endanger human, animal and plant health shall be subject to water license or authorization.

The fore-mentioned polluting substances and the technical standards for handling them shall be determined by the Government Sub Decree.

In performing this Article, the MOWRAM shall consult with the concerned ministries.

- ***Article 23:*** The MOWRAM may declare contingency or protected "water use" zones in the following cases:
  - when surface or underground water sources seriously affect their quantity, quality or ecological balance;
  - when watershed is degraded by human activities or natural cause;
  - When water is hazardous to the people health.

The geographical scope of such zones shall be established on a case-by-case basis by way of the MOWRAM regulations.

- ***Article 32:*** All disputes relating to the establishment and operation of servitude in water use shall be mediated by the MOWRAM, and other Ministries concerned and Local Authorities.
- ***Article 35:*** The Royal Government may grant a reward or incentives to those who engage in research on, or the development of, new technologies, installations of modern equipment, that will contribute to the reduction of waste and improvement in water quality, and increase water use efficiency.

The criteria and modalities for the granting of rewards or incentives shall be defined by the MOWRAM regulations.

- ***Article 38:*** In addition to the provisions in the preceding Articles, the perpetrator shall remove all kinds of works constructed in violation of this Law, and to repair and restore the status quo of the sites, and all equipments and machinery will be confiscated as the state property.
- ***Article 40:*** All legal provisions inconsistent with this Law are hereby repealed.

3.6 LAW ON FISHERY, 2006

This law was adopted on March 30, 1997 by the National Assembly of the Kingdom of Cambodia during the 4th session of its third legislature, and promulgated due to Preah Reachrom no. ns/ rkm /0208/007, Enacted on February 15, 2008 which related to the project as below:

- ***Article 1:*** This law aims to ensure fisheries and fishery resource management, enhance aquaculture development, the management of production and processing, and to promotion the livelihood of people in local communities for the social-economic and environmental benefits, include the sustainability of the conservation of biodiversity and natural culture heritages in the Kingdom of Cambodia.
- ***Article 2:*** This law extends the implementation to all fisheries whether it is natural, artificial and aquaculture.

The state ensures the rights on traditional use of fishery resources for local communities under the regulations of this law or other related law.

- ***Article 3:*** The fishery management shall be under the jurisdiction of the Ministry of Agriculture, Forestry and fisheries.

The management of Riverside vegetation and mangrove forest which cohere to lifecycle of fishery resources shall be under the extent of this law.

The state provides the management rights of natural protected areas to the Ministry of Environment under regulations of the law on the establishment and delimitation of natural protected areas, and the law on environmental protection and natural resources management and other legislative norms.

The Ministry of Agriculture, Forestry and Fisheries has right to cooperate in law enforcement to all illegal fishing activities, which happened in natural protected areas by coordinating with the Ministry of Environment according to the regulation stipulated in chapter 14 of this law. These activities will not affect the management competency of the Ministry of Environment as stipulated in the law on environment protection and natural resource management.

- ***Article 4:*** Fishery resources include inter alias any freshwater and marine organisms, living or non-living fauna and flora for example fish, mollusk, amphibian, insect, reptile, mammal and other invertebrate that get fertilized in water, plankton, seaweed, sea grass, coral reef, Riverside vegetation including mangrove etc.
- ***Article 22:*** Disposing, discharging, dumping or littering toxic substances (solid or liquid) in fishery domain, which were determined by law and other juridical legislations of the Kingdom of Cambodia, and Conventions or agreements, or any activities that cause toxic or harm to aquatic animals shall be prohibited.

3.7 LAW ON TRAFFIC, 2006

The law is adopted by the National Assembly of the Kingdom of Cambodia on 20th December 2006 on the fifth National Assembly Meeting session of the third legislature, and promulgated:

- ***Article 1:*** Driving of all kinds of vehicles in the Kingdom of Cambodia has to be adhered to the right- and side.

All vehicles, which are moving along the roads, MUST have drivers.

- ***Article 5****:* In order to carry out the traffic law, the following terms have to be defined:
  - The word "Road" refers to the whole size of the trunk/torso of the road and the roadsides
  - The word "Trunk of the road" is part of the road left for all kinds of vehicles to traffic.
  - Roadsides are parts of both sides of the trunk of the road located outside the cities and towns (densely populated area) and that it can be parked if necessary
  - Sidewalks are the roadsides in cities or towns, which are prepared for pedestrians. The sidewalks are not allowed for vehicles to park.
  - The word "Traffic lane" is part of the road separated by dotted or long lines along the road, with enough width for all kinds of vehicles to traffic in one row.
  - The word "Town" refers to the place where buildings or houses are closely constructed with each other, and that the exit or entrance there are placed with the signs or names of cities or towns to show the entry or the name of cities or towns with the red lines to show the exit from cities or towns via roads and with many people trafficking.
  - The word "junctions" refers to the places where two or more roads are converged with one flat and are not defined by the angle of the axis of the road. The junctions have different shapes such as **+, X, T, Y or roundabout** etc.
  - The word "Roundabout" refers to the junctions of two or more roads, and that in the central part, it has the terrace or sculpture or other monuments and has one-way road surrounded with arrow signs for traffic direction.
  - The word "public road" refers to the roads offer for public trafficking.
  - The word "private road" is the road built by private, which is divided into two following species:
    a) The private road for public traffic is the road, which is open for general traffic and isbuilt or repaired by the private in accordance with the contract with the state.
    b) The private road, which is not open for public traffic, is the road preserved for the work in any compounds of the house, factory, enterprise, building, or square.
  - The word "trail" refers to the land road connecting national/provincial roads to villages or communes in rural areas
  - The word "Stop" refers to the state of motionlessness of vehicles on the road for a necessary moment in which the driver is still in or nearby the vehicle in order that the passengers or other vehicles pass by or stop for loading and unloading goods or passengers.

- The word "Parking" refers to the leaving of vehicle in the state of motionlessness in long or short period in which the driver can leave the vehicle alone.
- The word "Driver" refers to the person who commands vehicle including the animal rider, animal carrier on the road.
- The word "Vehicle" refers to the vehicles for transporting/carrying people or goods on the rood or for towing or is towed by the other.
- The word "Motor vehicle" refers to any vehicles with machine, which traffic on the road, such as motorbikes, tri-wheel motorbike, cars, tractors, and other tools equipped trucks.
- The word "tools equipped trucks" refers to the special trucks equipped with additional mechanical tools without loading any persons or goods out of its driver's room such as the cement mixing trucks or any trucks serving for the construction of roads, bridge etc.
- The word "road user" refers to the vehicle drivers or any pedestrians who are travelling on the roads.
- The word "net weight" of vehicle refers to the purely weight of vehicle regardless of human or goods weights but with fuels to support engines, repairing tools and the spare tires.
- The word "Maximum loading weight" of vehicle refers to the sum of loading weights of both human and goods which was defined by factories manufacturing the vehicle.
- The word "Total maximum weight" of vehicle is the sum of the net weight of vehicle and the maximum loading weight of the vehicle. If the vehicle has the cart, the total maximum weight of the vehicle is the sum of total maximum weight of each vehicle (weight of vehicle plus weight of cart)
- The word "Total permitted maximum weight" of vehicle is the sum of the net weight of the vehicle with the weight of human or goods loads. If the vehicle has the cart, the total permitted maximum weight of the vehicle is the sum of total maximum weight of each vehicle.
- The word "Total actual weight" of vehicle is the sum of net weight of the vehicle with the actual weight of human and goods loads.
- The word "Remorque or cart" refers to the vehicle which is towed by the motor vehicle.
- The word "Semi-Remorque" refers to the vehicle which is towed with the motor vehicle engine.

- ***Article 6:***Traffic signs comprise of the signs placed along the roads, traffic lights and traffic lanes on the roads, the traffic direction of the traffic agents and other signs. The traffic signs, traffic lights and traffic lanes on the roads are arranged in a coherent system at the important places to make it easier for the roads users. The impermanent danger signs along the roads are placed in an appropriate distance according to the type of roads, rank of road and the condition of road for which the drivers can be able to take precaution. Sticking papers or other things or drawing on the traffic signs or using the traffic sign supporting frames or other things used as the traffic signs are prohibited as these acts would cause the driver(s) from seeing the traffic signs clearly or understand the meaning of the traffic signs improperly, or for they would blind the driver's eyes. The pictures and meaning of the land traffic signs are defined in Prakas (regulation) of the Ministry of Public Works and Transport.
- ***Article 7:*** The direction signs of the traffic police are as follows:
  - The right hand raised up in the air with the palm opened straight to the vehicles that aremoving toward the traffic police as the precaution signs to a stop except any drivers who cannot afford to stop safely can go ahead.
  - Two hands or one hand are or is stretched along the shoulders, means to stop the vehicles that are moving toward the traffic police or coming behind the traffic police.
  - In the same gesture, the vehicles that are moving from the left or right hand sides of the traffic police are allowed to pass through.
  - When the traffic police carry a red light lamp or a red light stick to point to any vehicles, it means to stop that vehicle from moving.
  - The traffic police can use a whistle instead of the above body signs.
- ***Article 8:*** The levels of priorities are defined as follows:

1. The traffic signs have the priority over the traffic regulations.
2. The traffic lights have the priority over the traffic signs.
3. The direction signs of the traffic police have the priority over the traffic lights, the traffic lanes on the roads, the traffic signs along the roads, and the traffic regulations.

- ***Article 9:*** The drivers of all kinds of vehicles should implement and follow the following measures:

1. All drivers who drive the vehicles with the cylinder size from 49 cm3 upward must obtain the driving licenses according to the species of vehicles.
2. When driving, the drivers must always be precautious and that they should be in the easy-to-drive situation and fast particularly the possibility to move without any disturbances. Passengers, goods or other things loaded must not block the drivers' sight.
3. The drivers and passengers who sit at the front seats of the vehicles must wear the safety seat belts.
4. The drivers who drive motorcycles, tricycles and the motorcycles with trailers/Remorque must wear safety helmets.
5. No passengers or goods are allowed to load in front of the driver.
6. Children under 10 years are not allowed to sit in the front seats of vehicles without the accompanying adults or without wearing the seat belt.
7. Babies under 10 months of age must put inside the baby seat and wear with the safety belt tied firmly to this baby seat with the car's backseat.
8. Children in the age of 10 months up to 4 years must sit in the baby seat with the safety belt tied up to this seat to the backseat of the car.
9. No interruption to the road side residents and the road users.
10. The drivers are prohibited from drinking the liquor with the alcoholic rate from 0,5 mg per liter of gas or from 0,25 mg per liter of blood.
11. The vehicles with caterpillar tracks are banned from being driven on the roads. These kinds of vehicles must be transported on the vehicles with rubber tires.
12. Telephones are banned from being operated during driving. The telephones can be operated when they are connected to the communication equipment, or the drivers must stop the vehicles to operate the telephones.

- ***Article 10:*** On the roads with two traffic directions without the traffic lane, the drivers must use the middle part of the roads on the right hand side and keep driving on the right hand side. On the roads with one traffic direction without the traffic lane, the drivers must drive on the right hand side except when turning left. The drivers can only use the middle part of the roads on the left – hand side when overtaking or stopping. But in the densely-populated areas, the use of the middle of the road shall be determined by the direction of the Ministry of Public Works and Transport.
- ***Article 12****:* When the traffic light indicates in yellow, it is the sign to prepare to stop or to go forward, When the traffic light is green, it is the sign to depart. When the traffic light is red, it is the sign to stop. When the traffic light is red, it is the sign to stop, the drivers must stop in front of the white zebra lines crossing the width of the roads or in front of the lines assigned for pedestrians, If there is no obstacle a head, the vehicles on the most right hand side can turn right at the red light corners where there are signs to allow turning right.
- ***Article 14****:* The drivers must not drive side by side on the roads or the same path of the roads. The drivers must not drive passing through the military or police convoys or other kinds of convoys.
- ***Article 17:*** The driving speeds of vehicles are defined in accordance with the conditions as follows:

1. The driving speeds for vehicles in general:

A. In towns:

- The drivers of all motorcycles and tricycles must drive in the maximum speed of 30 km per hour
- The drivers of all kinds of cars must drive in the maximum speed of 40 km per hour

B. Outside towns:

- The drivers of all kinds of vehicles must drive in the maximum speed of 90 km per hour, except for the trucks with the net weight of over 3.5 tons is limited with 70 km per hour and the maximum speed of the vehicles with trailers is limited with 60 km per hour

2. The driving speeds for the vehicles loading with dangerous substances:

A. In towns:

- The drivers of motorcycles or tricycles must drive in the maximum speed of 30 km per hour.
- The drivers of vehicles must drive in the maximum speed of 40km per hour.

B. Outside towns:

- The drivers of the vehicles must drive in the maximum speed of 70km per hour for the vehicle with net weight not over 3.5 tons and vehicles with net weight over 3.5 tons using the braking system to hold the tires from stiffness.
- The maximum driving speed of the vehicles with the maximum net weight of over 3.5 tons is 60 km per hour only those vehicles without the braking system to hold the tires from stiffness.

3. The driving speeds for the vehicles driving on the motorways:

A. In towns:

- The drivers of all species of vehicles must drive in the maximum speed of 60km per hour.

B. Outside towns:

- The drivers must drive in maximum of 100 km per hour for all species of vehicles, except for the trucks with maximum net weight over 3.5 tons will be limited to 80km per hour and that the vehicles with trailers will be limited to 70km per hour in the maximum.

4. Driving speed for vehicles with priorities:

- The regulations stated in Point 1 and 2 of the Article do not apply to the drivers who drive the police, military, military police vehicles, fire engines, ambulances, and some other vehicles equipped with sirens and special light signs on duty.
- The drivers must not drive in an abnormally slow speed without proper reasons because it disturbs other vehicles. The drivers who drive in a slow speed must stay on the right hand side by leaving the other drivers who drive in a high speed to be able to overtake easily on the left hand side. Any drivers who are forced to slow down in an abnormal manner must alert the other drivers by using emergency light signs and keep driving on the most right hand side of the roads.

- ***Article 19****:* A vehicle moving behind another vehicle must keep an adequate safety distance to avoid crashing with the front vehicle when it slows down or stops unintentionally. When driving in a higher speed, this kind of safety distance must be kept as far as possible. When driving in a row and in the same speed outside towns, all vehicles with the maximum net weight over 3.5 tons or with the length over 7 m must keep a distance from one vehicle to another at least 50 m.

- ***Article 21:***

Passing:

1. The drivers of all kinds of vehicles must pass each other by keeping driving on the right hand side respectively.
2. Before passing each other, both drivers must feel confident that the move does not lead to any danger.
3. To pass each other, the drivers must drive on the right hand side respectively by leaving the paths of the roads on the left hand side unoccupied as big as possible.

4. When passing each other at the narrow roads or the roads that could lead to danger, the drivers must slow down their vehicles respectively. If it is necessary, both vehicles must stop. If the two vehicles are in the same type, the vehicle that wants to go first must give a request signal by raising the hand up in the air or by honking during the daytime and using the low and high beams as a signal at nights and then wait until the vehicles coming from the opposite give a signal of approval before starting to go first. But if the vehicles are in the different type, the drivers of the bigger vehicles must leave the paths of the roads to allow the smaller vehicles to go first. 5. When passing each other at the narrow roads that are accessible only for one vehicle and there is a place that can be used to pass each other, the vehicle that arrives first at the place must stop and wait in order to allow the other vehicle to pass easily.
6. In case the paths of the roads are very narrow and the vehicles cannot pass each other and one of the vehicles is required to go backward, the drivers must act as follows:
   A. for the vehicles that are in the same type, any vehicle that wants to go first must give a requested signal and that it is agreed by the other vehicle to go backward.
   B. for the vehicles without and with trailers, the vehicles without trailers must go backward.
   C. for the light and heavy vehicles, the light vehicles must go backward.
   D. for the goods loading vehicles and passenger vehicles, the goods loading vehicles must go backward.
7. When passing each other at the slope and narrow roads, the vehicles going down the slope must stop and allow the vehicles going up the slope to go first.
8. When passing each other, if any vehicle drivers see that there is an obstacle ahead such as the road is damaged or a vehicle is stopping, that vehicle must stop and allow the other vehicles to go first.
9. On the narrow bridge that is accessible only one vehicle, the heavy vehicles must allow the light vehicles to go first.
10. Before passing each other at nights outside towns without lights along the roads, the two vehicles must turn off the high beams and turn on only the low beams.

- ***Article 24**: Stop and park on public road:*

1. All kinds of vehicles or animals that stop or park have not to make problem to the other vehicles, which are making the traffic.
2. in town, all kinds of vehicles have to stop or park along the traffic direction that they are trafficking by implementing the regulation as following:
   A. on the road with two traffic directions, the drivers of vehicles have to stop or park on the right hand side in accordance with their traffic direction.
   B. on the one-way road, vehicles have to be stopped or parked in the right or left hand side along with the traffic direction except having the opposite sign.
3. Outside town, the vehicles or animals have to be stopped or parked outside the middle lane if it is possible. If there is no place for parking besides the middle lane, the drivers have to carry out the regulation, which is provided in point 2 of this article.
4. At night or at the place where there is "no stopping/parking" signs, all vehicles and carts, which are malfunctioned or which are forced to stop or park on the middle lane, have leave the signs in the appropriate distance for information for other road users.
5. In town, the vehicles have to be stopped or parked for carrying or loading or unloading goods or passengers not beyond 25 centimeters from the sidewalk and at least 5 meters from the junction or interjection or the curved road and at least 10 meters in between the junctions or intersections or the curved roads of the boulevard. When outside town, all vehicles have to be stopped or parked at least10 meters away from the junctions or intersections or the curved roads.
6. For the parking, before leaving the vehicle, the drivers have to put handbrake or other measures to prevent the eventual accident from occurring while they are absent.

7. Parking or stopping the vehicles or animals is prohibited in the following cases:
   - On the middle lane and sidewalk preserved for pedestrians and leave at least 5 meters away from the crossroad sign for pedestrians or on this line.
   - On the place preserved for some kinds of vehicles parking or stopping.
   - Between the edge of the middle land of the road and dotted line land, if in between the lines and the parked vehicle is less than 3 meters which does not enable another vehicle to pass through without crossing the long line.
   - Near the pole of traffic light or traffic signs, that prevents the road users from seeing these traffic signs.
   - In all the places where the vehicles block the entrance or the parking of others vehicles.
   - On the bridge, underpass, underground road, steep road, junction road, on the road crossing the railway, roundabout, curved road in which others vehicles cannot be seen from the distance.
   - Less than 20 meters in front of the road crossing the railway.
   - Less than 10 meters between the front and the rear pump station of the fire engine and in front of fire engine station
   - On the entrance and exit of public building.
   - In front of the entrance and exit of private house except the vehicle of house's owner.
   - In two parallel lines.
   - On the edge of the middle of the road if another opposite edge is left for parking of vehicle except in the case that the vehicles can park on both sides.
   - At the place where there are no parking/stopping signs.
   - On the public road beyond 72 hours.
   - Less than 10 meters between the front and the rear of the bus stop sign.
   - Less than 1 meter between the front and the rear parking vehicles or the long row of the parking vehicles
   - Near the junction road or turning road.

- ***Article 25:*** Opening the vehicle's door to get off or in can be conducted when it does not cause the accident to the others who are using the same road and have to pay attention constantly, especially to the opening of the left door when get off or in.

- ***Article 28:*** At night or day time, when could not see clearly such as during the heavy raining, fogging, or passing through underground road, the drivers on the road have to use vehicle light as following conditions:

1. In case in the time of driving the vehicles:
   A. Far-light (high beam) light is generally used at night time on the road without electric lamps, to look far ahead but the driver has to be careful not to interfere with other vehicles coming in opposite direction. The far-light is prohibited to turn on in city or town where there is enough light of electric lamps, except in the case of giving signal for overtaking or making way by using both high and low beams.
   B. Low beam light is used in the following cases:
      - At night time inside and outside towns where there is light of electric lamps on the road
      - At night time outside town where there is no light of electric lamps on the road, in the case of being about to pass another vehicle, and when driving close after another vehicle.
      - At day time when could not see clearly due to bad weather such as heavy rain or foggy.
      - Normal light (low beam) can be used alternatively with far-light (high beam) as the signal to replace the horn at day time

C. Location light: At night time in town, all vehicles, which are being driven, at least have to have the location lights without using normal light (low beam light) if there is enough light of electric lamps on the road. The location light is used for indicate the presence of vehicle and the size of the vehicle to other road users in opposite direction.

D. Other lights: At night or day time when the weather is not good and cannot see clearly ahead, the drivers have to use:

- Red light: To tell the presence and width size of vehicle to users who look from back side
- Number plate light: To let the other see the number plate of the vehicle clearly from the back side
- Width light of vehicle: To indicate the width of vehicle or other loadings to other road users
- Sidelight (or traffic indicator light): To inform other road users when changing direction to left or right
- Reversing light: To inform other road users behind the vehicle when it moves backward
- Stopping light: To inform other road users behind the vehicle when braking to slow down or stopping the vehicle
- Emergency light: To inform other road users about accident, which might occurs, for example, when the drivers are forced to drive the vehicles slowly due to the towing of the broken vehicles or when loading heavy objects at night time or parking on the road outside town because the vehicles were broken or related to accident or because of the dropping of goods that cannot be re-loaded immediately.
- Foggy light: is used when there is fog or heavy rain. Foggy light can be used instead of the normal light (low beam) light or in addition to the normal light.

2. In the case of driving vehicles, which are not the motor vehicles, drivers have to carry out the following regulation:

- The human-driven cart must equipped with lights or white or yellow reflectors in the front end and the lights or the red reflector in the back. The two lights must put in the corner facing the road.
- The animal-driven cart must equipped with lights or two white or yellow reflectors in the front corners in both sides and also must equipped with lights and two red reflectors in the back corners in both sides.
- The bicycle and tricycles must equipped with lights or at least with one white reflector in the front end and at least have one red reflector or red light in the back.
- The trailer/remorque driven by motorcycle or bicycle must equipped with the reflector or two red lights placed in the two sides of the back corners.
- This kind of vehicle must park or stop in row close to the roadside

3. In the case of stopping or parking motor vehicles on the road, which has no public electric lamps, the drivers have to use:

- Location light: To inform other road users from the opposite direction about the presence and the width size of the vehicle
- Red light: To inform other road users from the back about the presence and the width size of the vehicles
- Number plate light: To let other road users behind the vehicles to see the number plate clearer. In town, the use of light, which is provided in this article, will not be necessary if there is the light of electric lamps on the road with enough light, which enable the road users to see the vehicles clearly from a proper distance.

4. In the case of parking the trailers or semi-trailers which were disconnected from the vehicles, it has to be parked near sidewalk or roadside and must use the white or yellow lights in front of vehicle and one red light in the back of vehicle. Each light has to be placed at the corner of the cart facing to the road that the trailers are parked along in rows.

In town, the use of this light is not necessary if there is enough light of electric lamps on the road that other road users can see the parked vehicles on the road from a proper distance.

5. In case the vehicles are forced to stop or park on the road, which can provoke obstacle or traffic accident such as near junction road, turning road, curved road, steep road, and road crossing railway, as because of the vehicles did not work or related to the traffic accident and cannot be removed from the road, the drivers have to inform other drivers about the obstacle by using emergency light or placing triangular sign at least 30 meters behind the vehicles. For vehicles dropping goods on the road, which cannot be re-loaded immediately, the drivers have to make the sign or inform other drivers by using triangular sign simultaneously with emergency light or at least using any triangular sign by placing 30 meters from the dropped goods.
6. For vehicles used for police, military or military police, fire engines, and ambulances, the drivers have the right to use special light all the times.

- ***Article 35:***
  - All traffic accidents are under the competency of the traffic police.
  - Every time when having traffic accidents, the traffic police must try their best to:
    1. Keep the public order at the accident scene.
    2. Take immediate action to save the victim
    3. Take the skilful action to collect the evidence and information to make the statement on the traffic accident.
    4. Maintain security for all related parties
    5. Record all identities and addresses from all involved parties
    6. Settle the dispute caused from the traffic accident in accordance with the stipulated law.
- ***Article 38:*** In case people are getting injuries or killed, the drivers or other road users involved in the accident or the by-standers shall do as the following:
  1. Must report immediately to the nearby local authorities or the traffic police.
  2. Must prepare the information or refer the victims to the nearby hospital. Denials from the drivers of all species of vehicles to the referral request are not accepted if inappropriate reasons are raised.
  3. To collaborate in ensuring the security to all related parties and to the process of the traffic movements around the accident site.
  4. Avoid changing of the accident site or loss marks or tracks which is very useful leading to the finding of person responsible for the accident.
  5. Keep waiting at the accident site until the arrival of the traffic police. The accident provokers are not allowed to leave the place before obtaining the permission from the traffic police.
- ***Article 51:*** All automobiles, trailers, or semi-trailers doing transportation business shall obtain the permission letter issued by Ministry of Public Works and Transport.

The permission letter for transportation business is valid for one year. The owners of the vehicles shall extend the validation for every year; it shall be fined if found of being late. Ministry of Public Works and Transport shall issue the detailed Prakas on the issuance of permission letter to the Transportation Companies.

- ***Article 52:*** While transporting, each vehicle shall obtain the documents issued by Ministry of Public Works and Transport and the concerning institutions as follow:

  a) Vehicle identification card, and number plate;

  b) The correct driving license with the type of vehicle;

  c) Certificate of technical check up of the vehicle;

  d) Permission letter allowing the vehicle to do transportation business;

  e) Permission letter allowing to do transportation business;

f) Insurance card issued by insurance company;

g) Other permission letters issued by other competent institutions.

- ***Article 54:*** Carrying goods on vehicle shall not exceed maximum weight of the sustaining axles and shall not exceed the limited by the company producing the vehicles and shall not be over permitted weigh as follow:

1. Maximum weight on the sustaining axle of automobile, trailers or semi-trailers is limited as fallow:
    - 6 tons for single axle with two wheels under the steering wheel;
    - 11 tons for twin axles with four wheels under the steering wheel;
    - 10 tons for single axle with four wheels;
    - 19 tons for twin axles with eight wheels;
    - 24 tons for triple axles adjacent to each others with twelve wheels.
2. Permitted maximum total weigh of automobile is defined as follow:
    - 16 tons for automobiles with twin axles which one axle is located in the front of the automobile with two wheels, and the other one located in the back with four wheels.
    - 25 tons for automobile with triple axles as one axle is located in the front of the automobile where there are two wheels and the twin ones located in the back of the automobile where there are eight wheels.
    - 30 tons for automobile with four axles as twin ones are in the front of the automobile where there are four wheels and the other two axles are in the back of the automobile where there are eight wheels.
3. Limitation of permitted maximum total weight of automobile with trailers shall be defined as follow:
    - 40 tons for automobile with trailers having five axles onward.
4. Limitation of permitted maximum weight of automobile with semi-trailers shall be defined as below:
    - 35 tons for automobile with semi-trailers having four axles as a single axle is located in the front of automobile where there are two wheels and the other single axle in the back of the vehicle where there are four wheels and the twin axles of the semi-trailers with eight wheels.
    - 40 tons for automobile with semi-trailers having five axles onward.

The total weighs of the automobile and the trailers or semi-trailers which are not included in points above shall be asked for permission letter from Ministry of Public Works and Transport.

When crossing the bridges, all drivers of automobiles, automobile with trailers, or semitrailers shall obey the permitted-maximum-weight signs put in front of the bridges.

The size of automobiles, automobiles with trailers or semi-trailers with no loading shall be defined as below:

- Maximum width of the vehicles shall not exceed 2.5 meters except vehicles equipped with tools should not be more than 3 meter width
- Maximum height should not be higher than 4.2 meters
- Maximum length of each automobile shall not exceed 12.2 meters
- Maximum length of the automobiles towing semi-trailers shall not exceed 16 meters
- Maximum length of the automobiles towing trailers shall not exceed 18 meters. Technical standard of size and weight of other species of vehicles shall be defined by Prakas of Ministry of Public Works and Transport.

3.8 LAW ON LAND, 2001

The land Law which was passed by the National Assembly of the Kingdom of Cambodia on July 20, 2001 during the sixth session of its second legislature, and its legal substances by the Senate on August 30, 2001 during the sixth session of its second legislature:

- ***Article 1:*** This law has the objective to determine the regime of ownership for immovable properties in the Kingdom of Cambodia for the purpose of guaranteeing the rights of ownership and other rights related to immovable property, according to the provisions of the 1993 Constitution of the Kingdom of Cambodia.
- ***Article 3:*** All persons shall respect the property of the State and legally acquired private property. The management of the cadastral administration of immovable property belonging to the State and the competence to issue titles related to immovable property throughout the Kingdom of Cambodia are under the authority of the Ministry of Land Management, Urban planning and construction.

The regulations and procedures for the administration of State immovable properties will be determined by sub-decree.

- ***Article 5:*** No person may be deprived of his ownership, unless it is in the public interest. An ownership deprivation shall be carried out in accordance with the forms and procedures provided by law and regulations and after the payment of fair and just compensation in advance.
- ***Article 7:*** Any regime of ownership of immovable property prior to 1979 shall not be recognized.
- ***Article 30:*** Any person who, for no less than five years prior to the promulgation of this law, enjoyed peaceful, uncontested possession of immovable property that can lawfully be privately possessed, has the right to request a definitive title of ownership.

In case the granting of a definitive title to ownership is subject to an opposition, the claimant has to prove that he himself fulfills the conditions of peaceful, uncontested possession for no less than five years over the contested immovable property or to prove that he purchased the immovable property from the original possessor or his legal beneficiary; or from the person to whom the ownership was transferred, or from their successors.

- ***Article 42:*** Notwithstanding the foregoing, any person who, due to ignorance or negligence, failed to register his possession has the right to the protections of Article 29, Article 30, and Article 31 of this law.
- ***Article 43:*** In no case can the public property of the State be the subject of acquisition of ownership. The situation of an occupant of State public property remains precarious and illegal if such occupation was not authorized in the manner determined by this law.

An illegal occupant shall be forced to vacate the premises immediately and shall be punished in accordance with Article 259 of this law.

An illegal occupant is not entitled to any indemnity for any works and improvements carried out on the immovable property.

- ***Article 58:*** A land concession can only be granted on lands that are part of the private property of the State.

The land concession may not violate roadways or transportation ways or sidewalks or their borders and the ground necessary for their maintenance, nor to waterways, pools, ponds and water reserves to be used by the people in their daily lives.

- ***Article 59:*** Land concessions areas shall not be more than 10,000 hectares. Existing concessions which exceed such limit shall be reduced. However, if such reduction would result in compromising the exploitation in progress, a concessionaire may obtain a specific exemption. The procedures for reductions and specific exemptions shall be determined by sub-decree.

3.9 LAW ON LABOR, 1997

This law was adopted on January 10, 1997 by the National Assembly of the Kingdom of Cambodia during the 7th session of its first legislature, and promulgated on March 13, 1997:

- ***Article 229:*** All establishments and work places must always be kept clean and must maintain standards of hygiene and sanitation or generally must maintain the working conditions necessary for the health of the workers.

The Ministry in charge of Labor and other relevant ministries shall prepare a Prakas (minis trial order) to monitor the measures for enforcing this article in all establishments subject to the provisions of this Chapter, particularly regarding:

- The quality of premises;
- Cleaning
- Hygienic arrangement for the needs of personnel;
- Beverages and meals;
- Lodging of personnel, if applicable;
- Work stations and the seating arrangements;
- Ventilation and sanitation;
- Individual protective instruments and work clothes;
- Lighting and noise levels in the workplace.

- ***Article 230:*** All establishments and workplaces must be set up to guarantee the safety of workers. Machinery, Mechanism, transmission apparatus, tools, equipment and machines must be -installed and maintained in the best possible safety conditions. Management of technical work utilizing tools, equipment, machines, or products used must be organized properly for guaranteeing the safety of workers. The Prakas covered in Article 229 shall also determine the measures for enforcing this article, particularly regarding:
  - Risks of falling ;
  - Moving heavy objects;
  - Protection from dangerous machines and apparatus;
  - Preventive measures to be taken for work in confined areas or for work done in an isolated environment;
  - Risks of liquids spilling;
  - Fire prevention.
- ***Article 246:*** The ministry in charge of Labor and the Ministry of Health shall issue a joint Prakas to determine:
  - a- the organization and operation of the labor health services;
  - b- the minimums time that the labor physician must devote to personnel at the establishments in question based on the size of their work force and the nature of their activities, as well as the physician' s mandatory tasks;
  - c- The frequency and the content of the reports to be filed by the manager of the enterprise or by the representative of inter-enterprise services with regard to the organization, operation and financial management of the health service.
- ***Article 248:*** An accident is considered to be work related, regardless of the cause, if it happens to a worker working or during the working hours, whether or not the worker was at fault; it is the accident inflicted on the body of the worker, or on an apprentice with or without wage, who is working in whatever capacity, or whatever place for an employer or a manger of an enterprise.

  Equally, accidents happening to the worker during the direct commute from his residence to the work place and home are also considered to be work- related accidents as long as the was not interrupted nor a detour made for a personnel or non-work-related reason. All occupational illness, as defined by law, shall be considered a work-related accident and shall be remedied in the same manner.
- ***Article 249:*** Managers of enterprise are liable for all work-related accidents stipulated in the Article above regardless of the personal status of each worker.

The same liability applies:

- Directors of private hospitals, but solely for the personnel they employ
- Professionals, solely for their employees
- Craft shops, only for workers other than the wife and the children of the craft man
- Properly owners, only for their domestic workers
- Agricultural enterprises, for their workers

Apart from categories expressly mentioned in the preceding paragraph, any person who engages the services of a worker for a specific, occasional worker is required to make reparation for accidents that victimized the worker during the work.

- ***Article 250:*** Every manager of enterprise shall manage or have someone take all appropriate measure to prevent work-related accidents.

3.10 LAW ON THE PROTECTION OF CULTURAL HERITAGE, 1996

The Law on the Protection of Cultural Heritage adopted on 25 January 1996 by the National Assembly during the fifth session of its first legislature, which reads as follows:

- ***Article-1:*** The purpose of this law is to protect national cultural heritage and cultural property in general against illegal destruction, modification, alteration, excavation, alienation, exportation or importation.
- ***Article-2:*** The national cultural heritage comprises cultural property created or discovered on national territory.
- ***Article-3:*** This law shall apply to movable and immovable cultural property, whether publicly or privately owned, whose protection is in the public interest.

  Except as otherwise provided elsewhere in this law, it shall apply only to cultural property that forms part of the national cultural heritage.
- ***Article-4:*** For the purposes of this law, cultural property is considered to be any work produced by human agency and any natural phenomenon of a scientific, historic, artistic or religious nature which bears witness to a certain stage in the development of a civilization or of the natural world and whose protection is in the public interest.

  Specific cultural property is to be registered by *Anukret*.

3.11 LAW ON LAND MANAGEMENT, URBAN PLANNING AND CONSTRUCTIONS, 1994

This law was adopted on May 24, 1994 by the National Assembly of the Kingdom of Cambodia, and promulgated on August 10, 1994:

- ***Article 4:*** All documents related to the Land Management, Urban Planning and Construction shall be classified according to each specific case, and according to the particular conditions of the land of each province, municipality and region, in the spirit of protecting the patrimony, environment and protecting natural resources as well as development of the economy.
- ***Article 5:*** The Committee for Land Management, Urban Planning and Construction of Phnom Penh or the Sub-Committee for Land Management, Urban Planning and Construction of each province and municipality, shall respectively draw up their own development master-plans for the re-organization and development of their respective city, province and municipality. Such master-Plan shall be approved by the National committee for Land Management, Urban Planning and Construction and shall be determined by a Sub-decree.

In order to protect the patrimony and the environment, and to assure the economic development of any particular region specified by the Council of Ministers, the National Committee for Land Management, Urban Planning and Construction, shall have duty to prepare a specific master-plan for such special region and submitting it to the Council of Ministers for approval.

- ***Article 7:*** Land use master plan shall be clearly indicating the area to be allocated for national defence, agriculture, commerce, industry, handicraft, culture, tourism, religion, and

administrative buildings and public facilities. These plans shall also specify of the possibility for construction.

- ***Article 8:*** Land use master plan shall comply with the development master-plans as stated in the article 5 of this law.
- ***Article 9****:* Land use master plans for each capital city, province and municipality, shall be first approved by the Committee for Land management, Urban Planning and Construction of the Capital City, or from the Sub-Committees for Land Management, Urban Planning and Construction of each province or municipality, and shall be approved subsequently by the National Committee for Land Management, Urban Planning and Construction. Private entities and public authorities shall strictly adhered to such master plan.
- ***Article 11:*** All the explorations or surveys which produce and effect on archaeology, shall be firstly authorized by the Royal Government.

In every construction process, in case encouraging any object which give value or advantages in archaeological or history, the supervisor of the construction shall be obliged to report to competent authorities. After receiving the report, the competent authority has to immediately stop such construction.

- ***Article 13:*** The work of construction and settlement shall be conducted in obedience with all documents relating to the organization of territory, urbanization and construction and to the master plans mentioned in the Article 4 and 5 of this Law.
- ***Article 14:*** All construction and modifying or renovations of the building aspect shall be subjected to construction permission issued by the competent authorities.

The necessary documents and plan shall be attached with the application for construction permit. The implementing procedure of this article shall be determined by a sub-decree.

3.12 ROYAL-DECREE ONTHE ESTABLISHMENT AND MANAGEMENT OF TONLE SAP BIOSPHERE RESERVE, 2001

Royal-decree number 0401/070 NS/RKT enacted April 10, 2001 on the Establishment and Management of Tonle Sap Biosphere Reserve. In this sub-decree have object as following:

- ***Article 1:*** Recognizing the unique ecological, environmental, economical, social, and cultural significance of Tonle Sap Lake, a Tonle Sap Biosphere Reserve is hereby established in accordance with the statutory framework of the World Network of Biosphere Reserve.

The Tonle Sap Biosphere Reserve shall fulfill three complementary functions:

a) a conservation function to contribute to the conservation of biological diversity, landscapes, and ecosystem, including genetic resources, plant, fishery and animal species, and to the restoration of the essential character of the environment and habitat of biodiversity;

b) a development function to foster sustainable development of ecology, environment, economy, society, and culture;

c) a logistic function to provide support for demonstration projects, environmental education and training, research and monitoring of environment related to the local, national and global issues of conservation and sustainable development.

- ***Article 2:*** In order to fulfill three complementary functions as articulated in article 1, the Tonle Sap Biosphere Reserve is hereby divided into core areas, a buffer zone and a flexible transition zone. Tonle Sap Biosphere Reserve, including the flexible transition zone is limited within the National Road N5 in the west, National Road N6 in the east, the confluence of National road N5 and N6 (13036'51 N, 103006'32E) in the north, and commune Saeb (12005'06N, 104043'59E), district Kampong Tralach, Kampong Chhnang province in the south. The map of Tonle Sap Biosphere Reserve and coordinates are attached in the annex 1 and annex 2 of the Royal Decree.
- ***Article 3:*** The three core areas are as the following:

1. Prek Toal Core Area is located in Koh Chiveang Commune, Ek Phnom District, Battambang province, and has the area of 21342 ha;
2. Boeng Tonle Chhmar Core Area is located in Peam Bang Commune (Stong District, Kampong Thum province) which has the area of 14,560 ha;

3. Stoeng Sen Core Area is located in Phat Sanday commune (Kampong Svay district, Kampong Thom province) and has the area of 6,355 ha.

The core areas are defined likewise national park or wildlife sanctuary, which are devoted to long term protection and conservation of natural resources and ecosystem, in order to preserve flooded forest, fish, wildlife, hydrological system, and natural beauty. Scientific researches, monitoring, and ecotourism are allowed here in the core areas. Management activities that would cause degradation and destruction of biodiversity are not permitted.

Fishing lots within the core areas of Tonle Sap Biosphere Reserve shall continue to function in accordance with the Fishery Law, while the fishing lot owners must be committed to the long-term conservation objectives as defined above. These fishing lots are then subject to a periodic review every four years and adequate reform in order to be consistent with long term protection and conservation objectives of the core areas.

The family and middle scale fishing located within the core areas shall continue in accordance with the Fishery law by organizing community fishery in order to enable local people to participate in the protection as prescribed by this Royal Decree.

- ***Article 4:*** The buffer zone covers the area of 541,482 ha. Its boundary corresponds to the outer boundary of the Tonle Sap Multiple-Use Area.

The buffer zone surrounding such core areas which are covered by flooded forest of a variety of species. Activities are managed to be consistent to the protection and conservation plan of the core areas. Fishery activities and other development plans will be managed based on existing law and regulations in a co-ordinated and cooperative manner. The buffer zone is also subject to experimental research and discovery of method for the management of flooded forest, fishery, agriculture, housing settlement, land use, water resources, navigation and tourism to ensure their sustainability, increased production, while preserving the environmental quality and fish.

- ***Article 5:*** The transition area covers an area of 899,600 ha, is limited between the outer boundary of the buffer zone and National Road N5 and National Road N6.

The flexible transition area is the integrated economic zone, which is managed for the sustainable agriculture, human settlement and land uses, without having adverse effects on the flooded forest, water quality and soils of the region around the Tonle Sap Lake.

3.13 SUB-DECREES ON ENVIRONMENTAL IMPACT ASSESSMENT PROCESS, 1999

Sub-decree on environmental impact assessment process, number 72ANK, Enacted on August 11, 1999. In this sub-decree is having objective:

- To determine the environmental impact assessment under projects and activities of private or public and it shall be monitored, and evaluated by ministry of environment. Before the royal government agree and approve.
- To determine type and size of projects, activities that it proposed and activities available and under process included private and public in the requirement need environmental impact assessment.
- To emerge public to participate in the process of environmental impact assessment and also got idea from participants for analyses in order to achievement for project progress.

In the annex of Sub-decree no. 72ANK, Enacted on August 11, 1999, described about categorizing that need to do environmental impact assessment that related with this project, it is an exploitation infrastructure no. **4.8 for ≥100Km** size of National Road construction.

3.14 SUB-DECREE ON THE MANAGEMENT THE RESERVED LAND ALONG THE NATIONAL ROAD AND RAILROAD OF THE KINGDOM OF CAMBODIA, 2009

Sub-decree number 197 ANK-BK enacted November 23, 2009 on the Management the Reserved Land along the National Road and Railroad of the Kingdom of Cambodia. In this sub-decree have object as following:

- ***Article 1:*** The goal of the Sub-decree is to determine the management and use of the pavements along national roads and railroads aligned with the development and growth of the Kingdom of Cambodia.
- ***Article 2:*** The objectives of the Sub-decree are as follows:
    - Eliminating the appropriation of pavements for the purpose of construction or planting;
    - Preventing road accidents and maintaining social order which frequently occurs on road channels;
    - Reducing any obstacles to road development;
    - Reducing all state expenditures on the settlement of the impacts on residents' housing along road channels;
    - Facilitating competent authorities involved in legalizing residents with ownership on road channels;
    - Ensuring sustainable physical infrastructure development in the Kingdom of Cambodia.
- ***Article 3:*** The scope of the Sub decree covers any national roads with 1 (one) digit and 2 (two) digits and railroads in the Kingdom of Cambodia, which is under the competency of the Ministry of Public Work and Transports.

The scope of the Sub decree does not cover development roads along the borders which are non-national road, national road in wildlife sanctuary and national parks, national roads in flora conservation areas, rural trails, paths with a canal in between, all of which are under the management and responsibilities of the Ministry of Environment, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Rural Development, and the Ministry of Water Resources and Meteorology, and other national roads built by communes, districts, communities and residents.

- ***Article 7:*** Pavements on national roads and railroads are the state properties in compliance witharticle 15 of the law on land management.
- ***Article 8:*** Pavements shall be determined to serve physical infrastructure development as follows:
    - National road grade 1: Symbolized by a number with 1 (one) digit for the pavement located 30 (thirty) meters from both sides of the road;
    - National road grade 2: Symbolized by a number with 2 (two) digits for the pavement located 25 (twenty-five) meters from both sides of the road.

Pavements on the above 2 (two) kinds of national roads which cross the capital or city of a province or an urban area will be determined separately on the pavements on national roads of the capital and city of a province or an urban area.

- ***Article 9:*** Pavements on railroads shall be determined to serve physical infrastructure development as follows:
    - Pavements on railroads outside the capitals, towns, and urban areas shall be 30 (thirty) meters from both sides of the road axle.
    - Pavements on railroads in mountainous areas with falling rocks or in jungle shall be 100 (one hundred) meters from both sides of the road axle.
    - Besides, land surrounding rail stations shall be determined in accordance with the plan in force.

Pavements on the railroads which cross the capital or city of a province or an urban area will be determined separately from the pavements on the railroads of the capital and city of a province or an urban area

- ***Article 10:*** The determination of the above pavements shall be undertaken only once and remain the same in spite of further road development.
- ***Article 11:*** All line competent ministries-institutions shall not authorize any construction or cultivation along the pavements on national roads and railroads.

Some subsistence cultivation shall be authorized in principle by the Royal Government and shall be under contract with line ministries-institutions. In the event of road development, the state is not responsible for paying the compensation.

- ***Article 12:*** The Ministry of Public Work and Transports shall issue a Prakas or a notification to determine the use of the pavements on national roads and railroads to serve the public and private interest such as burying optical cable network, pure water pipe, setting up electrical poles, optical poles, and billboard pole, and other uses related to national roads and railroads.

  The Ministry of Public Work and Transports shall conduct a study to display the illustration board on the determination of the pavements on national roads and railroads instead of setting up pavement poles.

3.15 SUB-DECREES ON AIR POLLUTION CONTROL AND NOISE DISTURBANCE CONTROL, 2000

Sub-decree number 42 ANK.BK enacted JULY 10, 2000 on monitoring water and Air pollution. In this sub-decree have object as following:

- ***Article 1:*** This sub-decree has a purpose to protect the environment quality and public health from air pollutants and noise disturbance through monitoring, curb and mitigation activities.
- ***Article 2:*** This sub-decree applies to all movable sources and immovable sources of air pollution and noise disturbance.
- ***Article 4:*** Air quality standard shall be specified in the Annex-1 of this sub-decree. The standard of maximum quality of hazardous substance allowing in the air shall be specified in the Annex-2 of this sub-decree.
- ***Article 13:*** The emission of pollutants and noise from immovable source into the atmosphere shall be asked for permission from the Ministry of Environment and shall be sent the application form copy to concerned ministries and agencies.
- ***Article 15:*** The asking for discharge permission as stipulated in the Article 13 of the sub-decree shall be carried out for new project and ongoing activities, except projects that have the Environment Impact Assessment's report.
- ***Article 20:*** Ministry of Environment shall be taken sample at all emission points of pollution source. The master of person who responsible for pollution source shall collaborate the staffs of environment who conduct a sampling to fulfill their technical duty.
- ***Article 22:*** The owner or responsible person of pollution sources shall bear the cost of the cost of the analyses of his/her own sample following the tariff determined by the Ministry of Environment and the Ministry of Economic and finance. This income shall be included into the National budget in order to allocate to the Environmental Endowment Fund Account.
- ***Article 24:*** The owner or responsible person of pollution source shall:
  - Responsible for installing or equipping any equipment to purity toxic substances and to reduce noise and vibration in order to respond to Air pollution standard as stipulated in the Annexes.
  - Responsible for installing the equipment for measurement of amount of pollutant contained in his/her pollution sources and keeps the result for record keeping. The result must send to the Ministry of Environment every 3 months.
  - Have at least an environmental compromising and prepare environmental protection plan in their institution. Environmentalist shall list and recognized from the Ministry of Environment and have the capability as required by the Ministry of Environment.
- ***Article 26:*** The Ministry of Environment shall regularly control and monitor the situation of the air quality throughout the Kingdom of Cambodia in order to take measure to prevent and reduce the pollution.
- ***Article 30:*** Where if there is complaint or report that any source of pollution discharges contaminant into human health or public property. The Ministry of Environment in collaboration with concerned ministries may enter the site of this source of pollution and conduct inspection and take sample for testing.

- ***Article 31:*** In the case of serious accident or imminent danger resulting from air pollution at public water area, the Ministry of Environment shall make urgent inspection on the above problem and shall inform the concerned ministries and local authority.

ANNEX 1: Ambient Air Quality Standard

No	Parameter	1 Hour Average mg/m³	8 Hours Average mg/m³	24 Hours Average mg/m³	1 Year Average mg/m³
1	Carbon Monoxide (CO)	40	20		
2	Nitrogen dioxide (NO_2)	0,3		0,10	
3	Sulfur dioxide (SO_2)	0,5		0,30	0,10
4	O Zone (O_3)	0,2			
5	Lead (Pb)			0,005	
6	Total Suspended Particulate (TSP)			0,33	0,10

ANNEX 7: Noise Control Standard at Workshop, Factory and Industry

Noise Level (dB (A))	Maximum Period of Time	Level
75	32	Ear protection equipment shall be provided to worker who works at a location with noise level over 80dB(A)
80	16	
85	8	
90	4	
95	2	
100	1	
105	0,5	
110	0,25	
115	0,125	

3.16 SUB-DECREES ON MONITORING WATER POLLUTION, 1999

Sub-decree number 27 enacted April 06, 1999 on monitoring water pollution. In this sub-decree have object as following:

- The purpose of this sub-decree is to regulate the water pollution control in order to prevent and reduce the water pollution of the public water areas so that the protection of human health and the conservation of bio-diversity should be ensured.
- This sub-decree applied to all sources of pollution and all activities that cause pollution of the public water areas.

- ***Article 10:*** The discharge or transport of wastewater from any sources of pollution to other places for any purpose is subject to prior permit from the Ministry of Environment. The application for this permit shall be copied to the concerned ministries or agencies.
- ***Article 11:*** The species of any source of pollution that shall be required to have a permit from the Ministry of Environment before discharging or transporting their effluent to other places as mentioned in the article 10 of this sub-decree shall be listed in the Annex 3 of this sub-decree and are classified into two following categories:

  a- The source of pollution of category I that are subject to the prior permit from the Ministry of Environment when the amount of their effluent exceed ten cubic meter per day (10 M^3/day) but not including the amount of water volume used for according the engine.

  b- The sources of pollution of category II that shall be necessarily required to apply for the permission from the Ministry of Environment.

- ***Article 13:*** The owner or responsible person of the pollution source as mentioned in the article 11 of this sub-decree that intend to release or transport his/her effluent to other place shall be apply for permit to the Ministry of Environment:

- Forty days (40 days), before the beginning of the functioning, for the new source of pollution located in Phnom Penh, and sixty days (60 days) for the new source of pollution located in provinces and cities.
- Thirty days (30 days), within the after receiving guideline from MoE of the functioning, for the new source of pollution located in Phnom Penh, and fifty days (50 days) for the new source of pollution located in provinces and cities.

Annex 1: Type of the hazardous substance

1. Organophalogen compounds and substances which may form such compounds in the aquatic environment.
2. Organ phosphorous compounds.
3. Organotin compounds.
4. Substances that possess carcinogenic (cancer causing) properties in or via the aquatic environment.
5. Mercury and its compounds.
6. Cadmium and its compounds.
7. Persistent mineral oil and hydrocarbons of petroleum origin.
8. Persistent synthetic compounds which may float remain in suspension or sink and which may interfere with any use of waters.
9. Radio activated substances.
10. Metals and their compounds.

Zinc (Zn)	Selenium (Se)	Tin (Sn)	Vanadium (V)
Copper (Cu)	Arsenic (As)	Barium (Ba)	Cobalt (Co)
Nickel (Ni)	Antimony (Sb)	Beryllium (Be)	Tellurium (Te)
Lead (Pb)	Titanium (Ti)	Uranium (U)	Silver (Ag)

11. Toxic or persistent organic compounds of silicon.
12. Inorganic compounds of phosphorous and elemental phosphorous.
13. Non-persistent mineral oils and hydrocarbons of petroleum origin.
14. Cyanides and fluorides
15. Substances which may have an adverse effect on the oxygen balance, particularly ammonia, and nitrites...etc.

Annex 4: Water Quality Standard in public water areas for bio-diversity conservation water

1. For water River

N°.	Parameter	Unit	Standard Value
1	pH	mg/l	6.5-8.5
2	COD	mg/l	1-10
3	Suspended Solid	mg/l	25-100
4	Dissolves Oxygen	mg/l	2.0-7.5
5	Coli form	MPN/100ml	<5000

2. For Lake and Reservoir

N°.	Parameter	Unit	Standard Value
1	pH	mg/l	6.5-8.5

N°.	Parameter	Unit	Standard Value
2	COD	mg/l	1-8
3	Suspended Solid	mg/l	1-15
4	Dissolves Oxygen	mg/l	2.0-7.5
5	Coli form	MPN/100ml	<1000
6	Total Nitrogen	mg/l	0.1-0.6
7	Total Phosphorus	mg/l	0.005-0.05

3.17 SUB-DECREES ON SOLID WASTE MANAGEMENT, 1999

Sub-decree on solid waste management, number ANK36, enacted on April 27, 1999. In this sub-decree have objectives as following:

- ***Article 1:*** The purpose of this sub-decree is to regulate the solid waste management with proper technical manner and safe way in order to ensure the protection of human health and the conservation of bio-diversity.
- ***Article 2:*** This sub-decree applies to all activities related to disposal, storage, collection, transport, recycling, dumping of garbage and hazardous waste.
- ***Article 3:*** Technical terms used in this sub-decree shall have the meaning ascribed there to:
  a. Solid waste refers to hard objects, hard substances, products or refuse which are useless, disposed of, are intended to be disposed of, or required to be disposed of;
  b. Household waste is the part of solid waste which does not contain toxin or hazardous substance, and is discarded from dwellings, public buildings, factory, market, hotel, business building, restaurant, transport facilities, recreation site etc.;
  c. Hazardous waste refers to radioactivity substances, explosive substances, toxic substances, inflammable substances, pathogenic substances, irritating substances, corrosive substances, oxidizing substances, or other chemical substances which may cause the danger to human (health) and animal or damage plants, public property and the environment. The hazardous waste may be generated from dwelling houses, industries, agricultural activities, business and service activities, mining, etc. The type of hazardous waste is listed in the Annex of this sub-decree.
- ***Article 7:*** The disposal of waste in public sites or anywhere that is not allowed by the authorities shall be strictly prohibited.
- ***Article 13:*** The owner of the hazardous waste shall be responsible for temporary storageof his/her waste in proper technique and in safe manner.
- ***Article 14:*** The owner of the hazardous waste shall make quarterly report on his/he waste and forward it to the Ministry of Environment. The report includes:
  a. Type and amount of the waste,
  b. Temporary storage method, and
  c. Treatment or elimination method.
- ***Article 15:*** The storage, transportation and disposal of the hazardous waste shall be performed separately from the household waste which will be stipulated by the Prakas of the Ministry of Environment.

The disposal of hazardous waste into public site, public drainage systems, public water area, rural area and forest area shall be strictly prohibited.

- ***Article 18:*** The owner or responsible person of storage place or landfill of the hazardous waste shall make quarterly report on the hazardous waste which is transported for disposal of or for storage and forward this report to the Ministry of Environment. The report shall include as follows:

a. Type and amount of the waste,

b. Sources of the waste,

c. Packing and transport facility, and

d. Process and management of the waste inside his/her location and forward this report to the Ministry of Environment.

Annex Type of the hazardous waste

8. Oil waste from oil refinery, use of lubrication oils, washing oils;

9. Acid waste;

10. Alkalis waste;

13. Inorganic fluorine and parts electronic of electricity wastes;

14. Inorganic batteries wastes;

18. Ethers wastes lead to infection or diseases;

21. Waste from production of drugs and medicines, and expired drugs;

22. Wastes produced as a result of wastewater treating or soil pollution.

3.18 SUB-DECREES ON ENDANGEROUS FISHERIES RESOURCES, 2009

Sub-Decree No. 123 on species results, fisheries products which is suffering dangerous was approved by Royal Government of Cambodia, date August 12, 2009. In below are some Articles that concerning to the project:

- ***Article 1:*** This sub-decree shall determine on species results, fisheries products include freshwater and marine water which have source from fisheries resource is suffering of dangerous in Royal Government of Cambodia for management, protection and sustainable conservation accordance with the fishery Law.
- ***Article 2:*** The fisheries resource which is suffering of dangerous is classified into 3 groups according to condition and situation of suffering dangerously as below:

1. Detaching Closed Species Group: is fisheries resource in Natural suffering dangerous which is challengeable to stock yield, this group is challenging to serious danger and can be destroyed of species in the nature, it is not so longer in the future because, the fish yield totally was decreased at least 80% in last period of 10 years or further passed of 3 generations accordance observations, estimations or conclusions.
2. Suffering Dangerous Species Group: is fisheries resources in Natural suffering dangerous which had proof show clearly that this group is challengeable to very dangerous and can be destroyed of species in the nature, it is not so longer in the future because, the fish yield totally was decreased at least 50% in last period of 10 years or further passed of 3 generations accordance observations, estimations, conclusions or expectations.
3. Vulnerable Species Group: is fisheries resources in Natural suffering dangerous which is very easy vulnerable and can be destroyed of species in the natural near future because, the fish yield totally was decreased at least 20% in last period of 10 years or further passed of 3 generations accordance observations, estimations, conclusions or expectations.

3.19 PRAKAS ON GENERAL GUIDELINE FOR CONDUCTING INITIAL AND FULL ENVIRONMENTAL IMPACT ASSESSMENT REPORTS, 2009

The Ministry of Environment has issued General Guideline for Conducting Initial and Full Environmental Impact Assessment Report dated on September 02, 2009. In below are some Articles that concerning to the project:

- ***Article-2:*** The project owner either, as private individuals or private companies, joint-venture companies, public companies or ministries/government agencies must prepare an IEIA or Full EIA report for proposed projects and existing activities, as mentioned in the Appendix of Sub-decree N. 72 ANKR.BK, dated 11 August 1999 on the process of Environmental Impact

Assessment and submit these for reviewed and approved by the Ministry of Environment except some particular and urgently needed projects that are decided by the Royal Government.

- ***Article-4:*** Project's owner as stated in Article 2 and 3 above can use a consultant company service that shall be responsible for preparing an IEIA or Full EIA report following these general guidelines.
- ***Article-7:*** The Department of Environmental Impact Assessment Monitoring and Review or Royal Municipal-Provincial Department of Environment shall visit and comment a project site as stated in Article 2 and 3 above to appropriated screening that whether the investment project should prepare the IEIA or Full EIA report.

3.20 NATIONAL POLICY ON GREEN GROWTH, 2013

National Policy on Green Growth has been agreed from the council Ministry during the meeting dated on 01 March 2013. In below are some points that concerning to the project:

1.. Introduction:

The policy aims at contributing to environment protection, natural resources management, biodiversity and forest conservation, and maintaining quality of soil, water, soil and air and efficient ecosystem safety, and following the directionof the United Nations on" **The Future We want**" that the RGC has been implementing it today in the areas of fishery and forestry sector, economical use of energy and water, renewable energy usage, efficiency of natural resources for the support of people's livelihood and the implementation of **New Action Old Policy on Land** in order to keep natural resources for the next generations while at the same time keeping up with national economic development.

Green Growth is to strike balance between economic development and environment, society and culture to reach sustainable development goals.

2.. Vision:

The national policy is invisaged to strike balance of economic development with environment, society, culture and sustainable use national resources through intergration, matching and adaption as well as harmonization between growth principle and national policy.

3.. Gaol and Objectives:

3.1..Goal

The policy aims at enhancing the well-being and livelihood of all people in harmonization with ecological safety through green development growth, basing on green economy, blue economiy, environment protection, social safety nets system and uphold of national culture identify.

3.2.. Objectives

- Developing an economy in balance with environment, society and culture;
- Create a favourably enabling environment for green growth in equity, balance, fraternity, and quality of socio-economic systems and ecology that uphold national culture value;
- Effective management of access to water resources management and sanitation, access to food security and food safety, access to development, forest conservation, and mixed resources water, and sustainable land use, access to rewable energy, and energy efficiency, access to information and knowledge and skill, access to finance for creation of small medium enterprise and investment associated with green growth;
- Enhancing education and training on green growth;
- Strengthening information exchance, knowledge, good experiences, technology and investment related to green growth;
- Stimulating green growth cooperation at a national and sustainational leval, region and the world.

6.. Monitoring and Evaluation:

In order to implement this national policy successfully and effectively as expected and with transparency the NCGG must have a monitoring and evaluation system and propose to improve the implementation by focusing on indicators a follows:

- Having established and reviewing a legal framework and national institution on green growth and improving the system of identifying management, monitoring and evaluation;
- Determining and analyzing the sources and reasons lead to no sustainability among economy, environment, society and culture;
- Improving and strengthening capacity building of relavant officials of green growth;
- Setting up a level of education for the public and the private sectors, society and general public about green growth and encouraging the public at the local levels tobe involved in activities and dissemination programs on green growth and encouraging them to participate;
- Improvement green growth at national and subnational levels;
- Reducing economic development activity imacts on economy, society, culture.

3.21 JICA'S GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS, APRIL 2010

JICA has prepared "Guidelines for Environmental and Social Considerations, April 2010" as the referential guidelines for environmental and social considerations. The objectives of the guidelines are to encourage Project proponents etc. to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents etc., in order to facilitate the achievement of these objectives. In doing so, JICA endeavors to ensure transparency, predictability, and accountability in its support for and examination of environmental and social considerations.

According to the guidelines, JICA classifies development projects into four categories with regards to the extent of environmental and social impacts, and taking into account the outlines, scale, site and other conditions. The four categories are as follows:

Category A: Proposed projects are likely to have significant adverse impacts on the environment and society.

Category B: Proposed projects are classified as Category B if their potential adverse impacts on the environment and society are less adverse than those of Category A projects.

Category C: Proposed projects are classified as Category C if they are likely to have minimal or little adverse impact on the environment and society.

Note: all these 3 types above are negative and positive *(±A, ±B, ±C)*

Category FI: A proposed project is classified as Category FI if it satisfies all of the followings:

- JICA's funding of the project is provided to a financial intermediary or executing agency;
- The selection and appraisal of the components is substantially undertaken by such an institution only after JICA's approval of the funding, so that the components cannot be specified prior to JICA's approval of funding (or project appraisal); and
- Those components are expected to have a potential impact on the environment

In JICA's preparatory survey, JICA conducts environmental and social surveys at the EIA level for Category A projects and at the IEE (Initial Environmental Examination) level for Category B projects and Master Plan Studies. JICA prepares drafts of mitigation measures - including avoidance, minimization, and compensation - as well as drafts of monitoring plans and of institutional arrangements for environmental and social considerations.

Over a certain period of time, JICA confirms with project proponents etc. the results of monitoring the items that have significant environmental impacts. This is done in order to confirm that project proponents etc. are undertaking environmental and social considerations for projects that fall under Categories A, B, and FI.

National Road No.5 (Middle Section) Thlea Ma' am to Battambang Improvement Project" is classified as "Category A", according to JICA Guidelines (2010), which causes a significant adverse impact due the large scale of involuntary resettlement. Thus, preparation of the survey report at EIA level is required.

CHAPTER-4
PROJECT DESCRIPTIONS

CHAPTER-4

PROJECT DESCRIPTIONS

The NR5 is an economic blood vessel for international transportation, liking from Phnom Penh Capital City to border of Thailand. This national road is 407.45 Km length in total which goes across six provinces (Phnom Penh Capital City was not included) such as: Kandal, Kampong Speu, Kampong Chnang, Pursat, Battambang and Banteay Meanchey. Really, this project description is not so detailed; however, it is the first observation for rehabilitation project from Thlea Ma'am in Pursat to Battamtang province (started point at the Kilometer PostKP-171 in Pursat province to Kilometer PostKP282+200 in Battambangwith 112.8Km of total length for this road portion, including bypass of road in Pursat province with 8.8Km from PK183 to PK190+200 on the right side. The purpose of this study is to find the data and information out which require/need for cost estimation of loan project (ODA) from Japan Government.

4.1 Type of Project

This project is the rehabilitation project for NR5 of Ministry of Public Works &Transport under loan project from Japan Government. The standard of project design was mentioned as the following:

In the Rural area, the total road width is 17m paving with asphalt consisted of 4 lanes, with each 2 lanes of opposite direction, including sidewalks and lanes for bike and motorbike is 3m at both sides. The total road surface width is 23m which each lane's width of road is 3.5m x 4 for median central line is 3m and excluding sidewalks and lanes for bike at both sides is 3m X 2 as well.

In the Town area, the total road width is 22m paving with asphalt consisted of 4 lanes, with each 2 lanes of opposite direction. There is vehicle parking and bike and motorbike lane width is 2.5m, excluding sidewalks width is 3m for both sides. The total road surface width is 28m which each lane's width of road is 3.5m x 4 for median central line is 3m and excluding sidewalks and lanes for bike at both sides is 2.5m X 2 and sidewalks width is 3m X 2 as well.
On this project, there were 28 concrete bridges with different length from 16 to 120 meters finding out on this project, 112.8Km length for road improvement. Also, other 98 culverts in total (35-boxculvert and 63-concretepipe). For Pursat by-pass road require to construct two new bridges pass the River: (1) at Pursat Steung and (2) at O-Sdav including some new culverts construction along the canal and creeks as well.

Basic Component of Project Design:

- Project justification (by proving the project with relevant document);
- Feasibility Study including 3 options;
- First draft of project design (drawing layout);
- Cost estimation for project;
- Activity schedule for project implementation;
- Activity schedule and plan for road maintenance/fix;
- Resettlement plan (Ministry of Public Works & Transport is responsible for this work, supported the technical works by JICA Survey Team and national consultants);
- Prepared the report of Environmental and Social Impact Assessment (Ministry of Public Works & Transport is responsible for report preparation and procedure work of EIAby submitting to Ministry of Environment in order to approve supported the technical works by JICA Survey Team and national consultants).

4.2 Project Needed and Project Alternative

4.2.1 Project Needed

As mentioned above, NR5 is an economic blood vessel for national and international transportation. The Kingdom of Cambodia became a Member State of The Association of Southeast Asian Nations (ASEAN) on 30 April 1999. Then NR5 was called ASEAN Highway A-1 (AH-1), which connected with Phnom Penh City through NR5 to Bangkok City, Thailand. The road from Cambodia to Vietnam is started from Poipet Town on NR5 and then it connects NR1 to Ho Chiminh City, Vietnam through Bavit gateway.



On the other hand, this national road was damaged by flood in 2000, thus, it needs to rehabilitate and fix temporarily in some places after flooded as the following:

Table 4-1:Record of road fixing works for NR5

Resources	Itinerary	Road width in average (m)	Length (Km)	Type of pavement	Inaugurate
Engineering Forces	Phnom Penh-Kampong Chhnang	9.8	91	DBST	2003
ADB	Kampong Chhnang-ThleaMaam	7.7	80	DBST	2004
ADB	Thlea Maam-Battambang	9.8	130	DBST	2003
ADB	Battambang-Sisophon	7.8	68	DBST	2004
ADB	Sisophon-Poi Pet	10.2	49	Asphalt Concrete	2008

Soruce:*Inception ReportJICA Study Team March 2011*

However, the condition of NR5 still has some problems at the moment after fixed such as:

- The road width is still small that the cause of traffic acidents;
- Traffic activities on the road are increasing and so busy;
- The pavement type of this road is DBS which eases to damage due to busy traffic of this road. Then the cost of road maintanance of this type is more than type of AC (Asphalt Concrete);
- Road was frequently flooded;
- Some of bend roads are less curve, it is not a standard of Highway.

The purposes of this road rehabilitation project are:

- To rehabilitate and expand road with 4 lanes and road shoulder (at the Town area)for pedestrianand righ-way (at Rural area) for bike and motorbike at the both road sides;
- To change pavement from DBS to AC;
- To increase height of road only some portions to prevent aften flooded due to the result of topography survey;

- To improve the drainage/hydraulic structures (such as: culverts and bridges);
- To improve curve roads as a standard of highway;
- To facilitate/make sure the traffic activities go smoothly and safety on this new road;
- To increase the social economic development in national and regional level.

4.2.2 Project Alternative

A..Alternative Analysia of Middle Section of NR 5 Improvement

For the improvement of Middle Section of NR 5, three alternatives of cross section and 0 option were studied. The following table compares advantages and disadvantages of these alternatives. After the discussion between the JICA Survey Team and RGC counterparts: MPWT and DPWT, Alternative-2 in the following Table and Figure was selected.

Table 4-2 (A):Comparison of Alternatives of Improvement of Existing NR 5

Alternatives	Alt-0：Zero Option; No action	Alt-1：Existing road width is maintained; Only pavement is improved into asphalt concrete (AC).	Alt-2：Widen into 4-lane; pavement is improved into AC.	Alt-3：Widen into 'Opposed 2-lane + motorcycle lane on both sides; pavement is improved into AC
Objective	Maintain the existing conditions. No impact to social & natural environment. No construction cost is required.	Resettlement is not required. Pavement is improved so that maintenance cost can be reduced.	Secure sufficient traffic capacity and smooth traffic. Improve traffic safety by slow traffic & fast traffic.	Reduce construction cost and number of households/houses to be relocated, securing required traffic capacity.
Social Impact				
Resettlement	No resettlement required.	Same as Alt-1.	Large number of households/ houses	Considerable number of (less than in Alt-2) households/houses need to be relocated.
Separation of Local Community	There is no change in conditions for crossing of road except new difficulty due to increase in traffic volume.	Same as Alt-1.	Crossing of road becomes difficult due to increase of road width and increase of vehicles speed.	Same as Alt-2 except that the degree of difficulty of crossing due to widening of road width is less than that in Alt-2.
Influence to Socio-Economic Activities and Regional Development	Sound growth of socio-economic activities is hampered, resulting in impedance in regional development, caused by traffic congestion.	Same as Alt-0.	Smooth traffic is secured resulting in growth in socio- economic activities and regional development. Increased job opportunities for local laborers and increase demand for consumer goods contributes to increase in gross income of the region.	Same as Alt-2 in principle; however, there is a possibility that traffic congestion start earlier than in Alt-2 and socio-economic activities and regional development will be hampered.
Impact to Natural Environment	Exiting conditions are maintained and no impact to natural environment is anticipated.	Only pavement structure is changed and practically no impact to natural environment is anticipated.	Since the main work is widening of an existing road, no large impacts are anticipated.	Same as Alt-2.
Impact to Living Environment/Pollution	There is a high possibility of traffic jam as traffic volume increase in future. When traffic jam occurs, travel speed is decreased and frequency of stop & start increases, resulting in increase in emission of pollutant.	Same as Alt-0.	Increased traffic demand in future will be accommodated and traffic jam will be substantially reduced resulting in prevention of crease of emitted pollutant is prevented. On the other hand, increased traffic capacity will induce traffic demand and increase total emission of pollutants.	Same as Alt-2 in principle; however, smaller traffic capacity than in Alt-2 will result in traffic jam and increase of emitted pollutants starting at earlier time in future.

Alternatives	Alt-0 : Zero Option; No action	Alt-1 : Existing road width is maintained; Only pavement is improved into asphalt concrete (AC).	Alt-2 : Widen into 4-lane; pavement is improved into AC.	Alt-3 : Widen into 'Opposed 2-lane + motorcycle lane on both sides; pavement is improved into AC
Impact to Traffic Condition				
Road/ Transport Function	Smooth traffic cannot be secured due to traffic jam which will occur as traffic volume increase in future.	Same as Alt-0.	Smooth traffic can be secured owing to sufficient traffic capacity.	Same as Alt-2 in principle; however, traffic jam will start to occur at earlier time in future than in Alt-2 because traffic capacity is smaller than Alt-2.
Traffic Safety	High risk of traffic accident due to narrow road width which forces travelling in the opposite lane when overtaking.	Same as Alt-0: Risk of accident increases due to higher travel speed which becomes possible owing to improved road surface.	Slow traffic, such as agricultural tractor, and fast traffic, such as passenger car, are separated resulting in less risk of accident. Also, risk of head-on collision is decreased since necessity to travel in the opposite lane for overtaking is greatly reduced. On the other hand, risk of accident may increase due to increased travel speed of vehicles.	Slow traffic and fast traffic are separated and risk of accident is decreased, although to less extent than in Alt-2.
Construction Cost/ Maintenance Cost	No construction cost is required while maintenance cost remains large due to vulnerable pavement.	Cost for improvement of pavement is required. On the other hand, maintenance cost is reduced since pavement becomes durable.	Costs for resettlement, civil works of widening, pavement etc are required. On the other hand, maintenance cost is reduced owing to improved durability of pavement.	Same as Alt-2 in principle; costs for resettlement, widening, pavement etc are smaller than in Alt-2 due to narrower road width.
Evaluation				
Main Advantage	No resettlement is required	No resettlement is required	Smooth traffic is secured. (Main objective of Project is achieved.)	Smooth traffic is secured for about 10 years after completion of the Project. Number of houses/ households to be relocated is less than those in Alternative-2.
Main Disadvantage	Traffic jam due to future increase in traffic demand and retardation in development in socio-economic activities.	Traffic jam due to future increase in traffic demand and retardation in development in socio-economic activities.	Large number of houses/ households need to be relocated.	Large number of houses/households, although less than in Alternative-2, needs to be relocated. Widening will become necessary within about 10 years after completion of the Project.
Overall Evaluation	Not recommended because the objectives of the Project are not achieved.	Not recommended because the objectives of the Project are not achieved.	Recommended with condition that due consideration is given to mitigation of negative impacts.	Recommended only when the fund needs to be minimum.

B..Alternative of Pursat Bypass

For Pursat Bypass of of NR 5, six alternatives were studied. After the discussion between the JICA Survey Team and RGC counterparts: MPWT and DPWT of Pursat, "N-1" route in the following Table and Figure was selected. It is proposed that the section of existing NR 5 which runs parallel to the bypass be excluded from the scope of "the Middle Section Improvement Project".

Table 4-2 (B):Comparison of Alternatives ofAlternative Routes of Pursat Bypass

Alternative	Widen Existing NR 5	N-1	N-2	N-3	S-1	P-1
Description of Alternative	- Widen existing NR 5	- Long detour route on the north side of the city to allow future expansion of the urbanized area	- Short detour on the north side of the city	- Set intersections of bypass with NR 5 distant from the urbanized area.	- Short detour on the south side of the city - Crosses railroad by flyover	- Set intersections of bypass with NR 5 distant from the urbanized area.
Advantage	- Travel distance is shortest	- No railroad crossing - Smooth connection with existing NR 5	- No railroad crossing - Smooth connection with existing NR 5	- Intersections are sufficiently remote from the urbanized area and remain outside of the urbanized area for long future.	- Increase in travel distance is little. - No serious influence to future expansion of the urbanized area.	- Intersections are sufficiently remote from the urbanized area and remain outside of the urbanized area for long future.
Disadvantage	- Need large-scale relocation	- Travel distance becomes longest. - Impact to Tonle Sap natural environment	- Travel distance becomes longer. - Impact to Tonle Sap natural environment	- Construction cost is 2nd largest.	- Railroad crossing (2 locations: need flyover; expensive) - Connection to NR 5 in the west of the city becomes rectangular.	- Construction cost is the largest.
Total Length (km)	10.8	12.5	11.9	11.8	11.6	11.8
Bypass Length (km)	0	8.8	6.9	7.7	5.8	11.8
No. of Houses to be Relocated	240	17	78	55	25	18
Total Cost (US$ Million)	22.6	35.3	31.1	37.7	49.4	60.9
Bypass Construction	0	29.4	24.3	33.8	41.9	58.1
Widen NR 5	20.2	3.3	4.5	1.2	5.2	0
Resettlement	2.4	1.3	1.4	1.1	1.4	1.1
Land Acquisition	0	1.3	1.0	1.6	0.9	1.8

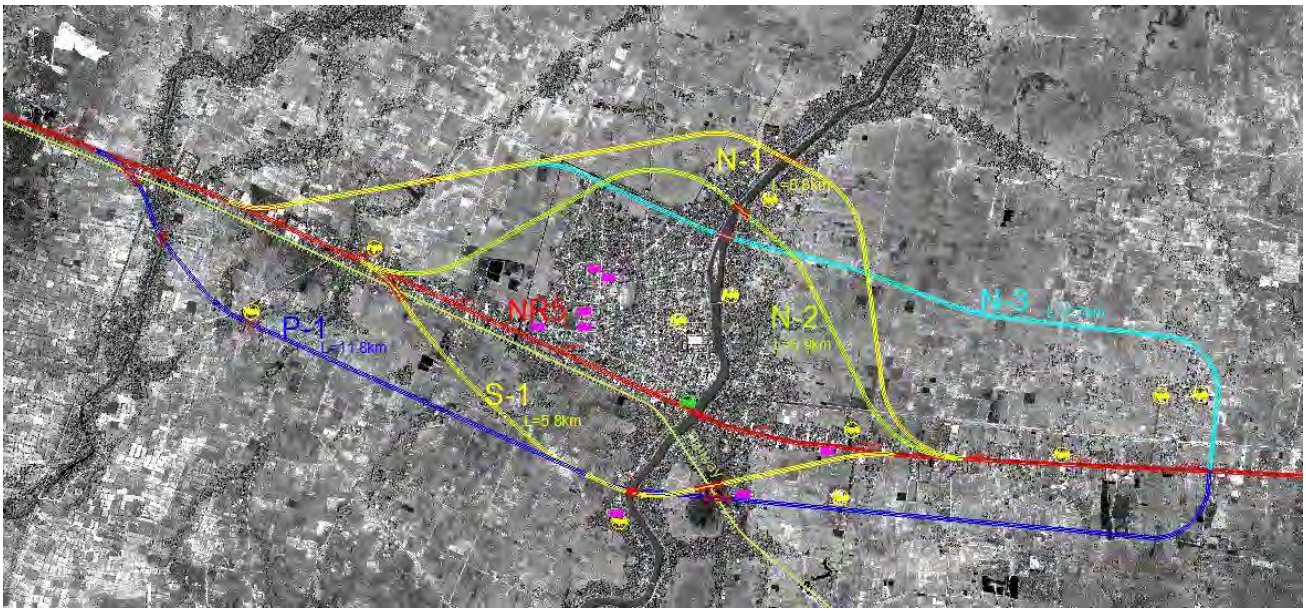


Figure: Alternative Routes of Pursat Bypass

4.3 Project Location

4.3.1 Project Infrastructure Sites

The rehabilitation project for portion of NR5 from Pursat to Battambang is located in two different provinces, Pursat and Battambang. It started from Kilometer Post KP171 in Pursat province to Kilometer Post KP282+200 next to the bypass of Battambang City in Battambang province. It located in the latitude 12º29' and 13º07' at north and longitude 103º15' and 104º05' at east.

The detailed coordinates of project sites are showed in the table below:

Table 4-3:The detailed coordinates of rehabilitation project for portion of NR5 from Thlea Ma'am in Pursat to Battambang province (KP171 – KP282+200), total length of 112.8Km.

#	KP	starting PointX, Y	Ending PointX, Y	Lenght of Road (Km)	Commune Name	District Name	Province Name	Remarks
1	Right 171 to 177+ 285	397339, 1384659	391116, 1384661	6.29	BoengKantuot	Krakor	Pursat	Existing Road
2	Left 171 to 177+ 280	397339, 1384659	391121, 1384661	6.28	Tnaot Chum	Krakor	Pursat	Existing Road
3	Right 177+285 to 183+ 000	391116, 1384661	385474, 1384951	5.71	Prey Nhi	Pursat Town	Pursat	Existing Road
4	Lefl 28+1770to 18 3 +000	391121, 1384661	385474, 1384952	5.72	Roleab	Pursat Town	Pursat	Existing Road
5	Lefl 0+000 +to 1 012 (KP-bypass)	385474, 1384951	385462, 1384951	0.01	Roleab	Pursat Town	Pursat	New Road
6	Lefl 0+012 +to 1 498 (KP-bypass)	385462, 1384951	384676, 1386035	1.49	Prey Nhi	Pursat Town	Pursat	New Road
	Right0 +000+to 1 498 (KP-bypass)	385474, 1384951	384676, 1386035	1.50				
๗	Lefl,Right 1 +498 to 3+478 (KP-bypass)	384676, 1386035	383874, 1387688	1.98	Banteay Dey	Pursat Town	Pursat	New Road
8	Lefl,Right 3 +478 to 4+486 (KP-bypass)	383874, 1387688	382626, 1387857	1.31	Veal	Kandiengreay	Pursat	New Road
9	Right4 +786 to 8+800 (KP-bypass)	382626, 1387857	378712, 1387315	3.98	Phteah Prey	Pursat Town	Pursat	New Road
	Left4 +786 to 8+755 (KP-bypass)	382626, 1387857	378712, 1387315	3.97				
10	Left8 +755 to 8+800 (KP-bypass)	378716, 1387313	378712, 1387315	0.01	Svay At	Pursat Town	Pursat	New Road
11	Right 190+ 200 to 191+131	378712, 1387315	378097, 1387559	0.99	Phteah Prey	Pursat Town	Pursat	Existing Road
12	Left 190+ 200 to 191+131	378712, 1387315	378097, 1387559	0.99	Svay At	Pursat Town	Pursat	Existing Road
13	Right 191+132 to 198+875	378097, 1387559	371225, 1391471	7.74	Snam Preah	Bakan	Pursat	Existing Road
	Left 191+132 to 198+875	378097, 1387559	371225, 1391471					
14	Right 198+875 to 206+150	371225, 1391471	365026, 1395374	7.28	Trapeang Chong	Bakan	Pursat	Existing Road
	Left 198+875 to 206+150	371225, 1391471	365026, 1395374					
15	Right 206+150 to 213+670	365026, 1395374	358245, 1398564	7.42	Boeng Khnar	Bakan	Pursat	Existing Road
	to 213+470 150+206 Left	365026, 1395374	358441, 1398478					
16	Right 213+670 to 217+840	358245, 1398564	354478, 1400320	4.28	O Tapaong	Bakan	Pursat	Existing Road
	Left 213+460 to 217+840	358441, 1398478	354478, 1400320					
17	470+221 Right 217+840 to	354478, 1400320	351345, 1401998	3.63	Svay Daunkev	Bakan	Pursat	Existing Road
	Left 217+840 to 221+470	354478, 1400320	351345, 1401998					
18	Right 221+470 to 228+040	351345, 1401998	345673, 1404843	6.57	Ruessei Krang	Moung Ruessei	BTB	Existing Road
	Left 221+470 to 228+040	351345, 1401998	345673, 1404843					
19	Right 228+040 to 240+030	345673, 1404843	334568, 1408670	11.99	Prey Svay	Moung Ruessei	BTB	Existing Road
	Left 228+040 to 240+030	345673, 1404843	334568, 1408670					
20	Right 240+030 to 250+960	334568, 1408670	328299, 1417515	10.93	Kear	Moung Ruessei	BTB	Existing Road
	Left 240+030 to 244+380	334568, 1408670	332171, 1412205	4.35				

#	KP	starting PointX, Y	Ending PointX, Y	Lenght of Road (Km)	Commune Name	District Name	Province Name	Remarks
21	Left 244+380 to 250+390	332171, 1412205	328637, 1417056	6.01	Moung	Moung Ruessei	BTB	Existing Road
22	Right 250+960 to 255+600	328299, 1417515	325656, 1421277	4.64	Kakoh	Moung Ruessei	BTB	Existing Road
	Left 250+390 to 255+600	328637, 1417056	325656, 1421277	5.21				
23	Right 255+600 to 264+620	325656, 1421277	322297, 1429637	9.02	Prey Toch	Moung Ruessei	BTB	Existing Road
	Left 255+600 to 264+620	325656, 1421277	322297, 1429637					
24	Right 264+620 to 271+900	322297, 1429637	318681, 1435913	7.28	Kampung Preang	Sangke	BTB	Existing Road
	Left 264+620 to 272+950	322297, 1429637	318175, 1436823	8.33				
25	Right 271+900 to 280+460	318681, 1435913	313733, 1442396	8.56	Kampung Preah	Sangke	BTB	Existing Road
	Left 272+950 to 280+245	318175, 1436823	313883, 1442240	7.30				
26	+Right 280+460 to 282200	313733, 1442396	312417, 1443525	1.64	Anlong Vil	Sangke	BTB	Existing Road
27	+Left 280+245 to 282200	313883, 1442240	312417, 1443525	1.86	O Dambang Pi	Sangke	BTB	Existing Road

Note: *Pursat by-pass started from KP-183, counted from KP-0+000 to KP-8+800 then connected to existing road again at KP-190+200*

Table 4-4:Locations of bridge or road enlarge construction with coordinates

#	KP	X	Y	Code	euuturutuurScut S	Province Name
1	177+200	391124	1384661	Br40	R.C, Steel Bridge	Pursat
2	178+500	389813	1384734	Br41	PC Bridge	Pursat
3	181+800	386557	1384892	Br42	R.C Bridge	Pursat
4	182+800	385620	1384941	Br43	PC Bridge	Pursat
5	3+700	383874	1387688	Pursat Steung	New PC Bridge	Pursat
6	5+860	380581	1387512	O-Sdav	New PC Bridge	Pursat
7	190+150	378683	1387331	Br54	PC Bridge	Pursat
8	191+100	378110	1387557	Br55	PC Bridge	Pursat
9	201+800	368677	1393080	Br56	PC Bridge	Pursat
10	208+500	362918	1396512	Br57	PC Bridge/R.C Bridge	Pursat
11	215+750	356373	1399491	Br58	R.C, Steel Bridge	Pursat
12	219+600	352809	1400937	Br59	R.C, Steel Bridge	Pursat
13	220+800	351814	1401567	Br60	PC Bridge	Pursat
14	222+650	350444	1402836	Br61	PC Bridge	BTB
15	223+650	349751	1403474	Br62	PC Bridge	BTB
16	242+850	332764	1410763	Br63	PC Bridge	BTB
17	243+600	332465	1411498	Br64	PC Bridge	BTB
18	244+400	332175	1412206	Br65	PC Bridge	BTB
19	245+900	331275	1413455	Br66	R.C Bridge	BTB
20	255+250	325867	1420974	Br67	PC Bridge	BTB
21	255+600	325657	1421278	Br68	PC Bridge	BTB
22	256+600	325237	1422110	Br69	PC Bridge	BTB
23	257+900	324702	1423337	Br70	PC Bridge	BTB
24	265+900	321753	1430710	Br71	PC Bridge	BTB
25	270+900	319177	1435026	Br72	PC Bridge	BTB
26	271+700	318820	1435676	Br73	PC Bridge	BTB
27	272+650	318358	1436519	Br74	PC Bridge	BTB

#	KP	X	Y	Code	euuturutuurScut S	Province Name
28	273+300	318030	1437126	Br75	PC Bridge	BTB
29	275+650	317208	1439359	Br76	PC Bridge	BTB
30	276+550	316817	1440114	Br77	PC Bridge	BTB

Table 4-5:Locations of culverts (pipe) construction with coordinates

#	KP	X	Y	Code	euuturutuurScut S	Province Name
1	171+800	396457	1384656	Pc148	et et rSuS	Pursat
2	172+200	396084	1384648	Pc149	et et rSuS	Pursat
3	174+100	394323	1384601	Pc150	et et rSuS	Pursat
4	174+700	393646	1384585	Pc151	et et rSuS	Pursat
5	175+000	393348	1384573	Pc152	et et rSuS	Pursat
6	175+600	392789	1384562	Pc153	et et rSuS	Pursat
7	176+100	392244	1384592	Pc154	et et rSuS	Pursat
8	176+200	392180	1384597	Pc155	et et rSuS	Pursat
9	176+400	391999	1384608	Pc156	et et rSuS	Pursat
10	176+500	391925	1384613	Pc157	et et rSuS	Pursat
11	176+700	391731	1384625	Pc158	et et rSuS	Pursat
12	177+900	390397	1384702	Pc159	et et rSuS	Pursat
13	180+500	387794	1384836	Pc160	et et rSuS	Pursat
14	182+600	385895	1384928	Pc161	et et rSuS	Pursat
15	192+100	377213	1387897	Pc162	et et rSuS	Pursat
16	192+700	376669	1388102	Pc163	et et rSuS	Pursat
17	193+600	375761	1388624	Pc164	et et rSuS	Pursat
18	194+100	375393	1388856	Pc165	et et rSuS	Pursat
19	194+400	375139	1389018	Pc166	et et rSuS	Pursat
20	197+300	372462	1390696	Pc167	et et rSuS	Pursat
21	198+800	371205	1391491	Pc168	et et rSuS	Pursat
22	200+300	369504	1392561	Pc169	et et rSuS	Pursat
23	203+400	367100	1394082	Pc170	et et rSuS	Pursat
24	204+000	366843	1394239	Pc171	et et rSuS	Pursat
25	204+700	366219	1394627	Pc172	et et rSuS	Pursat
26	206+300	365008	1395389	Pc173	et et rSuS	Pursat
27	206+600	364944	1395432	Pc174	et et rSuS	Pursat
28	207+200	364190	1395907	Pc175	et et rSuS	Pursat
29	207+400	363961	1396051	Pc176	et et rSuS	Pursat
30	210+300	361303	1397226	Pc177	et et rSuS	Pursat
31	211+100	360556	1397552	Pc178	et et rSuS	Pursat
32	211+400	360284	1397670	Pc179	et et rSuS	Pursat
33	211+500	360180	1397716	Pc180	et et rSuS	Pursat
34	212+800	358963	1398253	Pc181	et et rSuS	Pursat
35	213+200	358635	1398398	Pc182	et et rSuS	Pursat
36	213+500	358350	1398520	Pc183	et et rSuS	Pursat
37	213+600	358242	1398569	Pc184	et et rSuS	Pursat
38	214+500	357476	1398939	Pc185	et et rSuS	Pursat
39	214+900	357110	1399123	Pc186	et et rSuS	Pursat
40	216+800	355416	1399970	Pc187	et et rSuS	Pursat
41	217+800	354483	1400315	Pc188	et et rSuS	Pursat
42	218+300	354043	1400481	Pc189	et et rSuS	Pursat

#	KP	X	Y	Code	euuturutuurScut S	Province Name
43	224+700	348877	1404080	Pc190	et et rSuS	BTB
44	226+700	346958	1404536	Pc191	et et rSuS	BTB
45	227+700	345936	1404779	Pc192	et et rSuS	BTB
46	228+000	345683	1404844	Pc193	et et rSuS	BTB
47	228+600	345121	1404974	Pc194	et et rSuS	BTB
48	230+700	343091	1405459	Pc195	et et rSuS	BTB
49	231+700	342061	1405702	Pc196	et et rSuS	BTB
50	232+200	341582	1405818	Pc197	et et rSuS	BTB
51	239+200	335095	1408169	Pc198	et et rSuS	BTB
52	250+100	328772	1416877	Pc199	et et rSuS	BTB
53	253+100	327055	1419249	Pc200	et et rSuS	BTB
54	253+600	326725	1419706	Pc201	et et rSuS	BTB
55	257+000	325021	1422615	Pc202	et et rSuS	BTB
56	260+800	323612	1426027	Pc203	et et rSuS	BTB
57	268+500	320350	1432892	Pc204	et et rSuS	BTB
58	269+600	319775	1433937	Pc205	et et rSuS	BTB
59	272+200	318572	1436131	Pc206	et et rSuS	BTB
60	275+000	317448	1438721	Pc207	et et rSuS	BTB
61	278+000	315658	1441162	Pc208	et et rSuS	BTB
62	279+200	314739	1441667	Pc209	et et rSuS	BTB
63	282+200	312417	1443525	Pc210	et et rSuS	BTB

Table 4-6:Locations of box culvert construction with coordinates

#	KP	X	Y	Code	Structure species	Province Name
1	171+800	396489	1384657	Bc54	et et rSuS	Pursat
2	179+100	389289	1384762	Bc55	et et rSuS	Pursat
3	179+500	388866	1384782	Bc56	et et rSuS	Pursat
4	179+800	388561	1384798	Bc57	et et rSuS	Pursat
5	182+200	386330	1384904	Bc58	et et rSuS	Pursat
6	196+500	373211	1390225	Bc59	et et rSuS	Pursat
7	199+300	370806	1391742	Bc60	et et rSuS	Pursat
8	214+100	357887	1398735	Bc61	et et rSuS	Pursat
9	218+800	353619	1400639	Bc62	et et rSuS	Pursat
10	218+900	353500	1400682	Bc63	et et rSuS	Pursat
11	221+400	351346	1402000	Bc64	et et rSuS	Pursat
12	221+700	351155	1402176	Bc65	et et rSuS	Pursat
13	230+400	343378	1405391	Bc66	et et rSuS	Pursat
14	232+800	340999	1405954	Bc67	et et rSuS	Pursat
15	237+400	336532	1407103	Bc68	et et rSuS	Pursat
16	238+200	336005	1407495	Bc69	et et rSuS	Pursat
17	240+000	334572	1408668	Bc70	et et rSuS	Pursat
18	245+400	331626	1412967	Bc71	et et rSuS	Pursat
19	248+500	329783	1415503	Bc72	et et rSuS	Pursat
20	249+000	329456	1415950	Bc73	et et rSuS	Pursat
21	251+000	328305	1417516	Bc74	et et rSuS	Pursat
22	252+400	327462	1418686	Bc75	et et rSuS	Pursat
23	254+700	326177	1420517	Bc76	et et rSuS	Pursat
24	255+900	325523	1421532	Bc77	et et rSuS	Pursat

#	KP	X	Y	Code	Structure species	Province Name
25	259+100	324149	1424619	Bc78	e t et rSuS	Pursat
26	261+400	323430	1426509	Bc79	e t et rSuS	Pursat
27	262+300	323076	1427513	Bc80	e t et rSuS	Pursat
28	264+100	322479	1429151	Bc81	e t et rSuS	Pursat
29	267+000	321136	1431670	Bc82	e t et rSuS	Pursat
30	269+700	319752	1433980	Bc83	e t et rSuS	Pursat
31	270+400	319408	1434606	Bc84	e t et rSuS	Pursat
32	274+200	317615	1438038	Bc85	e t et rSuS	Pursat
33	276+100	317006	1439755	Bc86	e t et rSuS	Pursat
34	280+700	313562	1442562	Bc87	e t et rSuS	Pursat
35	281+700	312758	1443259	Bc88	e t et rSuS	Pursat

Source: *JICA Study Team Date Inventory Year 2013*

Mark: All of coordination above is in system of UTM, Datum Indian 1960, Zone 48N

Map-1

4.3.2 Survey Area and Target Section

The Survey areas are provinces of Pursat and Battambang. The target section is "Middle Section" in the following:

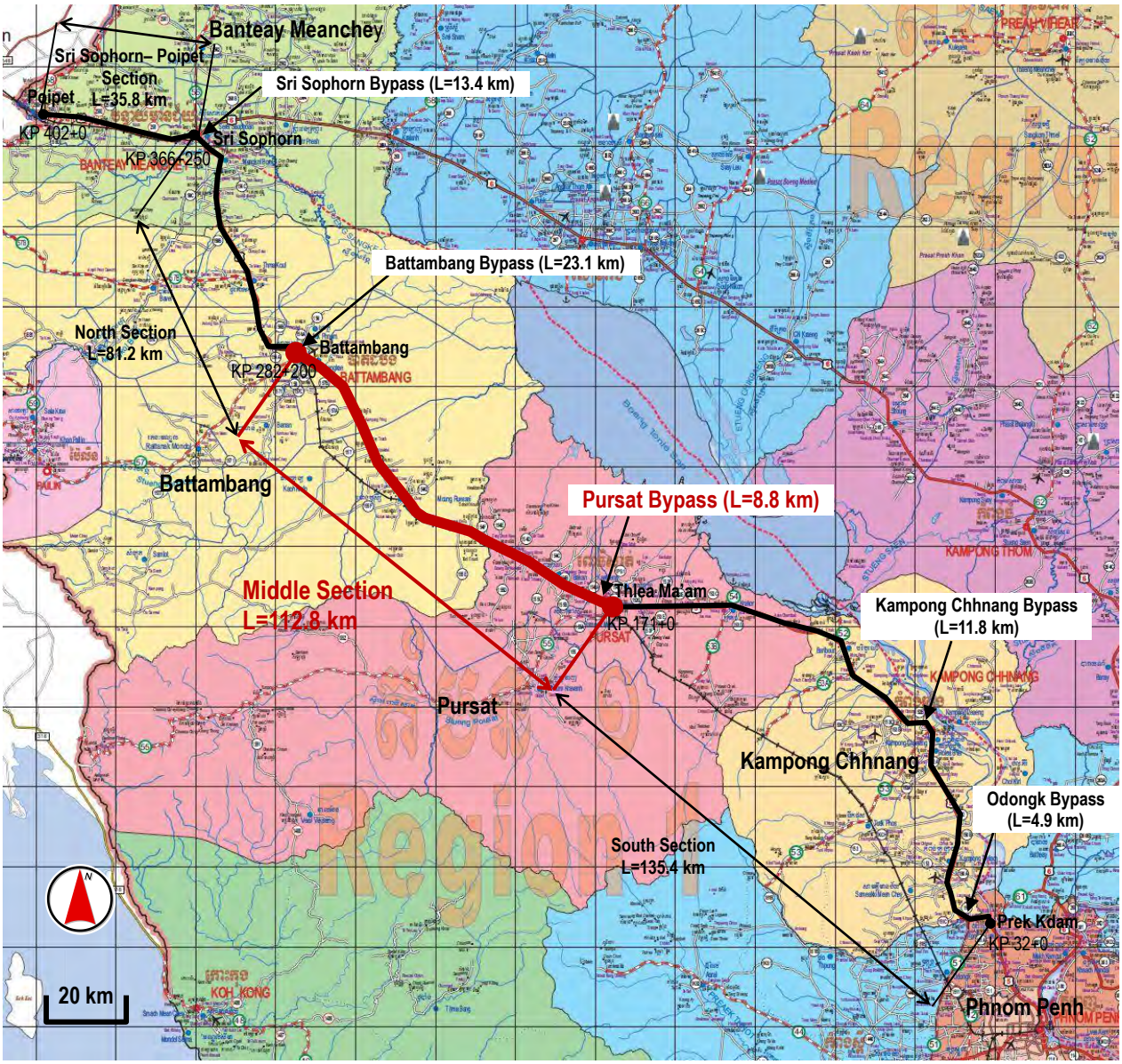


Figure: Location of Map

4.3.3Present Condition of Middle Section

The present condition of Middle Section of NR 5 can be summarized as follows:

1. **<u>Cross Section:</u>**

The existing cross section of Middle Section comprises two undivided opposing lanes and shoulders. All of road surface along Middle Section is Double Bituminous Surface Treatment (DBST) with a gravel shoulder. The average width of pavement of Middle Section is 10.4 m. The typical cross section of Middle Section is shown in the following Figure.

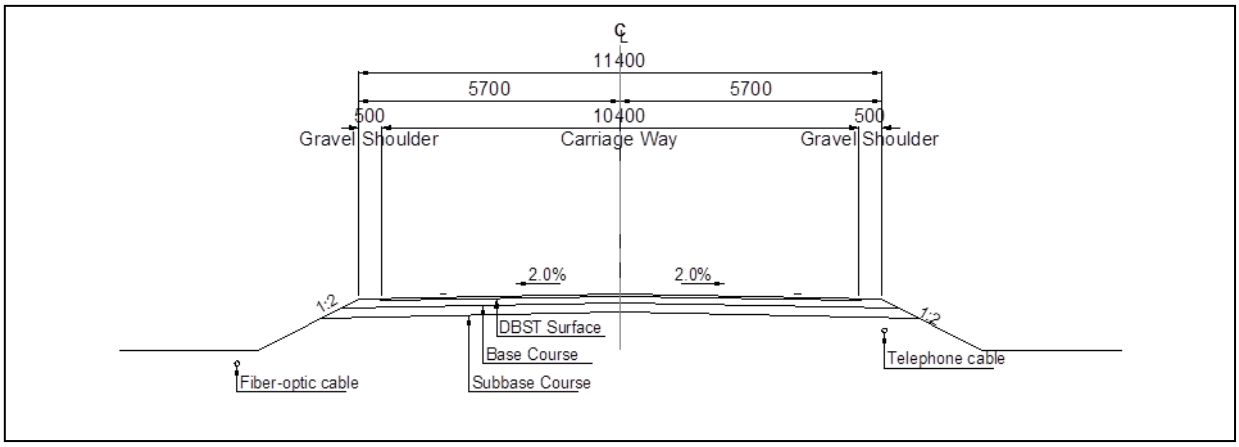


Figure: Typical Cross Section of Middle Section

2. **Horizontal and vertical alignment:**

In Middle Section, there are six curves with radii smaller than 350 m which is the minimum value for the design speed of 100 km/h. The curve lengths at 25 locations, including one location in urban, area are shorter than the minimum value. As NR 5 generally traverses flat terrain, and its vertical alignment is generally flat. The steepest grade on Middle Section is observed on the approach sections of the bridges. Even on the sections approaching bridges, the gradients are less than 4%, the maximum grade stipulated in the Cambodian Standard for Geometric Design. Thus, the gradient itself is not imposing serious problems. Rather, the height of the road surface near the bridges needs to be examined in relation to flooding/inundation.

3. **Bridges:**

There are four steel bridges and 34 concrete bridges in Middle Section.

4. **Roadside land use:**

There are many rice milling factories and warehouses which are functioning as the base stations of transportations of rice in Middle Section. And the roadside has been developed rapidly for new factories, commercial activities and residential buildings. Many factories, shops, stalls, vendors, and houses are observed adjacent to the road. About 55 villages, 23 communes/Sangkats are located along Middle Section, but amoung of those there are 14 villages and 2 communes/Sangkats located along the Pursat by-pass in the pursat province . The basic form of land use outside urbanized areas is agriculture, especially the cultivation of rice paddies.

4.3.4 Problem of Present Middle Section

The problems of present Middle Section can be summarized as follows:

(1) Insufficient Road Width

- The average width of existing carriage way is 10.4 m. A carriage way with this width cannot provide with sufficient space for full 4-lanes.
- Forecasted traffic demand in 2033 on the section between Thlea Ma'am and Battambang is approximately. 25,500 pcu/day as it is forecasted in this Survey. A full 4-lane road is necessary to accommodate this traffic volume.
- Thus, widening to full 4-lanes will become necessary before year 2033.

(2) Weak Pavement Structure

- Existing pavement is DBST. Because of small bearing capacity of DBST, damages occur every year, especially after rainy season.
- Because of potholes and other defects, vehicles are forced to slowdown. This is causing great economic loss.
- MPWT are spending considerable amount of fund in repair of damaged pavement every year. This financial burden to the Royal Government of Cambodia (RGC) can be reduced if the pavement is improved to asphalt concrete (AC).

- Thus, improvement of pavement to AC is needed.

(3) Insufficient Road Height

- Flood water flew over the road surface at some places of Middle Section in October 2013.
- Thus, raising the height of the road at those places is needed.

(4) Passing Through Urbanized Areas

- Existing NR 5 is passing through cities and towns, such as Pursat.
- This is not desirable not only from viewpoint of traffic congestion but also from viewpoint of traffic accident and air pollution.

4.3.5 Project Outline

1. Objective of Project

Objective of the project is to solve or mitigate the problems of exiting Middle Section of NR 5:

- Improvement of traffic safety by providing separate lanes for high-speed traffic and slow traffic;
- Provide sufficient traffic capacity by widening and mitigate traffic congestion which is anticipated in the near future;
- Improving pavement into AC to support heavy traffic;
- Construct bypasses to let the through traffic detour Pursat City and avoid widening of the existing NR 5 which necessitates resettlement of large number of houses and families.

2. Improved Section

Middle Section is divided into three sections; Section I, II and III as shown in the follow Figure of conceptual drawing.

Section-I:

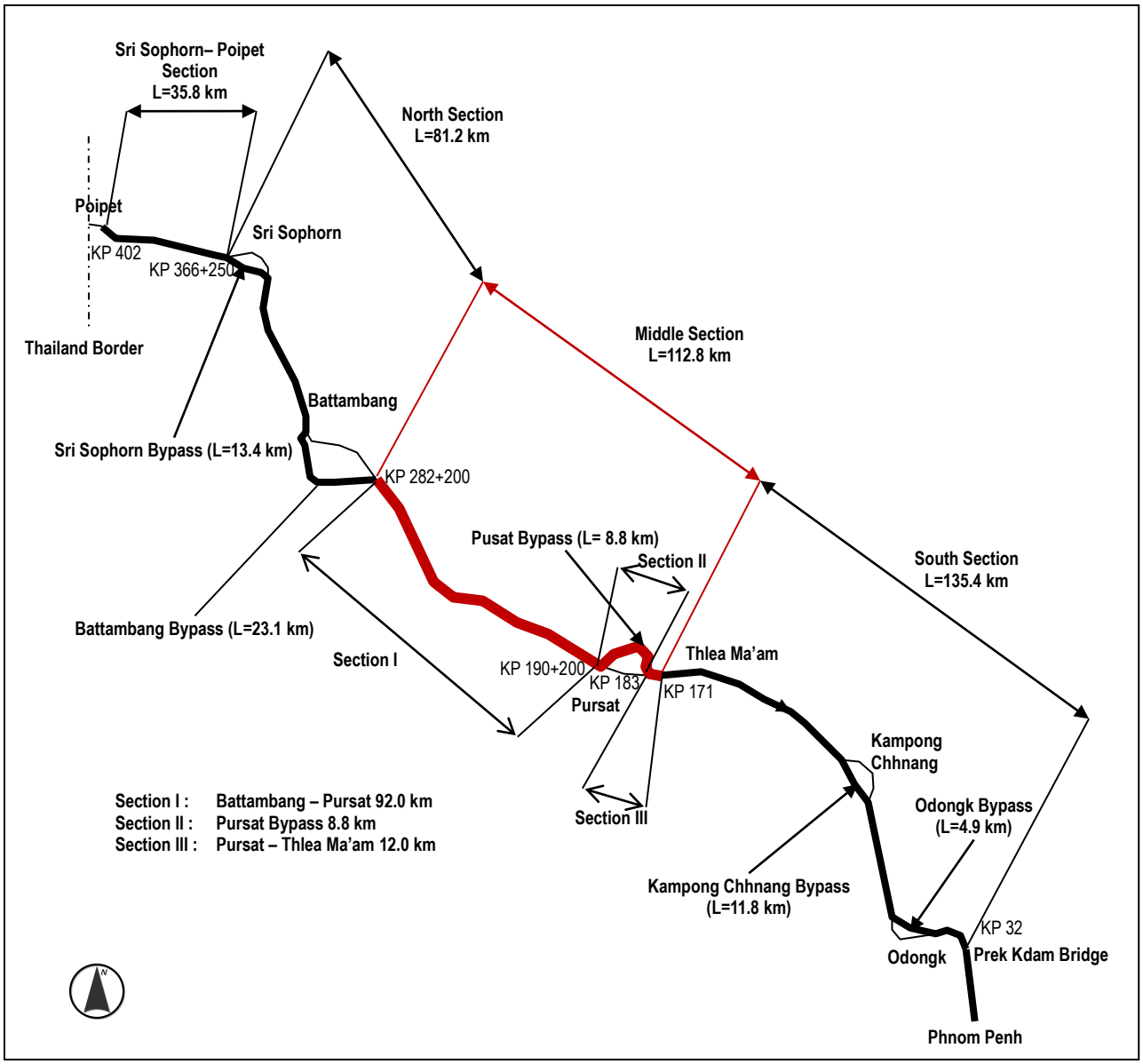
Section-I starts from KP171+000 in Thlea Ma'am to at the end of the South Section and end up to KP183+000 at the starting point of Pursat Bypass (Middle Section).

Section-II:

The main scope of work of this section is construction of Pursat Bypass. This section starts from KP183 to KP190+200, and it is proposed as a new bypass to avoid large scale relocation of households/buildings in the urbanized area of Pursat city.

Section-III:

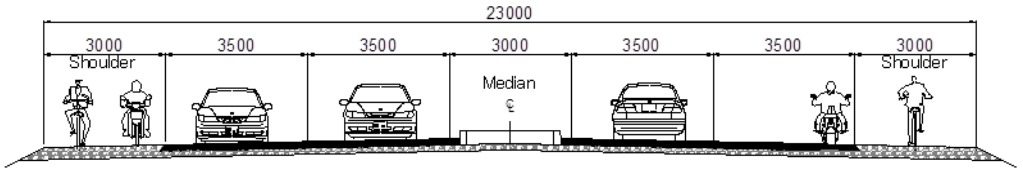
The main scope of work of this section is widening into 4-lane. Section III starts from KP190+200 (the end point of Pursat Bypass), and to KP282+200 that it connected at the starting point of Battambang Bypass which included in the North Section.



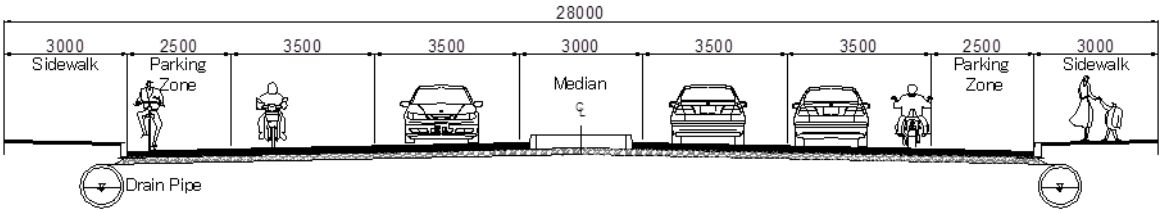
3. General Scheme of Improvement

A. Cross Section:

It is proposed to widen the existing NR 5 into full 4-lanes with raised median division. The following Figure shows the proposed typical cross sections.



Rural Area
Raised Median (w=3.0 m) + full 4-lane Carriageway (w=3.5 m) + Shoulder (w=3.0 m)



Urban Area
Raised Median (w=3.0 m) + full 4-lane Carriageway (w=3.5 m) + Parking Zone (w=2.5 m) + Sidewalk (w=3.0 m)

Figure: Proposed Cross Section



Road Design After Construction

B. Horizontal Alignment:

Middle Section of NR 5 will be improved basically keeping the present road center line. However, horizontal alignment of some sections of the road not satisfying the minimum radius of curve will be improved.

C. Elevation of Road Surface:

Elevation of the road surface and installation of new drainage facilities are planned based on the survey on the flood water level.

D. Improvement of Pavement Structure:

It is proposed that the pavement structure be improved from DBST to AC.

E. Improvement of Intersection:

For the smooth traffic and traffic safety and access road to NR 5, improved intersection without traffic signal is applied to every intersection for the highway design in response to the forecasted traffic volume.

F. Improvement of Bridge:

It is proposed that the bridge structure be improved from 2-lane to 4-lane.



Concrete bridge RC needs to improve



Concrete bridge RC needs to improve

G. Culvert:

There are 98 culverts needed to rehabilitate in total, included 35 box-culverts and 63 pipe-culverts making from Reinforcement Concrete that will be constructed on location of main rivers and streams crossing the road in order to drain water from flooding at upstream in time. Moreover, through by-pass there are Canals and creeks that these locations need to construct culverts also.

Multiple box culverts with twin and triple cell will be constructed according to the size of streams or natural moats and water discharge calculation. On the other hand, these hydraulic structures will flow current of water and drain water from flooding at upstream. Also these are able to conserve the local ecosystem and aquatic plants; then there are 4 species of pipe culverts such as single, double, triple, and four cells (see picture below).



Rehabilitated and expanded double cell pipe culvert



Rehabilitated and expanded single cell pipe culvert



Rehabilitated and expanded triple cell pipe culvert



Rehabilitated and expanded four-cell pipe culvert



Rehabilitated and expanded singe cell box culvert



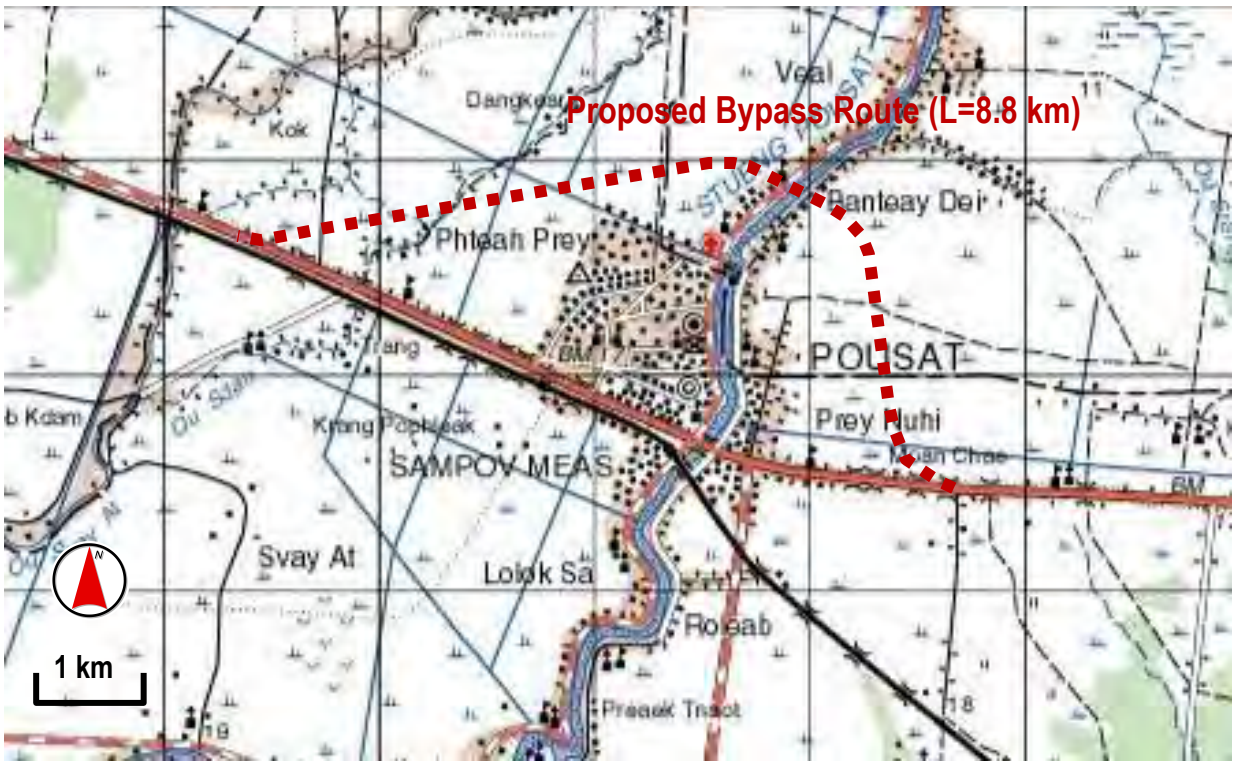
Rehabilitated and expanded double cell box culvert



Rehabilitated and expanded triple cell box culvert

H. Pursat Bypass:

A new road with 8.8 km long, 4-lane cross section and AC pavement is to be constructed traversing mainly agricultural land (rice paddy) in the north suburbs of Pursat City.



Figur: Proposed Route of Pursat Bypass

4.3.6 Construction Plan and Activity Schedule

Rehabilitation and expansion of NR5 have some components and activities as the following:

- Study, observe, measure, test, examine are done on the existing road with the cooperation between JICA Survey Team and Ministry of Public Works and Transport including other concerned institutes;
- First draft of the rehabilitated and expanded drawing of NR5 was prepared and drafted by JICA Survey Team;
- Project assessment and cost estimation for ODA loan of Japan were done and prepared by JICA Survey Team;

- Measurement, observation, study of immovable properties and crops of people along the project site, 20meters from center line or CIO:20m (Total Width 40m). Then the resettlement plan will be studied by JICA Survey Team cooperating with local consultants;

- Environmental and Social Impact Assessment was be prepared by JICA with the cooperation with local consultants;

- Ministry of Public Works and Transport (MPWT) will submit the report of Environmental and Social Impact Assessment to Ministry of Environment (MoE) in order to approve;

- Ministry of Public Works & Transport (MPWT) and Ministry of Economy and Finance (MEF) will sign on agreement with JAPAN for ODA loan;

- Ministry of Public Works & Transport (MPWT) and JICA Survey Team will respond for procurements in order to select technical consultants (national and international consultants) for stage of detailed design;

- Technical consultants will respond for study detailed plan layout, and preparation of document for procurement of rehabilitation and expansion of NR5;

- Inter-ministries Resettlement Committee (IRC) leaded by MEF will work for Detail Measure Survey (DMS) for affected immovable property and crops according to detailed plan layout;

- Inter-ministries Resettlement Committee (IRC) will give the compensation and other supported money to affected people by project;

- Procurement of Contractor (international) in the construction of the project will be prepared by the Ministry of Public Works & Transport, Ministry of Economic & Finance and JICA;

- The contractors company will work under management of technical consultant of the Ministry of Public Works and Transport to construct and expand this road;

- Site observation and construction quality test will be conducted by Ministry of Public Works & Transport (MPWT);

- The official inauguration of the road will be celebrated under the high sovereignty of Prime Minister of the Kingdom of Cambodia, **Samdech Akka Moha Sena Padei Techo Hun Sen**;

  Rehabilitation project on NR5, from Thlea Ma'am in Pursat province to Battambang province will have planned to sign on the loan agreement by 2014 then the project will start constructing inMay 2017 and it will complete in April 2020.

Note: *for the location of the construction, borrow pit of laterite and stone, it cannot detail identify because the project owner is not recruited the technical consultant for detail project design, because the technical consultant has to identify about soil, stone and laterite quality following to the standard of highway and it will make clear in the detail report of the project.*

4.3.7 Wastes Management

The national road no. 5 improvement project, middle section Thlea Ma' Am from Pursat to Battambang are existed 2 types of wastes: it is solid waste and liquid waste, it decribed below:

A. Solid Waste

To take out of solid waste for this project it is in the construction stage in period of 3 years which disposed by the staff-workers of contractor and staff-workers of the project; this waste such as: papers, plastic bags, bottle plastic, can or bottle metal, class bottle, waste from the kitchen, old tires, wooden cases, concrete waste, waste rubber floor, old clothes, lamps, car battery or battery etc.,. these wastes the contractor should do separate waste into 2 types; it is hazard waste such as old clothes contaminated with oil or cement, can or bottle contained with oil or paint or chemical bag, cement, lamps, battery should keep in the garbage bin that painted with red color in Khmer and English language stated" hazard waste". This waste, the contractor should contact to garbage collection service firm in the Town (in Pursat Town there is garbage collection firm, it name is Pov Sitha firm, and in Battambang there is SINTRY Firm), they should transport this waste disposed into the dump site. Old tire car and car battery

they should sell it to the Junk buyer. Ther is Junk shop located along the NR5, His name is Leng Thea (Tel: 012 404022 or 088 6718188), for cement bags they should re use it as other tools or provide it to the villager for mat to dry of paddy, donot burn it. For the normal waste, it is not hazard waste such as wooden case or metal case, bottle or can plastic they should reuse or sell to Junk shop. Anotherhand, concrete waste should do break it into small pieces, the rubber waste they should contact to local Authority to transport it to fill on rural road or provide it to the villager to fill on front of their house, donot through it into the water sources.

B. Liquid Waste

As well as the same sloid waste, the liquid waste in the period of construct stage is 3 years which disposed by the staff-workers of contractor and staff-workers of the project; this waste such as: liquid waste outlet from the toilets and bath rooms, liquid waste that making freezer and it expired bring out from machines, oil and oil waste, fuel, oil used, chemical solution waste etc., for this liquid waste should devide into 2 types separately. The normal waste such as waste outlet from the toilet, bath rooms and kitchen etc., should do moderm septic tank with 2-3 blocks for treatment. For the hazard waste such as oil solution waste, liquid waste that making freezer and it expired bring from the machines, and other oil and oil waste, fuel, oil used etc., should do properly manage, water and oil wste should do spreading water out, for the oil and water that it very viscous and liquid waste that making freezer with viscous and other solution should dispose it into the pit and it is far from the water sources. For oil used should do reuse it or provide to the villager for their fire kiln.

4.3.8 Water and Energy Use Planning

A. Water Use

Water use is 3 types: (1) water use drinking, (2) water use for bathing, cooking, and (3) water use for spaying on road. The water for drinking they use water bottle or tank. Water use for bathing, cooking, and others cleaning they use from water supply station or water transport by truck container and they store it in the tank or storage. Water use for spaying on road they do pumping from the River of Pursat direct and water sources where is water nearest from construction site.

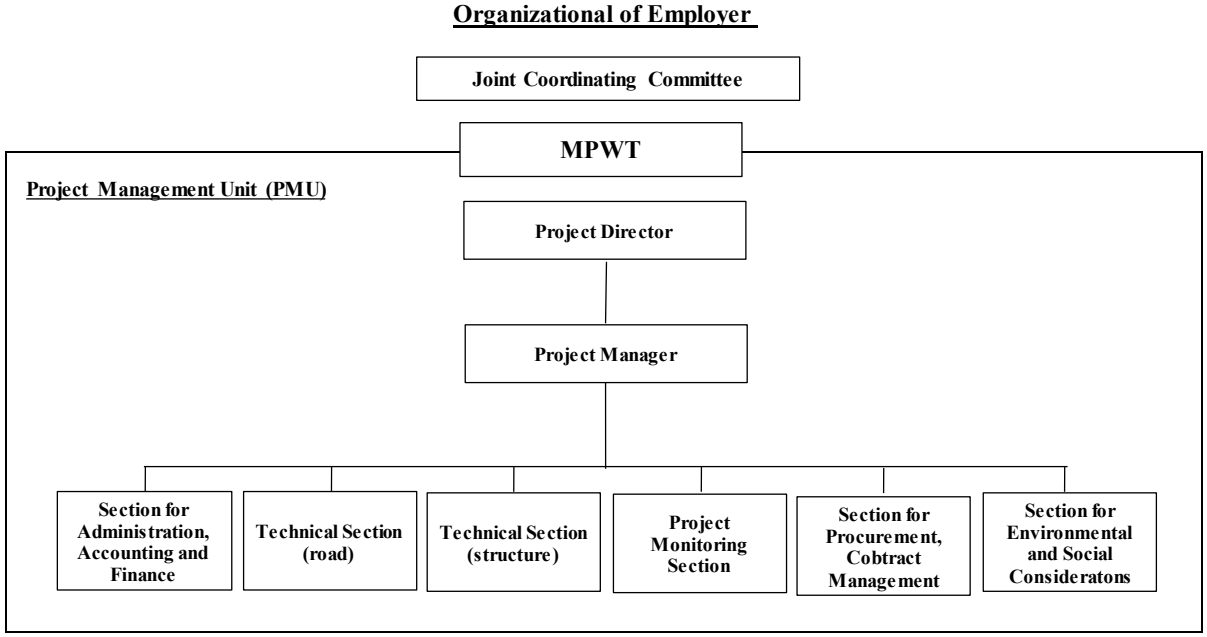
B. Energy Use

Electricity Energy use is 2 types: (1) from the generator that it has a box to protect noise (Silient Genertor), and (2) from the connection electricity network.

Note: *the volume of water use and energy use, it is not do detail design because the project is in the feasibility study for estimation loan from Japan, and in the detail design project stage it will identify next step by the technical consultant.*

4.3.9 Organizational Chart of Work Management for NR5

Chart of Structure Administration for Project Improvement of NR5



CHAPTER-5

EXISTING ENVIRONMENT RESOURCES IN THE PROJECT AREA DESCRIPTIONS

CHAPTER-5

EXISTING ENVIRONMENT RESOURCES IN THE PROJECT AREA DESCRIPTIONS

In this chapter has given a very detailed description of the existing environmental resources (Physical, natural and Socio-economic environment) at the project area that collected from involved institution/agency and from field investigation on natural resources, as basic data for analysing and evaluating to prepare report of Environmental and Social Impact Assessment (ESIA), which will be affected by project activity. For environmental resource at the project site, the survey team studied 150 meters away from centre line of road (there are 300 m width X 112.8Km), its area is 3,384ha.

5.1 Natural Environment

5.1.1 Physical Resources

5.1.1.1 Geology, Topography and Soil Profile in Project Area

1- Topography

Geology of project area is located in lower part which is almost flat with elevation from 8m up to 15m (m.s.l). Land uses along this road are agricultural land, residential land, urban/counties/towns, streams/rivers, lakes/ponds, some re-growth Riverside vegetation along the bank of stream or river or lake or pond (see map 1). Average slope in project area is about I=0.0008 (0.08%), equaling to 0.56 degree (it doesn't include the river bed of Pursat and other streams which the project goes across). For a road portion from Thlea Maam to Battambang of NR5, the water is mostly flowed from the left side of the road (called upstream of road) to the right (called downstream of road). Sometime, water is from upstream and it continuously flows along the road, then it goes forward to streams/rivers at downstream by culverts or bridges; water from these rivers/streams will flow directly to Tonle Sap Lake.

2- Soil Type

Based on Crocker's map in 1963 with scale of 1/1.000.000 mentioned that there are fives pecies of soil in both sides of NR5 (NR5),a portion from Thlea Ma'am in Pursat to Battambang that were described as the following table:

Table 5-1: **Soil species in both sides of NR5, a portion from Thlea Ma'am/Pursat- Battambang**

No.	Section	Soil type	Direction	Located Kilometer Post (KP)	Remarks
1	Section-3	Cultural Hydromorphics	Right and Left	171 to 177+380	1 section
2		Gray Hydromorphics	Right and Left	177+380 to 182+390	1 section
3		Alluvial Lithosols	Right and Left	182+390 to 183	1 section
4	Section-2	Alluvial Lithosols	Right and Left	183(0+00) to 3+800	1 section
5		Gray Hydromorphics	Right and Left	3+800 to 8+800 (KP190+200)	1 section
6	Section-1	Gray Hydromorphics	Right and Left	190+200 to 194+380, 210+120 to 214+370	2 section
7		Cultural Hydromorphics	Right and Left	194+380 to 206+750, 214+370 to 224+610	2 section
8		Lacustrine Alluvial Soils	Right and Left	206+750 to 210+120	1 section
9		Brown Hydromorphics	Right and Left	224+610 to 282+200	1 section



Soil type:Cultural Hydromorphics in project area.
Picture: July 9, 2013



Soil type:Gray Hydromorphics in project area.
Picture: July 15, 2013





Soil type:Brown Hydromorphics in project area.
Picture: August 10, 2013



Soil type:Alluvial Lithosols in project area.

Picture: July 11, 2013





Soil type:Lacustrine Alluvial Soils in project area.

Picture: July 11, 2013

- **Cultural Hydromophic**: this soil type is the mixture of smooth sandy soil and hard alluvial soil with reddish-brown or become grey. Its layer is from 30 cm to 40 cm, and depth from 60cm to 120 cm is sandy soil with clay and mixing with gravel-texture which is the cause of lightly grey or rust color. Most of this soil type is lowland rice field flooding in wet season, its nutrient is poor.
- **Grey Hydromorphics**: In project area, soil type is the mixture of hard alluvial soil and some sandy soil with reddish-brown and dark color. Its layer is from 30 cm to 50 cm, and depth from 50cm to 100 cmis sandy soil with clay and mixing with gravel-texture which is the cause of lightly grey or rust color. A long the road, this soil type is residential land and lowland rice field flooding in wet season, its nutrient is pretty good for rice field, vegetable and crops.
- **BrownHydromorphics**: In the project area, it is adherent soil with reddish-brown. Its layer is from 40 cm to 50 cmand depth from 50cm to 100 cmis clay with reddish-brown or become yellow. For this soil type along the road, we saw some residential land and agricultural land flooded in wet season, its nutrient is pretty good for rice field, vegetable, and other crops (mango, orange and pineapple).

- **Alluvial Lacustrine**: This soil type is mostly along the Pursat River flooded in wet season. It is adherent hard alluvial soil with reddish-brown or become grey. Its layer is over 130 cm. For this soil type along the road, we saw some residential land and agricultural land that people can plant crops vegetable and paddy rice.
- **Lacustrine Alluvial Soils**: In the project area, this soil type is flooded in wet season. It is the mixture of hard alluvial soil and some smooth sandy soil with light reddish-brown and dark color. Its layer is from 40 cm to 80 cm, and depth from 80cm to 120 cm it is reddish-brown clay and mix with Terra Cotta (hard, baked reddish-brown clay) that it is hard to absorb water. A long the road, this soil type is residential land and rice field, its nutrient is average for rice field and other crops like green soybean, soybean, watermelon, cantaloupes…etc. that people can plant in dry season.

3- Geology

According to geological map of Department of Geology that sponsored by JICA in 2002, it mentioned that the project area is located in the lowland of Pursat river of Pursat lowland and Sandas of Battambang lowland. This lowland existed in quaternary period of Holocene Epoch and Cenozoic Era that was 2.58 million years Old still now due to have two species of alluvial sediments, deltaic deposits and lake bed deposits. It is deltaic deposits started from Kilometer Post: KP171 to Svay Daun Keo River, this type was from sediments of delta; while the type of lake bed deposits was made up from sediments of lake bed. These two species of alluvial soil are called Young Alluvium.

A. Soil and Rock Layer

According to the drilling of geology for foundation of Bridge that drilled by the JICA Survey Team for 12 boreholes which can be concluded as follows:

a) In general, from depth 0m to 15m it is no hard or rock layer to bear the weight of bridges. But the hard layer is on the depth more than 50m (Referred to SPT results). But, there is rock layer was deeper 50m;

b) In general, common soil of top layer in this area from depth 0m to 15m most is clayey-silt and sandy-silt and started from 15m to 25m are clay, clayey-sand and clayey-gravel;

c) From depth 0m to 15m, the SPT was done with N value from 2 to 52blowsand from depth 15m to 25m with N value from 15 to 120 blows according to clay layer and sand layer. The observation is shown that at the clay layer, the N value blow is less than at the coarse sand layer and gravel layer;

d) Design of friction (skin) piles shall be considered for news bridge foundation referred to the site test result.

B. Ground Water

The NR5, for apportion from Thlea Ma'am in Pursat to Battambang, is the middle part of lowland which covered by the young alluvium with layer of hard alluvial soil, clay, smooth sand, rough sand, and gravel-texture from 0m to 50m depth. According to the experiences of engineer of drilling well for rural clean water, the project area is covered by old alluvium that the amount of ground water is more than area that covered by young alluvium. The aquifer is in the layer of smooth sand with small and average grainy size (from 0.25mm to 0.5mm) and its color is dark reddish-brown or become rust color. For layer of rough sand (its grainy size is from 2mm to 4mm), the sand color is light clear yellow or become yellow; this layer has no water. The amounts of water have small or much according to thickness of sand layer. Thicker sand layer has water much more than thinner sand layer.

There are two layers of grown water: (1) the upper layer of ground water is unconfined aquifer which its flow direction is to Tonle Sap with the depth from 5m to 14m. (2) Layer of confined aquifer with pressure is generally found out in the young and old alluvium at depth from 15m to 50m. The sand layer is separated by clay layer. However, some location of young alluvium has no water as in the Svay Daun Keo commune; there is no ground water from Confined Aquifer layer using. The location of tube/drilling and shallow wells in the communes/Sangkat along the NR5 for a portion from Thlea Ma'am in Pursat province to Battambang province are showed in the following table:

Table 5-2: Wells located on both sides of NR5 for a portion from Thlea Ma'am in Pursat to Battambang province

No.	Commune/ Sangkat	Direction	Location of Kilometer Post (KP)	Shallow well (%) (Unconfined Aquifer)	Drilling well (%) (Coffined Aquifer)	Remarks
1	Boeng Kantuot	Right	Right from 171 to 177+285	5	10	Some loctions have no water
2	Tnoat Chhum	Left	Left from 171 to 177+280	10	0	No Confined Aquifer
3	Prey Nhi	Right + Left	Right from 177+ 285 to 1+ 500 Left from 183 to 1+500	20	0	No Confined Aquifer
4	Roleab	Left	Left from 177+240 to 183+000	11	0	No Confined Aquifer
5	Banteay Dey	Right + Left	Right from 1+ 500 to 3+ 480 Left from 1+500 to 3+480	6	21	Some loctions have no water, people using water pipe
6	Veal	Right + Left	Right from 3+ 480 to 4+ 790 Left from 3+480 to 4+790	2	7	Some loctions have no water, people using water pipe
7	Phtaesh Prey	Right + Left	Right from 4+ 790 to 8+ 800 Left from 4+790 to 8+800	0	0	No either Unconfinedor Coffined Aquifer
8	Svay At	Left	Left from 190+200 to 191+130	5	0	No Confined Aquifer
9	Snam Preah	Right + Left	Right from 191+130 to 198+875 Left from 191+130 to 198+875	70	0	Ground water has limite for Confined Aquifer
10	Trapeang Chong	Right + Left	Right from 198+875 to 206+150 Left from 198+875 to 206+150	68	11	Some loctions have no water
11	Boeng Khnar	Right + Left	Right from 206 +150 to 213 +670 Left from 206 +150 to 213 +670	22	30	Some loctions have no water
12	Ou Tapaong	Right + Left	Right from213+ 670 to 217+840 Left from 213+460 to 217+840	15	25	Some loctions have no water
13	Svay Doun Keo	Right + Left	Right from 217+840 to 221+470 Left from217+840 to 221+470	0	0	No either Unconfinedor Coffined Aquifer
14	Ruessei Krang	Right + Left	Right from221+470 to 228+040 Left from 221+470 to 228+040	0	0	No either Unconfinedor Coffined Aquifer
15	Prey Svay	Right + Left	Right from228+040 to 240+030 Left from228+040 to 240+030	0	29	Ground water has limit
16	Kear	Right + Left	Right from240+030 to 250+960 Left from240+030 to 250+960	0	0	No either Unconfinedor Coffined Aquifer
17	Moung	Left	Left from 244+380 to 350+390	0	0	No either Unconfinedor Coffined Aquifer
18	KaKaoh	Right + Left	Right from250+960 to 255+600 Left from250+960 to 255+600	0	0	No either Unconfinedor Coffined Aquifer
19	Prey Touch	Right + Left	Right from255+600 to 264+620 Left from255+600 to 264+620	30	50	Some loctions have no water
20	Kampong Preang	Right + Left	Right from264+620 to 271+900 Left from264+620 to 271+900	40	30	Some loctions have no water
21	Kampong Preah	Right + Left	Right from271+900 to 280+460 Left from272+950 to 280+245	29	1	It is dificult to look for Confined Aquifer
22	Anlong Vil	Right	Right from280+460 to 282+200	0	20	Ground water has limit
23	Ou Dambong-2	Left	Left from280+245 to 282+200	0	50	Ground water has limit

Note: The consumption of wells was calculated by percentage of people in commune.

5, 6 and 7 is Pursat by-pass, KP is started from KP-0+000.

Source: Interviewed with Sangkat/commune cleaks or chiefe of commune council from July 1 to August 10, 2013.

4-Mines

Due to the survey right of way for NR5 (There are 60m m in total, or 30m off set from center line to both sides), a portion from Thlea Ma'am in Pursatto Battambang province included Pursat by-pass, there is no any important mine exploitation which is found in the project area.

5.1.1.2 Climate

1. Rainfall

Due to data from Provincial Department of Water Resources and Meteorology in Pursat (2002-2010) and data from Ministry of Water Resources and Meteorology (2000-2001 and 2011-2012), it indicated that average rainfall in Pursat province for 13 years of return period, from 2000 to 2012, is **1372.9mm**. However, the highest rainfall is **454.6 mm** in October 2003.

According to the data from Provincial Department of Water Resources and Meteorology in Battambang province (2000-2002) and data from Ministry of Water Resources and Meteorology (2003-2012), it indicated that average rainfall for 12 years of return period, from 2000 to 2012, is 1291.6 mm. Then, the highest rainfall is in October, 440.9**mm** in 2011.

Table 5-3 (A):Rainfall in millimeters for 13 years period (2000-2012) in Pursat

Monthly / Yearly	Jan / I	Feb / II	Mar / III	Apr / IV	May / V	Jun / VI	Jul / VII	Aug / VIII	Sep / IX	Oct / X	Nov / XI	Dec / XII	Yearly Total (mm)
2000	2.5	6.9	36.0	182.4	285.8	214.9	153.6	237.1	146.9	411.5	37.5	25.3	**1740.4**
2001	4.8	0.0	214.1	25.4	143.6	134.3	77.2	260.5	212.0	171.9	31.0	22.0	**1296.8**
2002	0.0	0.0	31.5	208.6	82.7	102.0	65.7	316.3	198.0	253.2	139.3	11.6	**1408.9**
2003	0.0	2.0	247.2	13.0	98.2	206.0	237.6	43.0	203.0	454.6	75.6	2.4	**1582.6**
2004	2.0	9.8	48.4	65.5	175.8	148.8	233.4	105.3	257.6	101.2	26.4	0.0	**1174.2**
2005	0.0	0.0	42.8	99.8	170.1	164.7	113.6	190.6	309.5	154.0	74.2	4.5	**1323.8**
2006	0.0	6.5	88.5	101.8	89.7	180.2	120.0	329.0	199.8	191.7	3.7	82.4	**1393.3**
2007	0.0	0.3	88.2	122.8	264.5	208.7	83.0	181.9	234.7	199.6	111.8	0.0	**1495.5**
2008	13.5	7.0	77.0	171.7	226.8	168.0	188.8	361.2	210.1	305.9	224.2	8.0	**1962.2**
2009	3.6	28.4	56.2	135.0	135.1	127.9	146.7	162.9	175.2	140.1	44.7	0.0	**1155.8**
2010	6.4	26.7	49.6	92.8	86.9	202.5	197.3	241.6	167.6	286.0	42.6	30.3	**1430.3**
2011	73.2	71.4	70.4	76.5	77.6	79.0	80.2	83.6	84.2	83.9	78.4	78.7	**937.0**
2012	79.0	80.0	70.0	65.0	68.6	72.0	75.0	85.0	89.0	90.0	88.0	85.0	**946.6**
Monthly Mean	**14.2**	**18.4**	**86.1**	**104.6**	**146.6**	**154.5**	**136.3**	**199.8**	**191.4**	**218.7**	**75.2**	**26.9**	**1372.9**
Max	**79.0**	**80.0**	**247.2**	**208.6**	**285.8**	**214.9**	**237.6**	**361.2**	**309.5**	**454.6**	**224.2**	**85.0**	**2787.6**
Min	**0.0**	**0.0**	**31.5**	**13.0**	**68.6**	**72.0**	**65.7**	**43.0**	**84.2**	**83.9**	**3.7**	**0.0**	**465.5**

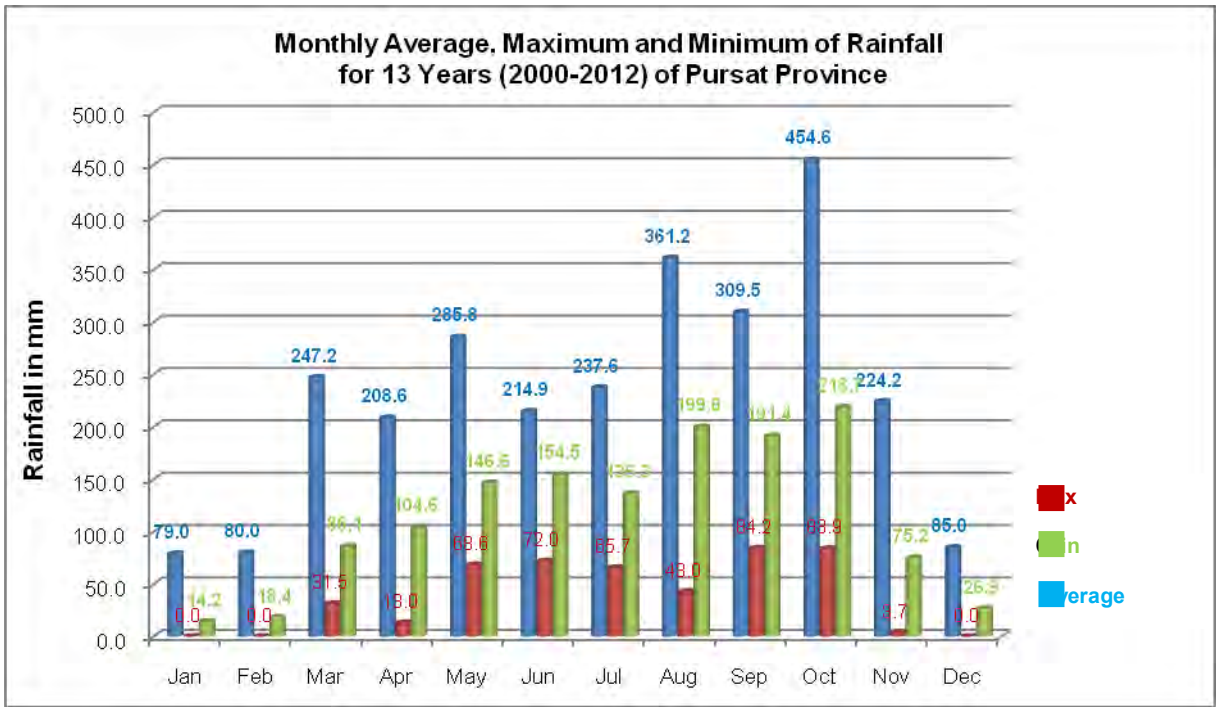
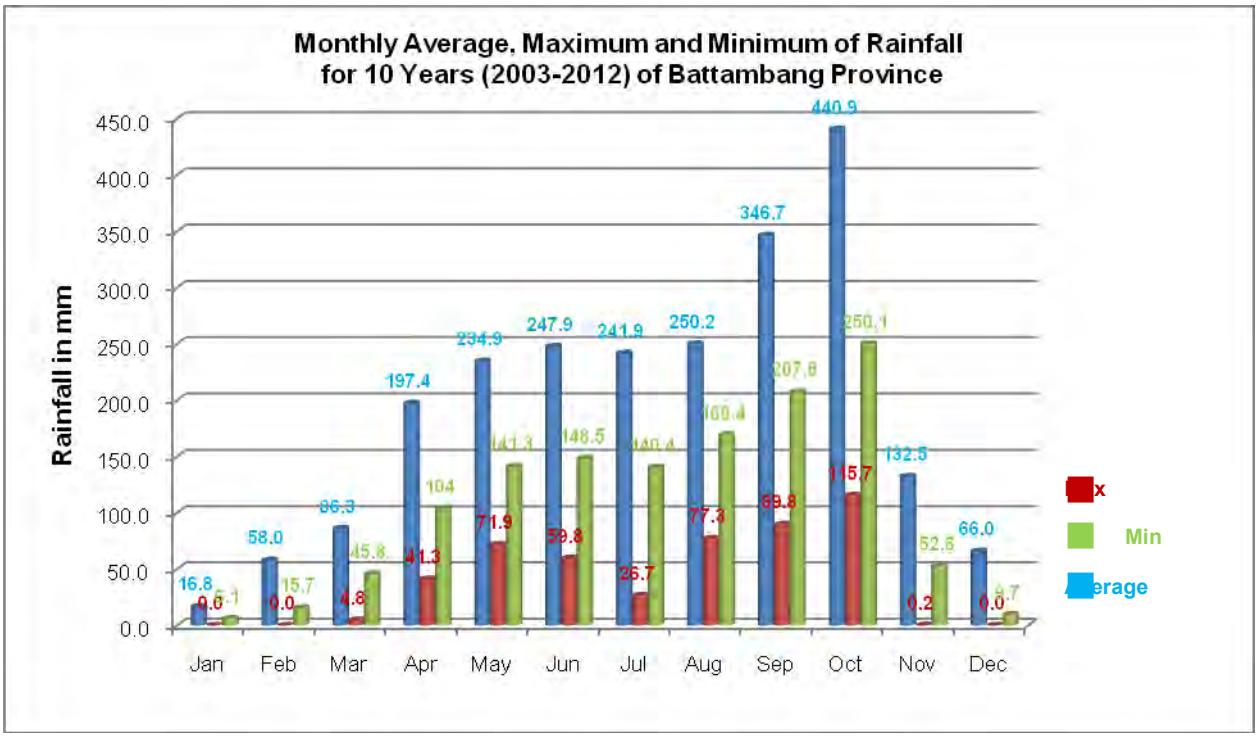


Table 5-3 (B):Rainfall in millimeters for 10 years period (2003-2012) in Battambang

Monthly / Yearly	Jan I	Feb II	Mar III	Apr IV	May V	Jun VI	Jul VII	Aug VIII	Sep IX	Oct X	Nov XI	Dec XII	Yearly Total (mm)
2000	0.0	12.5	36.9	105.6	156.6	183.9	204.5	199.2	136.1	318.5	30.2	66.0	**1450.0**
2001	11.9	23.6	72.7	52.9	146.5	192.8	102.5	185.9	89.8	163.9	87.2	16.5	**1146.2**
2002	2.9	0.0	23.2	87.7	71.9	147.8	26.7	190.8	179.5	336.0	116.5	14.1	**1197.1**
2003	0.0	0.0	28.5	197.4	77.8	172.1	110.8	198.5	132.1	140.3	0.2	0.6	**1058.3**
2004	9.0	0.0	4.8	45.1	80.5	247.9	197.0	118.3	161.0	115.7	14.5	0.0	**993.8**
2005	3.3	0.0	25.6	160.0	157.6	59.8	134.3	92.6	217.5	316.4	50.9	19.1	**1237.1**
2006	10.8	27.0	48.1	60.1	125.9	161.2	227.6	246.7	124.7	165.1	20.9	1.3	**1219.4**
2007	16.8	24.7	86.3	41.3	234.9	195.8	112.8	77.3	283.2	116.2	132.5	0.0	**1321.8**
2008	0.0	0.0	74.9	162.7	194.4	128.4	73.3	166.4	274.5	281.6	32.3	1.6	**1390.1**
2009	0.0	0.0	74.9	162.5	196.4	128.4	73.3	166.4	274.5	281.6	38.8	1.6	**1398.4**
2010	8.3	12.0	25.2	69.9	77.3	121.2	241.9	216.6	193.3	325.2	40.5	0.6	**1332.0**
2011	0.0	58.0	35.1	150.3	151.5	107.0	186.8	250.2	289.1	440.9	34.3	4.2	**1707.4**
2012	16.2	46.8	58.6	56.3	166.2	83.7	133.6	93.2	346.7	249.4	87.9	0.0	**1338.6**
Monthly Mean	**6.1**	**15.7**	**45.8**	**104.0**	**141.3**	**148.5**	**140.4**	**169.4**	**207.8**	**250.1**	**52.8**	**9.7**	**1291.6**
Max	**16.8**	**58.0**	**86.3**	**197.4**	**234.9**	**247.9**	**241.9**	**250.2**	**346.7**	**440.9**	**132.5**	**66.0**	**2319.5**
Min	**0.0**	**0.0**	**4.8**	**41.3**	**71.9**	**59.8**	**26.7**	**77.3**	**89.8**	**115.7**	**0.2**	**0.0**	**487.5**



2. Temperature

Due to data from station in Pursat Provincial Department of Water Resources and Meteorology, it was showed that:

- Maximum temperature in average for return period, 13-year, is 33.7 degree Celsius.
- Minimum temperature in average for return period, 13-year, is 23.2 degree Celsius.
- Maximum temperature in average for return period, 1 year, is 28.5 degree Celsius.
- Perennial maximum temperature for return period, 13-year, is 39.8 degree Celsius in 2010.
- Perennial minimum temperature for return period, 13-year, is 17 degree Celsius in 2011.

However, due to data from station in Battambang Provincial Department of Water Resources and Meteorology, it was showed that:

- Maximum temperature in average for return period, 10-year, is 33.7 degree Celsius.
- Minimum temperature in average for return period, 10-year, is 23.2 degree Celsius.
- Maximum temperature in average for return period, 1 year, is 28.3 degree Celsius.
- Perennial maximum temperature for return period, 10-year, is 39.6 degree Celsius in 2010.
- Perennial minimum temperature for return period, 10-year, is 16.2 degree Celsius in 2011.

Table 5-4 (A): Monthly perennial maximum temperature in °C for return period of 13-year (2000-2012) in Pursat province

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Mean
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	(°C)
2000	31.3	33.1	35.1	34.1	34.3	33.1	33.0	33.0	31.9	30.1	29.9	30.5	**32.5**
2001	31.8	33.6	33.8	35.9	34.9	34.1	33.9	33.3	32.4	31.3	29.1	30.4	**32.9**
2002	31.3	33.3	35.4	35.7	35.4	35.2	36.1	33.3	32.7	32.1	31.3	31.7	**33.6**
2003	31.2	33.5	34.0	35.4	35.6	35.2	33.6	34.5	33.2	31.3	31.7	29.7	**33.2**
2004	31.8	33.2	36.2	37.1	NA	NA	NA	NA	NA	NA	NA	NA	**34.6**
2005	35.4	35.7	35.1	36.5	36.3	35.2	32.7	33.8	32.1	31.8	31.4	29.7	**33.8**
2006	32.6	34.2	35.8	34.5	34.3	34.7	33.8	32.9	32.1	31.8	32.6	31.0	**33.4**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Mean
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	(^{0}C)
2007	31.8	33.9	35.6	35.6	33.8	34.3	33.3	33.0	32.7	31.2	29.5	31.3	**33.0**
2008	31.6	32.0	34.6	34.8	33.8	33.3	33.8	32.7	32.1	31.5	29.8	29.7	**32.5**
2009	29.8	33.7	34.5	35.1	33.9	35.0	33.2	33.6	31.9	31.3	30.9	31.7	**32.9**
2010	34.8	37.5	39.0	39.8	39.5	37.3	35.1	34.3	34.5	33.3	32.8	33.5	**36.0**
2011	32.8	35.0	36.5	37.5	36.5	35.1	34.7	35.3	37.5	33.7	33.6	33.6	**35.2**
2012	34.9	36.1	37.1	38.5	37.0	36.5	35.5	37.0	34.3	35.0	34.5	35.1	**36.0**
Monthly Total	**421.1**	**444.8**	**462.7**	**470.5**	**425.3**	**419.0**	**408.7**	**406.7**	**397.4**	**384.4**	**377.1**	**377.9**	**416.3**
Monthly Mean	**32.4**	**34.2**	**35.6**	**36.2**	**35.4**	**34.9**	**34.1**	**33.9**	**33.1**	**32.0**	**31.4**	**31.5**	**33.7**
Max	**35.4**	**37.5**	**39.0**	**39.8**	**39.5**	**37.3**	**36.1**	**37.0**	**37.5**	**35.0**	**34.5**	**35.1**	**37.0**

Source: Provincial Department of Water Resources and Meteorology in Pursat

Table 5-4 (B): Monthly perennial minimum temperature in ^{0}C for return periodof 13 years (2000-2012) in Pursat

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Mean
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	(^{0}C)
2000	22.1	21.4	24.3	24.8	25.2	25.0	24.5	24.7	24.3	24.1	22.6	22.8	**23.8**
2001	22.5	22.0	24.1	25.9	25.2	25.2	24.5	24.9	24.3	24.5	21`.7	21.1	**24.0**
2002	19.5	21.3	23.8	24.5	24.7	24.7	24.6	23.8	24.1	23.5	23.3	23.0	**23.4**
2003	19.3	22.0	23.6	24.9	25.1	24.3	24.1	24.4	23.9	23.6	22.4	19.5	**23.1**
2004	20.6	21.2	24.1	24.7	NA	NA	NA	NA	NA	NA	NA	NA	**22.7**
2005	23.2	23.3	24.0	25.6	25.9	25.5	24.5	24.7	24.4	24.3	23.6	21.9	**24.2**
2006	21.9	23.3	24.3	24.8	24.9	24.8	25.2	24.4	24.5	24.0	23.5	20.9	**23.9**
2007	21.5	20.8	24.3	25.0	25.0	25.2	24.9	24.4	24.3	23.8	21.8	21.7	**23.6**
2008	21.2	22.1	23.8	24.9	25.1	25.1	25.0	24.6	24.6	24.0	23.2	20.8	**23.7**
2009	18.8	22.1	24.0	24.6	25.0	24.6	24.6	24.5	24.1	23.8	22.1	20.5	**23.2**
2010	20.7	22.7	23.7	24.8	25.3	24.1	23.8	24.4	25.5	24.7	24.1	22.4	**23.9**
2011	17.0	18.8	17.8	22.0	23.5	22.3	21.5	23.2	22.7	21.6	21.6	17.3	**20.8**
2012	20.3	20.9	21.2	21.1	20.4	22.6	22.6	22.6	22.7	20.4	21.0	19.3	**21.3**
Monthly Total	**268.6**	**281.9**	**303.0**	**317.6**	**295.3**	**293.4**	**289.8**	**290.6**	**289.4**	**282.3**	**249.2**	**251.2**	**284.4**
Monthly Mean	**20.7**	**21.7**	**23.3**	**24.4**	**24.6**	**24.5**	**24.2**	**24.2**	**24.1**	**23.5**	**22.7**	**20.9**	**23.2**
Min	**17.0**	**18.8**	**17.8**	**21.1**	**20.4**	**22.3**	**21.5**	**22.6**	**22.7**	**20.4**	**21.0**	**17.3**	**20.2**

Source: Provincial Department of Water Resources and Meteorology in Pursat

Table 5-4 (C): Monthly perennial maximum temperature in ^{o}C for return period of 10-year (2003-2012) in Battambang province

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yeraly Mean
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2003	30.9	34.1	34.6	36.4	34.4	34.9	32.8	32.4	32.7	32.3	31.8	30.3	**33.1**
2004	31.9	32.9	35.7	37.0	35.1	33.0	32.7	32.7	31.4	30.9	31.5	30.7	**33.0**
2005	31.4	35.9	35.7	37.4	34.8	34.7	32.7	33.4	33.3	31.6	30.8	28.1	**33.3**
2006	31.3	35.0	34.5	36.0	34.2	34.0	32.0	33.0	33.2	31.8	30.4	29.5	**32.9**
2007	31.2	34.2	35.2	36.5	34.0	33.8	32.5	33.4	33.5	31.2	31.0	29.5	**33.0**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yeraly Mean
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2008	31.4	31.8	35.0	35.2	33.4	32.7	32.9	33.1	32.2	31.5	29.3	29.6	**32.3**
2009	28.8	31.8	36.4	35.2	33.3	33.2	32.9	32.9	31.9	31.4	29.3	29.5	**32.2**
2010	34.9	37.2	39.3	39.6	39.5	38.7	35.1	33.8	34.0	33.1	33.2	33.7	**36.0**
2011	33.2	35.7	36.2	37.2	35.7	35.3	36.3	34.7	33.7	33.2	33.4	32.6	**34.8**
2012	34.2	36.3	36.8	38.8	37.2	36.0	36.1	35.6	33.9	39.3	34.2	34.9	**36.1**
Monthly Total	**319.2**	**344.9**	**359.4**	**369.3**	**351.6**	**346.3**	**336.0**	**335.0**	**329.8**	**326.3**	**314.9**	**308.4**	**336.8**
Monthly Mean	**31.9**	**34.5**	**35.9**	**36.9**	**35.2**	**34.6**	**33.6**	**33.5**	**33.0**	**32.6**	**31.5**	**30.8**	**33.7**
Max	**34.9**	**37.2**	**39.3**	**39.6**	**39.5**	**38.7**	**36.3**	**35.6**	**34.0**	**39.3**	**34.2**	**34.9**	**37.0**

Source: Department of Meteorology, MOWRAM

Table 5-4 (D): Monthly perennial minimum temperature in ^{0}C for return periodof 10-year (2003-2013) in Battambang

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yeraly Mean
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2003	20.5	22.3	24.5	25.6	25.4	24.9	25.6	24.8	25.0	23.6	21.5	20.2	**23.7**
2004	18.4	21.2	24.0	25.4	25.5	25.1	24.9	24.5	24.2	24.0	23.5	20.8	**23.5**
2005	21.3	22.1	25.3	25.7	26.4	25.3	25.5	25.6	25.1	24.2	23.3	19.0	**24.1**
2006	19.5	21.0	24.5	25.0	25.2	25.0	25.2	25.0	24.7	24.0	22.5	19.5	**23.4**
2007	20.2	22.0	24.0	25.2	25.2	25.0	24.5	25.5	24.0	23.8	23.0	20.0	**23.5**
2008	18.5	19.6	21.8	24.0	24.2	24.4	24.3	24.5	24.0	24.3	22.2	20.1	**22.7**
2009	18.3	22.9	24.5	25.8	25.5	25.9	25.5	25.5	25.0	25.0	23.1	22.0	**24.1**
2010	18.8	23.4	20.5	24.7	24.0	24.3	24.0	23.0	20.5	20.0	21.0	17.8	**21.8**
2011	16.8	18.8	18.3	22.3	24.1	23.2	23.0	22.8	23.5	23.5	22.5	16.2	**21.3**
2012	19.4	19.3	22.8	23	23.4	25	21.5	23.6	23.5	21.7	22.7	18.5	**22.0**
Monthly Total	**191.7**	**212.6**	**230.3**	**246.7**	**248.9**	**248.1**	**244.0**	**244.8**	**239.5**	**234.1**	**225.3**	**194.1**	**230.0**
Monthly Mean	**19.2**	**21.3**	**23.0**	**24.7**	**24.9**	**24.8**	**24.4**	**24.5**	**23.9**	**23.4**	**22.5**	**19.4**	**23.0**
Min	**16.8**	**18.8**	**18.3**	**22.3**	**23.4**	**23.2**	**21.5**	**22.8**	**20.5**	**20.0**	**21.0**	**16.2**	**20.4**

Source:Department of Meteorology, MOWRAM

3. Wind Speed and Wind Direction

According to **Ms. Tep Pholaroth**,secretary of Department of Meteorology in MOWRAM, there is no station for wind record for direction and speed in Pursat province while Battambang province has already installed for several years.

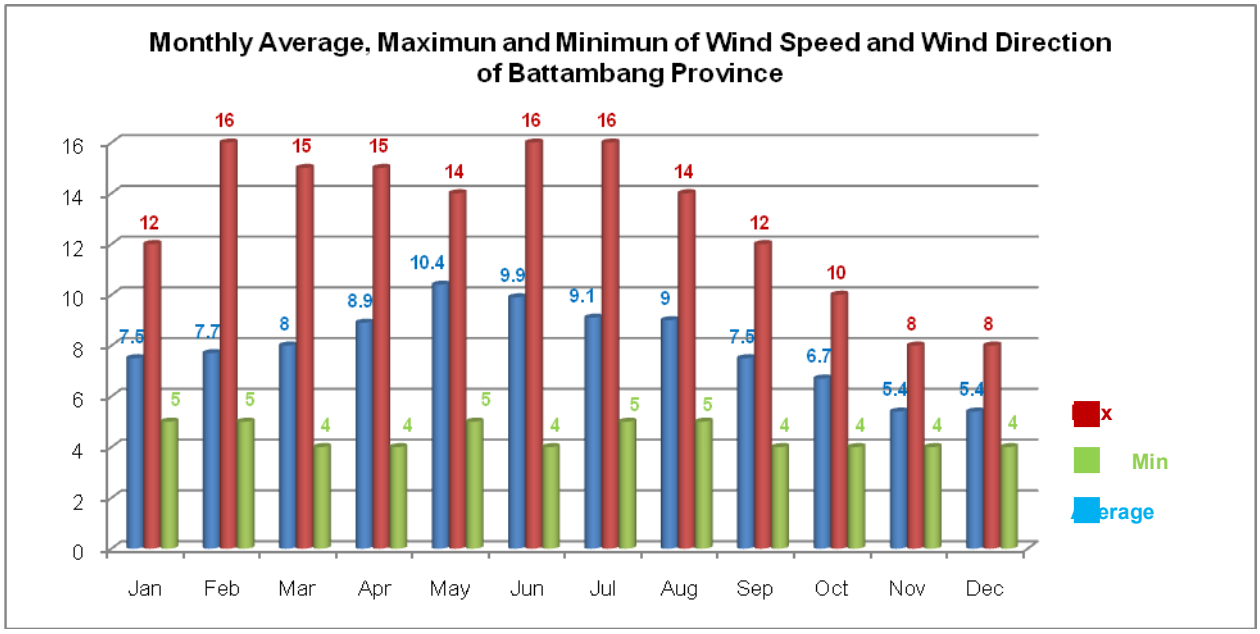
Referring to data from Department of Meteorology of MOWRAM, dry season started from November to April, wind blew from Northeast. Then wet season is from May to October, wind blew from Southwest. The average of wind speed for 10 years return period is 8 m/s. The highest speed of wind is in February and July, 2008; then 16/s in June 2007.

Table 5-5 (A):Monthly average of wind speed and direction for 10 years return period (2003-2012) in Battambang

Month	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Yearly Mean
Year	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	
2003	9.0	NE	7.0	W	7.0	E /NW	9.0	NE	10.0	W	10.0	W	8.0	W	9.0	SW	9.0	W	7.0	E	5.0	E	5.0	NE	7.9
2004	9.0	NE	5.0	E	5.0	W /NW	6.0	SW	5.0	SW	4.0	S /SW	5.0	W /WS	5.0	S /SW	4.0	S /SW	4.0	E	4.0	N /NE	5.0	SE	5.1

2005	9.0	N /NE	10.0	N /NE	11.0	NE	15.0	NE	13.0	NE	10.0	W	8.0	W	7.0	SW	7.0	W	9.0	SE	4.0	N /NE	4.0	N /NE	8.9
2006	9.0	NW	11.0	NE	9.0	E	12.0	SE	11.0	W	12.0	S /SW	10.0	W	14.0	W	12.0	W	9.0	E	8.0	NE	8.0	E	10.4
2007	12.0	N	16.0	W	15.0	E	10.0	NE	14.0	W	12.0	W	16.0	W	12.0	SW	9.0	W	10.0	SW	8.0	N	8.0	E	11.8
2008	5.0	NE	5.0	E	7.0	NE	7.0	SE	12.0	SW	16.0	SE	9.0	SW	5.0	W	4.0	SW	6.0	NE	6.0	N	5.0	NE	7.3
2009	5.0	NE	5.0	N	6.0	NE	7.0	NW	7.0	SW	10.0	SW	5.0	SW	7.0	SW	10.0	SW	7.0	W	5.0	NW	5.0	NE	6.6
2010	5.0	NE	6.0	SW	4.0	S	4.0	SW	14.0	NW	7.0	SW	10.0	SW	8.0	E	6.0	SW	5.0	NE	5.0	N	4.0	E	6.5
2011	6.0	NW	5.0	NW	7.0	SE	12.0	S	8.0	W	10.0	W	10.0	W	12.0	SW	5.0	S	4.0	NE	4.0	N	5.0	N	7.3
2012	6.0	NW	7.0	NW /N	9.0	SW /NE	7.0	NE	10.0	W /SW	8.0	SW /S	10.0	SW	11.0	SW	9.0	W /SW	6.0	NE	5.0	N/ NNE	5.0	NE	7.8
Average	7.5	NE	7.7	N	8.0	NE	8.9	NE	10.4	SW	9.9	SW	9.1	W	9.0	SW	7.5	W /SW	6.7	NE	5.4	N	5.4	NE	8.0
Max	12.0		16.0		15.0		15.0		14.0		16.0		16.0		14.0		12.0		10.0		8.0		8.0		13.0
Min	5		5		4		4		5		4		5		5		4		4		4		4		4.4

Source:Department of Meteorology, MOWRAM



4. Humidity and Sunlight

According to data from Department of Meteorology, Ministry of Water Resources and Meteorology, it indicated that the average of humidity and sunlight in Pursat for 12-years return period (2001-2012) is **81%**. Then highest humidity and sunlight is 98% in September 2007; while the lowest humidity and sunlight is 48% in March 2004.

However, for Battambang province the average of humidity and sunlight of 10-year return period (2003-2012) is **78%** due to the data Department of Meteorology, Ministry of Water Resources and Meteorology. The highest humidity and sunlight is 96% in October 2009; while the lowest humidity and sunlight is 62% in February 2004.

Table 5-6 (A):Humidity and Sunlight for 12-year return period (2001-2012) in Pursat

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Mean
Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2001	78	76	78	76	80	80	82	86	84	85		81	**81**
2002	93	88	86	90	91	92	89	94	95	95	95	95	**92**
2003	92	88	91	89	90	91	92	91	94	95	95	93	**92**
2004	57	60	48	55	51	64	64	72	72	66	71	65	**62**
2005	78	73	77	84	83	84	84	89	91	90	85	85	**84**
2006	71	59	68	76	72	70	74	78	83	82	71	78	**74**
2007	83	86	92	95	93	95	96	96	98	98	91	93	**93**

Month / Years	Jan / I	Feb / II	Mar / III	Apr / IV	May / V	Jun / VI	Jul / VII	Aug / VIII	Sep / IX	Oct / X	Nov / XI	Dec / XII	Yearly Mean
2008	84	81	78	84	90	88	87	89	89	91	88	85	**86**
2009	73	70	64	77	84	78	75	80	82	83	77	81	**77**
2010	69	68	59	69	71	78	81	83	84	82	76	73	**74**
2011	73.2	71.4	70.4	76.5	77.6	79.0	80.2	83.6	84.2	83.9	78.4	78.7	**78**
2012	79.0	80.0	70.0	65.0	68.6	72.0	75.0	85.0	89.0	90.0	88.0	85.0	**79**
Monthly Mean	**78**	**75**	**73**	**78**	**79**	**81**	**82**	**86**	**87**	**87**	**83**	**83**	**81**
Max	**93**	**88**	**92**	**95**	**93**	**95**	**96**	**96**	**98**	**98**	**95**	**95**	**95**
Min	**57**	**59**	**48**	**55**	**51**	**64**	**64**	**72**	**72**	**66**	**71**	**65**	**62**

Source:Department of Meteorology, MOWRAM

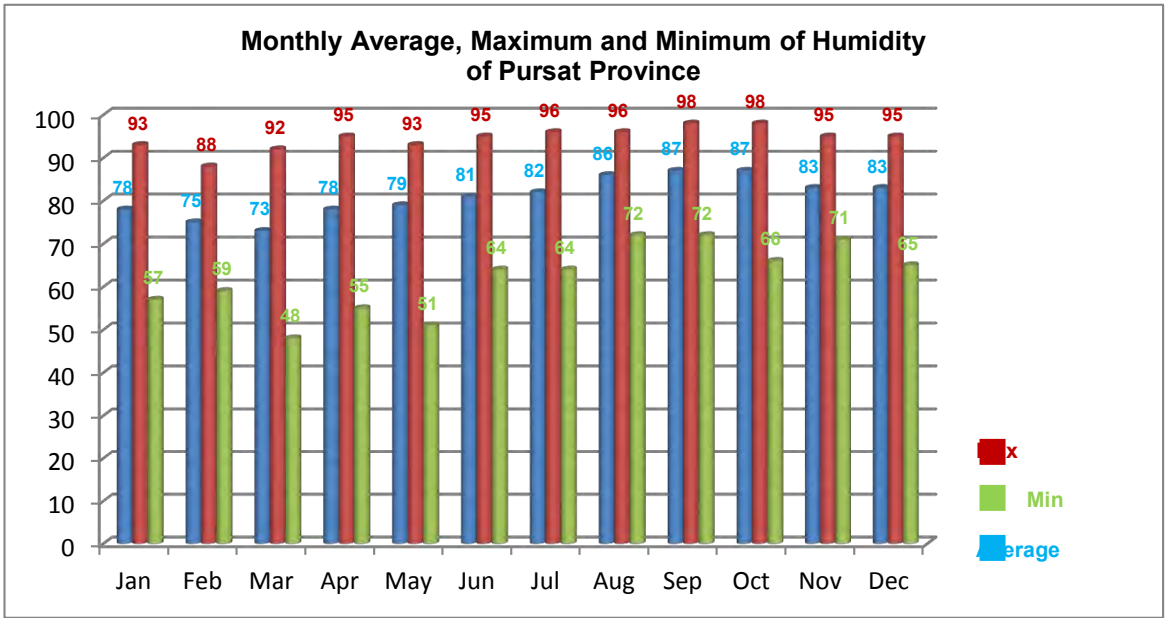
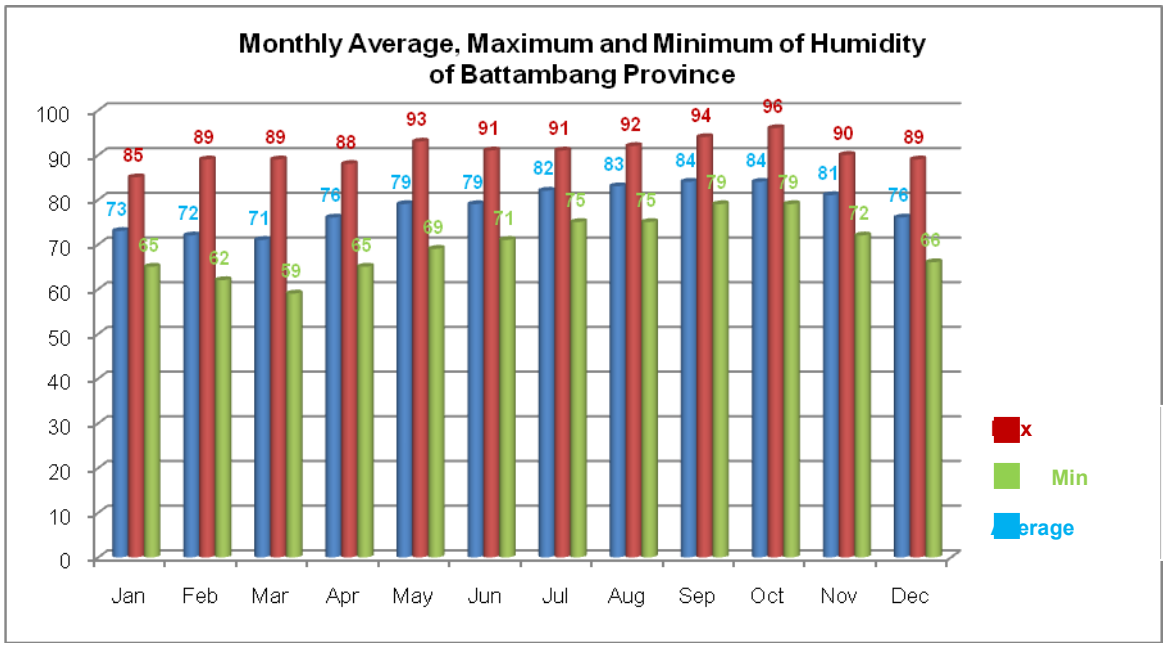


Table 5-6 (B):Humidity and Sunlight for 10-year return period (2003-2012) in Battambang

Month / Years	Jan / I	Feb / II	Mar / III	Apr / IV	May / V	Jun / VI	Jul / VII	Aug / VIII	Sep / IX	Oct / X	Nov / XI	Dec / XII	Yearly Mean
2003	79	75	77	73	78	78	83	83	86	85	77	68	**79**
2004	65	62	59	65	69	74	75	75	79	79	72	66	**70**
2005	74	72	65	69	72	71	78	76	80	80	78	72	**74**
2006	75	65	68	78	80	77	80	82	83	82	75	75	**77**
2007	72	70	72	75	84	78	81	81	81	83	85	72	**78**
2008	75	81	84	88	89	91	91	91	92	89	90	89	**87**
2009	85	89	89	88	93	89	89	92	94	96	89	87	**90**
2010	69	68	59	69	71	78	81	83	84	82	76	73	**74**
2011	65	67	67	76	77	76	79	81	84	84	77	74	**76**
2012	69	74	74	76	78	82	83	85	81	85	87	86	**80**
Monthly Mean	**73**	**72**	**71**	**76**	**79**	**79**	**82**	**83**	**84**	**84**	**81**	**76**	**78**
Max	**85**	**89**	**89**	**88**	**93**	**91**	**91**	**92**	**94**	**96**	**90**	**89**	**90**
Min	**65**	**62**	**59**	**65**	**69**	**71**	**75**	**75**	**79**	**79**	**72**	**66**	**70**

Source:Department of Meteorology, MOWRAM



5. Evaporation

According to **Ms. Tep Pholaroth**,secretary of Department of Meteorology in MOWRAM, there is no station for evaporation record in Battambang province while Purat province has already been installed for years.

The evaporation in Pursat for 5 years return period is 5720.70 mm; then the average of annual evaporation is 1430.18 mm (see table 5-7 below).

Table 5-7: The annual evaporation in millimeters (mm), Pursat province

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Total
Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2005	122.50	135.00	155.70	140.40	131.60	123.00	95.20	108.30	83.20	96.90	89.70	90.40	**1371.90**
2006	112.40	131.20	143.40	125.30	123.30	112.50	108.70	99.30	88.50	96.80	93.30	101.40	**1336.10**
2007	114.70	115.80	143.30	141.70	108.80	129.90	109.90	103.00	108.00	95.40	90.60	130.40	**1391.50**
2008	130.40	148.60	188.40	136.40	127.70	134.00	141.30	133.10	141.40	115.30	108.30	116.30	**1621.20**
Monthly Total	**480.00**	**530.60**	**630.80**	**543.80**	**491.40**	**499.40**	**455.10**	**443.70**	**421.10**	**404.40**	**381.90**	**438.50**	**5720.70**
Monthly Mean	**120.00**	**132.65**	**157.70**	**135.95**	**122.85**	**124.85**	**113.78**	**110.93**	**105.28**	**101.10**	**95.48**	**109.63**	**1430.18**

Source:Provincial Department of Water Resources and Meteorology, Pursat

Conclusion of Meteorology in Pursat Province

According to above statement, the average rainfall in Pursat is 1372.9mm for 13 years return period (2000-2012); then the highest rainfall is 454.6mm in October 2003. For temperature, the average of maximum for 12 years of return period (2000-2012) is 33.7 ^{0}C; while the average of minimum 23.2 ^{0}C. In addition, the perennial maximum temperature is 39.8 ^{0}C in 2010, but the perennial minimum is 17 ^{0}C in 2011. However, there is no data for wind speed and direction in Pursat province. For humidity and sun light, the average is 81% for 12 years of return period (2000-2012); then highest humidity and sunlight is 98% in September 2007; while the lowest humidity and sunlight is 48% in March 2004. Last, the evaporation in Pursat for 5 years of return period is 5720.70 mm; then annual evaporation is 1430.18 mm.

Conclusion of Meteorology in Battambang Province

For Meteorology in Battambang province, we can conclude that average rainfall for 12 years of return period (2003-2012) is 1291.6 mm. Then, the highest rainfall is 440.9**mm** in October 2011. Anyway, the average of maximum temperature for 10 years of return period (2003-2012) is 33.7 ^{0}C; while the average of minimum 23 ^{0}C. In addition, the perennial maximum temperature is 39.6 ^{0}C in 2010, but the perennial minimum is 16.2 ^{0}C in 2011. Hence, wind speed and direction in dry season started from November to April, wind blew from Northeast. Then wet season is from May to October, wind blew from Southwest. The average of wind speed for 10 years return period is 8 m/s. The highest speed of wind is in February

and July, 2008; then 16m/s in June, 2007. However, for the average of humidity and sunlight of 10-year return period (2003-2012) is **78%;** the highest humidity and sunlight is 98% in September 2007; while the lowest humidity and sunlight is 62% in February 2004. Finally, there is no station for evaporation record in Battambang province.

5.1.1.3 Air, Noise and Vibration Quality

1. Air Quality Measurement

For air quality measurement and analysis, the survey team did cooperation with laboratory working team of Ministry of Environment (MoE) in order to conduct the survey 24 hours of working days for each six sites. There were two times measured and analyzed for air quality, once in dry season and wet season respectively; then the location sites of air quality measurement are showed as the following:

- **Survey Location No 1**: it located at the road site in Ra village, Phtaesh Prey Sangkat, Pursat City, Pursat province. The surveys were done on 15 July and on 2 December 2013 (see the detailed survey locations for section 1 below).

Survey Location Card for Section 1

Location: KP 187+560(KP: Kilometer Post), Ra Village, Pursat Town at CarRepairing.

Road Site:	Lat(º)	12.53964	E (m)	380916
Datum: WGS 84	Lon(º)	103.90390	N (m)	1386474



- **Survey Location No 2**: it located about 100 m away from the first location)>100 From the Road)in Ra village, Phtaesh Prey Sangkat, Pursat City, Pursat province. The surveys were done on 16 July and on 3 December 2013 (see the detailed survey locations for section 1 below).

Location:KP 187+560**,** Ra Village**,** Pursat Town far from the road site more than 100 m.

Baseline:	Lat(º)	12.54046	E (m)	380953
Datum: WGS 84	Lon (º)	103.90424	N (m)	1386565

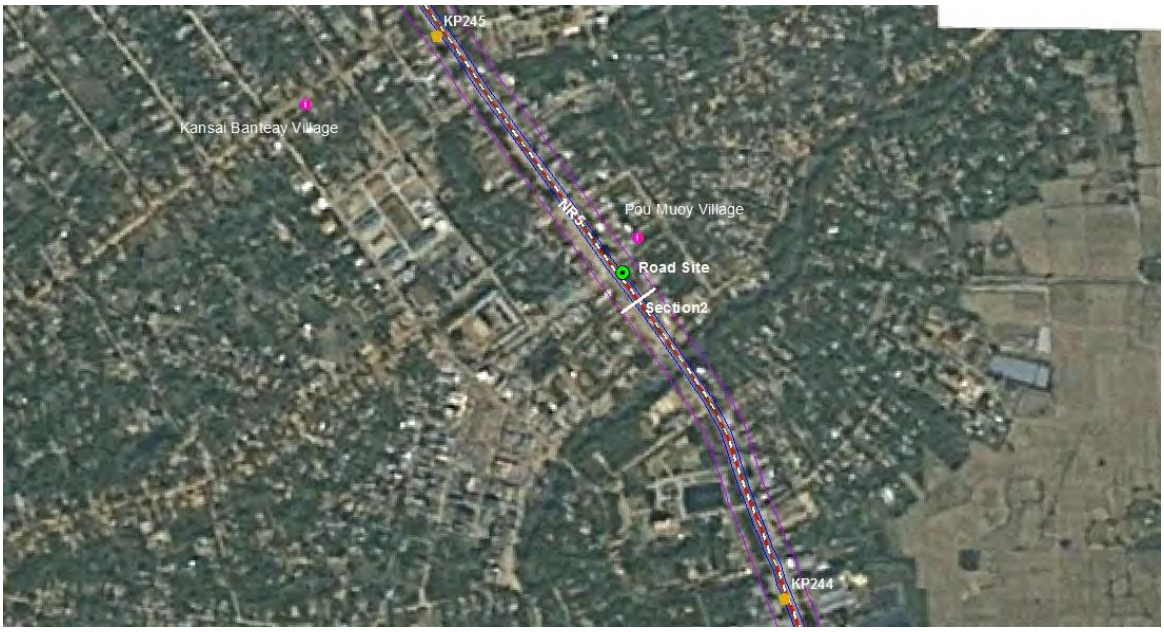


- **Survey Location No 3**: The station for air measurement was installed on the road side in Pou Mouy village, Moung commune, Moung Russei district, Battambang province. The surveys were done on 17 July and on 4 December 2013 (see the detailed survey locations for section 2 below).

Survey Location Card for Section 2

Location: KP 244+550, Pou Mouy Village, Moung Ruessei District Center at Lim Seng Kea Shop

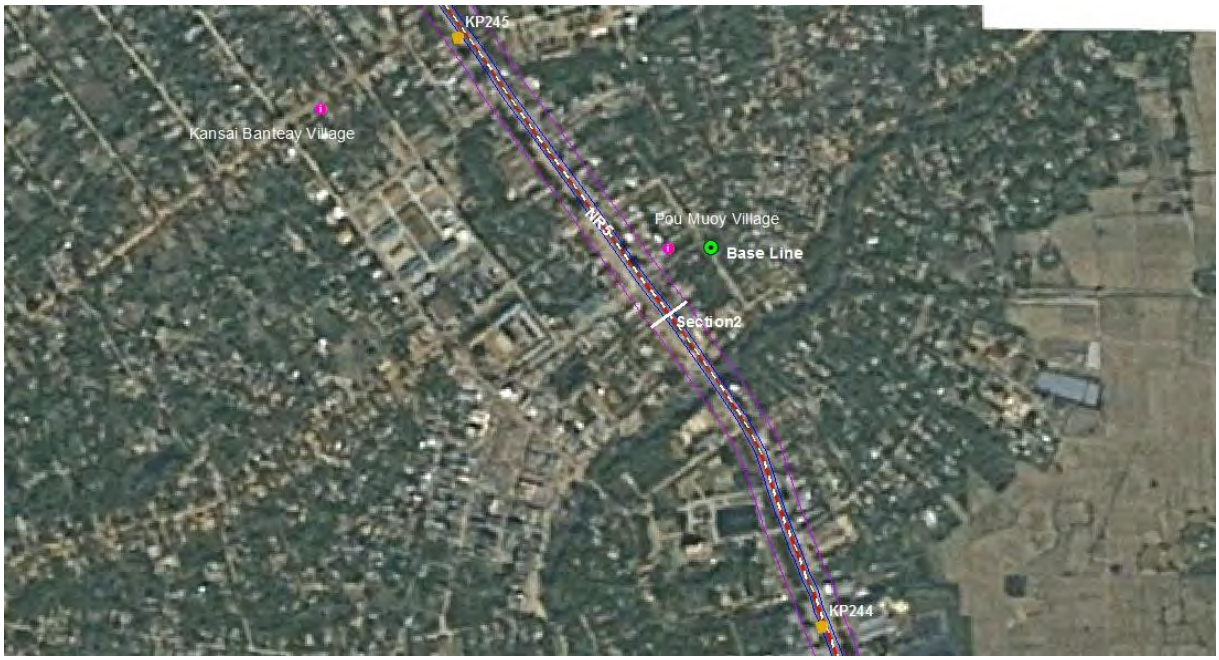
Road Site:	Lat (º)	12.77418	E (m)	331651
Datum: WGS 84	Lon (º)	103.44912	N (m)	1412667



- **Survey Location No 4**: it located about 100 m away from the third locationin Pou Mouy village, Moung commune, Moung Russei district, Battambang province. The surveys were done on 18 July and on 5 December 2013 (see the detailed survey locations for section 2 below).

Location: KP 244+550 and >100m form Road Site, Pou Mouy Village Moung Ruessei District Center at Mr. Prong Dam House

Base Line:	Lat (º)	12.77472	E (m)	331741
Datum: WGS 84	Lon (º)	103.44995	N (m)	1412726



- **Survey Location No 5**: The station for air measurement was installed on the road side in Dambouk Khpos village, Ou Dambang Pir commune, Sangkae district, Battambang province. The surveys were done on 19 July and on 6 December 2013 (see the detailed survey locations for section 3 below).

Survey Location Card for Section 3

Location: 282+78, Dambok Kpous Village, O Dambang Pi Commune, Battambang Province

Road Site:	Lat (°)	13.05302	E(m)	312111
Datum: WGS 84	Lon (°)	103.26724	N(m)	1443641



- **Survey Location No 6**: it located about 100m away from the road site in Dambouk Khpos village, Ou Dambang Pir commune, Sangkae district, Battambang province. The surveys were done on 22 July and on 9 December 2013 (see the detailed survey locations for section 3 below).

Location: 282+78 and >100m for Road Site, Dambouk Kpos Village, Ou Dambang Pir Commune, Battambang Province

Baseline:	Lat	13.05507	E	312162
Datum: WGS 84	Lon	103.26769	N	1443867



According to table and graphic below, the result of air quality by each selected station, the existing air quality in the project area still in good condition in wet and dry seasons; all the pollution values are lower than the ambient air quality standard of the MoE (see table 5-8 (A)-(F) for details).

Table 5-8 (A): Air quality measurement at road site (Survey Location No1), dated 15 July and 2 December 2013

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method
1	Nitrogen Dioxide (NO_2)	mg/m^3	0.011	0.019	0.1	0.10	Saltzman Method
2	Sulfur Dioxide (SO_2)	mg/m^3	0.004	0.010	0.3	0.30	Pararosaniline Method
3	PM2.5	mg/m^3	0.049	0.071	NA	0.02	Method Weight Concentration Measuring
4	PM10	mg/m^3	0.099	0.155	NA	0.05	Method Weight Concentration Measuring

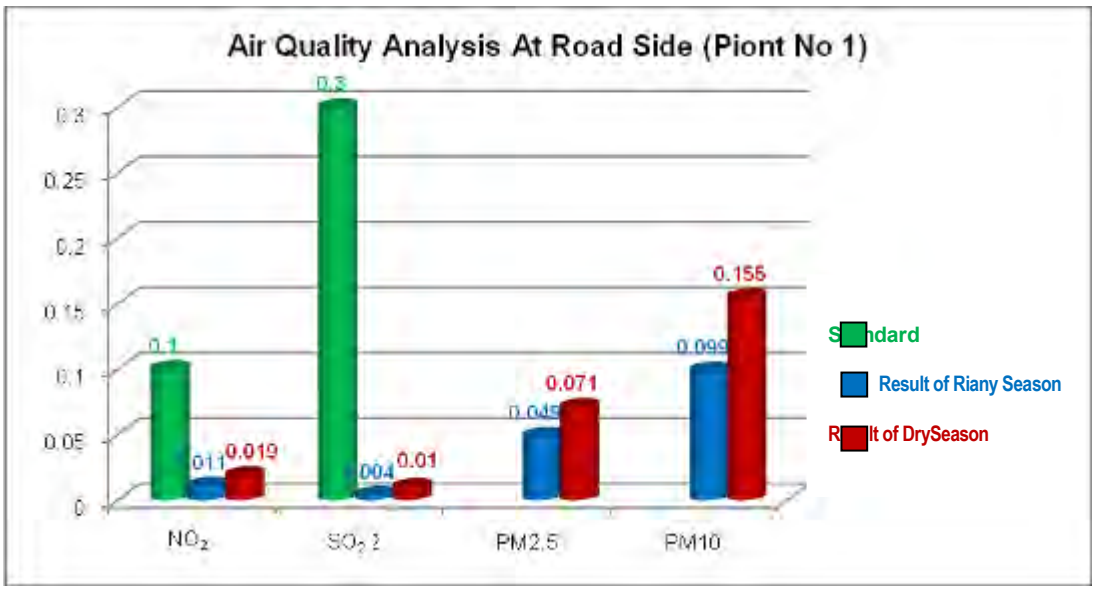


Table 5-8 (B): Air quality measurement about 100 m away from the first location (Survey Location No 2), dated 16 July and 2 December 2013

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method
1	Nitrogen Dioxide (NO_2)	mg/m³	0.005	0.009	0.1	0.10	Saltzman Method
2	Sulfur Dioxide (SO_2)	mg/m³	0.002	0.007	0.3	0.30	Pararosaniline Method
3	PM2.5	mg/m³	0.015	0.024	NA	0.02	Method Weight Concentration Measuring
4	PM10	mg/m³	0.049	0.051	NA	0.05	Method Weight Concentration Measuring

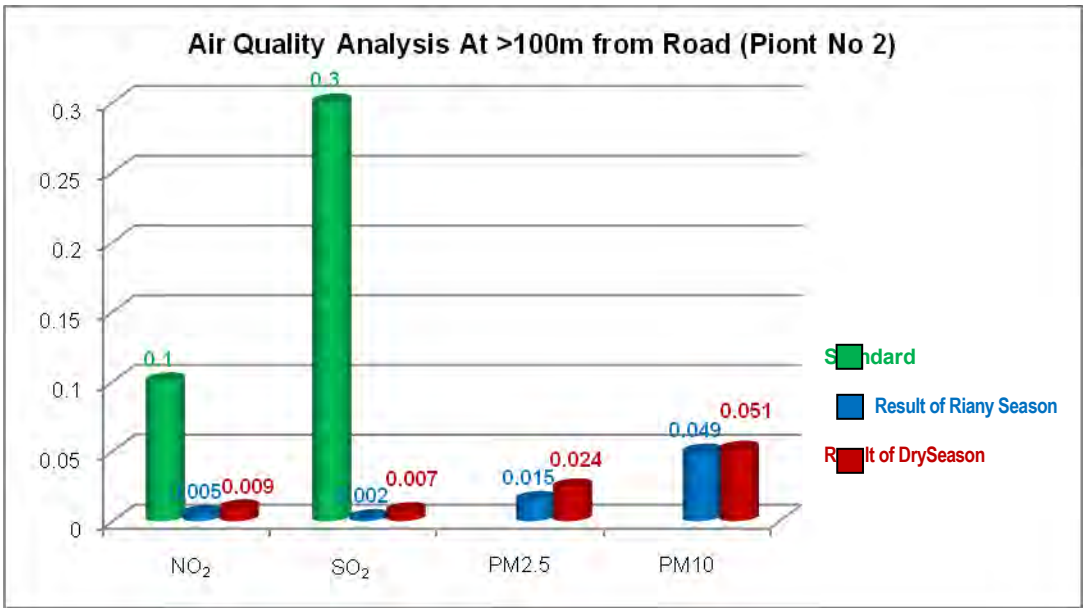


Table 5-8 (C):Air quality measurement at the road site (Survey Location No 3), dated 17 July and 4 December 2013

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method
1	Nitrogen Dioxide (NO_2)	mg/m³	0.010	0.022	0.1	0.10	Saltzman Method
2	Sulfur Dioxide (SO_2)	mg/m³	0.009	0.016	0.3	0.30	Pararosaniline Method
3	PM2.5	mg/m³	0.041	0.078	NA	0.02	Method Weight Concentration Measuring
4	PM10	mg/m³	0.170	0.208	NA	0.05	Method Weight Concentration Measuring

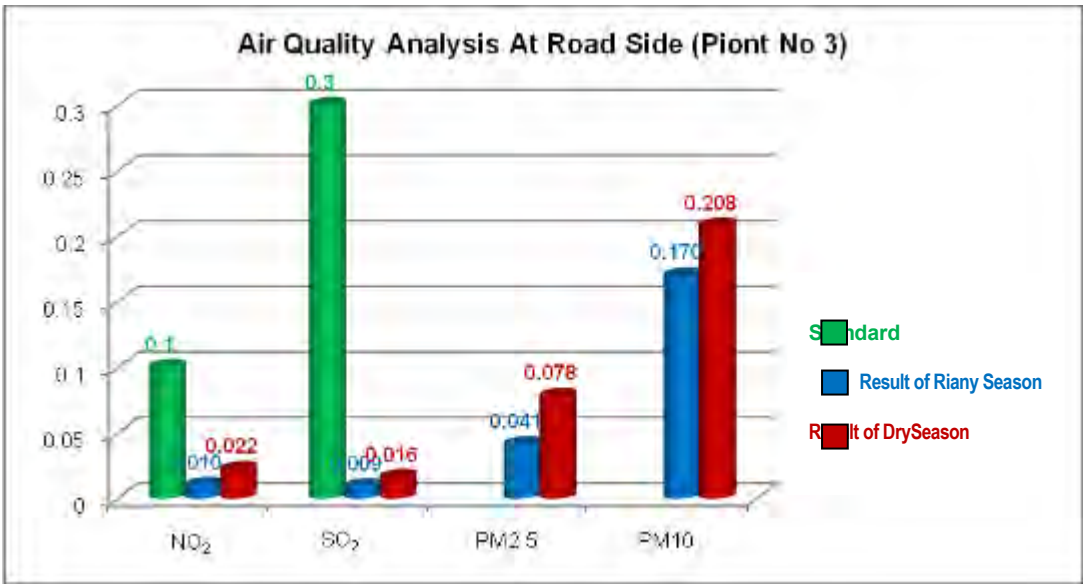


Table 5-8 (D):Air quality measurement about 100 m away from road site (Survey Location No 4), dated 18 July and 5 December 2013

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method
1	Nitrogen Dioxide (NO_2)	mg/m^3	0.007	0.015	0.1	0.10	Saltzman Method
2	Sulfur Dioxide (SO_2)	mg/m^3	0.002	0.009	0.3	0.30	Pararosaniline Method
3	PM2.5	mg/m^3	0.017	0.029	NA	0.02	Method Weight Concentration Measuring
4	PM10	mg/m^3	0.068	0.075	NA	0.05	Method Weight Concentration Measuring

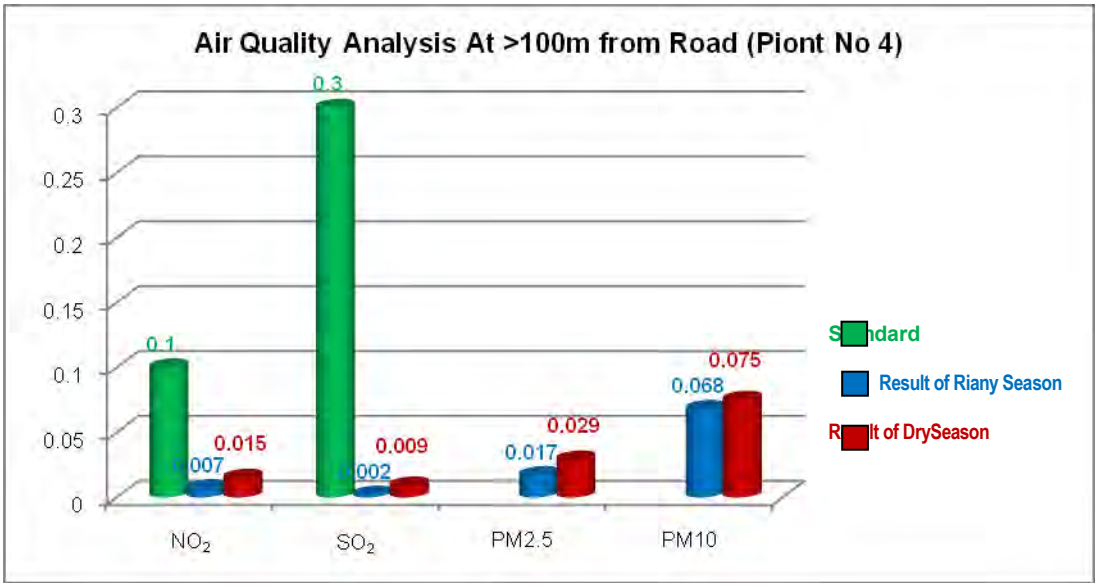


Table 5-8 (E):Air quality measurement at road site (Survey Location No 5), dated 19 July and 6 December 2013

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method
1	Nitrogen Dioxide (NO_2)	mg/m^3	0.013	0.019	0.1	0.10	Saltzman Method
2	Sulfur Dioxide (SO_2)	mg/m^3	0.005	0.011	0.3	0.30	Pararosaniline Method
3	PM2.5	mg/m^3	0.043	0.059	NA	0.02	Method Weight Concentration Measuring
4	PM10	mg/m^3	0.073	0.105	NA	0.05	Method Weight Concentration Measuring

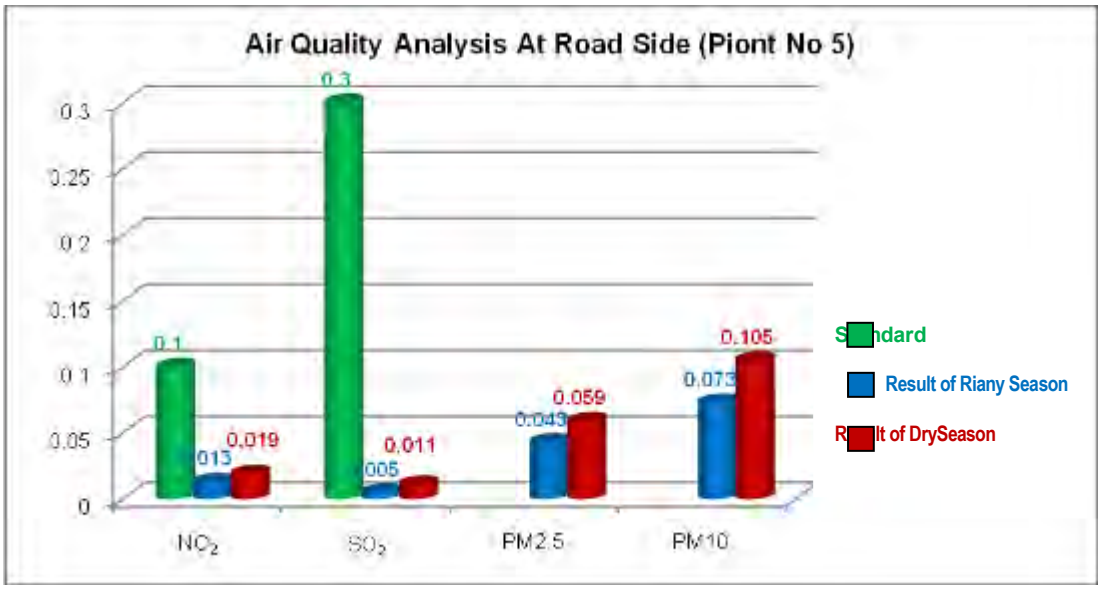
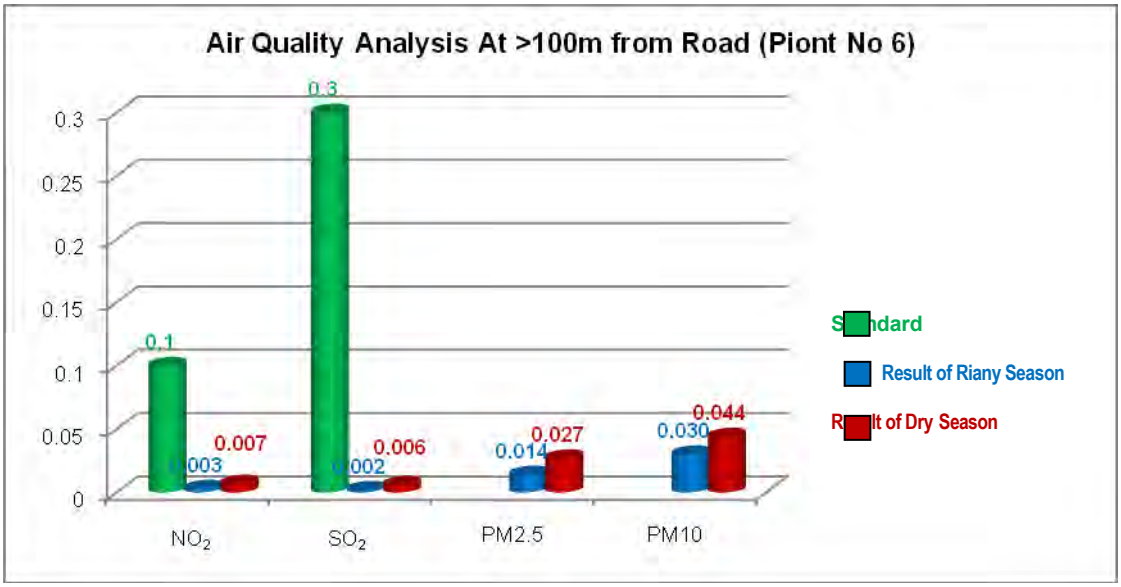


Table 5-8 (F): Air quality measurement about 100 m away from road site (Survey Location No 6), dated 22 July and 5 December 2013

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method
1	Nitrogen Dioxide (NO_2)	mg/m³	0.003	0.007	0.1	0.10	Saltzman Method
2	Sulfur Dioxide (SO_2)	mg/m³	0.002	0.006	0.3	0.30	Pararosaniline Method
3	PM2.5	mg/m³	0.014	0.027	NA	0.02	Method Weight Concentration Measuring
4	PM10	mg/m³	0.030	0.044	NA	0.05	Method Weight Concentration Measuring





Activities of Air measurement at Survey Location No 1 near the Garage on 15-07-13 (in wet season)



Activities of Air measurement at Survey Location No 1 near the Garage on 02-12-13 (in dry season)



Activities of Air measurement at Survey Location No 2, on 16-07-13, wet season



Activities of Air measurement at Survey Location No 2, on 03-12-13, dry season



Activities of Air measurement at Survey Location No 3, on 17-07-13, wet season



Activities of Air measurement at Survey Location No 3, on 04-12-13, dry season



Activities of Air measurement at Survey Location No 4, on 18-07-13, wet season



Activities of Air measurement at Survey Location No 4, on 05-12-13, dry season



Activities of Air measurement at Survey Location No 5, on 19-07-13, wet season



Activities of Air measurement at Survey Location No 5, on 06-12-13, dry season



Activities of Air measurement at Survey Location No 6, on 22-07-13, wet season



Activities of Air measurement at Survey Location No 6, on 09-12-13, dry season

2. Noise and Vibration

For noise and vibration measurement, we have done the cooperation with laboratory of Ministry of Environment in order to conduct the measurement survey at 3 locations, 24 hours of each site. Really, the measurement survey will have been done two times for year, both dry and wet season in official working days (not holiday or weekends). All of the survey sites for noise and vibration will have conducted only at road sites; then those locations are showed as the following:

- **Survey location No 1**: it located at the road site in Ra village, Phtaesh Prey Sangkat, Pursat City, Pursat province, with the coordinate X: 380916 and Y: 1386474. The survey was done on 15 July and on 2 December 2013.
- **Survey location No 2**: it located in Pou Mouy village, Moung commune, Moung Russei district, Battambang province, with the coordinate X: 331651 and Y: 1412667. The survey was done on 17 July and on 4 December 2013.
- **Survey location No 3**: it located in Dambouk Khpos village, Ou Dambang Pir commune, Sangkae district, Battambang province, with the coordinate X: 312086, Y: 144376. The survey was done on 19 July and on 6 December 2013

Due to the result of noise measurement by selected location No 1 in wet and dry seasons, it indicated that average of noise level from 6:00AM in the morning to 13:00PM was 65.70dB (in wet season), 66.72dB (in dry season) which not identified over the standard level (standard is 70 dB). Also, it was 63.20dB (in wet season), 64.30dB (in dry season) from 14:00PM to 18:00PM that it was still lower than standard (65dB). However, average of noise level at night was 61.6dB (in wet season), 64.31dB (in dry season), over the standard of Ministry of Environment, from 23:00PM to 5:00AM (the standard is 50dB). (See table 5-9 (A) for details).

For result from survey location No 2 in wet season and dry seasons, the average of noise level from 6:00 AM to 13:00 PM was 65.8 dB (in wet season), 66.18dB (in dry season) which is lower than standard (the standard is 70dB). Also, the same of result from 14:00 PM to 18:00 PM was 62.3 dB in average that islower standard. Another, in average noise in dry season is over the standard of MoE, it was 66.18dB (the standard is 65dB). In contrast, the average of noise level at night in wet and dry seasons were a little bit higher than standard, 59.9 dB (in wet season), 61.59dB (in dry season) (the standard is 50dB) from 23:00PM to 5:00AM. (See table 5-9 (B) for details).

The result from survey location No 3 was 65.7 dB (in wet season), 67.75dB (in dry season), in average that didn't identify over than standard (the standard is 70dB) from 6:00 AM to 13:00PM. For the noise level from 14:00PM to 18:00PM, it was 63.2 dB (in wet season), 61.20dB (in dry season), that it is still low if we are comparing to the standard (65dB). It is the same above result for night time, 61.6 dB (in wet season), 61.29dB (in dry season), in average was a little bit higher than standard of Ministry of Environment (50dB) from 23:00PM to 5:00AM. (See table 5-9 (C) for details).

In conclusion, the results of three survey locations for noise measurement in wet and dry seasons were not identified over the standard for time in morning and afternoon, while the standard for time of night was a little bit high if we compared with the standard of Ministry of Environment due to at night started from 23:00 to 3:00 there was sound from the insects were cried such as crickets ect., and from 4:00 to 5:00 there were heavy trucks travelling. Additional, the noise quality in dry season is high quality than noise in wet season.

Table 5-9 (A): Noise level in the project area for survey location No 1, both dry and wet season Dated: 15 July 2013 and 02 December 2013

Time	Survey Period	Nosie Level dB (A) 15.July.2013 (Riany Season)				Mean	Nosie Level dB (A) 2.December.2013 (DrySeason)				Mean
		Laeq	Standard Laeq	Lmax	Lmin		Laeq	Standard Laeq	Lmax	Lmin	
Day	6:00 - 7:00	65.7	70	81	40.7	65.67	66.7	70	87.3	44.8	66.72
	7:00 - 8:00	66.1		79.4	41.9		71.7		92.4	48.4	
	8:00 - 9:00	65.4		84.8	44		67.1		89	47.7	
	9:00 - 10:00	66.5		82.7	50.2		66.4		90.8	49.4	
	10:00 - 11:00	67.2		85.4	49.5		67.6		90.5	47.3	
	11:00 - 12:00	66		84.2	49.8		64		81.3	46.5	
	12:00 - 13:00	65.9		83.2	50		67.4		85.6	45.3	
	13:00 - 14:00	64.1		81.5	42.2		64.8		88.3	45.9	

Time	Survey Period	Nosie Level dB (A) 15.July.2013 (Riany Season)				Mean	Nosie Level dB (A) 2.December.2013 (DrySeason)				Mean
		Laeq	Standard Laeq	Lmax	Lmin		Laeq	Standard Laeq	Lmax	Lmin	
	14:00 - 15:00	64.6		82.4	44.3		67		88.1	46	
	15:00 - 16:00	65.2		81.6	45.3		64.5		81.7	45	
	16:00 - 17:00	65.4		79.5	45.9		67.3		86.1	46.2	
	17:00 - 18:00	65.4		80.5	45.7		68.3		85.2	46.4	
	18:00 - 19:00	66.2		81.3	45.6		64.6		86.1	49.9	
Evening	19:00 - 20:00	65.1		81.5	43		64.1		81.2	47.7	
	20:00 - 21:00	61.4	65	75.3	43.4	63.23	63.6	65	80.2	47.1	64.30
	21:00 - 22:00	63.9		79.6	45.9		65.4		81.3	44.1	
	22:00 - 23:00	62.5		79.1	41.6		64.1		80.1	44.5	
Night	23:00 - 00:00	61.3		78.7	40.4		63.6		78.9	42.2	
	00:00 - 1:00	60.9		76.8	40.1		64.8		81.4	42.6	
	1:00 - 2:00	59.8		76.6	40.6		63.9		80.6	42.8	
	2:00 - 3:00	59.9	50	77.5	40.7	61.61	64.4	50	84.1	42.7	64.31
	3:00 - 4:00	61.6		80.4	40.1		64.2		78.3	44.4	
	4:00 - 5:00	63.4		81.7	40.6		63.7		79.6	44.6	
	5:00 - 6:00	64.4		81.4	40.3		65.6		80.3	45.8	
24 hours Average		64.08		80.67	43.83		65.62		84.10	45.72	

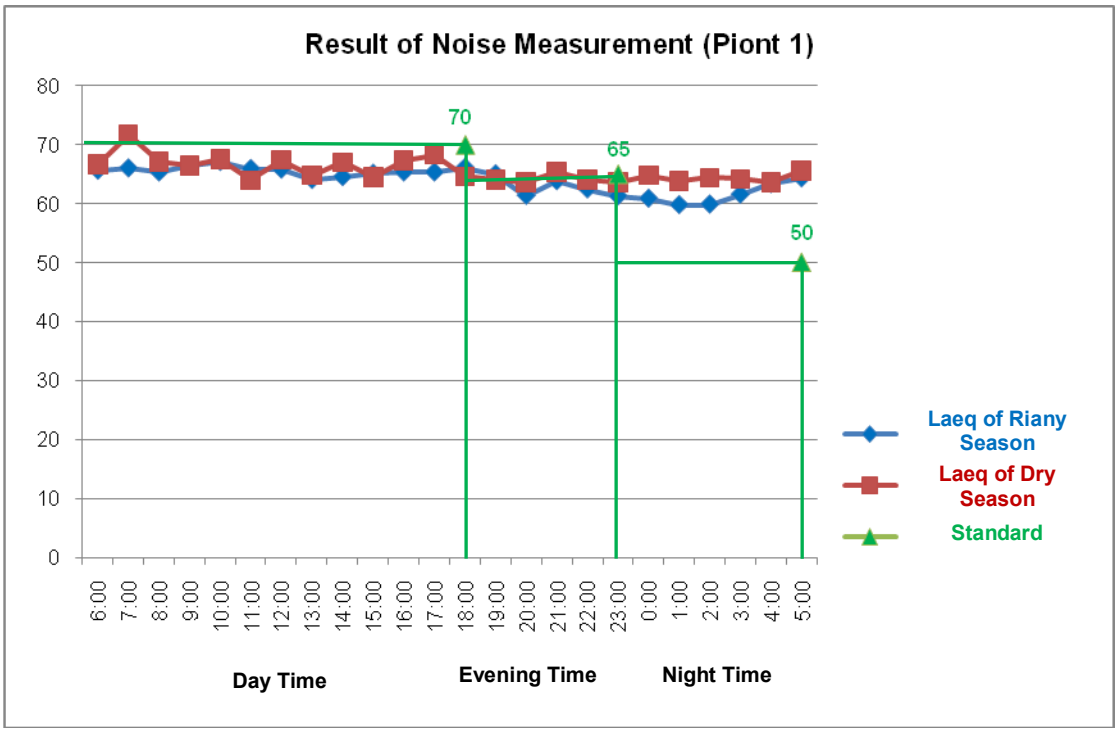


Table 5-9 (B): Noise level in the project area for survey location No 2, both dry and wet season Dated: 17 July 2013 and 04 December 2013

Time	Survey Period	Nosie Level dB (A) 17.July.2013 (Riany Season)				Mean	Nosie Level dB (A) 4.December.2013 (Dry Season)				Mean
		Laeq	Standard Laeq	Lmax	Lmin		Laeq	Standard Laeq	Lmax	Lmin	
	6:00 - 7:00	67		86.6	51.2		63.7		77.2	52.1	
	7:00 - 8:00	64.4		81.7	55.6		64.3		78.4	53.6	
	8:00 - 9:00	66		87.3	56.8		66.8		83.2	55.1	
	9:00 - 10:00	66.1		83	57.4		67.6		85.4	55.4	
Day	10:00 - 11:00	65.8	70	83.9	54.2	65.8	68.5	70	88.9	56.7	66.79
	11:00 - 12:00	65.2		80.2	51		66.5		83.8	54.9	
	12:00 - 13:00	63.4		77.3	52.6		68		88.5	53.4	
	13:00 - 14:00	68.3		83	52.9		67.3		88.8	54.4	
	14:00 - 15:00	66.2		83.5	52.5		66.7		86.9	51.7	

Time	Survey Period	Nosie Level dB (A) 17.July.2013 (Riany Season)				Mean	Nosie Level dB (A) 4.December.2013 (Dry Season)				Mean
		Laeq	Standard Laeq	Lmax	Lmin		Laeq	Standard Laeq	Lmax	Lmin	
	15:00 - 16:00	64.1		80.5	53.2		67		88.6	53.3	
	16:00 - 17:00	65.1		81.6	52.6		65.6		84.1	53.6	
	17:00 - 18:00	66.2		83.5	51.1		68.3		92.3	54.7	
	18:00 - 19:00	67.6		88.4	50.6		68		84.3	53.9	
Evening	19:00 - 20:00	63.1		84.7	54.4		68		86.6	53.9	
	20:00 - 21:00	65.1	65	83.8	49.7	62.3	66.6	65	84.3	53.4	66.18
	21:00 - 22:00	61.5		77.3	53.1		66.4		80.7	51.4	
	22:00 - 23:00	59.4		72	51.8		63.7		79.6	51.3	
Night	23:00 - 00:00	59.6		70.6	50.8		63.6		75.3	50.8	
	00:00 - 1:00	58.9		70.2	49.5		62.8		75.1	50.6	
	1:00 - 2:00	59.1		74.5	46.7		60.1		72.1	50.1	
	2:00 - 3:00	58.8	50	72.6	46.6	59.9	60.3	50	76.4	50.6	61.59
	3:00 - 4:00	60.6		78.4	48.8		60.4		72.3	50.4	
	4:00 - 5:00	61.8		80.7	48.6		61.6		73.4	51.6	
	5:00 - 6:00	60.4		78.9	49		62.3		78.9	51.7	
24 hours Average		63.49		80.18	51.7		65.17		81.88	52.86	

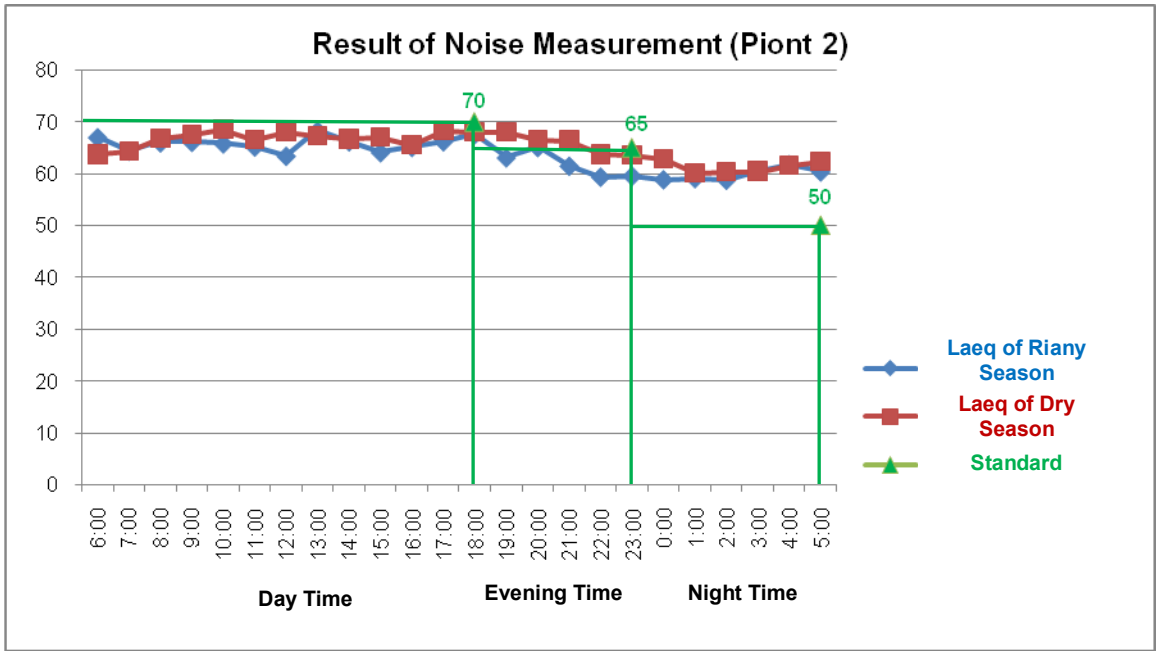
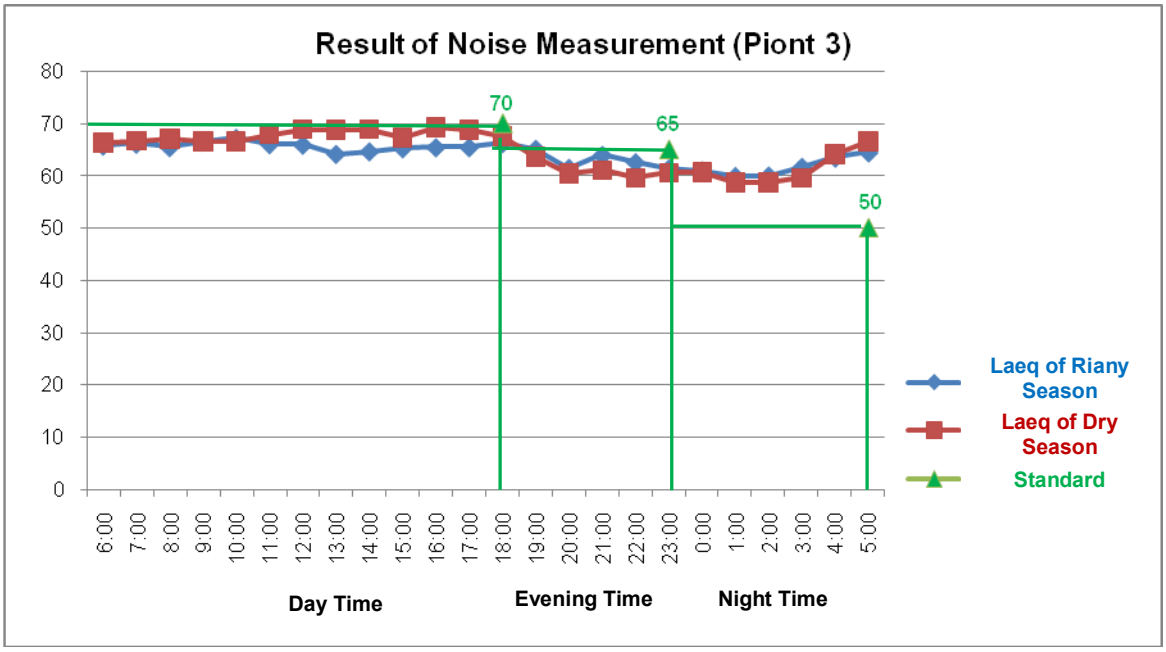


Table 5-9 (C): Noise level in the project area for survey location No 3, both dry and wet season Dated: 19 July 2013 and 06 December 2013

Time	Survey Period	Nosie Level dB (A) 19.July.2013 (Riany Season)				Mean	Nosie Level dB (A) 6.December.2013 (Dry Season)				Mean
		Laeq	Standard Laeq	Lmax	Lmin		Laeq	Standard Laeq	Lmax	Lmin	
Day	6:00 - 7:00	65.7		81	40.7		66.4		82.6	47.1	
	7:00 - 8:00	66.1		79.4	41.9		66.7		85.7	50.5	
	8:00 - 9:00	65.4		84.8	44		67.1		80.1	50.3	
	9:00 - 10:00	66.5		82.7	50.2		66.5		80.5	49.7	
	10:00 - 11:00	67.2		85.4	49.5		66.6		83.1	49.8	
	11:00 - 12:00	66	70	84.2	49.8	65.7	67.9	70	84.7	50.3	67.75
	12:00 - 13:00	65.9		83.2	50		68.9		86.1	51.5	
	13:00 - 14:00	64.1		81.5	42.2		68.7		88.6	50.1	
	14:00 - 15:00	64.6		82.4	44.3		68.9		87.2	49.8	
	15:00 - 16:00	65.2		81.6	45.3		67.3		82.4	47.6	
	16:00 - 17:00	65.4		79.5	45.9		69.3		86.6	48.1	

Time	Survey Period	Nosie Level dB (A) 19.July.2013 (Riany Season)				Mean	Nosie Level dB (A) 6.December.2013 (Dry Season)				Mean
		Laeq	Standard Laeq	Lmax	Lmin		Laeq	Standard Laeq	Lmax	Lmin	
	17:00 - 18:00	65.4		80.5	45.7		68.8		86	49	
	18:00 - 19:00	66.2		81.3	45.6		67.6		83.4	48.8	
Evening	19:00 - 20:00	65.1		81.5	43		63.7		79.6	45.4	
	20:00 - 21:00	61.4	65	75.3	43.4	63.2	60.4	65	72.8	45.1	61.20
	21:00 - 22:00	63.9		79.6	45.9		61.1		73.4	45.2	
	22:00 - 23:00	62.5		79.1	41.6		59.6		70.9	44.8	
Night	23:00 - 00:00	61.3		78.7	40.4		60.6		74.6	45.2	
	00:00 - 1:00	60.9		76.8	40.1		60.7		72.4	44.8	
	1:00 - 2:00	59.8		76.6	40.6		58.8		73.6	44.7	
	2:00 - 3:00	59.9	50	77.5	40.7	61.6	58.7	50	74.3	44.4	61.29
	3:00 - 4:00	61.6		80.4	40.1		59.6		77.1	44.6	
	4:00 - 5:00	63.4		81.7	40.6		64.1		82	44.3	
	5:00 - 6:00	64.4		81.4	40.3		66.5		85	44.6	
24 hours Average		64.08		80.67	43.83		64.77		80.53	47.32	



Note: The red numbers are over standard of Ministry of Environment.

For vibration in the project area in wet and dry seasons, its were still lower than standard of Ministry of Environment. (See table 5-10 (A)-(C) for details).

Table 5-10 (A): Vibration level in the project area, survey location No.1, both dry and wet season Dated: 15 July 2013 and 02 December 2013

Time	Survey Period	Leq	Vibration Level dB 15.July.2013 (Riany Season)			Mean	Leq	Vibration Level dB 2.December.2013 (Dry Season)			Mean
			Standard (Leq)	Lmax	Lmin			Standard (Leq)	Lmax	Lmin	
Day	6:00 - 7:00	40.2		56.5	20.1		39.8		55.5	20.2	
	7:00 - 8:00	39.5		56.8	21.8		41.9		57.6	21.2	
	8:00 - 9:00	42.3		57.8	21.4		41.5		59	21.3	
	9:00 - 10:00	41.8		59.1	20.6		40.9		58.3	25.3	
	10:00 - 11:00	41.5	65	59.5	23.4	41.8	42.9	65	60.7	22.4	42.13
	11:00 - 12:00	43.3		59	21.8		45.6		61.8	23.5	
	12:00 - 13:00	41.6		58.2	19.7		42.2		61.3	23	
	13:00 - 14:00	40.2		60.3	18.5		42.6		62.9	25.9	
	14:00 - 15:00	42.4		60.6	19.6		40.7		58.8	24.9	

	15:00 - 16:00	42.7		59.7	18.7		42.2		60.7	23.2	
	16:00 - 17:00	43.5		60.1	20.9		43		61.3	24.6	
	17:00 - 18:00	43		57.9	20.3		42.2		65.4	24.8	
Night	18:00 - 19:00	41	60	56.4	18.2	35.1	40.1	60	57	20.5	39.85
	19:00 - 20:00	40.6		56.6	18.6		39.9		56.6	20.4	
	20:00 - 21:00	40		56.6	18.7		40.5		55.8	20.5	
	21:00 - 22:00	37.5		54.1	18.6		39.1		56	24.1	
	22:00 - 23:00	34.8		51.4	18.1		38.7		55.1	20.1	
	23:00 - 00:00	30.8		50.7	18.4		40.6		58.4	21.6	
	00:00 - 1:00	31		50.6	19		39.9		56.4	21.5	
	1:00 - 2:00	29.9		51.4	18.3		40.2		58.8	21.6	
	2:00 - 3:00	30.6		50.9	18.5		40.1		61.4	22.2	
	3:00 - 4:00	30.5		50.7	18.4		38.9		58.3	21.7	
	4:00 - 5:00	37.4		56.9	18.2		39.8		58.6	21.6	
	5:00 - 6:00	37.5		54.5	18.3		40.4		56.8	21.5	
24 hours Average		**38.48**		**56.1**	**19.5**		**40.99**		**58.85**	**22.40**	

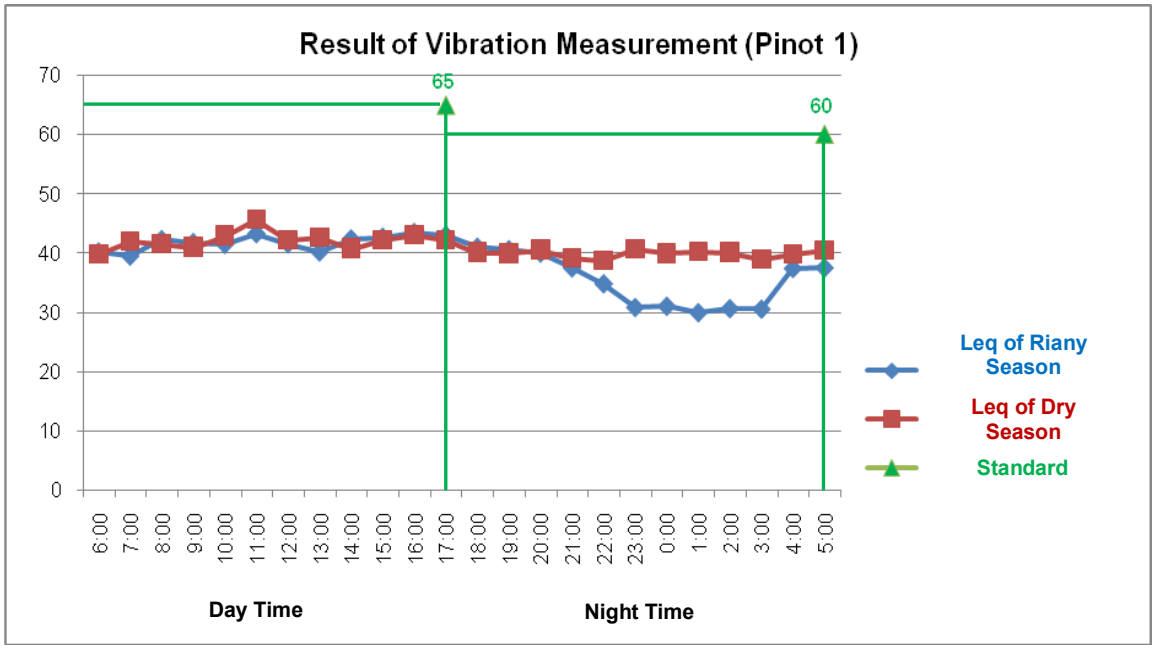


Table 5-10 (B):Vibration level in the project area for survey location No 2, both dry and wet season, Dated: 17 July 2013 and 04 December 2013

Time	Survey Period	Leq	Vibration Level dB 17.July.2013 (Riany Season)			Mean	Leq	Vibration Level dB 4.December.2013 (Dry Season)			Mean
			Standard (Leq)	Lmax	Lmin			Standard (Leq)	Lmax	Lmin	
Day	6:00 - 7:00	35.8	65	56.3	24.6	35.7	32.3	65	55.6	21.9	34.77
	7:00 - 8:00	34.6		56.7	24.7		35.1		58.9	22.4	
	8:00 - 9:00	38		58.3	24.4		34.7		50.9	22	
	9:00 - 10:00	36.3		49.2	23.3		34.3		54.3	22.1	
	10:00 - 11:00	36.2		52.9	22.5		40.3		60.7	19.9	
	11:00 - 12:00	35.1		52.7	22		35.4		54.8	19.7	
	12:00 - 13:00	34.3		52.1	21.7		36.4		56.9	21.8	
	13:00 - 14:00	36.6		66.5	20		34.1		53.7	19.8	
	14:00 - 15:00	34.3		49.3	20.9		33.7		51.5	20.1	
	15:00 - 16:00	34.9		54.7	23.3		33.1		52.5	21	
	16:00 - 17:00	38.1		55.3	21		35.9		58.1	23.4	
	17:00 - 18:00	33.8		47.5	20.9		31.9		49.8	19.1	
Night	18:00 - 19:00	33.6	60	49.6	20.5	30.9	32.8	60	51.9	19.8	31.06
	19:00 - 20:00	31.8		48.1	20.6		31.8		59.2	19.8	
	20:00 - 21:00	31.6		49.4	20.1		32.6		50.7	19.1	
	21:00 - 22:00	33.3		51.7	21.2		32.3		47.7	17.1	

	22:00 - 23:00	28.5		55.4	20.1		30.9		49.5	17.4	
	23:00 - 00:00	28.9		49.3	20.2		30.1		48.4	16.7	
	00:00 - 1:00	29.7		49.2	19.6		30.8		51.6	16.8	
	1:00 - 2:00	30.6		51.3	20.5		29.3		48.1	16.6	
	2:00 - 3:00	29.1		52.8	20.7		30.2		47.8	16.5	
	3:00 - 4:00	29.4		49.9	19.9		29.6		50.1	16.7	
	4:00 - 5:00	30.6		51.1	20.8		30.7		51.1	17.8	
	5:00 - 6:00	31.9		49.2	20.8		31.6		53.3	19.9	
24 hours Average		**33.21**		**52.44**	**21.43**		**32.91**		**52.80**	**19.48**	

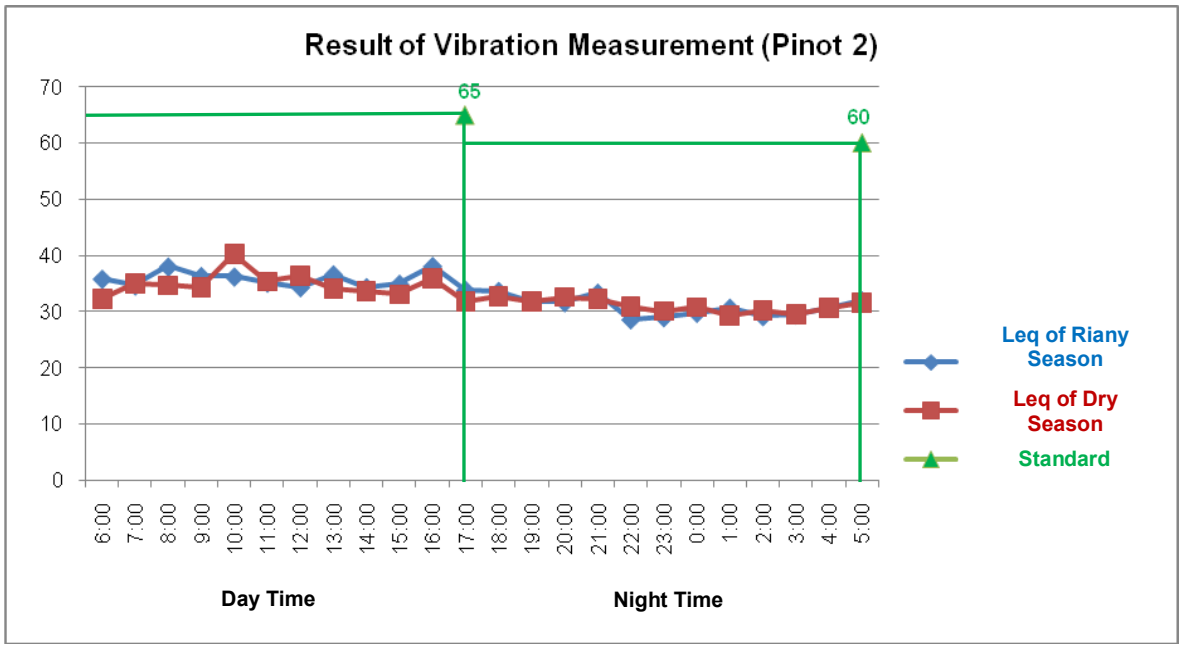
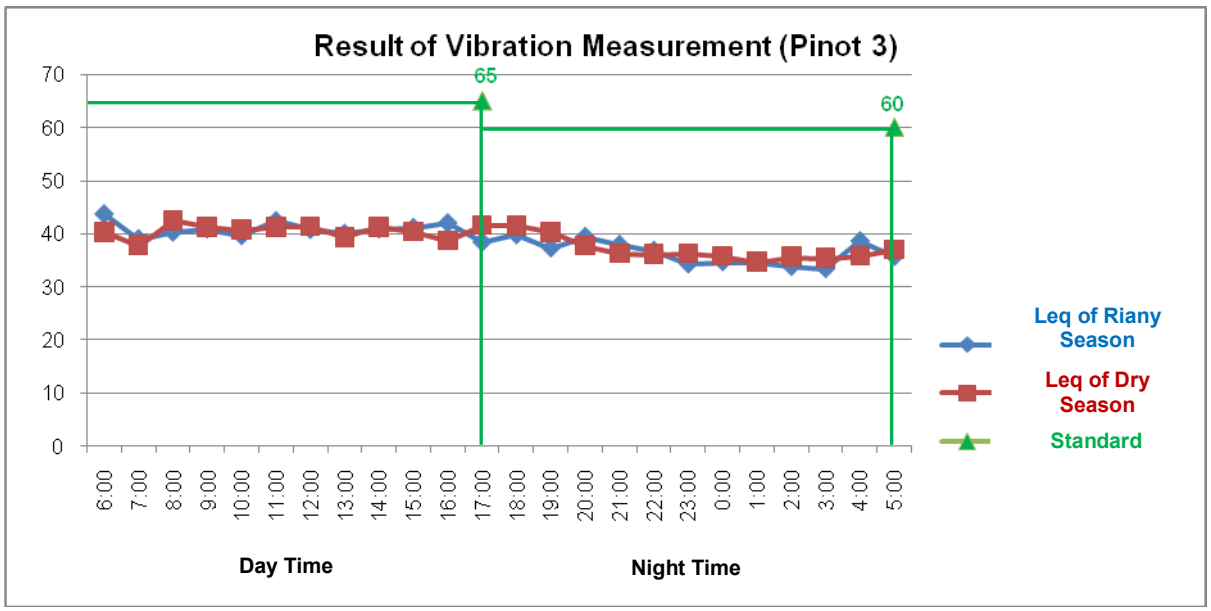


Table 5-10 (C):Vibration level in the project area for survey location No 3, both dry and wet season, Dated: 19 July 2013 and 06 December 2013

Time	Survey Period	Leq	Vibration Level dB 19.July.2013 (Riany Season)			Mean	Leq	Vibration Level dB 6.December.2013 (Dry Season)			Mean
			Standard (Leq)	Lmax	Lmin			Standard (Leq)	Lmax	Lmin	
Day	6:00 - 7:00	43.7	65	39.8	39.8	40.8	40.3	65	58.6	18.9	40.52
	7:00 - 8:00	39		37.3	37.3		37.8		58.1	16.6	
	8:00 - 9:00	40.3		39.4	39.4		42.5		59.1	16.7	
	9:00 - 10:00	40.9		37.9	37.9		41.2		59.1	16.2	
	10:00 - 11:00	39.6		36.8	36.8		40.7		58	16.8	
	11:00 - 12:00	42.4		34.3	34.3		41.2		57.6	17.9	
	12:00 - 13:00	40.8		34.7	34.7		41.3		58.9	17	
	13:00 - 14:00	40		34.6	34.6		39.3		60.5	16.8	
	14:00 - 15:00	40.9		33.8	33.8		41.2		60.5	16.1	
	15:00 - 16:00	41.1		33.4	33.4		40.4		56.6	15.7	
	16:00 - 17:00	42		38.6	38.6		38.7		59	15.8	
	17:00 - 18:00	38.4		35.7	35.7		41.6		58.4	16	
Night	18:00 - 19:00	39.8	60	58.7	20.9	36.4	41.5	60	58.7	17.1	36.85
	19:00 - 20:00	37.3		54.6	19.8		40.3		56.6	18	
	20:00 - 21:00	39.4		51.1	19.6		37.7		55.6	16.9	
	21:00 - 22:00	37.9		56.6	18.6		36.3		54.3	16.6	
	22:00 - 23:00	36.8		55.9	17.9		36.1		56.6	16.1	
	23:00 - 00:00	34.3		53.8	17.5		36.2		58.4	16.2	
	00:00 - 1:00	34.7		54.6	17.3		35.8		56.9	16.1	
	1:00 - 2:00	34.6		54.8	18.6		34.6		57.7	16.3	
	2:00 - 3:00	33.8		55.2	20.1		35.6		58.8	16.4	
	3:00 - 4:00	33.4		52.7	19.6		35.4		59.6	16.1	
	4:00 - 5:00	38.6		59.4	18.1		35.7		57.7	16.4	
	5:00 - 6:00	35.7		59.1	20.5		37		54.9	16.4	

24 hours Average	38.56		57.77	20.89		38.68		57.93	16.63	





Activities of Noiseand Vibration Level measurement at Survey Location No 1 on 15 July 2013, wet season



Activities of Noiseand Vibration Level measurement at Survey Location No 2 on 17 July 2013,wet season



Activities of Noiseand Vibration Level measurement at Survey Location No 3 on 19 July 2013, wet season



Activities of Noiseand Vibration Level measurement at Survey Location No 1 on 02 Dec. 2013, dry season



Activities of Noiseand Vibration Level measurement at Survey Location No 2 on 04 Dec. 2013, dry season



Activities of Noiseand Vibration Level measurement at Survey Location No.3 on 06 Dec. 2013, dry season

5.1.1.4 Hydrology

Referring to digital map with scale 1:1,000,000 from department of Geology, the survey team conducted at project area, from 1 July to 15 Decembe 2013, in order to identify ditch, stream, river which NR5 for portion from Thlea Ma'am in Pursat to Battambang (all of the existing bridges was counted; then the detailed information was showed in heading 4.3.1 of Chapter-4); moreover, the location of bridges got from JICA Survey Team, Progress Report 2013.

A. Pursat Province

The NR5, for portion from Thlea Ma'am in Pursat to Battambang province, has 12 main streams and rivers in Pursat as the following:

1. Srangthom stream (bridge: Br40) that it has width from 10m (in dry season) to 15m (in wet season).

2. Srangtouch stream (bridge: Br41) that it has width from 7m (in dry season) to10m (in wet season).
3. Stream without name (bridge: Br42, called Putrea bridge) that its small bottom is 5m width and its big bottom is 13m width. The amount of water flows in this stream is so small in wet season; the diameter of water flow in the stream is from 2m to 3m.
4. Stream without name (bridge: Br 43, called Chan bridge) that it has width from 25m (in dry season) to 30m (in wet season).
5. Pursat river (bridge: Br 47) that it has width from 70m (in dry season) and surface water river is 110m (on 19 November 2013). For Pursat Steung width at the point of by-pass is 118m of width.
6. Stream without name, bridge: Br 54, that it has width from 11m (in dry season) to 16m (in wet season).
7. Svay At stream (bridge: Br 55, called Svay At bridge) that it has width from 13m (in dry season) to 18m (in wet season).
8. Stream without name (bridge: Br 56, called Trapeang Chong bridge) that it has width from 5m (in dry season) to 7m width (in wet season).
9. Kamboth stream (bridge: Br 57, called Boeng Khna bridge) that it has width from 13m (in dry season) to 19m width (in wet season).
10. Tapaong or Srah Mnak stream (bridge: Br 58, called Ou Tapaong bridge) that it has width from 31.3m (in dry season) to 42.5m (in wet season).
11. Svay Doun Keo river (bridge: Br 59, called Svay Doun Keo bridge) that it has width from 40.4m (in dry season) to 88m (on 24 November 2013).
12. Sa-art stream, bridge: Br60 that it has width from 14m (in dry season) to 18 m (in wet season).

B. Battambang Province

The NR5, for portion from Thlea Ma'am in Pursat to Battambang province, has 17 main streams and rivers in Bttambang as the following:

1. Stream without name, bridge: Br 61, that it has width from 5m (in dry season) to 7m (in wet season).
2. Stream without name, bridge: Br 62, that it has width from 5m (in dry season) to 7m (in wet season).
3. Stream without name, bridge: Br 63, which its mall bottom is 12m width and its big bottom, is 23m width; moreover, this stream has no water in both dry and wet seasons.
4. Stream without name, bridge: Br 64, that it has width from 20m (in dry season) to 26m (in wet season).
5. Dountry or Moung river (bridge: Br 65, called Moung bridge) has width from 12m (in dry season) to 20m (in wet season).
6. Stream without name (bridge: Br 66, called bridge of Moung High School) has width from 5m (in dry season) to 9m (in wet season).
7. Stream without name, bridge: Br 67, that it has width from 9m (in dry season) to 14m (in wet season).
8. Chok River, bridge: Br68, which it has width from 18m (in dry season) to 24m (in wet season).
9. Stream without name, bridge: Br 69, that it has width from 8m (in dry season) to 12m (in wet season).
10. Stream without name, bridge: Br 70, that it has width from 7m (in dry season) to 8m (in wet season).
11. Stream without name, (bridge: Br 71, called Salakrao bridge) that it has width from 7m (in dry season) to 11m (in wet season).

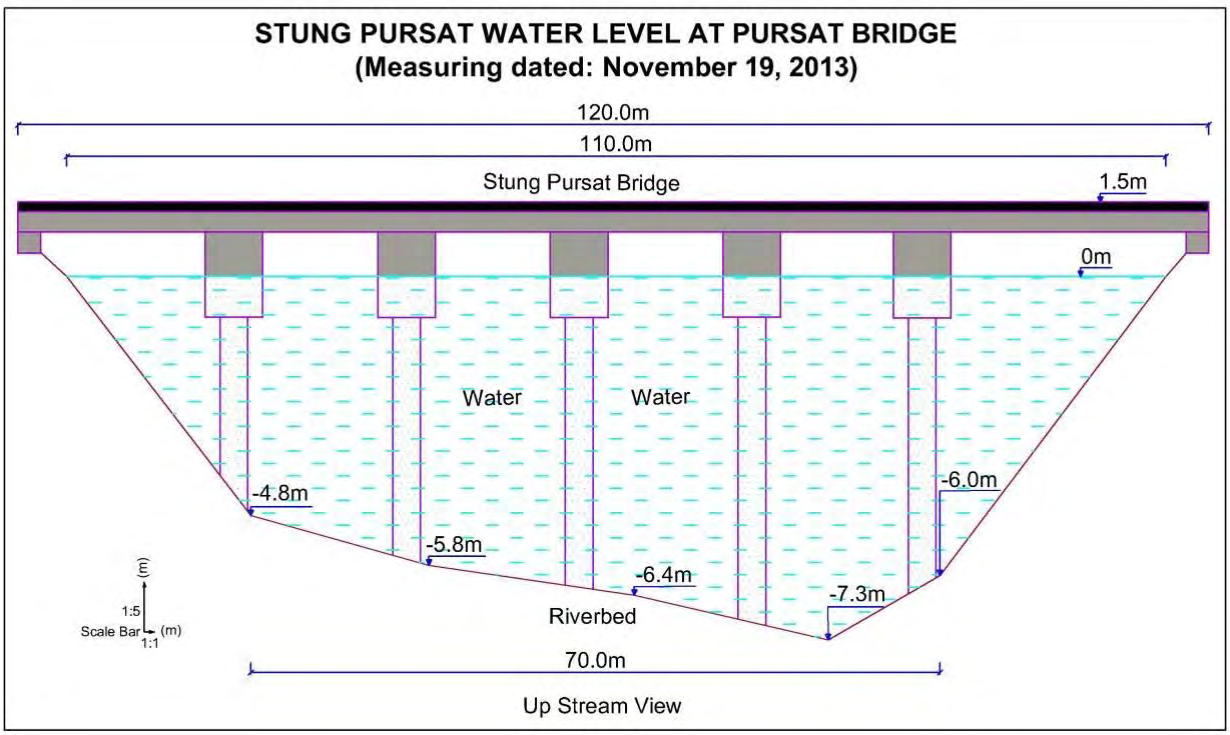
12. Stream without name, bridge: Br 72, that it has width from 6m (in dry season) to 7m (in wet season).
13. Stream without name, bridge: Br 73, that its mall bottom is 7m width and its big bottom is 16m width. This stream has no water in both dry and wet seasons.
14. Stream without name, bridge: Br 74, that its mall bottom is 10m width and its big bottom is 17m width. This stream has no water in both dry and wet seasons.
15. Sandas stream (bridge: Br 75, called Sandas bridge) that it has width from 17m (in dry season) to 19m (in wet season).
16. Stream without name, bridge: Br 76, that it has width from 5m (in dry season) to 8m (in wet season).
17. Stream without name, bridge: Br 77, which its mall bottom is 10m width and its big bottom is 17m width. This stream has no water in both dry and wet seasons.

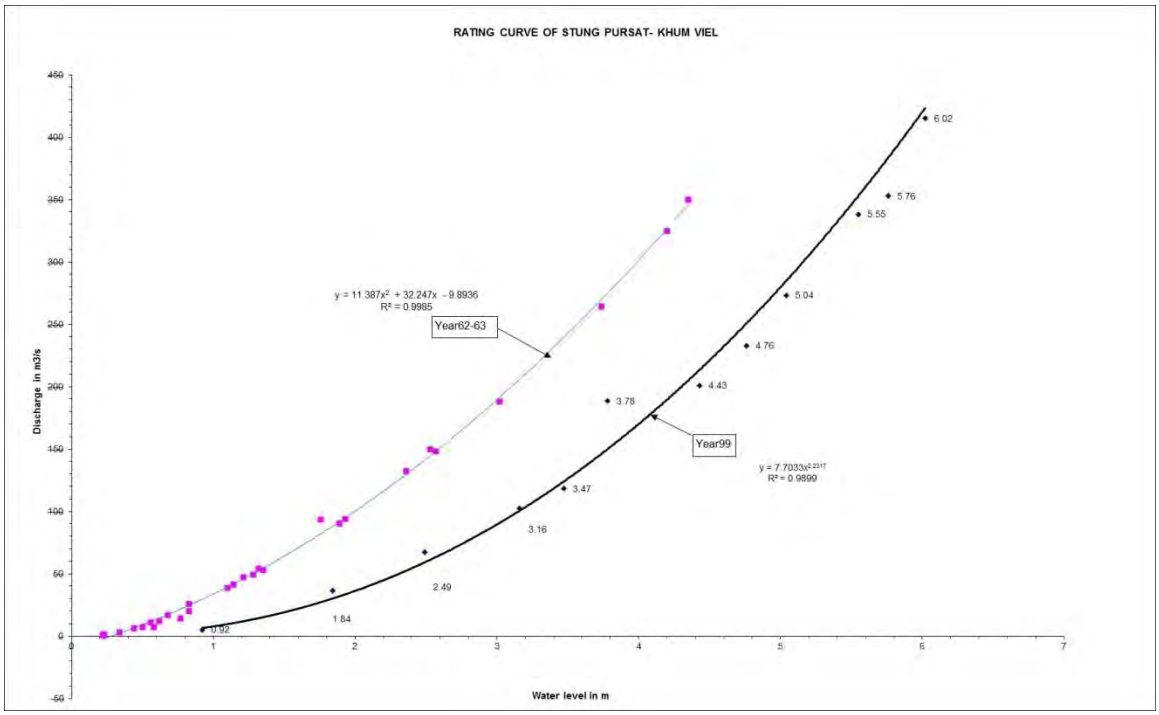
1. Hydrology of Pursat and Svay Doun Keo River

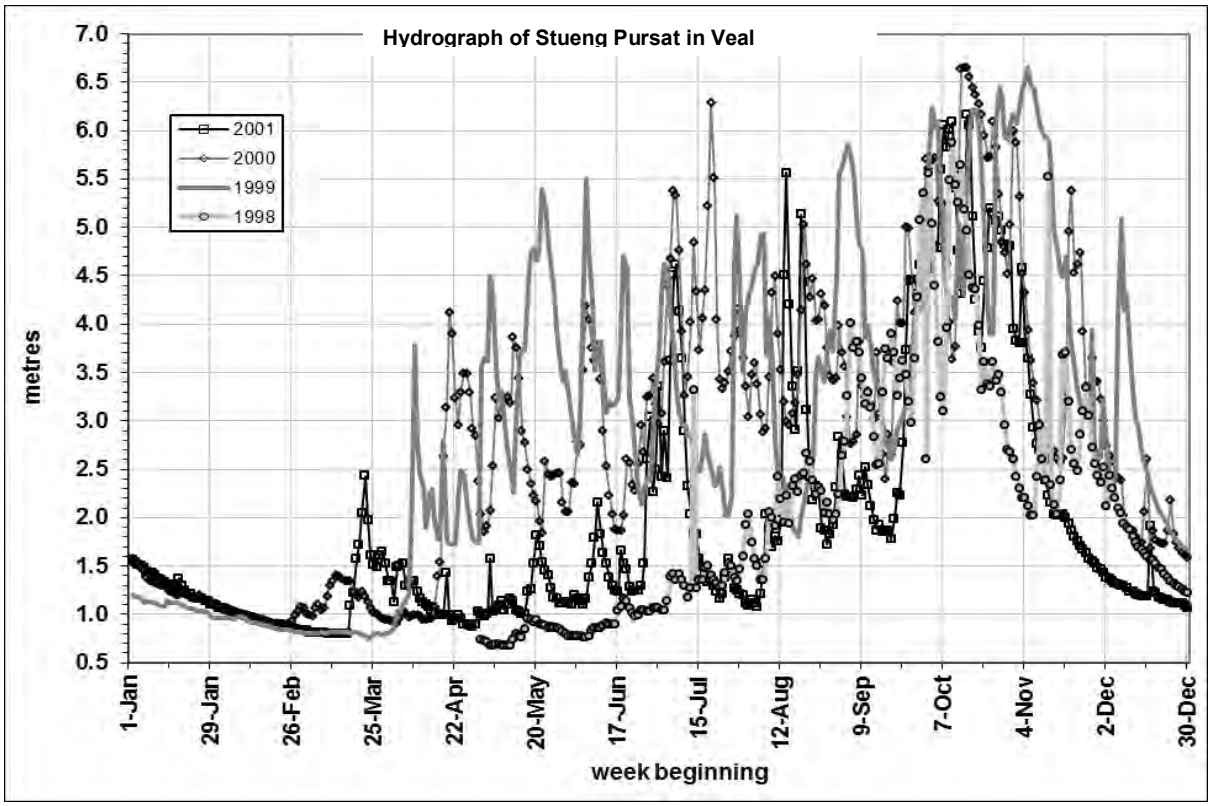
The survey team did the cooperation with the Ministry of Water Resources and Meteorology (MOWRAM) and concerned provincial departments in order to find the data of hydrology of rivers and streams in the project area, however, we were not able to find out data of hydrology of all rivers and streams, excepted Pursat and Svay Doun Keo river. The data of water flow and height for these two rivers are described as the following: (source: MOWRAM/ADB-TA 3758-CAM Northwest Irrigation Sector Project).

i. Pursat River

There is no data of hydrology for Pursat river on site of Pusat bridge; but, we got only the data of hydrology of this river in another location, in Veal commune, Kandieng district; it located at downstream of intake regulator, where it is 3.7 Km away from Pursat bridge. It indicated that the water level in river was 6.2 m in 1999 (the highest water level) and the maximum flow was 415m^3/s. Then the minimum water level in river was 0.92m and its minimum flow was 5.21m^3/s. In 1962 and 1963, the maximum water level was 4.35m and maximum water flow was 350m^3/s; then the minimum water level was 0.22 m and the minimum water flow was 0.93m/s (see graphic below). The catchment area in Veal commune is 4,480 Km^2. Cross section of Pursat Steung below:







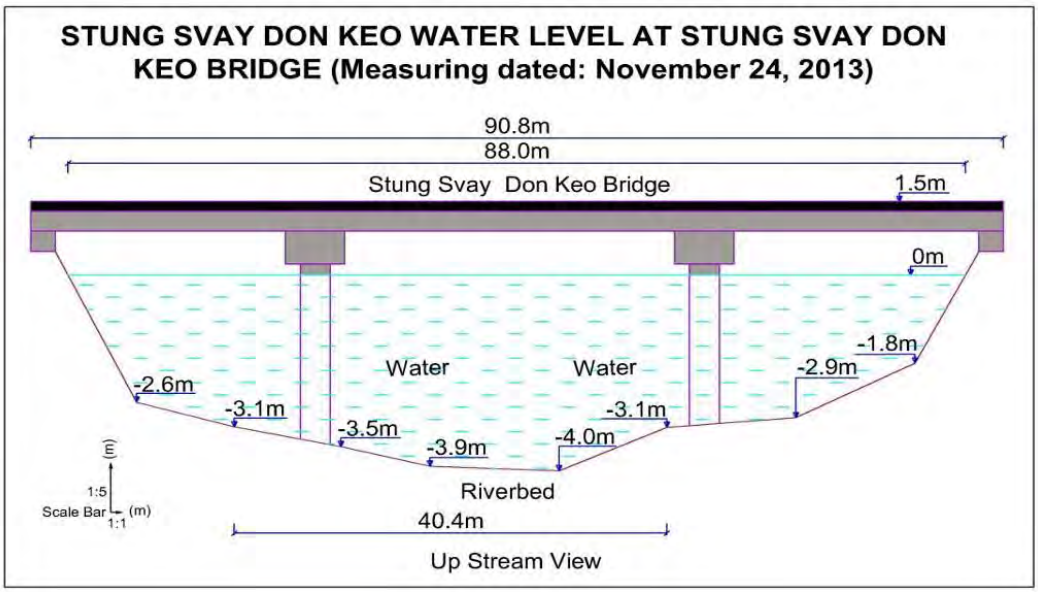
According to the graphic above and the field survey from July 1 to 15 December 2013, it showed that water level of Pursat river started increasing from in the middle of June to the end of November; then water level started decreasing from in the beginning of December to in the middle of June (excepted in case of flooding occurred in 1999, 2000 and 2013).

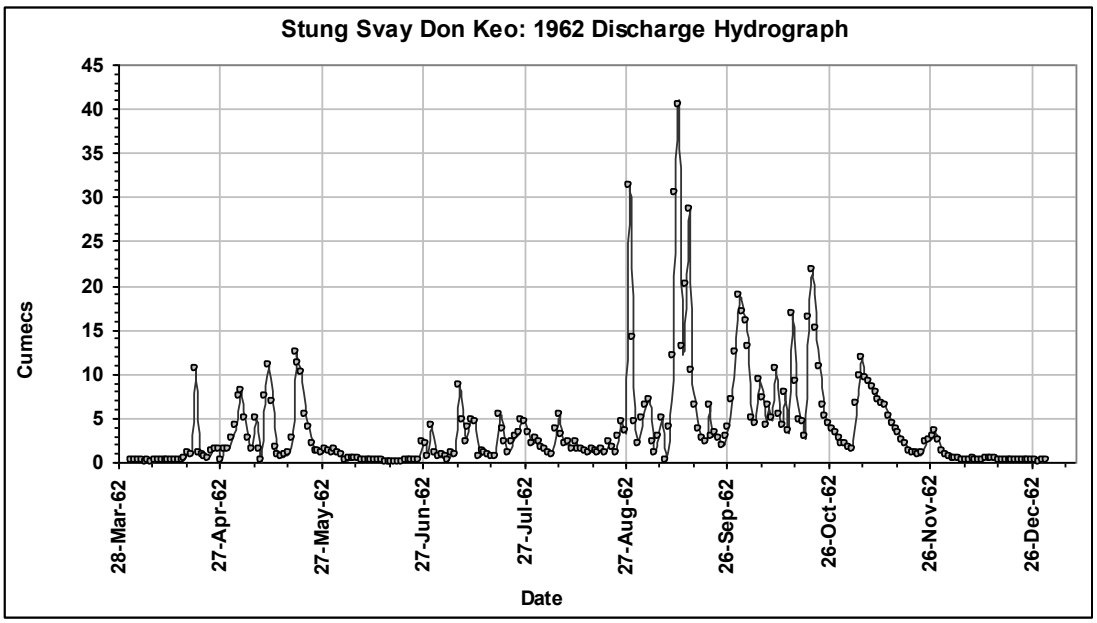
ii. Svay Doun Keo River

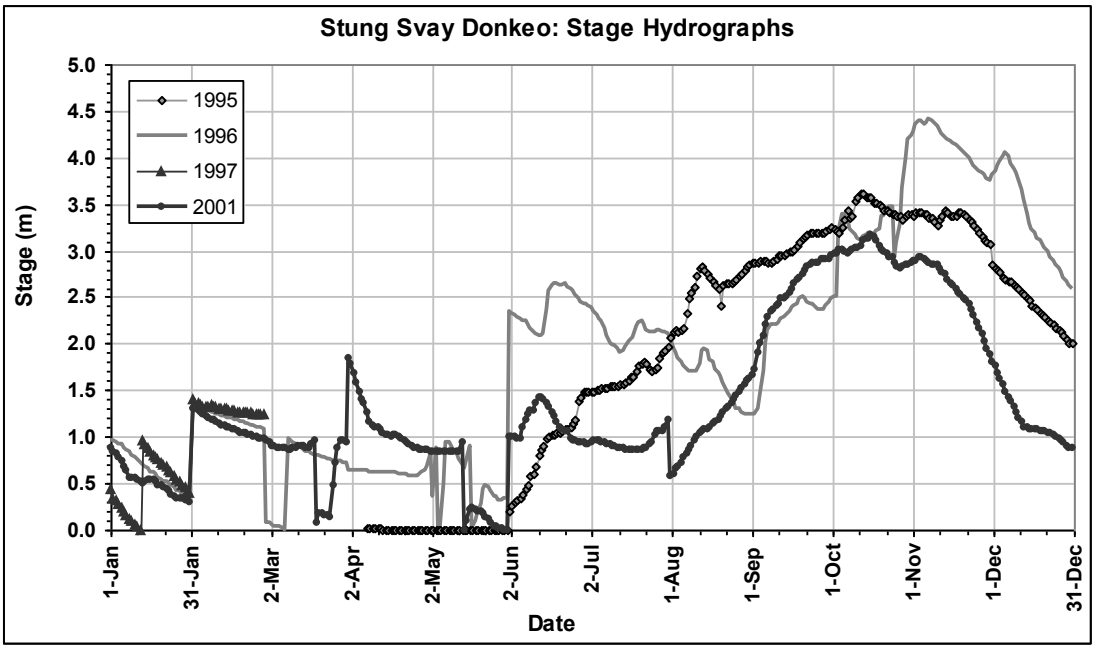
At the present, there is no data of hydrology for **Svay Doun Keo river**; but, we got only the data of hydrology for this river in 1963, from 1995 to 1997, and in 2011 which studied by ADB project, ADB-TA 3758-CAM Northwest Irrigation Sector Project. The catchment area of Svay Doun Keo River, at the point of Svay Doun Keo Bridge, is 396 Km^2.

The maximum water flow of Svay Doun Keo River is 41m^3/s and the maximum water level is 4.4m; then the minimum water flow is 0m and the minimum water level is also 0m^3/s (in dry season, this River has no water flow; it was drought mostly, but there was some water in the small pond of River bed only).

According to the graphic below and the field survey from July 1 to 15 December 2013 and graph study below, it showed that ingeneral Svay Daun Keo River was increased water level at the begining of June to the end of November and it started to decreasing from the beginning of December to the beginning of April. Water in River was drought from the beginning of April to the end of May which it is lack of water in dry season for the villager in the area. At the present, in the dry season, the water River is received additional water from the Damnak Ampil Dam through the main Canal.







2. Surface Water Quality Analysis

Water quality analysis in the project area was selected by JICA Survey Team. There were 6 points in total with 5 parameters selected in Pursat and Battambang province; for 3 points in Pursat: Pursat river, Ou Tapaong river, and Svay Doun Keo river; while the other 3 points were in Battambang such as: Maung river, Chak river and Sangkae river. Water Quality Analysis is held twice in total: once in the dry season and another was in rainy season.

Location and date of water sampling (both dry and rainy season) are shown as the following:

- **Location No 1:** in Pursat river, it located in Prey Nhi village, Prey Nhi Sangkat, Pursat city with Coordinates X = 382614; Y = 1385691 on 24 July 2013 and on 05December 2013.
- **Location No 2:** in Ou Tapaong river, it located in the Ou Tapaong village, Ou Tapaong Commune, Bakan district, Pursat province with Coordinates X = 355975; Y = 1399820 on 24 July 2013 and on 05 December 2013.
- **Location No 3:** in Svay Doun Keo river, it located in Svay Doun Keo Mouy village, Svay Doun Keo commune, Bakan district, Pursat province with Coordinates X = 352389; Y = 1401262 on 24 July 2013 and on 05 December 2013.
- **Location No 4:** in Maung river, it located in Ream Kon village, Kea commune, Maung Russei district, Battambang province with coordinates X = 331754; Y = 1412530 on 24 July 2013 and on 05 December 2013.
- **Location No 5:**in Chak river, it located in Stueng Chak village, Prey Touch commune, Maung Russei district, Battambang province with coordinates X = 325233; Y = 1421598 on 24 July 2013 and on 05 December 2013.
- **Location No 6:** in Sangke river, it located in Preaek Moha Tep village, Svay Pao Sangkat, Battambang City, Battambang coordinates X = 305013; Y = 1449616 24 July 2013 and on 05 December 2013.

Water samples were sent to analyze in the Laboratory of Ministry of Environment on July 24, 2013 for water quality test in wet season. Again activity was done on 03 December 2013 at the same places for dry season testing. Also, the results of water quality are in the following table. The original certificates of results for water quality were attached in annex-2. ***Note:*** *the coordination above is WGS84.*

Table 5 -11 (A):The result of surface water quality test for location No-1 (Sample No 1)

No.	Parameter	Unit	Standard of Water Quality in Public Sources for Biodiversity, MoE.	Standard of Drinking Water, MIME	Sample No. 1	
					Pursat River	Pursat River
					July 24, 2013 (in wet season)	Dec. 05, 2013 Dry Season
1	pH	No Unit	6.5 - 8.5	6.5 – 8.5	8.06	7.5
2	BOD_5	mg/l	11-1	NA	2.59	1.30
3	COD	mg/l	NA	NA	4.70	3.85
4	TSS	mg/l	25-100	NA	124.00*	92.00
5	Total Coliform	MPN/100ml	<5000	0	4600**	300**

Table 5 -11 (B):The result of surface water quality test for location No 2 (Sample No 2)

No.	Parameter	Unit	Standard of Water Quality in Public Sources for Biodiversity, MoE.	Standard of Drinking Water, MIME	Sample No. 2	
					Ou Tapaong river	Ou Tapaong river
					July 24, 2013 (in wet season)	Dec. 05, 2013 Dry Season
1	pH	No Unit	6.5 - 8.5	6.5 – 8.5	8.79***	7.3
2	BOD_5	mg/l	11-1	NA	3.84	3.40
3	COD	mg/l	NA	NA	7.45	5.74
4	TSS	mg/l	25-100	NA	138.00*	125.00*
5	Total Coliform	MPN/100ml	<5000	0	150**	110**

Table 5 -11 (C):The result of surface water quality test for location No 3 (Sample No 3)

No.	Parameter	Unit	Standard of Water Quality in Public Sources for Biodiversity, MoE.	Standard of Drinking Water, MIME	Sample No. 3	
					Svay Doun Keo river	Svay Doun Keo river
					July 24, 2013 (in wet season)	Dec. 05, 2013 Dry Season
1	pH	No Unit	6.5 - 8.5	6.5 – 8.5	8.32	7.2
2	BOD_5	mg/l	11-1	NA	5.20	3.50
3	COD	mg/l	NA	NA	8.23	7.10
4	TSS	mg/l	25-100	NA	142.00*	108.00*
5	Total Coliform	MPN/100ml	<5000	0	350	750**

Table 5 -11 (D):The result of surface water quality test for location No 4 (Sample No 4)

No.	Parameter	Unit	Standard of Water Quality in Public Sources for Biodiversity, MoE.	Standard of Drinking Water, MIME	Sample No. 4	
					Maung River	Maung River
					July 24, 2013 (in wet season)	Dec. 05, 2013 Dry Season
1	pH	No Unit	6.5 - 8.5	6.5 – 8.5	8.63***	7.3
2	BOD_5	mg/l	11-1	NA	2.05	1.10
3	COD	mg/l	NA	NA	4.12	3.39
4	TSS	mg/l	25-100	NA	128.00*	97.00
5	Total Coliform	MPN/100ml	<5000	0	11000***	2100**

Table 5 -11 (E):The result of surface water quality test for location No 5 (Sample No 5)

No.	Parameter	Unit	Standard of Water Quality in Public Sources for Biodiversity, MoE.	Standard of Drinking Water, MIME	Sample No. 5	
					Chak river	Chak river
					July 24, 2013 (in wet season)	Dec. 05, 2013 Dry Season
1	pH	No Unit	6.5 - 8.5	6.5 – 8.5	8.56***	7.1
2	BOD_5	mg/l	11-1	NA	2.67	1.20
3	COD	mg/l	NA	NA	7.25	3.20
4	TSS	mg/l	25-100	NA	142.00*	95.00
5	Total Coliform	MPN/100ml	<5000	0	280	94

Table 5 -11 (F):The result of surface water quality test for location No.6 (Sample No.6)

No.	Parameter	Unit	Standard of Water Quality in Public Sources for Biodiversity, MoE.	Standard of Drinking Water, MIME	Sample No. 6	
					Sangke river	Sangke river
					July 24, 2013 (in wet season)	Dec. 05, 2013 Dry Season
1	pH	No Unit	6.5 - 8.5	6.5 – 8.5	8.18	7.9
2	BOD_5	mg/l	11-1	NA	2.36	1.35
3	COD	mg/l	NA	NA	4.31	2.60
4	TSS	mg/l	25-100	NA	140.00*	116.00*
5	Total Coliform	MPN/100ml	<5000	0	4600**	1500[88]

- **MoE** :Ministry of Environment)**Standard of Water Quality in Public Sources, lake and reservoir, for Biodiversity).**
- **MIME** :Ministry of Industry, Mines and Energy)**Standard of Drinking Water)**

Note : ɕ*is over Standard of Ministry of Environment.

ɕ**is over the Standard of Ministry of Industry, Mines and Energy.

ɕ***is over the standard of Ministry of Environmentand Ministry of Industry, Mines and Energy.

According to table 5-11 (A) and 5-11 (F), in dry and wet seasons showed that: there is only one parameter, TSS, exceeded the standard of Water Quality in Public Sources, lake and reservoir, for Biodiversity of Ministry of Environment (MoE). Meanwhile, it is a parameter of Total Coliform that exceeded the standard of drinking water quality of the Ministry of Industry, Mines and Energy (MIME). Moreover, there were two parameters found to exceed the standards of MoE and MIME; those parameters are pH and Total Coliform.

Conclusion with Surface Water Quality before project implementation:

- **pH**: in the rainy/wet season (from July to October) water in Ou Tapaong river increased due to rain, water of rain flowed across the residential area to this river. During taking the water sample, the flow of water in this river was not good, water flow was extremely slow. According to the results of water test, pH is over the standard, for both of the Ministries, MoE and MIME; the cause is from releasing of the solid waste and waste water from the kitchen and bathrooms of the people living around the area. Really, there are many households settled next to this location of water sampling point. In dry season (December) pH is decreased.
- **Total Coliform**: rain started to fall down in the wet season from July to October that all of streams and rivers along the project area are full of water. Because of much water, it flooded solid waste which people deposed on the bank of rivers or streams. So, it is the reason of coliform exceeded the standard in these six rivers for both MoE and MIME. In dry season (December) Total Coliform is decreased.
- **TSS**: It is the same as parameters above. In wet season, rain eroded soil from catchment area of rivers/streams which were cause of increasing sediments, not clear water, and especially total suspended solid in water exceeded the standard of MoE and MIME. In dry season (December) TSS is decreased.



Picture of Water Sampling in Location No 1, in wet season (in Pursat river)



Picture of Water Sampling in Location No 1, in dry season (in Pursat river)



Picture of Water Sampling in Location No 2, in wet season (in Ou Tapaong river/stream)



Picture of Water Sampling in Location No 2, in dry season (in Ou Tapaong river/stream)



Picture of Water Sampling in Location No 3, in wet season (in Svay Doun Keo river)



Picture of Water Sampling in Location No 3, in dry season (in Svay Doun Keo river)



Picture of Water Sampling in Location No 4, in wet season (in Maung river)



Picture of Water Sampling in Location No 4, in dry season (in Maung river)



Picture of Water Sampling in Location No 5, in wet season (in Chak river)



Picture of Water Sampling in Location No 5, in dry season (in Chak river)



Picture of Water Sampling in Location No 6, in wet season (in Sangke river)



Picture of Water Sampling in Location No 6, in dry season (in Sangke river)

3. Ground Water Investigation

As the description in heading B of Chapter-5, pages 81, there were two species of ground water, Confined Aquifer and Unconfined Aquifer, found along NR5 for portion from Thlea Ma'am in Pursat to Battambangprovince.

- Unconfined Aquifer: the layer is depth shallow if we compared to the sea elevation. The depth of surface land (upper surface of the ground water) is from 5m to 14m (due to land level) and statics level is from 0.5m to 8m, then its flow direction is to go down to Tonle Sap Lake. This water layer is covered by sand and mixture of sand and mud; then water quantity is less than

500L/hr to 3,000L/hr. In dry, the amount of water decreased very much, some wells were drought. Moreover, digging shallow wells of people were not able to get ground water too, as in Svay Doun Keo commune.



Shallow well along the road (Boeng Kantout commune, Pursat Province)

- Confined Aquifer: This layer of ground water is from 15m to 50m depth. The grain size of sand is medium for this layer with reddish-brown or become rust color. Then, it has water pressure and the statics level is from 7m to 15m. This layer of ground water (water table) has small amount of water from 1m^3/hr to 5m^3/hr. However, drillingwells of people were not able to get ground water too for some places, as in Bakan Referral Hospital that they drilled 120m depth, but there was no water.



Drilling well along the road (Boeng Anlong Vil commune, Battambang Province)

5.1.2. Biological Resources

5.1.2.1. Forestry

As description in heading 2.2.3 of Chapter-2, the working team defined the target areas with 3,384ha, both of road sides (300m width), from Kilometer Post (KP): KP-171 to KP-282+200. Basing on map of forest coverage area from the Forest Administration (GIS Datasets FA 2002and2006: scale 1/1000.000), it is illustrated that the project area is not covered by the forestry coverage area or protected forest. Also, along the NR5 for apportion from Thlea Ma'am in Pursat to Battambang province has some Riverside vegetations that regrow according to filed observation.

A. Riverside Vegetations

Basing on the field study by working team for COI: 20m (total: 40m), it illustrated that the affected Riverside vegetation, 10.13ha, along the NR5 for a portion from Thlea Ma'am in Pursat to Battambang

province. Most of the regenerating Riverside vegetation along the ditch/stream and canals normally found a small vegetation located in the inundated forestry area at the middle area as below::

- The Ou Srang Thom stream from KP-177+177 toKP-177+263, in Boeng Kantuot Commune and Tnaot Chum Commune;
- The Srang Touch stream from KP-177+177 toKP-177+263, in Boeng Kantuot Commune and Tnaot Chum Commune;
- The Svay Art Channel from KP-190+727 toKP-190+785, in Snam Preah Commune;
- Canals along both of the road sides, from KP-248+580 toKP-252+938and fromKP-254+252 to KP-255+121in Moung Commune, Kear Commune and Kakaoh Commune.

The Riverside vegetationspecies are in the table-5-12 below:

Table 5 -12:Name of Riverside vegetationspecies along road from Thlea Ma'am to Battamabng (COI:20m)(from 01 July to 15 December 2013)

Name of Riverside vegetation along right side of road (COI:20m)				Name of Riverside vegetation along left side of road)COI:20m)			
Kilometers(PK)	**Communes**	**Scientific Name**	**Name of Ou/Canals**	**Kilometers(PK)**	**Communes**	**Scientific Name**	**Name of Ou/Canals**
177+177to177+263	Beung Kanthouth	*Euphorbia milii*	Ou Srang Thom	177+180to177+231	Thoth Choum	*Cassia alata, L.*	Ou Srang Thom
		Cassia alata, L.				*Combretum trifoliatum*	
		Combretum trifoliatum				*Bridelia ovata, var. Curtisis*	
		Ixora cuneifolia, varians				*Cratoxylum cochinchinese*	
		Bridelia ovata, var. Curtisis				*Antidesma ghaesembilla, G*	
		Phyllanthus lasodiifolius				*Zizyphus oenoplia mill*	
		Hymnocardia wallichii				*Passiflora foetida Passifloraceae*	
		Barringtonia acutangula				*Streblus asper Lour. Moraceae*	
		Cratoxylum cochinchinese				*Gmelina asiatica*	
		Passiflora foetida Passifloraceae				*Tertracera indica*	
		Azadirachta indica Meliaceae		178+488to178+530	Prey Nhei	*Barringtonia acutangula*	Ou Srang Touch
		Streblus asper Lour. Moraceae				*Ixora cuneifolia, varians*	
		Sesbania grandiflora				*Euphorbia milii*	
		Zizyphus jujube				*Bridelia ovata, var. Curtisis*	
		Gmelina asiatica				*Phyllanthus lasodiifolius*	
		Tertracera indica				*Combretum trifoliatum*	
		Cayratia trifolia				*Streblus asper Lour. Moraceae*	
		Derris trifolia				*Gmelina asiatica*	
178+484 to 178+537	Prey Nhei	*Barringtonia acutangula*	Ou Srang Touch			*Derris trifolia*	
		Ixora cuneifolia, varians				*Cayratia trifolia*	
		Euphorbia milii		190+727to190+772	Snam Preash	*Cassia alata, L.*	Ou Svay At Khang Krom called Stung Touch
		Passiflora foetida Passifloraceae				*Bridelia ovata, var. Curtisis*	
		Bridelia ovata, var. Curtisis				*Breynia rhamnoides*	
		Phyllanthus lasodiifolius				*Cratoxylum cochinchinese*	
		Combretum trifoliatum				*Zizyphus oenoplia mill*	
		Streblus asper Lour. Moraceae				*Azadirachta indica Meliaceae*	

Name of Riverside vegetation along right side of road (COI:20m)			
Kilometers(PK)	**Communes**	**Scientific Name**	**Name of Ou/Canals**
		Zizyphus jujube	
		Gmelina asiatica	
		Derris trifolia	
		Tertracera indica	
		Cayratia trifolia	
190+727 to 190+785	Snam Preash	*Dalbergia herrida, Var.glabrescens*	Ou Svay At Khang Krom called Stung Touch
		Combretum trifoliatum	
		Phragmites karka Trin	
		Albizia myriophylla	
		Zizyphus oenoplia mill	
		Streblus asper Lour. Moraceae	
		Tertracera indica	
		Merremia hederacea	
208+378 to 208+457	Beung Khna	*Cassia alata, L.*	Ou Beung Khna
		Bridelia ovata, var. Curtisis	
		Cratoxylum cochinchinese	
		Zizyphus oenoplia mill	
		Azadirachta indica Meliaceae	
		Streblus asper Lour. Moraceae	
		Gmelina asiatica	
		Dalbergia herrida, Var.glabrescens	
		Combretum trifoliatum	
248+580 to 250+565	Kear	*Dalbergia herrida, Var.glabrescens*	Rigth Canal along Por 2 village road
		Uvaria rufa	
		Combretum trifoliatum	
		Phragmites karka Trin	
		Ixora cuneifolia, varians	
		Hydrolea zeylanica	

Name of Riverside vegetation along left side of road)COI:20m)			
Kilometers(PK)	**Communes**	**Scientific Name**	**Name of Ou/Canals**
		Streblus asper Lour. Moraceae	
		Sesbania grandiflora	
		Gmelina asiatica	
		Cynometra (inaequifolia)	
208+382to208+460	Beung Khna	*Bridelia ovata, var. Curtisis*	Ou Beung Khna
		Cratoxylum cochinchinese	
		Zizyphus oenoplia mill	
		Streblus asper Lour. Moraceae	
		Gmelina asiatica	
		Dalbergia herrida, Var.glabrescens	
		Combretum trifoliatum	
248+580to250+123	Maung	*Uvaria rufa*	Left Canal along Maung village road
		Combretum trifoliatum	
		Mimosa pigra Fabaceae	
		Mimosa pisdica	
		Mitragyna hirsuta Hav.	
		Antidesma ghaesembilla, G	
		Passiflora foetida Passifloraceae	
		Streblus asper Lour. Moraceae	
		Ixora cuneifolia, varians	
		Cayratia trifolia	
250+123 to250+573, 250+730to252+054, 252+184to252+938, 254+261to254+914, 254+948to255+121	Kor Koh	*Combretum trifoliatum*	Left Canal along Kor Koh village road
		Mimosa pigra Fabaceae	
		Mimosa pisdica	
		Schleichera oleosa (Lour) Oken	
		Breynia rhamnoides	
		Xanthophyllum glancam	
		Barringtonia acutangula	

Name of Riverside vegetation along right side of road (COI:20m)			
Kilometers(PK)	**Communes**	**Scientific Name**	**Name of Ou/Canals**
		Mimosa pigra Fabaceae	
		Mimosa pisdica	
		Mitragyna hirsuta Hav.	
		Phyllanthus lasodiifolius	
		Breynia rhamnoides	
		Barringtonia acutangula	
		Antidesma ghaesembilla, G	
		Passiflora foetida Passifloraceae	
		Streblus asper Lour. Moraceae	
		Sesbania grandiflora	
		Zizyphus jujube	
		Gmelina asiatica	
		Cayratia trifolia	
250+725 to 252+052, 252+169 to 252+938, 254+252 to 254+521, 254+578 to 254+884, 254+936 to 255+015, 255+024 to 255+088	Kor Koh	*Xanthophyllum glancam*	Rigth Canal along Kor Koh village road
		Uvaria rufa	
		Cynometra (inaequifolia)	
		Combretum trifoliatum	
		Ixora cuneifolia, varians	
		Hydrolea zeylanica	
		Maclura conchinchinensis	
		Mimosa pigra Fabaceae	
		Mimosa pisdica	
		Mitragyna hirsuta Hav.	
		Croton caudatus	
		Breynia rhamnoides	
		Barringtonia acutangula	
		Antidesma ghaesembilla, G	
		Zizyphus oenoplia mill	

Name of Riverside vegetation along left side of road)COI:20m)			
Kilometers(PK)	**Communes**	**Scientific Name**	**Name of Ou/Canals**
		Ficus racemosa	
		Ixora cuneifolia, varians	
		Dalbergia herrida, Var.glabrescens	
		Zizyphus jujube	
		Gmelina asiatica	
		Hydrolea zeylanica	
		Cynometra (inaequifolia)	
		Merremia hederacea	
		Cayratia trifolia	

Name of Riverside vegetation along right side of road (COI:20m)				Name of Riverside vegetation along left side of road)COI:20m)			
Kilometers(PK)	Communes	Scientific Name	Name of Ou/Canals	Kilometers(PK)	Communes	Scientific Name	Name of Ou/Canals
		Passiflora foetida Passifloraceae					
		Gmelina asiatica					
		Cayratia trifolia					
		Merremia hederacea					

Table 5 -13:Name of Riverside vegetationspecies along road from Thlea Ma'am to BattamabngCOI: 20mx2(Total 40m), (from 01 July to 15 December 2013)

#	Scientific Name	#	Scientific Name
01	*Xanthophyllum glancam*	19	*Zizyphus jujube*
02	*Dalbergia herrida, Var.glabrescens*	20	*Phyllanthus lasodiifolius*
03	*Euphorbia milii*	21	*Breynia rhamnoides*
04	*Cynometra (inaequifolia)*	22	*Hymnocardia wallichii*
05	*Cassia alata, L.*	23	*Barringtonia asiatica*
06	*Combretum trifoliatum*	24	*Cratoxylum cochinchinese*
07	*Phragmites karka Trin*	25	*Ficus racemosa*
08	*Ixora cuneifolia, varians*	26	*Tertracera indica*
09	*Hydrolea zeylanica*	27	*Cayratia trifolia*
10	*Albizia myriophylla*	28	*Merremia hederacea*
11	*Uvaria rufa*	29	*Derris trifolia*
12	*Bridelia ovata, var. Curtisis*	30	*Antidesma ghaesembilla Gaertn.*
13	*Maclura conchinchinensis*	31	*Zizyphus oenoplia mill*
14	*Mimosa pigra Fabaceae*	32	*Passiflora foetida Passifloraceae*
15	*Mimosa pisdica*	33	*Azadirachta indica Meliaceae*
16	*Mitragyna hirsuta Hav.*	34	*Streblus asper Lour. Moraceae*
17	*Croton caudatus*	35	*Sesbania grandiflora*
18	*Schleichera oleosa (Lour) Oken*	36	*Gmelina asiatica*

B. Planted Trees along the road

JICA Survey Team decided to study planted trees along the road sides, from both edge/side of the road to its slope. Depending on the study on sites, it illustrated that the total 30 species affected planted trees along the road were 5,210 trees, included 2,589trees at the left side and 2,621 trees at the right side with the direction from Thlea Ma'am in Pursat to Battambang province. The most of trees at the right side is Acacias, 1,053 trees and Acacias is 903 trees at the left side, as shown in table: 5-14.

Table 5 -14:Name and Numbers of Trees on the right side of NR5 from Tlea Ma'am-BattambangStudied from 01 July 2013 to 15 December 2013

Kilometers(PK)	Communes	Provinces		Scientific Name	Diameter of Tree(m)	Quantity
171 to 177+280	Boeung Kantaout	PST		*Sindora cochinchinensis*	0.1 to 0.6	**1**
				Delonix regia, (Boj. Ex		**2**
				Feroniella lucida Scheff.		**4**
				Dialium cochinchinensis		**11**
				Borassus flabellifer		**1**
				Lagerstroemia floribunda		**2**
				Eucalyptus camaldulensis		**42**
				Azadirachta indica		**1**
				Acacia auriculiformis, A		**157**
				Samanea saman		**2**
177+285 to 183	Prey Nhi	PST		*Delonix regia, (Boj. Ex*	0.1 to 1	**9**
				Acacia auriculiformis, A		**392**
190+200 to 191+132	Phtesh Prey	PST		*Dialium cochinchinensis*	0.1	**1**
191+132 to 198+875	Snam Preah	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.6	**5**
				Dialium cochinchinensis		**2**
				Combretum quadrangulare Kurz		**1**
				Acacia auriculiformis, A		**11**
				Samanea saman		**1**
198+875 to 206+150	Trapaing Chong	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.2	**1**
				Dialium cochinchinensis		**11**
				Eucalyptus camaldulensis		**2**
				Acacia auriculiformis, A		**2**

Kilometers(PK)	Communes	Provinces		Scientific Name	Diameter of Tree(m)	Quantity
206+150 to 213+670	Boeung Khna	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.2	**4**
				Feroniella lucida Scheff.		**1**
				Acacia auriculiformis, A		**37**
213+670 to 217+840	O-Tapaong	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.13	**2**
				Feroniella lucida Scheff.		**1**
				Butea monosperma (Lam.)		**3**
				Acacia auriculiformis, A		**4**
				Samanea saman		**5**
217+840 to 221+470	Svay Daun Keo	PST		*Dialium cochinchinensis*	0.1 to 0.2	**4**
				Butea monosperma (Lam.)		**1**
				Eugenia sp.		**1**
				Acacia auriculiformis, A		**60**
				Samanea saman		**3**
Total quantity of planted trees on right side of road in in Pursat Province						**787**
221+470 to 228+040	Russei Kraing	BTB		*Leucaena glauca Benth.*	0.1 to 0.2	**2**
				Delonix regia, (Boj. Ex		**38**
				Dialium cochinchinensis		**4**
				Eucalyptus camaldulensis		**120**
				Eugenia sp.		**6**
				Acacia auriculiformis, A		**91**
				Samanea saman		**38**
228+040 to 240+030	Prey Svay	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.3	**100**
				Dialium cochinchinensis		**3**
				Eucalyptus camaldulensis		**25**
				Eugenia sp.		**1**
				Acacia auriculiformis, A		**55**
				Samanea saman		**50**
240+030 to 250+960	Kea	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.3	**2**
				Swietenia macrophylla King		**2**
				Terminalia catappa L.		**2**
				Borassus flabellifer		**1**
				Peltophorum ferrugineum		**11**
				Eucalyptus camaldulensis		**1**
				Barringtonia acutangula		**4**
				Acacia auriculiformis, A		**37**
				Samanea saman		**31**
250+960 to 255+600	Kokoh	BTB		*Leucaena glauca Benth.*	0.1 to 0.6	**2**
				Delonix regia, (Boj. Ex		**2**
				Mitragyna hirsuta Hav.		**1**
				Butea monosperma (Lam.)		**1**
				Terminalia catappa L.		**1**
				Borassus flabellifer		**1**
				Peltophorum ferrugineum		**8**
				Eugenia sp.		**1**
				Combretum quadrangulare Kurz		**6**
				Acacia auriculiformis, A		**1**
				Samanea saman		**8**
255+600 to 264+620	Prey Touch	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.4	**38**
				Ceiba pentandra, (L.) G		**15**
				Butea monosperma (Lam.)		**7**
				Borassus flabellifer		**13**
				Peltophorum ferrugineum		**12**
				Eucalyptus camaldulensis		**1**
				Eugenia sp.		**11**
				Bombax ceiba L.		**1**
				Combretum quadrangulare Kurz		**3**
				Azadirachta indica		**1**
				Acacia auriculiformis, A		**131**
				Samanea saman		**100**
264+620 to 271+900	Kampong Preang	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.6	**102**
				Ceiba pentandra, (L.) G		**4**
				Butea monosperma (Lam.)		**7**

Kilometers(PK)	Communes	Provinces		Scientific Name	Diameter of Tree(m)	Quantity
				Terminalia catappa L.		**2**
				Borassus flabellifer		**13**
				Peltophorum ferrugineum		**13**
				Eucalyptus camaldulensis		**45**
				Eugenia sp.		**8**
				Barringtonia acutangula		**2**
				Cassia fistula		**41**
				Azadirachta indica		**1**
				Sesbania grandiflora		**1**
				Acacia auriculiformis, A		**29**
				Samanea saman		**106**
271+900 to 280+460	Kampong Preah	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.5	**136**
				Mitragyna hirsuta Hav.		**1**
				Feroniella lucida Scheff.		**1**
				Ceiba pentandra, (L.) G		**4**
				Butea monosperma (Lam.)		**3**
				Terminalia catappa L.		**14**
						2
				Morinda citrifolia		**2**
				Borassus flabellifer		**19**
				Peltophorum ferrugineum		**3**
				Eucalyptus camaldulensis		**4**
				Eugenia sp.		**4**
				Tectona grandis L. f.		**1**
				Cassia fistula		**96**
				Combretum quadrangulare Kurz		**6**
				Azadirachta indica		**2**
				Streblus asper Lour.		**1**
				Cassia siamea		**4**
				Sesbania grandiflora		**2**
				Acacia auriculiformis, A		**39**
				Samanea saman		**52**
280+460 to 282+200	Along Vill	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.4	**35**
				Ceiba pentandra, (L.) G		**1**
				Butea monosperma (Lam.)		**1**
				Terminalia catappa L.		**1**
				Eugenia sp.		**2**
				Cassia fistula		**15**
				Combretum quadrangulare Kurz		**4**
				Azadirachta indica		**1**
				Cassia siamea		**1**
				Acacia auriculiformis, A		**7**
				Samanea saman		**7**
Total quantity of planted trees on right side of road in Battambang Province						**1834**
Total Quanity of Trees						**2621**

Table 5 -15: Name and Numbers of Trees on the left side of NR5 from Tlea Ma'am-Battambang Studied from 01 July 2013 to 15 December 2013

Kilometers(PK)	Communes	Provinces		Scientific Name	Diameter of Tree(m)	Quantity
171 to 177+280	Tnaot Chum	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.2	**1**
				Dipterocarpus obtusifolou		**2**
				Eucalyptus camaldulensis		**7**
				Acacia auriculiformis, A		**37**
177+280 to 183+000	Roleab	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.12	**12**
				Azadirachta indica		**1**
				Acacia auriculiformis, A		**291**
190+200 to 191+138	Svay Ath	PST		*Dialium cochinchinensis*	0.1	**5**
191+138 to 198+875	Snam Preah	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.6	**4**
				Dialium cochinchinensis		**1**

Kilometers(PK)	Communes	Provinces		Scientific Name	Diameter of Tree(m)	Quantity
				Acacia auriculiformis, A		**5**
				Samanea saman		**1**
198+875 to 206+150	Trapaing Chuong	PST		*Delonix regia, (Boj. Ex*	0.1	**1**
				Dialium cochinchinensis		**7**
				Acacia auriculiformis, A		**4**
206+150 to 213+460	Boeung Khna	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.2	**2**
				Feroniella lucida Scheff.		**1**
				Dialium cochinchinensis		**3**
				Eucalyptus camaldulensis		**1**
				Acacia auriculiformis, A		**7**
213+460 to 217+840	o-Tapaong	PST		*Leucaena glauca Benth.*	0.1 to 0.2	**1**
				Ceiba pentandra, (L.) G		**1**
				Butea monosperma (Lam.)		**14**
				Eucalyptus camaldulensis		**1**
				Samanea saman		**4**
217+840 to 221+470	Svay Daun Keo	PST		*Delonix regia, (Boj. Ex*	0.1 to 0.2	**1**
				Butea monosperma (Lam.)		**1**
				Eucalyptus camaldulensis		**1**
				Acacia auriculiformis, A		**25**
				Samanea saman		**4**
Total quantity of planted trees on left side of road in Pursat Province						**446**
221+470 to 228+040	Russei Kraing	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.2	**6**
				Feroniella lucida Scheff.		**1**
				Borassus flabellifer		**18**
				Eucalyptus camaldulensis		**337**
				Eugenia sp.		**7**
				Acacia auriculiformis, A		**44**
				Samanea saman		**15**
228+040 to 240+030	Prey Svay	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.3	**81**
				Eucalyptus camaldulensis		**46**
				Eugenia sp.		**2**
				Acacia auriculiformis, A		**65**
				Samanea saman		**37**
240+030 to 244+380	Kea	BTB		*Acacia auriculiformis, A*	0.1 to 0.12	**81**
				Samanea saman		**15**
244+380 to 250+390	Moung	BTB		*Peltophorum ferrugineum*	0.1 to 0.4	**8**
				Combretum quadrangulare Kurz		**1**
				Acacia auriculiformis, A		**3**
				Samanea saman		**5**
250+390 to 255+600	Kokoh	BTB		*Borassus flabellifer*	0.1 to 0.3	**5**
				Peltophorum ferrugineum		**2**
				Schleicheria trijuga, Wi		**4**
				Eugenia sp.		**2**
				Barringtonia acutangula		**2**
				Cassia fistula		**1**
				Combretum quadrangulare Kurz		**1**
				Acacia auriculiformis, A		**15**
				Samanea saman		**9**
255+600 to 264+620	Prey Touch	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.4	**27**
				Ceiba pentandra, (L.) G		**10**
				Butea monosperma (Lam.)		**5**
				Terminalia catappa L.		**3**
						3
				Borassus flabellifer		**21**
				Peltophorum ferrugineum		**2**
				Eucalyptus camaldulensis		**17**
				Eugenia sp.		**9**
				Cassia fistula		**6**
				Combretum quadrangulare Kurz		**1**
				Sesbania grandiflora		**2**
				Acacia auriculiformis, A		**110**

Kilometers(PK)	Communes	Provinces		Scientific Name	Diameter of Tree(m)	Quantity
				Samanea saman		**83**
264+620 to 272+950	Kampong Preang	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.6	**105**
				Ceiba pentandra, (L.) G		**12**
				Butea monosperma (Lam.)		**6**
				Terminalia catappa L.		**4**
				Borassus flabellifer		**20**
				Peltophorum ferrugineum		**11**
				Eucalyptus camaldulensis		**43**
				Eugenia sp.		**18**
				Cassia fistula		**60**
				Combretum quadrangulare Kurz		**3**
				Azadirachta indica		**1**
				Sesbania grandiflora		**1**
				Acacia auriculiformis, A		**47**
				Samanea saman		**133**
272+950 to 280+245	Kampong Preah	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.5	**142**
				Mitragyna hirsuta Hav.		**4**
				Ceiba pentandra, (L.) G		**12**
				Swietenia macrophylla King		**1**
				Butea monosperma (Lam.)		**5**
				Terminalia catappa L.		**7**
				Borassus flabellifer		**17**
				Peltophorum ferrugineum		**4**
				Eucalyptus camaldulensis		**8**
				Eugenia sp.		**12**
				Barringtonia acutangula		**4**
				Cassia fistula		**46**
				Combretum quadrangulare Kurz		**10**
				Streblus asper Lour.		**3**
				Cassia siamea		**6**
				Sesbania grandiflora		**1**
				Acacia auriculiformis, A		**32**
				Samanea saman		**71**
280+245 to 282+200	O-Tambang-2	BTB		*Delonix regia, (Boj. Ex*	0.1 to 0.5	**17**
				Feroniella lucida Scheff.		**1**
				Butea monosperma (Lam.)		**1**
				Terminalia catappa L.		**4**
						2
				Borassus flabellifer		**7**
				Peltophorum ferrugineum		**3**
				Cassia fistula		**3**
				Combretum quadrangulare Kurz		**1**
				Acacia auriculiformis, A		**137**
				Samanea saman		**6**
Total quantity of planted trees on left side of road in Battambang						**2143**
Total Quanity of Trees						**2589**

Note: The planted trees along the road in Pursat province were planted by Provincial Forest Administration and some were planted by villagers.

Table 5 -16: Name and total quantity of trees along NR5 from Tlea Ma'am-Battambang(KP171-KP282+200), (from 01 July to 15 December 2013)

#	Scientific Name	Quantity
01	*Sindora cochinchinensis*	**1**
02	*Leucaena glauca Benth.*	**5**
03	*Delonix regia, (Boj. Ex*	**875**
04	*Mitragyna hirsuta Hav.*	**6**
05	*Feroniella lucida Scheff.*	**10**
06	*Dialium cochinchinensis*	**52**

#	Scientific Name	Quantity
07	*Ceiba pentandra, (L.) G*	**59**
08	*Swietenia macrophylla King*	**3**
09	*Butea monosperma (Lam.)*	**55**
10	*Terminalia catappa L.*	**38**
11		**7**
12	*Morinda citrifolia*	**2**
13	*Borassus flabellifer*	**136**
14	*Dipterocarpus obtusifolou*	**2**
15	*Lagerstroemia floribunda*	**2**
16	*Peltophorum ferrugineum*	**77**
17	*Eucalyptus camaldulensis*	**701**
18	*Schleicheria trijuga, Wi*	**4**
19	*Eugenia sp.*	**84**
20	*Tectona grandis L. f.*	**1**
21	*Bombax ceiba L.*	**1**
22	*Barringtonia acutangula*	**12**
23	*Cassia fistula*	**268**
24	*Combretum quadrangulare Kurz*	**37**
25	*Azadirachta indica*	**8**
26	*Streblus asper Lour.*	**4**
27	*Cassia siamea*	**11**
28	*Sesbania grandiflora*	**7**
29	*Acacia auriculiformis, A*	**1956**
30	*Samanea saman*	**786**
Total quantity of trees along road		**5210**



Pictures of planted trees
along the road sides

C. The conclusion of Riverside vegetations and the affected planted trees along the road by the project

According to the JICA survey team, the inundated plants and planted-tree counting along the road illustrated from table: 5-12 to table: 5-16 are able to be concluded that:

- This project will affect 10.13 hectares of Riverside vegetations, 36 species at vital streams and ditches such as: Srang Thom stream, Srang Touch stream, Svay Art stream, Beong Khna stream and unnamed ditches along both sides of the road.
- There are 30 species of planted trees and 5,210 total affected trees (diameter from 10cm to 130cm), 1,233 trees in Pursat province and 3,977 species in Battambang province. There are 2,589 species at the left side, in the direction from Thlea Ma'am in Pursat to Battabang province and 2,621 species at the right side. The most of trees at the right side is Acacia, 1,053 species and the left side is also Acacia, 903 species.
- Srang Thom stream, Srang Touch stream, Svay Art stream, Beong Khna stream and unnamed ditches along both sides of the road.
- There are 30 species of planted trees and 5,210 total affected trees (diameter from 10cm to 130cm), 1,233 trees in Pursat province and 3,977 species in Battambang province. There are 2,589 species at the left side, in the direction from Thlea Ma'am in Pursat to Battabang province

and 2,621 species at the right side. The most of trees at the right side is Acacia, 1,053 species and the left side is also Acacia, 903 species.

5.1.2.2. Wildlife and Fishin the Project Area

Working team defined field study for detail of wildlife in and next to project area with 150m distance along both of road sides. Within this study we used the method of Line Intersept Transect by investigating along the line of cross section area was 150m botsides, in the rice field is conducted for 5 sites, In the village is conducte for 4 sites, in the residential houses as a small Town is conducted for 4 sites and in the Town is conducted for 4 sites (detailed in heading 2.2.3.2 of Chapter-2). The results are illustrated in table below.

1.Mammals

There are five species of crucial mammals found in the project area. One of them is in the appendix of CITES II, Lyle's Flying-fox, but they just fly across the project area, according to the forest administration. Moreover, there is rare species (r) such as Phnom Tbeang Bat. (Detailed in table: 5-17 below)

Table 5 -17:Name of mammals in the project area studied from July 1- December 15, 2013

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
1	*Herpestes javanicus*	Small Asiun Mongoose	172 to 179, 191 to 194	LC		
2	*Tamiops rodolphii*	Cambodian Striped Tree Squirrel	171 to 175, 277 to 282	LC		
3	*(Order: CHIROPTERA)*	Bats	171 to 282+300			
4	*Otonops wroughtoni*	wroughton's Free-tailed Bat	214 to 216		r	
5	*Pteropus lylei*	Lyle's Flying-fox	218 to 222	VU	II	

Note: I, II and III are the CITES convention appendix number. They are classified by forest administration, consisting of endangered species (En), rare species (r), critically endangered species (Cr), vulnerable species (Vu) and Last Cosern (LC).

Working team took a few pictures of mammal at the project area such as:







Lyle's Flying-fox: Picture was taken on July 10, 2013 in project area.



Picture of nesting site for bats was taken on July 10, 2013, at Ou Ta Paong around the project area



Picture of bat guano dropping was taken on July 10, 2013, around the project area.

2. Birds

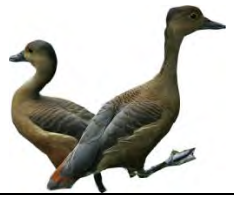
There are crucial 34 birds species found in the project area, with 4 species in Appendix of CITES (II and III). In the category-II: it is Barn Owl (*Tyto alba*) and Black-shouldered kite (*Elanus caeruleus*), and category-III, its are 2 speceis: Cattle Egret (*Bubulcus ibis*) and Great Egretta (*Egretta alble)*which were shown in table: 5-18 below.

Table 5 -18:Name of birds in the project area studied from July 1- December 15, 2013

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
1	*Caprimulgus indicus*	Grey Nightjar	172 to 181, 192 to 194, 248 to 278	LC		
2	*Emberiza aureola*	Yellow-breasted Bunting	217 to 236	EN		
3	*Prinia rufescens*	Rufescent Prinia	171 to 282	LC		
4	*Orthotomus sutorius*	Common Tailorbird	171 to 282	LC		
5	*Passer montanus*	Eurasian Tree Sparrow	171 to 282	LC		
6	*Passer flaveolus*	Plain-backed Sparrow	217 to 223	LC		

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
7	*Passer domesticus*	House Sparrow	171 to 282	LC		
8	*Pycnonotus goiavier*	Yellow-vented Bulbul	171 to 282	LC		
9	*Anastomus oscitans*	Asian Openbill	217 to 230	LC		 
10	*Corvus macrohynchos*	Large-billed Crow	247 to 259	LC		
11	*Dicrurus macrocercus*	Black Drongo	171 to 183, 190 to 244, 246 to 282	LC		
12	*Tyto alba*	Barn Owl	171 to 282	LC	II	
13	*Gallinago gallinago*	Common Snipe	217 to 224	LC		
14	*Rhipidura javanica*	Pied Fantail	171 to 282	LC		
15	*Rhipidura albicollis*	White-throated Fantail	171 to 282	LC		

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
16	*Alcedo atthis*	Common Kingfisher	219 to 223, 255 to 257	LC		
17	*Lacedo pulchella*	Banded Kingfisher	219 to 223, 255 to 257	LC		
18	*Gallicrex cinerea*	Watercock	215 to 223, 254 to 256, 273 to 274	LC		
19	*Bubulcus ibis*	Cattle Egret	172 to 179, 215 to 223, 254 to 256, 273 to 274	LC	III	
20	*Egretta alble*	Great Egretta	221 to 224	LC	III	
21	*Ixobrychus cinnamomeus*	Cinnamon Bittern	172 to 179, 215 to 223, 254 to 256, 273 to 274	LC		
22	*Ardeola bacchus*	Javan Pond Heron	172 to 179, 215 to 223, 254 to 256, 273 to 274	LC		
23	កុកសម្បុកត្រពាំង	*Ixobrychus sinensis*	Yellow Bittern	LC	172 to 179, 215 to 223, 254 to 256, 273 to 274	
24	*Streptopelia chinensis*	Spotted Dove	171 to 282	LC		

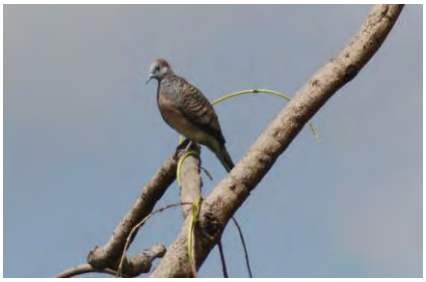
No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
25	*Streptopelia tranquebarica*	Red Collared Dove	171 to 282	LC		
26	*Geopelia striata*	Zebra Dove	173 to 179, 192 to 200, 214 to 221, 245 to 260	LC		
27	*Gallinula chloropus*	Common Moorhen	172 to 179, 215 to 223, 254 to 256, 273 to 274	LC		
28	*Dendrocygna javanica*	Lesser Whistling Duck	217 to 223, 254 to 258, 273 to 274	LC		
29	*Cypsiurus balasiensis*	Asian Palm Swift	171 to 282	LC		
30	*Acridotheres tristis*	Common Myna	171 to 282	LC		
31	*Acridotheres javanicus*	White-vented Myna	214 to 223	LC		
32	Coracias benghalensis	Indian Roller	171 to 183	LC		
33	*Elanus coeruleus*	Black-shouldered Kite	214 to 216	LC	II	
34	*Lanius cristatus*	Brown Shrike	216 to 219	LC		

Note: I, II and III are the CITES convention appendix number. They are classified by forest administration, consisting of endangered species (En), rare species (r), critically endangered species (Cr) and vulnerable species (Vu). IUCN noted on the table above for mammals.

Working team took some pictures at project area:



Plain-backed Sparrow: picture was taken on July 10, 2013 around the project area.



Peaceful Dove: picture was taken on July 5, 2013 around the project area.



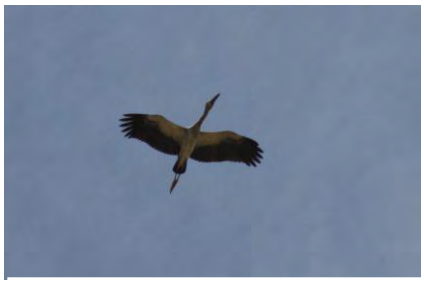
Common Myna: picture was taken on July 5, 2013 around the project area.



Cattle Egret: picture was taken on July 3, 2013 around the project area.



White-vented Myna:picture was taken on July 3, 2013 around the project area.



Asian Openbill:picture was taken on July 3, 2013 around the project area.





Cormorant and Asian Openbill: picture was taken on July 20, 2013 around the project area.



Red Collared Dove: picture was taken on July 22, 2013 around the project area.



Yellow-vented Bulbul: picture was taken on July 19, 2013 around the project area.



White-vented Myna: picture was taken on July 19, 2013 around the project area.



Red Collared Dove and Spotted Dove were raised by villagers:picture was taken on July 19, 2013 around the project area.



Great Egretta: picture was taken on November 25, 2013



Great Egretta: picture was taken on November 25, 2013



Javan Pond Heron: picture was taken on November 25, 2013



Plain-backed Sparrow: picture was taken on November 24, 2013



Indian Roller: picture was taken on November 25, 2013



Brown Shrike: picture was taken on November 25, 2013

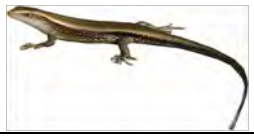
3. Reptiles and Amphibian

There are 29species of reptiles and amphibians found in the project area;however, it consisted two categories(**II** and **r**) in appendix of CITES. The reptileis in categolry-II such Monocle Cobra (*Naja kaouthia*)and Indochinese Spitting Cobra (*Naja siamensis*) according to working team found in the project area. Thereptile in the category of rare species (r) it is Monocle Cobra (*Naja kaouthia*) found in the project area according to Forest Administration (FA), shown in table 5-19 below:

Table 5-19:Name of reptiles and amphibians in the project area studied from July 1- December 15, 2013

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
1	*Calotes versicolor*	Garden Fence Lizard	171 to 282			
2	*Ahaetulla nasuta*	Long-nosed Whip Snake	177 to 179, 191 to194, 246 to 258			
3	*Ahaetulla prasina*	Oriental Whip Snake	177 to 179, 191 to194, 246 to 258	LC		
4	*Boiga cyanea*	Green Cat Snake	177 to 179, 191 to194, 246 to 258			
5	*Cylindrophis ruffus*	Red-tailed Pipe Snake	171 to 185, 188 to 201, 204 to 282	LC		

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
6	*Daboia russelli*	Russell's Viper	212 to 243, 246 to 282			
7	*Dendrelaphis subocularis*	Mountain Bronzeback	171 to 185, 188 to 201, 204 to 282	LC		
8	*Chrysopelea ornata*	Golden Tree Snake	171 to 185, 188 to 201, 204 to 282			
9	*Naja kaouthia*	Monocle Cobra	171 to 185, 188 to 201, 204 to 282	LC	II, r	
10	*Naja siamensis*	Indochinese Spitting Cobra	171 to 185, 188 to 201, 204 to 282	VU	II,	
11	*Oligodon taeniatus*	Striped Kukri Snake	171 to 185, 188 to 201, 204 to 282			
12	*Ptyas korros*	Indochinese Ratsnake	171 to 185, 188 to 201, 204 to 282			
13	*Xenochrophis piscator*	Chequered Keelback	171 to 282			
14	*Xenochrophis piscator*	*Chequered Keelred*	PS Bypass			
15	*Xenopeltis unicolor*	*Sunbeam Snake*	211 to 215, 217 to 219			
16	*Enhydris bocourti*	Bocourt's Watersnake	177 to 179, 219 to 224, 247 to 256	LC		
17	*Enhydris enhydris*	Rainbow Water Snake	171 to 185, 188 to 201, 204 to 282	LC		

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
18	*Elaphe radiata*	Radiated Ratsnake	217 to 219			
19	*Gekko gecko*	Tokay Gecko	171 to 282			
20	*Cosymbotus platyurus*	Flat-tailed Gecko	171 to 282			
21	*Scincella reevesii*	Speckled Leaf-litter Skink	171 to 282			
22	*Mabuya multifasciata*	Many-lined Sun Skink	171 to 282			
23	*polypedates cf. leucomystax*	Common Tree Frog	171 to 282	LC		
24	*Bufo melanosstictus*	Common Asian Toad	171 to 282			
25	*Kaloula pulchra*	Banded Bullfrog	171 to 282	LC		
26	*Glyphoglossus molossus*	Truncate snouted spadefoot frog	212 to 243, 246 to 282	NT		
27	*Fejervarga limnocharis*	Rice Field Frog	171 to 185, 187 to 243, 246 to 282			
28	*Limnonectes ibanorum*	Rough Backed River Frog	171 to 185, 187 to 243, 246 to 282	NT		
29	*Hoplobatrachus tigerinus*	Tiger Frog	171 to 185, 187 to 243, 246 to 282	LC		

Note: I, II and III are the CITES convention appendix numbers. They are classified by forest administration, consisting of endangered species (En), rare species (r), critically endangered species (Cr) and vulnerable species (Vu). According to the information from villagers in the project location, there was some wildlife presented along the both sides of the road, at the Kilometer Post (KP). IUCN noted on the table above for mammals.



Natricinae snake: which was run over by car, itspicture was taken on July 7, 2013 around the project area.



Striped Keelback which was run over by car, itspicture was taken on August 20, 2013 around the project area.

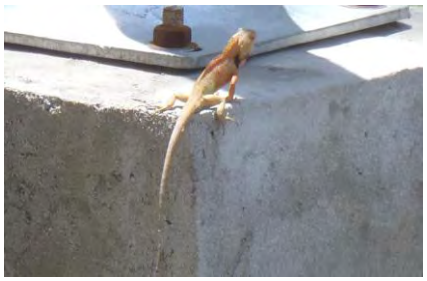


Gloden Tree Snake: which was run over by car, itspicture was taken on August 9, 2013 around the project area.



Keeled Rat Snake which was run over by car, itspicture was taken on August 9, 2013 around the project area.





Horned Lizard: This picture was taken on July 10, 2013 around the project area.



Tokay/gecko: picture was taken on July10, 2013 around the project area.



Common lizard or Viviparous lizard: picture was taken on July 5, 2013 around the project area.



Paddy frog: picture was taken on July 3, 2013 around the project area.



Chequered Keelred Snake died, taken on 11 Dec. 2013 near by-pass road.



Red-tailed Pipe Snake died, taken on 11 Dec. 2013 near by-pass road.

4. Fish

A. Target Area

JICA Survey Team defined field study for detail in Pursat River. For methodology of study, it illustrated that in heading 2.2.3.3 of Chapter 2. The target areas were divided into 4 areas.

1. Upstream of the project area is from Damnak Ampil hydraulic structure to Svay Meas village;
2. Upstream of the project area is from Koh village to Spean Thmor village;
3. The project area is from Spean Thmor village to Kampong Krabei village;
4. Downstream of the project area is from Svay Laoung village to Boeung Chhuk village.

Note: *Detail fish study in Steung Pursat was started from downstream of Pursat by-pass to upstream was about 12.5Km that it located in Tonle Sap Biosphere Reserve and continuing to Damnak Ampil Dam that it is outside of the protected area (the length of study area is 34Km, among of this there was length of Tonle Sap Biosphere Reserve is 16.5Km).*

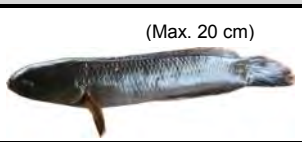
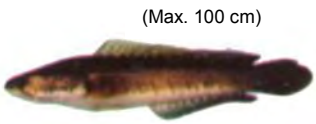
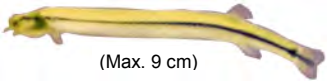
B. Fisheries resource found at the project area

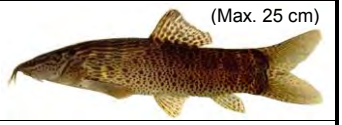
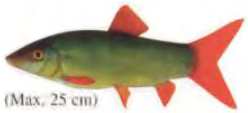
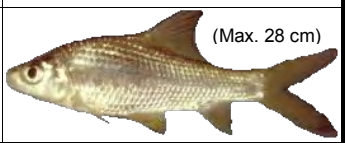
JICA Survey Team studied fish for detail at Pursat river by selected 4 fishermen (their occupations are fishermen). There was a fisherman worked in a sellected area to note fish species and its yields a day per month in wet season (July 07- August 06, 2013) and a day per month in wet season in dry season, (25 November to 25 December 2013). There were 97 fish species found out in four areas in Pursat river. Moreover, the team also studied fish in Svay Doun Koe river, Maung river, Chak river and Sandas stream which are the vastest waterways in the project area. It is 56 species in Svay Doun Koe river, 54species in Maung river, 61species in Chak river and 57 species in Sandas stream that were found. So, there were 114species of fish in total finding in project area, which one type is endangered species, Four-barred tigerfish (*Datnioides quadrifasciatus*), and other one is criticailly endangered species, Nandus nandus (*Gangetic leaffish*). The fish species in 5 steams are illustrated in table below:

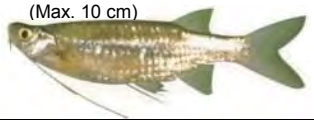
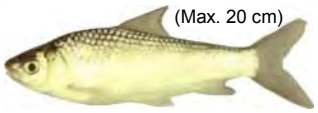
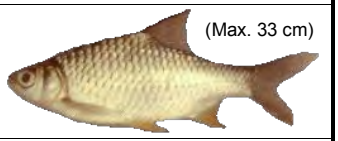
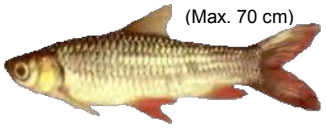
Table 5 -20:Major fish species in Pursat River, Svay Daun Keo River, Maung, Chork and Ou Sandash studied from July 1- December 25, 2013

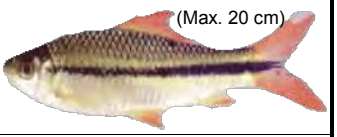
No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រឹ ១២៣	IUCN	Picture
1	Duskyfin glassy perchlet	*Parambassis wolffii*	AMBASSIDAE	Pursat, Moung, Chork, O Sandas		LC	 (Max. 20
2	Siamese glassfish	*Pseudambassis siamensis*	AMBASSIDAE	Pursat, Svay Donkeo, Chork, O Sandas		LC	 (Max. 6 cm)
3	Inridescent glassy perclet	*Parambassis apogonoides*	AMBASSIDAE	Pursat, Moung,		LC	 (Max. 10
4	Climbing perch	*Anabas testudineus*	ANABANTIDAE	Svay Donkeo, Chork, Moung, O Sandas			 (Max. 25 cm)
5		*Mystus wolffi*	BAGRIDAE	Pursat, Chork		LC	(Max. 20 cm) 
6		*Mystus singaringan*	BAGRIDAE	Pursat, Chork		LC	 (Max. 35 cm)

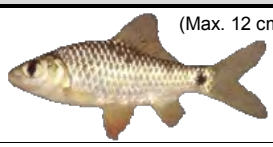
No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រ ១២៣	IUCN	Picture
7		*Mystus albolineatus*	BAGRIDAE	Moung, Chork, O Sandas		LC	
8		*Mystus bocouti*	BAGRIDAE	Svay Donkeo, Moung, Chork, O Sandas		VU	
9	Asian bumblebee catfish	*Pseudomystus siamensis*	BAGRIDAE	Pursat, Svay Donkeo, Chork		LC	
10	false black lancer	*Bagrichthys obscurus*	BAGRIDAE	Svay Donkeo, O Sandas		LC	
11		*Mystus atrifasciatus*	BAGRIDAE	Pursat, O Sandas		LC	
12	Striped catfish	*Mystus mysticetus*	BAGRIDAE	Svay Donkeo, Moung, O Sandas		LC	
13		*Hemibagrus spilopterus*	BAGRIDAE	Pursat, Svay Donkeo, Moung, Chork		LC	
14		*Hemibagrus filamentus*	BAGRIDAE	Pursat (Damnak Ampil upstream), O Sandas			
15		*Hemibagrus wyckioides*	BAGRIDAE	Pursat, O Sandas		LC	
16		*Xenentodon cancila*	BELONIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	
17	Talking gourami	*Trichopsis pumila*	BELONTIIDAE	Svay Donkeo, Chork, O Sandas		LC	
18	Croaking gourami	*Trichopsis vittata*	BELONTIIDAE	Svay Donkeo, Chork, O Sandas		LC	
19	Siamese fighting	*Batta splendens*	BELONTIIDAE	Svay Donkeo, Chork		VU	

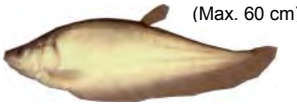
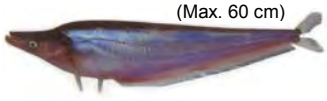
No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រ ១២៣	IUCN	Picture
20	Walking snakehead	*Channa orientalis*	CHANNIDAE	Pursat, Svay Donkeo, Moung, Chork			 (Max. 20 cm)
21	Giant snakehead	*Channa micropeltes*	CHANNIDAE	Pursat, Svay Donkeo, Chork, O Sandas		LC	 (Max. 130 cm)
22	Snackehead murrel	*Channa striata*	CHANNIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 100 cm)
23	Nile tilapia	*Oreochromis niloticus*	CICHLIDAE	Pursat		NT	 (Max. 46 cm)
24		*Clarias nieuhofi*	CLARIIDAE	Pursat, O Sandas			 (Max. 50 cm)
25	Walking catfish	*Clarias batrachus*	CLARIIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 47 cm)
26	Broad head catfish	*Clarias macrocephalus*	CLARIIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		NT	 (Max. 35 cm)
27	Blackskin catfish	*Clarias meladerma*	CLARIIDAE	Pursat, Chork, O Sandas		LC	 (Max. 35 cm)
28	Dwaf houseface	*Lepidocephalichthys birmanicus*	COBITIDAE	Pursat		LC	 (Max. 11 cm)
29		*Lepidocephalichthys berdmorei*	COBITIDAE	Pursat		LC	 (Max. 11 cm)
30	Striped horseface loach	*Acantopsis sp. 2*	COBITIDAE	Pursat			 (Max. 13 cm)
31	Spotted horseface loach	*Acantopsis sp. "Large spot"*	COBITIDAE	Pursat			 (Max. 12 cm)
32		*Acantopsis sp. "Stripe"*	COBITIDAE	Pursat, Chork			 (Max. 35 cm)
33		*Pangio anguillaris*	COBITIDAE	Pursat			 (Max. 9 cm)

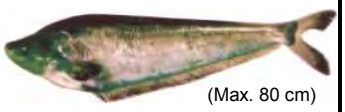
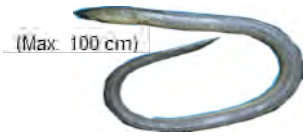
No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រ ១២៣	IUCN	Picture
34	Silver botia	*Botia lecontei*	COBITIDAE	Pursat		LC	 (Max. 15 cm)
35	Chameleon loach	*Syncrossus beauforti*	COBITIDAE	Pursat)Damnak Ampil Upstream(		NT	 (Max. 25 cm)
36	Skunk botia	*Yasuhikotakia morleti*	COBITIDAE	Pursat		LC	 (Max. 9.5 cm)
37		*Yasuhikotakia caudipunctata*	COBITIDAE	Pursat		LC	 (Max. 9 cm)
38	Speckletail botia	*Botia sp. juvenile*	COBITIDAE	Pursat			 (Max. 20 cm)
39	Tiger botia	*Syncrossus helodes*	COBITIDAE	Pursat		LC	 (Max. 35 cm)
40	Orangefin loach	*Yasuhikotakia modesta*	COBITIDAE	Pursat, Svay Donkeo, Moung, Chork		LC	 (Max. 25 cm)
41	Tinfoil barb	*Barbodes schwanefeldi*	CYPRINIDAE	Pursat, Moung, Chork			 (Max. 30 cm)
42	Bangkok river sprat	*Corica laciniata*	CYPRINIDAE	Pursat, Moung,			 (Max. 7 cm)
43	Beardless barb	*Cyclocheilichthys apogon*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 15 cm)
44		*Cyclocheilicthys repasson*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 28 cm)
45		*Cyclocheilichthys lagleri*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 23 cm)
46	Cyclocheilichthys Enoplos	*Cyclocheilichthys enoplos*	CYPRINIDAE	Pursat		LC	 (Max. 75 cm)
47		*Labiobarbus Lineatus*	CYPRINIDAE	Pursat, Svay Donkeo, Chork			 (Max. 18 cm)

No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រ ១២៣	IUCN	Picture
48	Siamese long fin carp	*Labiobarbus siamensis*	CYPRINIDAE	Pursat, Svay Donkeo, Chork, O Sandas		LC	 (Max. 22 cm)
49	Redtail barb	*Discherodontus ashmeadi*	CYPRINIDAE	Moung, Chork, O Sandas		LC	 (Max. 13.6 cm)
50	Esomus Goddardi	*Esomus longimanus*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas			 (Max. 10 cm)
51	Sidestripe rasbora	*Rasbora paviei*	CYPRINIDAE	Moung, Chork			 (Max. 12 cm)
52		*Crossocheilus reticulatus*	CYPRINIDAE	Pursat		LC	 (Max. 15 cm)
53		*Hampala dispar*	CYPRINIDAE	Pursat, Moung, O Sandas		LC	 (Max. 35 cm)
54		*Hampala macrolepidota*	CYPRINIDAE	Pursat, Svay Donkeo, O Sandas		LC	 (Max. 70
55	Cirrhinus Lineatus	*Henicorhynchus cryptopogon*	CYPRINIDAE	Pursat, Svay Donkeo			 (Max. 15 cm)
56	Siamese mud Carp	*Henicorhynchus siamensis*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas			 (Max. 20 cm)
57	Tawes	*Barbodes gonionotus*	CYPRINIDAE	Pursat, Moung, Chork, O Sandas		LC	 (Max. 33 cm)
58	Goldfin tinfoil barb	*Hypsibarbus malcolmi*	CYPRINIDAE	Pursat, O Sandas		LC	 (Max. 50 cm)
59		*Hypsibarbus wetmorei*	CYPRINIDAE	Pursat, Svay Donkeo, O Sandas		LC	 (Max. 25 cm)
60	Mad barb	*Leptobarbus hoeveni*	CYPRINIDAE	Pursat, Chork, O Sandas			 (Max. 70 cm)
61	Loboheilus Nigrovittantus	*Lobocheilo melanotaenia*	CYPRINIDAE	Pursat, Svay Donkeo, O Sandas		LC	 (Max. 16 cm)

No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រ ១២៣	IUCN	Picture
62	Luciosoma Bleekeri	*Luciosoma bleekeri*	CYPRINIDAE	Pursat		LC	 (Max. 26 cm)
63	Black sharkminnow	*Morulius chrysophekadion*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork		LC	 (Max. 60 cm)
64	Mystacoleucus Chilopterus	*Mystacoleucus marginatus*	CYPRINIDAE	Pursat		LC	 (Max. 10 cm)
65		*Mystacoleucus sp.*	CYPRINIDAE	Pursat (Damnak Ampil upstream)			 (Max. 7 cm)
66	Silver sharkminnow	*Osteochilus hasselti*	CYPRINIDAE	Pursat, Savy Donkeo, Chork, O Sandas		LC	 (Max. 30 cm)
67	Labeo Soplaoensis	*Osteochilus waandersi*	CYPRINIDAE	Pursat, O Sandas		LC	 (Max. 20 cm)
68	Bonylip barb	*Osteochilus microcephalus*	CYPRINIDAE	Say Donkeo, Chork, O Sandas		LC	 (Max. 24 cm)
69		*Osteochilus melanopleurus*	CYPRINIDAE	Pursat, Svay Donkeo, O Sandas		LC	 (Max. 40 cm)
70	Grey bony-lip carp	*Osteochilus schlegeli*	CYPRINIDAE	Svay Donkeo, Chork			 (Max. 40 cm)
71		*Paralaubuca typus*	CYPRINIDAE	Pursat, Moung, Chork, O Sandas		LC	 (Max. 18 cm)
72		*Paralaubuca riveroi*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 18 cm)
73		*Parachela oxygastroides*	CYPRINIDAE	Pursat		LC	 (Max. 15 cm)
74		*Puntioplites falcifer*	CYPRINIDAE	Pursat		LC	 (Max. 35 cm)
75	Puntioplites Proctorysron	*Puntioplites proctozysron*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas			 (Max. 25 cm)

No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រ ១២៣	IUCN	Picture
76	Swamp barb	*Puntius brevis*	CYPRINIDAE	Pursat		LC	 (Max. 12 cm)
77		*Systomus aurotaeniatus*	CYPRINIDAE	Pursat		LC	 (Max. 2.5 cm)
78	Pale rasbora	*Rasbora aurotaenia*	CYPRINIDAE	Pursat, Svay Donkeo, O Sandas		LC	 (Max. 17 cm)
79	Yellowtail rasbora	*Rasbora tornieri*	CYPRINIDAE	Pursat, Svay Donkeo , Moung, Chork, O Sandas		LC	 (Max. 17 cm)
80	Puntius Simus	*Puntius orphoides*	CYPRINIDAE	Pursat, Svay Donkeo, Moung, Chork			 (Max. 25cm)
81	Puntius Tetrazona	*Systomus partipentazona*	CYPRINIDAE	Pursat	En	LC	 (Max. 5 cm)
82		*Thynnichthys thynnoides*	CYPRINIDAE	Pursat, O Sandas		LC	 (Max. 25 cm)
83	Finescale tigerfish	*Datnioides undecimradiatus*	DATNIOIDIDAE	Pursat, Svay Donkeo	Cr	VU	 (Max. 40 cm)
84	Marbled sleeper	*Oxyeleotris marmorata*	ELEOTRIDAE	Pursat, Svay Donkeo, Moung, Chork		LC	 (Max. 30 cm)
85	Spotted algae eater	*Gyrinocheilus pennocki*	GYRINOCHELIDAE	Pursat		LC	 (Max. 28 cm)
86	Siames algae eater	*Gyrinocheilus aymonieri*	GYRINOCHELIDAE	Pursat		LC	 (Max. 28 cm)
87	Peacock eel	*Macrognathus siamensis*	MASTACEMBELIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 30 cm)
88		*Macrognathus taeniagaster*	MASTACEMBELIDAE	Svay Donkeo, Moung, Chork		LC	 (Max. 16 cm)
89	Tiretrack spiny eel	*Mastacembelus armatus*	MASTACEMBELIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 90 cm)

No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រ ១២៣	IUCN	Picture
90		*Macrochirichthys macrochirus*	CYPRINIDAE	Moung		NT	(Max. 70 cm) 
91	Catopra	*Pristolepis fasciata*	NANDIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	(Max. 20 cm) 
92	Clown featherback	*Chitala ornata*	NOTOPTERIDAE	Pursat		LC	(Max. 100 
93	Bronze featheback	*Notopterus notoperus*	NOTOPTERRUS	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	(Max. 60 cm) 
94	Moon light gourami	*Trichogaster microlepis*	BELONTIIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas			(Max. 15 cm) 
95	Threespot gourami	*Trichogaster trichopterus*	BELONTIIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	(Max. 15 cm) 
96	Snakeskin gourami	*Trichogaster pectoralis*	BELONTIIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas			(Max. 25 cm) 
97		*Pangasius larnaudii*	PANGASIIDAE	Pursat, Svay Donkeo		LC	(Max. 130 
98		*Pteropangasius micronema*	PANGASIIDAE	Pursat		LC	(Max. 100 
99		*Pangasius sanitwongsei*	PANGASIIDAE	Pursat		CR	(Max. 250 cm) 
100		*Pangasius macronema*	PANGASIIDAE	Pursat, Moung		LC	(Max. 35 cm) 
101		*Micronema micronema*	SILURIDAE	Pursat, Moung			(Max. 33 cm) 
102		*Micronema bleekeri*	SILURIDAE	Svay Donkeo, Chork, O Sandas			(Max. 60 cm) 
103		*Kryptopterus hexapterus*	SILURIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas			(Max. 24 cm) 

No	Fao name	*Scientific Name*	Farmily Name	River Name	អនុក្រ ១២៣	IUCN	Picture
104		*Kryptoperus cheveryi*	SILURIDAE	Pursat, Moung, Chork			 (Max. 35 cm)
105		*Hemisilurus mekongensis*	SILURIDAE	Pursat, Moung		LC	 (Max. 80 cm)
106	Butter catfish	*Ompok bimaculatus*	SILURIDAE	Pursat, Svay Donkeo, Moung, Chork		NT	(Max. 45 cm) 
107		*Ompok hypophthalmus*	SILURIDAE	Svay Donkeo, Chork			(Max. 30 cm) 
108		*Wallago attu*	SILURIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		NT	(Max. 200 cm) 
109		*Thryssocypeis tonlesapensis*	CYPRINIDAE	Moung, O Sandas			(Max. 7 cm) 
110		*Euryglossa harmandi*	SOLEIDAE	Pursat			(Max. 10 cm) 
111	Smallscale tonuesole	*Cynoglossus microlepis*	CYNOGLOSSIDAE	Moung		LC	(Max. 35 cm) 
112	Onegilled eel	*Ophisternon bengalense*	SYNBRANCHIDAE	Pursat, Moung, Chork		LC	(Max. 100 cm) 
113	Swamp eel	*Monopterus albus*	SYNBRANCHIDAE	Pursat, Svay Donkeo, Moung, Chork, O Sandas		LC	 (Max. 70 cm)
114		*Monotreta cambodgiensis*	TETRAODONTIDAE	Pursat, Chork, O Sandas			 (Max. 16 cm)

Note: Sub decree no. 123 dated August 12, 2009, stated about endangered species of fishery resources: endangered species (En), critically endangered species (Cr) and vulnerable species (Vu). IUCN noted on the table above for mammals.

Working team took some pictures of fish species at project area as below



***Hemibagrus spilopteru*:**Taken on July 6, 2013 in Svay Daun Keo river



Yasuhikotakia modesta: Taken on July 6, 2013 in Svay Daun Keo river



Henicorhynchus siamensis:Taken on July 6, 2013 in Pursat river



Acantopsis sp. 2:Taken on July 6, 2013 in Pursat river



Puntioplites proctozysron: Taken on July 6, 2013 in Maung river



Gyrinocheilus pennocki : Taken on July 6, 2013 in Pursat river



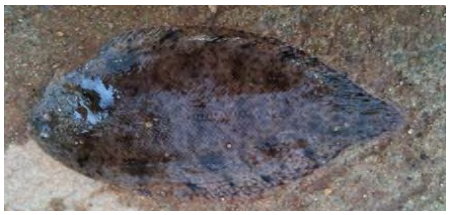
Mystacoleucus marginatus: Taken on July 6, 2013 in Pursat river



Rasbora aurotaenia: Taken on July 6, 2013 in Pursat river



Paralaubuca riveroi :Taken on July 6, 2013 in Pursat river



Euryglossa harmandi: Taken on July 6, 2013 in Pursat river



Labiobarbus siamensis: Taken on July 4, 2013 in Pursat river



Mystus mysticetus :Taken on July 4, 2013 in Pursat river



Big freshwater mussels andsmall freshwater clams:
Taken on July 4, 2013 in Pursat river



Freshwater Shrimps and small Freshwater Shrimps:
Taken on July 4, 2013 in Svay Daun Keo river



Yasuhikotakia modesta, Hemibagrus spilopterus, Mastacembelus armatus, Puntioplites proctozysron, Henicorhynchus siamensis.Gyrinocheilus pennocki and Mystacoleucus marginatus:
in Pursat river



Trichogaster trichopterus:Taken on July 9, 2013 in Pursat river



Clarias batrachus: Taken on July 16, 2013 in Chork river



Anabas testudineus: Taken on July 5, 2013 in Pursat river



Ompok bimaculatus*:* Taken on July 5, 2013 in Pursat river



Labiobarbus Lineatus :Taken on July 5, 2013 in Svay Daun Keo river



Clarias macrocephalus: Taken on July 5, 2013 in Pursat river



Monopterus albus: Taken on July 5, 2013 in Svay Daun Keo river



Macrobrachium Nipponese :Taken on July 6, 2013 in Pursat river



Pila scutata pila snail: Taken on July 8, 2013 in Ou Sandash



Somaniathelpusa sp.Black rice crab:Taken on July 8, 2013 in rice field near Ou Sandash



Somaniathlpusa sp.Black rice crab:Taken on July 8, 2013 in rice field near Chaork river



Pila scutata Pila snail: Taken on July 8, 2013 in rice field near Chaork river



Osteochilus melanopleurus:Taken on August 13, 2013 in Pursat river



Pseudomystus siamensis: Taken on August 13, 2013 in Pursat River



Pseudomystus siamensis , Kryptopterus hexapterus , Anabas testudineus , Hemibagrus spilopterus , Trichogaster trichopterus , and Mystus albolineatus: Taken on August 13, 2013 in Pursat River



Chameleon loan & Orangefin loan: Taken on 25/11/13 in Damnak Ampil Dam



Cyclochoilicthys repasson: Taken on 26/11/13 in Damnak Ampil Dam



Eleotridae: Taken on 23/11/13 in Damnak Ampil Dam



Micronema & Channa striata: Taken on 24/11/13 in Chareuk Pursat River



Hemibagrus wyckioides: Taken on 23/11/13 in Damnak Ampil Dam, Pursat River



Hampala macrolepidota: Taken on 23/11/13 in Damnak Ampil Dam, Pursat River



Black sharkminnow, Siamese Carp, Labiobarbus Lineatus, Loboheilus Nigrovittantus, Paralaubuca riveroi: Taken on 24/11/13 in Chareuk Pursat River



Dwaf houseface, Siamese qlassish, Chameleon botia : Taken on 24/11/13 in Chareuk Pursat River

C. Migration of vital fish species in project area

In wet season, migration fish is congested due to flood and especially whenever the water flooded the hydraulic structure of Charoek regulator (the water level during flooding was similar with the height of regulator gate) from in the middle of July to the end of November according to the field study and interview with commune chief, village chief and fishermen. Because of bleeding time for fish and abundant food, it makes fish migrate from Tonle Sap Lake to Pursat river, then the upstream of this river in the raining season. In the period of flooding, fishermen always catch some fish such as: Puntioplites falcifer (*Cyprinidae Minnows and Carps),* Mystus nemurus (*Bagridae*), Siamese mud carp (*Henicorhnchus siamensis*), Tiny scale barb (*Thynnichthys thynnoides*) Trey Krum, (*Osteochilus microcephalus),* Black sharkminnow *(Labeo chrysophekadion) ,* Wallago *(Wallagoattu),* Goldfin tinfoil barb *(Hypsibarbus malcolmi),*Orangefin Loach (Yasuhikotakia Modesta), Giant snakehead (*Chnna mucropeltes*), Toli shad, and Spot pangaasius (*Pangasiuslarnaudii*). However, some fish species moved from the upstream to Tonle Sap Lake such as Mystus ilamentus (*Hemibagrusfilamentus*), Trey Kame, Dusky face carp (*Osteochilus lini*), Tinfoil barb (Barbodes schwanefeldi), red tinfoil barb (*Barbonymus schwanenfeldii*), Waandersii's Hard-lipped Barb (*Osteochilus waandersii*), Osteochilus microcehalus, Trey Khcha (*Hemibagruswyckioides*)..

5.1.2.3. Habitat

According to field study along the NR5, a portion from Tlear Ma'am in Pursat to Battambang province, there was no protected area or protected forest that was habitat of vital wildlife. The bird habitats are on planted trees in villages, at the rice fields and some trees in density area. Furthermore, there were little regrowth Riverside vegetations (shown in heading 5.1.2.1 above) along rivers, streams and ditches that

are the habitats for aquatic species and fishes only. Riverside vegetations, when flooding occurred most commonly from heavy rainfall and an overflow of water from the Mekong River to Tonle Sap Lake in the wet season. Then, the overflow of water flowed into creeks connecting with rivers, streams and ditches. It helped the aquatic species such as: fish and water reptiles to migrate into the project area (name of vital rivers, streams and those locations shown in heading 5.1.1.4 of chapter 4, at the hydrology above). Some birds are Lesser Whistling Duck*(Dendrocygna javanica)*Asian Openbill*(Anastomus oscitans)*Barn Owl*(Tyto alba)*Grey Nightjar *(Caprimulgus indicus)*Large-billed Crow*(Corvus macrohynchos), Great Egretta (Egretta alble)*etc. They do not sleep and find food by the roads and just fly across the road.

5.1.2.4. Biodiversity and Ecosystem

There are 6 types of land uses along the NR5, a portion from Thlea Ma'am in Pursat to Battambang province, its ecosystem was described as the following:

1. Residential area: it is normal villages where are not in a town or density area. In this area, there are Khmer style houses (thatched house, wooden house with zinc roof and with tiles roof). Most of these houses are surrounded by rice fields and far away from each other. In the land around the houses, there are fruits, trees and vegetables planted by season. This area is green in the wet season, from in the middle of May to February; it is also the season of farming and animals are not allowed to walk to the rice field. For dry season, started from February to May, the farmers always allowed animals to walk to the field for free. Within this season they always seen the animals passed the NR5 especially in the morning (at 6:00am to 9:00am) and in the evening (at 5:00pm to 6:00pm). Most of planted crop is paddy rice, and planted fruits: mango, sugar palm, coconut, banana, jackfruit, milk fruit, lemon, grapefruit, guava, wood apple, and bamboo… etc. For wildlife in this area, it has a few shown in heading 5.1.2.2 above. There are some birds such as: Eurasian Tree Sparrow *(Passer montanus)*Spotted Dove *(Streptopelia chinensis)* Red Collared Dove*(Streptopelia tranquebarica)*Yellow-vented Bulbul *(Pycnonotus goiavier)*House Sparrow *(Passer domesticus)* Common Myna*(Acridotheres tristis)*and in some part of areas, *Peaceful Dove (Geopelia striata),*Refescent Prinia *(Prinia rufescens)*Pied Fantail*(Rhipidura javanica)*Barn Owl *(Tyto alba)*(at night) and chickens and ducks were raised by villagers. Also, reptiles were found in the project area as Chequered Keelback *(Xenochrophis piscator),*Common Blind Snake*(Ramphoryphlops braminus),*Indochinese Ratsnake*(Pyftas korros),*Gloden Tree Snake *(Chrysopelea ornata),*Paddy frog *(Fejervarga limnocharis),*frog*(Limnonectes ibanorum),*Common Asian bullfrog*(Kaloula pulchra),*Common Asian toad*(Bufo melanosstictus),* including crabs and cockles as well.





2. Households in Semi-urban: This area has more people living more than the first area. Houses were built in plot of lands closely. Also, the house types are similar with in the first area; however, some houses were built by brick. This area was near the commune offices such as:Snam Preah, Trapeang Chong, Ou Ta Paong, Svay Doun Keo, Ruessei Krang, Kear, Kakaoh, Prey Touch, Kampong Preah and Kampong Preang commune. There are some local markets and day markets (opened only in the morning from 6 am to 11 am). In the lots of land, fruits and vegetables were planted by the seasons. Here, the planted fruits were greener than planted fruits in the first area because of more water sources to supply (wells, ponds, pools, and water supply systems at some places). However, species of birds and reptiles are by no mean different from the first area.





3. Urban and town area: They are consisting of many houses built closely together (wooden house with zinc roof, with a tile roof and brick house with one or more floors), and there are a lot of people living in this area such as in Pursat city, Bakan district town, Maung Russei district town. Most of planted trees along the road sites are khan-na *(Eucalyptus camaldulensis)*, Acacia (*Acacia auriculiformis, A)*, rain tree *(Samanea saman)*,golden shower tree (*Cassia fistula)*, Calabura *(Muntingia calabura L.)*…etc. We also found mice, cats, dogs and cows. For birds in this area, there are: Eurasian Tree Sparrow *(Passer montanus),*Spotted Dove *(Streptopelia chinensis),*Red Collared Dove*(Streptopelia tranquebarica),*Yellow-vented Bulbul*(Pycnonotus goiavier),*House Sparrow*(Passer domesticus),*Common Myna*(Acridotheres tristis)*; then in some places of this areahas *Peaceful Dove (Geopelia striata)* that were raised by villagers as chickens and ducks. But, reptiles also found here as: Chequered Keelback *(Xenochrophis piscator),*Gloden Tree Snake *(Chrysopelea ornata)*,Common Asian bullfrog*(Kaloula pulchra),*Common Asian toad*(Bufo melanosstictus).*





4. The rice field area: there was no any villager's house, only field guard huts. It was green in the wet season from in the middle of May to February, it is also the season of rice cultivation and harvesting and animals are not allowed to walk to the rice field. For dry season started from February to May, most farmers always allowed animals to walk to the field for free. Within this season they always seen the animals passed the NR5 especially in the morning (at 6:00am to 9:00am) and in the evening (at 5:00pm to 6:00pm). Most of planted crops are paddy rice and fruits planting along bunds are mango *(Mangifera indica, L.)*, sugar palm *(Borassus flabellifer)*, Krasaang or Feroniella Lucida*(Feroniella lucida Scheff.)*, tamarind (*Tamarindus indica, L.*), Snay *(Streblus asper Lour.)*, Sdau or Margosa *(Azadirachta indica)*, Pring or Kelat *(Eugenia sp.)*and some places had small brushes…etc. For wildlife in this area, it has a few reptiles shown in heading 5.1.2.2 above. This area has more wildlife more than three areas above. There were reptiles also finding in this area: Chequered Keelback*(Xenochrophis piscator),*Blind snake (*Xenopeltis unicolor),*Indochinese Ratsnake *(Ptyas korros),*Indochinese Spitting Cobra *(Naja siamensis),*Monocled Cobra*(Naja kaouthia),*Russull's Viper *(Daboia russelli),*Gloden Tree Snake *(Chrysopelea ornata),*Natricinae snake *(Enhydris enhydris),* Keeled Rat Snake *(Elaphe radiata)*Paddy frog*(Fejervarga limnocharis),* frog*(Limnonectes ibanorum),* Common Asian bullfrog*(Kaloula pulchra),* Common Asian toad*(Bufo melanosstictus)*, crabs and cockles too, shown in detail in table 5-31. ***Note:*** *Fish in rice field was rarely found, even though in the*

flooding time, because farmers used chemical fertilizer, pesticides and chemical substance use for killing grass that were able to kill those fish in rice field.




5. Riverside vegetation re-growing in the watershed of streams and ditches along the road as description above, in heading A. These areas are in Ou Srang Thom and Ou Srang Touch and then from KP 177+177 to KP 177+263, fromKP178+484 toKP178+537, fromKP190+727 toKP190+785,fromKP248+580 toKP252+938, and fromKP254+252toKP255+121. This area flooded in the wet season from the middle of June to middle of December. Most of plants were described in 5.1.2.1 above. Most of wildlife found in the area are reptiles such as Chequered Keelback*(Xenochrophis piscator),* Blind snake (*Xenopeltis unicolor),*Indochinese Ratsnake *(Ptyas korros),*Indochinese Spitting Cobra *(Naja siamensis),*Monocled Cobra *(Naja kaouthia),*Russull's Viper *(Daboia russelli),*Gloden Tree Snake *(Chrysopelea ornata),*Keeled Rat Snake *(Elaphe radiata),*Green Cat Snake *(Boiga cyanea),*Natricinae snake *(Enhydris enhydris),*Bocourt's Water Snake *(Enhydris bocourti),* Paddy frog *(Fejervarga limnocharis),* frog*(Limnonectes ibanorum),*Common Asian bullfrog *(Kaloula pulchra),*Common Asian toad *(Bufo melanosstictus)* and crabs and cockle, etc,. ***Note:*** *ThisRiverside vegetatiosn are re-growing forests which are not vital habitat for fish and wildlife. Furthermore, around this area, the farmers always grow rice with chemical fertilizers and pesticides and chemical substance use for killing weed grass and insects that are extremely impact on baby fish and some insects that is food for fish. (This kind of vegetation is detailed in table 5-13 above).*





Picture of Riverside vegetations in (Ou, Canal, Pond) at Ou Srang Thum, taken on July 17, 2013





Picture of Riverside vegetations along the Road in Kokoah village, taken on 23/07/2014

6. There were water bodies as: lake, pond, ditch/stream, and river consisting along the NR5(Middle Section: Thlea Ma'am To Battambang)with all locations of culverts and bridges; including Pursat, Svay Daun Keo, Moung, Chark and Ou Sandan river/stream. It was Pursat River that water flewn both wet and dry seasons consisted a lot of fish (97 species). But Svay Daun Keo River, Moung River, Chark River and Sandan stream did not have water to flow in dry season; water remained in some deep spots of river only. There were 56 species of fish in Svay Daun Keo River, 54 species of fish in Moung River, 61 species of fish in Chark River, 57 species

of fish in Sandan stream. In detailed table 5-20 above, there were some water plant species growing in the water of river and stream as: Water Hyacinth(*Eichhornia crassipes*), Madagascar periwinkle(*Catharanthus roseus*), creeping water primrose(*Ludwigia adscendens*), Ipomoea aquatica (*Ipomoea aquatica),* Egyptian White Water-lily *(Nymphaea lotus,* Blue star water lily(*Nymphaea stelata*), water mimosa (*Neptunia oleracae*), Water Snowflake, Floating hearts(*Nymphoides indica*), lotus (*Nelumbo nucifera*), Taro or Eddoe (*Colocasia esculenta, Var.esculenta*), Water Shamrock(*Marsilia quadrifolia*), Whitehead Spike Sedge (*Cyperus kyllingia nemoralis*), Yeaplan plant, Banla Youn *(Mimosa pigra Fabaceae)*, Snaor *(Sesbana javnica)* etc.



Water Hyacinth

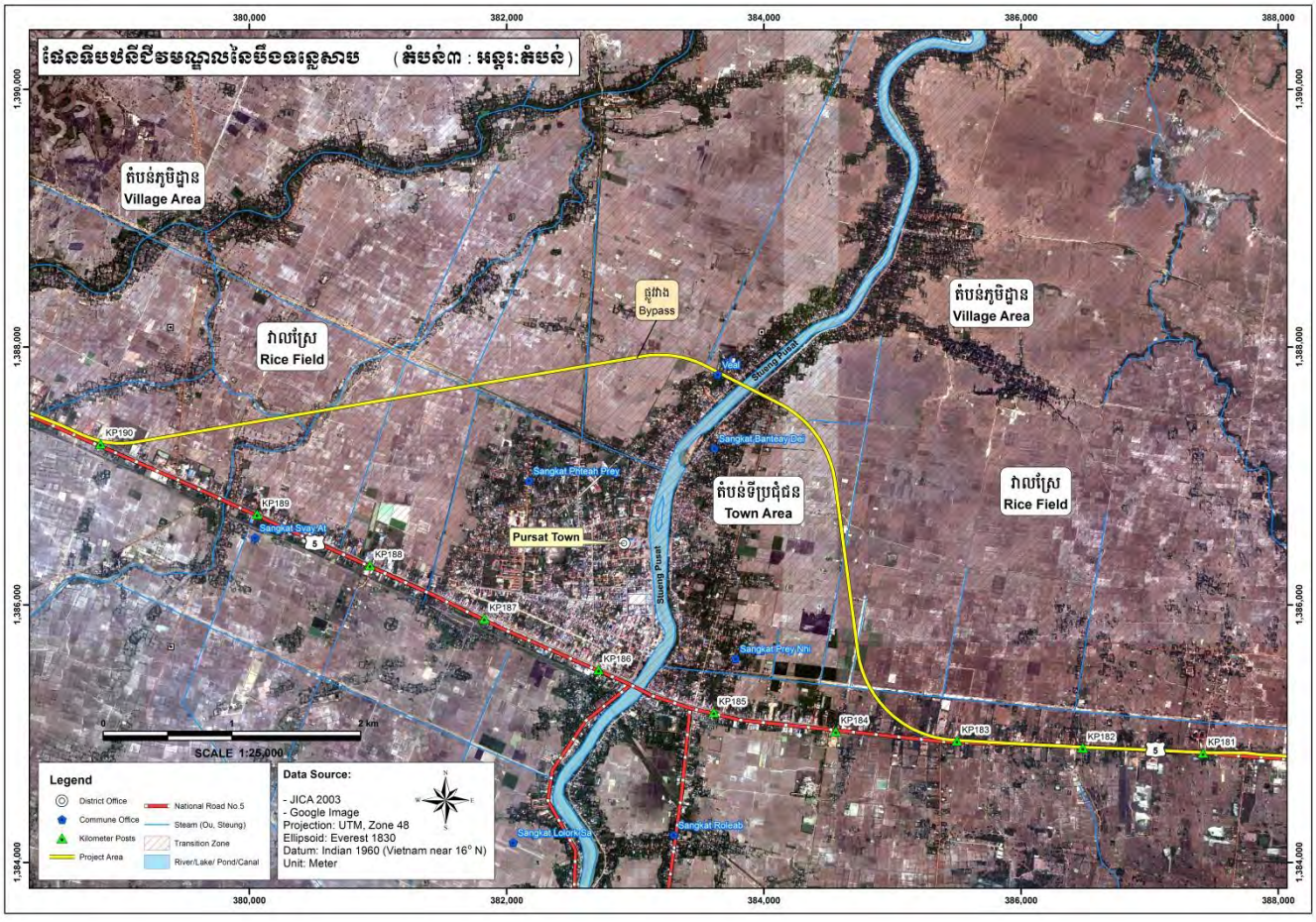


An aquatic herb



An edible aquatic plant

Note: *Detail fish study at downstream area and upstream of Pursat by-pass it length was 8.8Km that it located in Tonle Sap Biosphere Reserve, it shown that Ecological system mostly it was in rice field, residential house of Pursat Town and a small part in Veal commune, Kandieng district, Pursat province; their Ecological system ahs been described above (see map below).*



5.2 Socio-economic Resources

5.2.1 Intriduction

Socio-economic resources assessment for NR5 Improvement Project was done with people living along the National Road No.5 which was from Kilometer Post 171 in Tnoat Chum and Boeng Kantuot Commune, Krokor district, Pursat province to Kilometer Post 282+200 in Dambouk Khpos village, Ou Dambouk Pir commune, Sangkae district, Battambang province including bypass road of Pursat Town with length was 8.8Km. Moreover, working team also made the consultation meeting with introduction and explanation about purpose of improvement project to participants as well as local authorities in order that this road becomes the first Asian-A1 road. For the project of road expansion, its total width was 20.50 meters which one side of road was 10.25 meters width; however, the area requirement for road is also needed space for slope of the road, thus it needed 20 meters of each (COI: 20m). After public consultation meeting about project, the study working team decided to select from 10% to 20% rely on the more or few of population of people are living along both sides of the road in order to interview them about their income and collected, ideas/comments and suggestion about project. This study was conducted to analyze their socio-economic, and to compare some existing parameters in the pre-construction, construction, and project implementation phase.

Based on studied along middle section from Thea Ma'am to Battambang is 112.8Km length (included 8.8Km of by-pass) there is 84 villages, 5 Sangkats, 18 Communes, 5 Districts, 1 Town and two provinces: Pursat and Battambang (from KP-171 to 281+200).

5.2.2 Demography and Resettlement

Pursat located a province in northwest of Cambodia which is 186 Km way from Phnom Penh capital city. There are 3 species of the main roads such as: National Road No. 5 (NR5), railway and waterway (River and Tonle Sab Lake). This province has total area with 12,692 Km^2 and the provincial borders are: with Kampong Chhnang province at the east, at the west a part is with border of Battambang province and another is 80 Km length of Thailand's border line; Tonle Sab lake with 80 km at the north border, and at the south border it is Koh Kong and Kampong Speu province. In addition, Pursat province has 05 districts, 01 city, 05 Sangkats, 44 communes, and 501 villages. The population is 87,422 families, equaling to 435,001 persons excluded 222,850 persons of female; then the density is 33persons/square kilometer. For the main occupations in percentage of total population, it is agriculture with 86%, 8% of service, and 6% of public sectors or private sector and other. (Data 2012 is from annual conference report of working result in 2012 and working plan for 2013 of Pursat Provincial Hall).

Battambang province located in the northwest of Cambodia which is 291Km away from Phnom Penh capital city. The area of this province is 11,748Km^2 which divided into 11 districts, 01 city, 10 Sangkats, 92 communes and 799 villages. The population in Battambang province is 1,093,793 people in total with 553,223 people of female, equaling 226,764 families. (Data 2012 is from annual conference report of working result in 2012 and working plan for 2013 of Battambang Provincial Hall).

5.2.2.1 Ethnic Minority Groups

According to the field study, there were Khmer and other people living near the project area. Thus, its were98.8% Khmer people, 1.17% Cham and 0.03% Vietnam as shown in Table 5-21 below:

Table 5-21: Ethnic groups living in/surrounding project area, field study from July 01, 2013 to December 15, 2013

No.	Village	Total Family	Total people	Khmer	%	Cham	%	VN	%	Remarks
1	Thlea Ma' am (R)	124	554	124	100					Boeung Kantout Comm., Krakor Dist., Pursat (Existing road)
2	Takeo Krom (R)	139	566	139	100					Boeung Kantout Comm., Krakor Dist., Pursat (Existing road)
3	Tram)L)	178	889	178	100					Tnaot Chum Comm., Krakor Dist., Pursat (Existing road)
4	Takeo Leu (L)	94	448	94	100					Tnaot Chum Comm., Krakor Dist., Pursat (Existing road)
5	Toul Makak (L)	269	1341	269	100					Sangkat Roleab, Pursat Town, Pursat, (Existing road)
6	Prey Omal (L)	427	2287	427	100					Sangkat Roleab, Pursat Town, Pursat, (Existing road)
7	Srash Sraong (R)	64	292	64	100					Sangkat Preynhi, Pursat Town, Pursat, (Existing road)
8	Sala Kuru (R)	91	475	91	100					Sangkat Preynhi, Pursat Town, Pursat, (Existing road)
9	Maon Cher (R+L)	192	937	192	100					Sangkat Preynhi, Pursat Town, Pursat, (By-pass)

No.	Village	Total Family	Total people	Khmer	%	Cham	%	VN	%	Remarks
10	Banteay Dei Leu (R+L)	159	735	159	100					Sangkat Banteay Dei, Pursat Town, Pursat, (By-pass)
11	Banteay Dei Krom (R+L)	116	509	116	100					Sangkat Banteay Dei, Pursat Town, Pursat, (By-pass)
12	Islam (R+L)	180	851	0	0	180	100			Sangkat Banteay Dei, Pursat Town, Pursat, (By-pass)
13	Bandos Sandek(R+L)	112	507	99	88	13	12			Sangkat Banteay Dei, Pursat Town, Pursat, (By-pass)
14	Kbal Hong (R+L)	93	484	93	100					Sangkat Banteay Dei, Pursat Town, Pursat, (By-pass)
15	Keo Sovan Leu (R+L)	98	410	98	100					Sangkat Banteay Dei, Pursat Town, Pursat, (By-pass)
16	Keo Sovan Krom (R+L)	64	319	64	100					Sangkat Banteay Dei, Pursat Town, Pursat, (By-pass)
17	O-Bakrang Leu (R+L)	61	277	61	100					Sangkat Banteay Dei, Pursat Town, Pursat, (By-pass)
18	Po Damnak (R+L)	159	742	159	100					Veal comm., Kandieng Dist., Pursat, (By-pass)
19	Po Kambor (L)	145	625	145	100					Veal comm., Kandieng Dist., Pursat, (By-pass)
20	Pralay Thom (R+L)	189	983	122	65	60	32	7	4	Veal comm., Kandieng Dist., Pursat, (By-pass)
21	Dankea (R+L)	201	798	201	100					Sangkat Phtes Prey, Pursat Town, Pursat, (By-pass)
22	O-Sdav (R+L)	168	895	168	100					Sangkat Phtes Prey, Pursat Town, Pursat, (By-pass)
23	Tnaot Te (R+L)	178	892	178	100					Sangkat Phtes Prey, Pursat Town, Pursat, (Existing road+By-pass)
24	Kok)dR)	185	922	185	100					Sangkat Phtes Prey, Pursat Town, Pursat, (Existing road)
25	Svay Ath (L)	205	1121	205	100					Sangkat Svay Ath, Pursat Town, Pursat, (Existing road)
26	Svay Ath (R)	108	500	108	100					Snam Preah Comm., Bakan Dist., Pursat, (Existing road)
27	Kampeng Svay (L)	120	577	120	100					Snam Preah Comm., Bakan Dist., Pursat, (Existing road)
28	Anlong Mean (R)	171	759	171	100					Snam Preah Comm., Bakan Dist., Pursat, (Existing road)
29	Krapeu Ro (L)	189	883	189	100					Snam Preah Comm., Bakan Dist., Pursat, (Existing road)
30	Andong Sambour (R)	206	1028	206	100					Snam Preah Comm., Bakan Dist., Pursat, (Existing road)
31	Snam Preah (R)	147	605	147	100					Snam Preah Comm., Bakan Dist., Pursat, (Existing road)
32	Sdok Svay (R)	205	865	205	100					Snam Preah Comm., Bakan Dist., Pursat, (Existing road)
33	Andong Krasaing (R+L)	287	1182	287	100					Snam Preah Comm., Bakan Dist., Pursat, (Existing road)
34	Kdei Snoul (R+L)	135	723	135	100					Trapaing Chuong Comm., Bakan Dist., Pursat, (Existing road)
35	Koh Keo)dR)	384	1545	384	100					Trapaing Chuong Comm., Bakan Dist., Pursat, (Existing road)
36	Trapaing Choung (L)	337	2607	337	100					Trapaing Chuong Comm., Bakan Dist., Pursat, (Existing road)
37	Koh Svay (R)	132	595	132	100					Trapaing Chuong Comm., Bakan Dist., Pursat, (Existing road)
38	Kraol Krabei (R+L)	238	1194	238	100					Trapaing Chuong Comm., Bakan Dist., Pursat, (Existing road)
39	Snay Tol (R+L)	116	574	116	100					Trapaing Chuong Comm., Bakan Dist., Pursat, (Existing road)
40	Thmei)dR+L)	115	535	115	100					Trapaing Chuong Comm., Bakan Dist., Pursat, (Existing road)
41	Prey Phdav (R+L)	261	1079	261	100					Boeung Khna Comm., Bakan Dist., Pursat, (Existing road)
42	Khnay Romeas (R+L)	215	812	215	100					Boeung Khna Comm., Bakan Dist., Pursat, (Existing road)
43	Boeung Khna (R+L)	436	1898	436	100					Boeung Khna Comm., Bakan Dist., Pursat, (Existing road)
44	Prey Svay (R+L)	229	1012	229	100					Boeung Khna Comm., Bakan Dist., Pursat, (Existing road)
45	Deum Chres (R+L)	215	958	215	100					Boeung Khna Comm., Bakan Dist., Pursat, (Existing road)
46	O-Tapaong (R+L)	303	1592	303	100					O-Tapaong Comm., Bakan Dist., Pursat, (Existing road)
47	Prey Yeang (R+L)	67	354	67	100					O-Tapaong Comm., Bakan Dist., Pursat, (Existing road)
48	Svay daun Keo-1 (R+L)	348	1561	348	100					Svay Daun Keo Comm., Bakan Dist., Pursat, (Existing road)
49	Svay Sar)dL)	66	297	66	100					Svay Daun Keo Comm., Bakan Dist., Pursat, (Existing road)
50	Nikum Leu (R+L)	391	1883	391	100					Svay Daun Keo Comm., Bakan Dist., Pursat, (Existing road)
51	Thnaol Baot (R+L)	468	2213	468	100					Russei Kraing Comm., Moung Russei Dist., Battambang, (Existing road)
52	Ampil Chhoung (R+L)	289	1366	289	100					Russei Kraing Comm., Moung Russei Dist., Battambang, (Existing road)
53	Kralaong Phluk (R+L)	549	2521	549	100					Prey Svay Comm., Moung Russei Dist., Battambang, (Existing road)

No.	Village	Total Family	Total people	Khmer	%	Cham	%	VN	%	Remarks
54	Toul Thnung (R+L)	128	648	128	100					Prey Svay Comm., Moung Russei Dist., Battambang, (Existing road)
55	Prey Svay (R)	434	2178	434	100					Prey Svay Comm., Moung Russei Dist., Battambang, (Existing road)
56	Prey Preal (L)	349	1709	349	100					Prey Svay Comm., Moung Russei Dist., Battambang, (Existing road)
57	O-Kreat (R+L)	439	2097	439	100					Kea Comm., Moung Russei Dist., Battambang, (Existing road)
58	Anlong Sdav (L)	64	306	64	100					Kea Comm., Moung Russei Dist., Battambang, (Existing road)
59	Ream Kun (R+L)	506	2541	506	100					Kea Comm., Moung Russei Dist., Battambang, (Existing road)
60	Kea-3)dL)	255	1177	255	100					Kea Comm., Moung Russei Dist., Battambang, (Existing road)
61	Po-1)dR)	412	2223	412	100					Kea Comm., Moung Russei Dist., Battambang, (Existing road)
62	Po-2)dR)	320	1603	320	100					Kea Comm., Moung Russei Dist., Battambang, (Existing road)
63	Moung)dL)	362	1580	362	100					Moung Comm., Moung Russei Dist., Battambang, (Existing road)
64	Kansai Banteay (L)	435	2314	435	100					Moung Comm., Moung Russei Dist., Battambang, (Existing road)
65	Kokoh)dR+L)	364	1733	364	100					Kokoh Comm., Moung Russei Dist., Battambang, (Existing road)
66	Steung Chork (R+L)	221	1042	221	100					Prey Touch Comm., Moung Russei Dist., Battambang, (Existing road)
67	Dop Krasaing (R+L)	245	1164	245	100					Prey Touch Comm., Moung Russei Dist., Battambang, (Existing road)
68	Thmei)dR+L)	289	1287	289	100					Prey Touch Comm., Moung Russei Dist., Battambang, (Existing road)
69	Prey Touch (R+L)	280	1359	280	100					Prey Touch Comm., Moung Russei Dist., Battambang, (Existing road)
70	Kon Thlong (R+L)	411	2089	411	100					Prey Touch Comm., Moung Russei Dist., Battambang, (Existing road)
71	Prey Damrei (R+L)	431	1996	431	100					Prey Touch Comm., Moung Russei Dist., Battambang, (Existing road)
72	Sala Trav (R+L)	252	1239	252	100					Prey Touch Comm., Moung Russei Dist., Battambang, (Existing road)
73	Kach Rotes (R+L)	328	1384	328	100					Kampong Preang Comm., Sangkae Dist., Battambang, (Existing road)
74	Thmei)dL)	305	1322	305	100					Kampong Preang Comm., Sangkae Dist., Battambang, (Existing road)
75	Os Tuk (R+L)	525	2343	525	100					Kampong Preang Comm., Sangkae Dist., Battambang, (Existing road)
76	Kbal Thnaol (L)	363	1692	363	100					Kampong Preang Comm., Sangkae Dist., Battambang, (Existing road)
77	Srash Keo (R+L)	511	2457	511	100					Kampong Preah Comm., Sangkae Dist., Battambang, (Existing road)
78	Kampong Preah (R+L)	532	2247	532	100					Kampong Preah Comm., Sangkae Dist., Battambang, (Existing road)
79	Panha (R+L)	432	2032	432	100					Kampong Preah Comm., Sangkae Dist., Battambang, (Existing road)
80	Prey Chek (R+L)	302	1355	302	100					Kampong Preah Comm., Sangkae Dist., Battambang, (Existing road)
81	Dambok Khpous (L)	507	2461	507	100					O-Dambang-2 Comm., Sangkae Dist., Battambang, (Existing road)
82	Svay Thom (L)	440	2092	440	100					O-Dambang-2 Comm., Sangkae Dist., Battambang, (Existing road)
83	Puk Chhma (R)	156	773	156	100					Anlong Vil Comm., Sangkae Dist., Battambang, (Existing road)
84	Svay Kaang (R)	472	1861	472	100					Anlong Vil Comm., Sangkae Dist., Battambang, (Existing road)
	Total	**21688**	**102881**	**21428**	**98.8**	**253**	**1.17**	**7**	**0.03**	

Note: Data in 2013 from communes and Sangkats (PST and BTB province), R: Right, L: Left, PST: Pursat, BTB: Battambang

5.2.2.2 People living in and surounding the project area

According to field work and public consultation meeting with national grass root level such as provincial, district, commune and village level in/around the project area, they mentioned that the project area located along the both road sides from KP-171 in Tnoat Chum and Boeng Kantout commune in Krakor district, Pursat province to KP- 282+200 located in Dambouk Khpos village, Ou Dambang Pir commune, Sangkae district, Battambang province, 23 communes/Sangkat, 84 villages there are total households of21,688 with total population is 102,881 (See Table abve).

The selection sample for interviewed of people are living along the both side of road were selected 18.38% (n/N>10%) among the total of people living along the road is 3,993 families. For the total of interviewed people were 734 households with 3,284 person in which the total villages were 84, Pursat has 50 villages and Battamdang has 34 villages, in which 6 villages was not available of interviewed. Thee were two reasons: (1) there were 5 villages not dwellings along the both of road side, (2) there

were not available of interviewed owing to it had a few houses along the both of road side and the house owners were busy to work in Thailand. Detail see table below:

Table 5-22: Numbers of people living in and around the project area, field survey from July 1, 2013 to December 15, 2013

No.	Village	Commune/ Sangkat	District	Total Family	Total People	Total Female	Total >=18 year-old	Total >=18 year-old, female	Total Teacher along the road	%	Interviewed number sample	Total member in interviewed families	%	Remarks
1	Thlea Ma´ am (R)	Boeung Kantout	Krakor	124	554	217	288	161	22	17.74	11	42	50	PST, (Existing road)
2	Takeo Krom (R)	Boeung Kantout	Krakor	139	566	302	334	184	20	14.39	3	14	15	PST, (Existing road)
3	Tram) L)	Tnaot Chum	Krakor	178	889	468	580	293	10	5.62	3	16	30	PST, (Existing road)
4	Takeo Leu (L)	Tnaot Chum	Krakor	94	448	235	247	129	30	31.91	8	31	26.67	PST, (Existing road)
5	Toul Makak (L)	Roleab	Pursat Town	269	1341	679	806	442	32	11.9	6	28	18.75	PST, (Existing road)
6	Prey Omal (L)	Roleab	Pursat Town	427	2287	1443	1372	717	10	2.34	2	9	20	PST, (Existing road)
7	Srash Sraong (R)	Prey Nhi	Pursat Town	64	292	171	180	89	12	18.75	4	14	33.33	PST, (Existing road)
8	Sala Kuru (R)	Prey Nhi	Pursat Town	91	475	246	257	146	50	54.95	10	38	20	PST, (Existing road)
9	Maon Cher (R+L)	Prey Nhi	Pursat Town	192	937	462	556	330	60	31.25	12	55	20	PST, (Existing road)
10	Banteay Dei Leu (R+L)	Banteay Dei	Pursat Town	159	735	377	394	201						No people lived there (By-pass)
11	Banteay Dei Krom (R+L)	Banteay Dei	Pursat Town	116	509	264	315	174						No people lived there (By-pass)
12	Islam (R+L)	Banteay Dei	Pursat Town	180	851	429	557	284						No people lived there (By-pass)
13	Bandos Sandek(R+L)	Banteay Dei	Pursat Town	112	507	261	322	165						No people lived there (By-pass)
14	Kbal Hong (R+L)	Banteay Dei	Pursat Town	93	484	253	272	146						No people lived there (By-pass)
15	Keo Sovan Leu (R+L)	Banteay Dei	Pursat Town	98	410	211	242	129						No people lived there (By-pass)
16	Keo Sovan Krom (R+L)	Banteay Dei	Pursat Town	64	319	162	221	113	10	15.63	2	12	20	PST, (BY-pass)
17	O-Bakrang Leu (R+L)	Banteay Dei	Pursat Town	61	277	131	180	91			5	23		PST, (BY-pass)
18	Po Damnak (R+L)	Veal	Kandieng	159	742	373	528	274	6	3.77	3	13	50	PST, (BY-pass)
19	Po Kambor (L)	Veal	Kandieng	145	625	330	432	237	6	4.14	3	8	50	PST, (BY-pass)
20	Pralay Thom (R+L)	Veal	Kandieng	189	983	517	705	393						No people lived there (By-pass)
21	Dankea (R+L)	Phtes Prey	Pursat Town	201	798	409	497	270						No people lived there (By-pass)
22	O-Sdav (R+L)	Phtes Prey	Pursat Town	168	895	467	610	319	56	33.33	14	68	25	PST, (BY-pass)
23	Tnaot Te (R+L)	Phtes Prey	Pursat Town	178	892	479	606	302	25	14.04	5	22	20	PST, (BY-pass + Existing road)

No.	Village	Commune/ Sangkat	District	Total Family	Total People	Total Female	Total >=18 year-old	Total >=18 year-old, female	Total Teacher along the road	%	Interviewed number sample	Total member in interviewed families	%	Remarks
24	Kok) R)	Phtes Prey	Pursat Town	185	922	501	549	247						No people lived there (By-pass)
25	Svay Ath (L)	Svay Ath	Pursat Town	205	1121	614	746	398	30	14.63	6	30	20	PST, (Existing road)
26	Svay Ath (R)	Snampreah	Bakan	108	500	246	332	192	10	9.26	2	9	20	PST, (Existing road)
27	Kampeng Svay (L)	Snampreah	Bakan	120	577	272	372	133	5	4.17				PST, (Existing road)
28	Anlong Mean (R)	Snampreah	Bakan	171	759	415	475	255	10	5.85	2	12	20	PST, (Existing road)
29	Krapeu Ro (L)	Snampreah	Bakan	189	883	487	579	216	35	18.52	8	32	22.86	PST, (Existing road)
30	Andong Sambour (R)	Snampreah	Bakan	206	1028	693	602	308	15	7.28	3	11	20	PST, (Existing road)
31	Snam Preah (R)	Snampreah	Bakan	147	605	397	373	245	25	17.01	5	22	20	PST, (Existing road)
32	Sdok Svay (R)	Snampreah	Bakan	205	865	456	610	296						No people lived there (By-pass)
33	Andong Krasaing (R+L)	Snampreah	Bakan	287	1182	677	699	374	75	26.13	15	72	20	PST, (Existing road)
34	Kdei Snoul (R+L)	Trapaing Chuong	Bakan	135	723	375	433	211	23	17.04	4	16	17.39	PST, (Existing road)
35	Koh Keo) R)	Trapaing Chuong	Bakan	384	1545	797	100	508	20	5.21	3	18	15	PST, (Existing road)
36	Trapaing Choung (L)	Trapaing Chuong	Bakan	337	2607	1396	1276	679	60	17.80	17	76	28.33	PST, (Existing road)
37	Koh Svay (R)	Trapaing Chuong	Bakan	132	595	313	457	241	31	23.48	5	22	16.13	PST, (Existing road)
38	Kraol Krabei (R+L)	Trapaing Chuong	Bakan	238	1194	6066	704	350	58	24.37	9	31	15.52	PST, (Existing road)
39	Snay Tol (R+L)	Trapaing Chuong	Bakan	116	574	237	448	234	56	48.28	13	53	23.21	PST, (Existing road)
40	Thmei) R+L)	Trapaing Chuong	Bakan	115	535	310	368	162	28	24.35	5	27	17.86	PST, (Existing road)
41	Prey Phdav (R+L)	Boeung Khna	Bakan	261	1079	579	683	368	7	2.68	2	9	28.57	PST, (Existing road)
42	Khnay Romeas (R+L)	Boeung Khna	Bakan	215	812	406	474	189	50	23.26	12	47	24	PST, (Existing road)
43	Boeung Khna (R+L)	Boeung Khna	Bakan	436	1898	973	1646	855	60	13.76	11	46	18.33	PST, (Existing road)
44	Prey Svay (R+L)	Boeung Khna	Bakan	229	1012	541	663	370	44	19.21	7	28	15.91	PST, (Existing road)
45	Deum Chres (R+L)	Boeung Khna	Bakan	215	958	553	618	322	89	41.40	17	83	19.1	PST, (Existing road)
46	O-Tapaong (R+L)	O-Tapaong	Bakan	303	592	791	1181	572	87	28.71	15	64	17.24	PST, (Existing road)
47	Prey Yeang (R+L)	O-Tapaong	Bakan	67	354	188	216	92	10	14.93	2	7	20	PST, (Existing road)
48	Svay daun Keo-1 (R+L)	Svay Daun Keo	Bakan	348	1561	795	1126	612	96	27.59	19	94	19.79	PST, (Existing road)
49	Svay Sar) L)	Svay Daun Keo	Bakan	66	297	164	190	99						No people lived there (By-pass)

No.	Village	Commune/ Sangkat	District	Total Family	Total People	Total Female	Total >=18 year-old	Total >=18 year-old, female	Total Teacher along the road	%	Interviewed number sample	Total member in interviewed families	%	Remarks
50	Nikum Leu (R+L)	Svay Daun Keo	Bakan	391	1883	983	1575	734	53	13.55	13	58	24.53	BTB, (Existing road)
51	Thnaol Baot (R+L)	Russei Kraing	Muong Russei	468	2213	1121	1356	693	100	21.37	19	94	19	BTB, (Existing road)
52	Ampil Chhoung (R+L)	Russei Kraing	Muong Russei	289	1366	713	742	400	93	32.18	24	114	25.81	BTB, (Existing road)
53	Kralaong Phluk (R+L)	Prey Svay	Muong Russei	549	2521	1306	1505	726	115	20.95	13	65	11.3	BTB, (Existing road)
54	Toul Thnung (R+L)	Prey Svay	Muong Russei	128	648	325	424	211	50	39.06	11	51	22	BTB, (Existing road)
55	Prey Svay (R)	Prey Svay	Muong Russei	434	2178	1125	1104	495	200	46.08	12	48	6	BTB, (Existing road)
56	Prey Preal (L)	Prey Svay	Muong Russei	349	1709	866	1082	551	120	34.38	19	79	15.83	BTB, (Existing road)
57	O-Kreat (R+L)	Kea	Muong Russei	439	2097	1084	1539	816	126	28.70	24	114	19.05	BTB, (Existing road)
58	Anlong Sdav (L)	Kea	Muong Russei	64	306	131	279	132	15	23.44	3	11	20	BTB, (Existing road)
59	Ream Kun (R+L)	Kea	Muong Russei	255	1177	614	894	621	120	47.06	14	62	11.67	BTB, (Existing road)
60	Kea-3) L)	Kea	Muong Russei	506	2541	1318	1822	963	19	3.75	4	16	21.05	BTB, (Existing road)
61	Po-1) R)	Kea	Muong Russei	412	2223	1266	1556	908	37	8.98	9	31	24.32	BTB, (Existing road)
62	Po-2) R)	Kea	Muong Russei	320	1603	877	1140	939	97	30.31	17	92	17.53	BTB, (Existing road)
63	Moung) L)	Muong	Muong Russei	362	1580	764	868	534	78	21.55	15	59	19.23	BTB, (Existing road)
64	Kansai Banteay (L)	Muong	Muong Russei	435	2314	1145	968	507	42	9.66	10	45	23.81	BTB, (Existing road)
65	Kokoh) R+L)	Kokoh	Muong Russei	364	1733	836	1173	594	51	14.01	13	63	25.49	BTB, (Existing road)
66	Steung Chork (R+L)	Prey Touch	Muong Russei	221	1042	483	561	276	44	19.91	12	62	27.27	BTB, (Existing road)
67	Dop Krasaing (R+L)	Prey Touch	Muong Russei	245	1164	576	765	385	170	69.39	21	100	12.35	BTB, (Existing road)
68	Thmei) R+L)	Prey Touch	Muong Russei	289	1287	635	720	367	52	17.99	13	57	25	BTB, (Existing road)
69	Prey Touch (R+L)	Prey Touch	Muong Russei	280	1359	703	850	449	190	67.86	23	103	12.11	BTB, (Existing road)
70	Kon Thlong (R+L)	Prey Touch	Muong Russei	411	2089	1069	1333	449	40	9.73	8	33	20	BTB, (Existing road)
71	Prey Damrei (R+L)	Prey Touch	Muong Russei	431	1996	1007	1258	627	130	30.16	26	108	20	BTB, (Existing road)
72	Sala Trav (R+L)	Kampong Preang	Sangkae	252	1239	613	922	447	69	27.38	14	58	20.29	BTB, (Existing road)
73	Kach Rotes (R+L)	Kampong Preang	Sangkae	328	1384	694	1039	535	80	24.39	16	64	20	BTB, (Existing road)
74	Thmei) L)	Kampong Preang	Sangkae	305	1322	658	986	498	25	8.2	6	28	24	BTB, (Existing road)
75	Os Tuk (R+L)	Kampong Preang	Sangkae	525	2343	1265	1650	858	194	36.95	23	89	11.86	BTB, (Existing road)
76	Kbal Thnaol (L)	Kampong Preang	Sangkae	363	1692	821	1180	565	25	6.89	5	26	20	BTB, (Existing road)

No.	Village	Commune/ Sangkat	District	Total Family	Total People	Total Female	Total >=18 year-old	Total >=18 year-old, female	Total Teacher along the road	%	Interviewed number sample	Total member in interviewed families	%	Remarks
77	Srash Keo (R+L)	Kampong Preah	Sangkae	511	2457	1198	1793	899	125	24.46	21	97	16.8	BTB, (Existing road)
78	Kampong Preah (R+L)	Kampong Preah	Sangkae	532	2247	1165	1545	824	87	16.35	14	63	16.09	BTB, (Existing road)
79	Panha (R+L)	Kampong Preah	Sangkae	432	2032	1026	1506	779	100	23.15	21	99	21	BTB, (Existing road)
80	Prey Chek (R+L)	Kampong Preah	Sangkae	302	1355	710	985	497	28	9.27	8	43	28.57	BTB, (Existing road)
81	Dambok Khpous (L)	O-Dambang-2	Sangkae	507	2461	1196	1837	874	15	2.96	3	19	20	BTB, (Existing road)
82	Svay Thom (L)	O-Dambang-2	Sangkae	440	2092	1047	1557	762						No people lived there (Existing road)
83	Puk Chhma (R)	Anlong Vil	Sangkae	156	773	404	686	367	30	19.23	7	31	23.33	BTB, (Existing road)
84	Svay Kaang (R)	Anlong Vil	Sangkae	472	1861	964	1520	786						No people lived there (Existing road)
Total				**21688**	**102881**	**53376**	**68059**	**35182**	**3993**	**18.41**	**734**	**3284**	**18.38**	

5.2.2.3 People impacted by the project

This section is detail studied on social impact that conducted separetly by the working group-B. They had studied detail on resolution on affected people and planning preparated for resettlement site of NR5 improvement project from Thlea ma' am to Battambang and further from Sri Sophorn to Poipet. Based on relocation site map showed that the affected people both sides from the central line of road is 20m (from 0-20m) and as well as the affected people that they are living on Pursat by-pass. Total affected people is 1,860 families, among of these there are 1,636 families affected by road enlarging and there are 224 families affected by the Pursat by-pass (see detail in resettlement plan project). Among of 1,860 families there are 312 families equal 16.8% are landless, head families are vuinerable people (old people, unable for work, widow, poor people which they cannot earn for 20$/month).

Table 5-23 (A): Total No. of families impacted by the project, studied from September to January 2014

Province	District	Affected Households by section	Affected Households by pass (in Pursat)	Remarks
PST	Krakor	29		Vulnerable 5 HHs
	Pursat City	37	175	Vulnerable 47 HHs
	Kandieng		49	Vulnerable 18 HHs
	Bakan	722		Vulnerable 128 HHs
BTB	Moung Reussei	633		Vulnerable 90 HHs
	Sangke	215		Vulnerable 24 HHs
Total		**1636**	**224**	**312 HHs**

Note: Data provided by the working group-B for impact resolution. PST: Pursat, BTB: Battambang

Moreover, this project is affected on people's households and immovable property which they are living on the reserver land as showed in the table below:

Table 5-23 (B): Total No. of HHs and immovable property impacted by the project, studied from September to January 2014

Province	District	AHs According to Type of Structure					
		House	House-Shop	Shop/ Restaurant	Shelter	Other Structures	Total
BTB	Moung Reussei	104	70	2	242	64	482
	Sangke	23	40	1	101	12	177
	Subtotal (BTB)	**127**	**110**	**3**	**343**	**76**	**659**
PST	Bakan	148	81	4	299	53	585
	Krakor	6	2	0	15	0	23
	Pursat	10	2	0	16	5	33
	Subtotal (PST)	**164**	**85**	**4**	**330**	**58**	**641**
PSBP	Kandieng	7	0	0	2	0	9
	Pursat	9	0	1	1	3	14
	Subtotal (PSBP)	**16**	**0**	**1**	**3**	**3**	**23**
Total Thlea Maám-BB		**307**	**195**	**8**	**676**	**137**	**1323**

Note: PST: Pursat, BTB: Battambang, PSBP: Pursat by-pass, affected to socio-trees people's are 4,817, among of these there were 612 affected trees on bypass.

5.2.2.4 Impact on public infrastructures

Based on resettlement plan shows that there are Pagoda gate, School gate and Administration Office of public institution affected by the project need to do compensation according to the value of market studied as the private fence and gate inserted into the affected list by the project (detail in annex-6 of resettlement plan). Table below is shown impact on public Structure by the project:

Table 5-24 (A): Public Structures Affected

Items	Unit	Quantity	Unit Rate (USD)	Amount (USD)
2G) Construction roofing Zinc/Ferrocement, on the groud with platform or wood, wooden column, Zinc wall or Ferrocement)	m^2			0.00
2I) Construction roofing Zinc/Ferrocement, on the groud with platform or wood, wooden or concrete column, wooden wall)	m^2	0.50		0.50
2J) Construction roofing Zinc/Ferrocement, on the groud with platform or wood, wooden or concrete column, brick wall)	m^2	278.50	54.56	333.06
3C) Construction roofing tile, on the ground with plafform/concrete, brick wall)	m^2	71.59	100.64	172.23
S3) Roof/curtain make from Zinc or Ferrocement and do not have platform/iron/concrete	m^2		52.08	52.08
S4) Roof/curtain make from Zinc or Ferrocement and have platform/iron/concrete	m^2	66.95		66.95
Total		**417.54**	**207.28**	**624.82**

Source: Study team (B), Survey and Resettlement plan project (studied date from September 2013 to January 2014)

Table 5-24 (B): Immobility Public Structures Affected

Items	Unit	Quantity	Unit Rate (USD)	Amount (USD)
Concrete Well	set	1		1.00
Pump Well	set	1		1.00
Cement Mortar	m^2	350.30		350.30
Separated Toilet	set		1	1.00
FENCE&GATEWAY				
Concrete post with wire	lm	93.00		93.00
Brick Wall, 100mm	lm	816.00		816.00
Brick Wall, 200mm	lm	46.00		46.00
Pagoda gate (3.8m x 7.8m)	set	11		11.00
Gate of public service office (Normal)	set	8		8.00
Total		**1326.3**	**1**	**1327.3**

Source: Study team (B), Survey and Resettlement plan project (studied date from September 2013 to January 2014)

Table 5-24 (C): Public Trees Affected

Items	Unit	Quantity	Unit Rate (USD)	Amount (USD)
Coconut	tree		5.00	5.00
Jack Fruit	tree		1.00	1.00
Teuk Dos	tree	1.00		1.00
Acacia/Eucalyptus	tree	784.00		784.00
Mango	tree	8.00	12.00	20.00
Other	tree	1.00		1.00
Total		**794**	**18**	**812**

Source: Study team (B), Survey and Resettlement plan project (studied date from September 2013 to January 2014)

5.2.3 Socio-Economic condition of the People living along the NR5 (Thlea Ma' am-Battambang)

5.2.3.1 Career and Main Occupations People's living along NR5 (from Thlea Ma' am to Battambang)

It was classified into two main parts for career and occupations in/around the project area: (A) the people living on both sides of the road, and (B) people (fishermen) living along the Pursat River, from Damnak Ampil to Charek.

A. Career and Occupation of people living along road

Working team directly interviewed with local authority levels as communes, villages; public consultation meeting and interview were done with household head living along the road, in and around project area. As the result, the main occupations of interviewed people were farmers, business, government officers, staffs of private company, and other careers.

Agricultural employment was the main occupation of Khmer people in whole country with more than 80 percent. However, according to consultation meeting with local authority as communes and villages levels along the road, along the project area it indicated that most of farmers were able to farm only one time in season because of many impossible factors as the following:

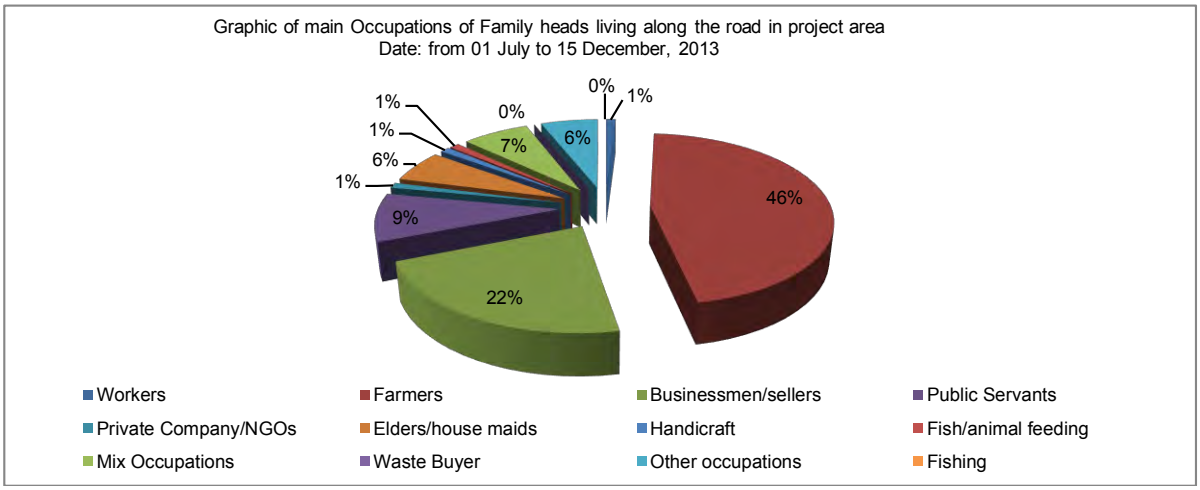
- Lack of water and irrigation system;
- Rice product/yield was small amount;
- Price of unhusked rice was cheap after harvested;
- Price of fertilizers was highly increased;
- Drought at the beginning of season and insects.
- Some farmers kept farmland abandoned or rent, and migrated to work as workers in neighbor countries because they think that working as workers will receive wage more than farming.

Note: *There are some people living along the road had cultivated rice 3 times per years such as: Svay Daun Keo village,Svay Sar village, Nikum Leu village, Svay Daun Koe commune and Thnol Baot village, Russei Kraing commune in between (PK-218 to PK-223).*

The main occupations of the household head interviewing were farmers with 368 families (46%), workers 11 families (1%), Sellers159 families (22%), Government officers 68 families (9%), Private company staffs 8 families (1%), Old people/wifehouse 43 families (6%), handicraft 4 families (1%), Raising fish 4 families (1%), Craftsmen 53 families (7%), fisherman 1 family (0%), Buyer junks 2 families (0%) and others business 43 families (6%). Those main occupations are shown in the following table:

Table 5-25: Main Occupations of family living in and around the project area, field survey from July 1, 2013 to December 15, 2013

No.	# interviewed families	Total village	Total comm..	Total district	Main Occupations of family											
					Farmer	Worker	Seller	Gover. officer	Private company staff	Wife-house	Handicraft	Raising fish	Craftsman	Fisherman	Buyer junk	Other
1	734	84	23	6	338	11	159	68	8	43	4	4	53	1	2	43
%		100			46	1	22	9	1	6	1	1	7	0	0	6



Moreover, people living along the Pursat River in Pursat city also have another occupation as fishing which described as follows:

B. Career and Occupation of Fisherman

Working team defined 4 locations for researching on fish from Damnak Ampil damp to Chareck damp as already mentioned above.

On both sides of Pursat River, there were 67 villages of 5 Sangkats and 5 communes in Pursat city and Kandieng district. There were 1,612 fishing families of 8,831 of total families living along the Pursat River.

Working team interviewed with 223 fishermen (14.75%), see for detail in table below.

B.1 Statistics of Fishermen and Type of Fishing Instrument

Working team did collaboration with JICA Survey team to work in the villages affected by NR5rehabilitation project. Working team directly interviewed with fishermen, the village chief, commune council chief and the Fisheries Administration in Pursat; then the results of interview were showed in Table 5-24 below.

Table 5-26: Statistics of Fishermen and Number of Fishing Instrument in Pursat River from Damnak Ampil damp to Chareck damp, field study from July 07, 2013 to Dec. 25, 2013

N0.	Village	Total Family	Fisherme n Family	Number of Intervie wed Family	%	Fishing Instrument				
						Cast Net (pieces)	Gill net (set)	Landing net (pieces)	Fishing tackle	Hooks (Pieces)
Fishing Area-1										
1	Damnak Ampil (L)	181	35	5	14.29	46	19	11	34	800
2	Daob Bat (L)	255	16	2	12.50	24	4	5		
3	Wat Loung (L)	235	31	3	9.68	38	7			300
4	PHSA Leu (L)	105	19	4	21.05	23	4			
5	Kdei Khvav (R)	208	32	10	31.25	45	10	4		
6	Svay Meas (R)	124	37	6	16.22	41	8			350
Fishing Area-2										
7	Koh (L)	219	17	4	23.53	25	6			400
8	Rolok Sar (L)	107	25	5	20.00	52	17	2		250
9	Prek Sdei (L)	257	37	4	10.81	43	8			
10	Po Takouy (L)	297	13	2	15.38	16	4			
11	O-Taung (R)	186	22	2	9.09	29	5			200
12	O-Leav (R)	105	32	3	9.38	37	4			500
13	Prek Tnaot (R)	182	15	7	46.67	39	7	3		
14	Soriya Leu (R)	74	15	2	13.33	19	5			300
15	Soriya Krom (R)	89	18	2	11.11	27	8			
16	Tnaol Japon (R)	209	19	2	10.53	24	6			
17	Spean Thmor (R)	203	18	2	11.11	21	5			
Fishing Area-3										
18	Kbal Hong (L)	150	16	2	12.50	19	7	5		
19	Veal (L)	129	21	3	14.29	29	6	4		
20	Po Kambor (L)	147	12	2	16.67	18	8	4		
21	Po Damnak (L)	160	23	3	13.04	32	6	5		
22	Kannheu Beidach (L)	91	14	2	14.29	18	4	2		
23	Boeung Year (L)	110	27	3	11.11	34	5	3		
24	Ta Sdei (L)	85	17	2	11.76	23	6	2		
25	Po Vong (L)	68	18	2	11.11	25	8	3		
26	Svay Chan (L)	93	13	2	15.38	17	6	3		
27	Spean Thmor (R)	95	14	2	14.29	19	0	0		
28	Doung Chrum (R)	135	22	3	13.64	29	6	0		
29	Pralay Thom (R)	100	17	2	11.76	23	0	0		
30	Bat Rotes (R)	207	23	3	13.04	24	2	0		
31	Banteay Dei Leu)R)	163	26	3	11.54	29	8	0		
32	Banteay Dei Krom)R)	118	17	2	11.76	23	4	5		
33	Islam)R)	706	15	2	13.33	27	8	6		50
34	Bandos Sandek)R)	120	25	3	12.00	29	0	0		
35	Kbal Hong)R)	95	29	3	10.34	38	8	0		
36	Keo Sovan Leuv)R)	115	35	4	11.43	47	12	0		
37	Keo Sovan Krom)R)	71	13	2	15.38	16	0	0		
38	O-Bakrong Leu)R)	60	38	5	13.16	54	6	2		
39	O-Bakrong Kandal)R)	63	23	3	13.04	29	4	2		

N0.	Village	Total Family	Fisherme n Family	Number of Intervie wed Family	%	Fishing Instrument				
						Cast Net (pieces)	Gill net (set)	Landing net (pieces)	Fishing tackle	Hooks (Pieces)
40	O-Bakrong Krom)R)	115	32	4	12.50	38	6	3		
41	O-Bakrong	64	16	2	12.50	21	0	3		
42	Wat Po-1)R)	77	21	4	19.05	29	0	4		
43	Wat Po-2)R)	51	16	2	12.50	19	0	3		
44	Kancheu Beidach)R)	62	19	2	10.53	26	0	2		
45	Kampong Krabei)R)	55	18	2	11.11	27	6	5		
Fishing Area-4										
46	Svay Loung (L)	60	12	2	16.67	19	5	3		
47	Rong Machine (L)	82	27	3	11.11	35	7	0		
48	Boeung Kranh (L)	123	34	8	23.53	46	5	2		
49	Kandieng (L)	70	15	3	20.00	18	4	0		
50	Sathany (L)	102	43	5	11.63	49	14	0		600
51	Yous (L)	66	23	3	13.04	51	18	0		
52	Prek Kdei Leu (L)	41	21	2	9.52	29	6	0		400
53	Prek Kdei Kandal (L)	50	14	2	14.29	17	4	0		
54	Prek Kdei Krom (L)	96	17	4	23.53	22	5	0		
55	Kampong Krasaing Leu (L)	74	16	7	43.75	21	4	3		
56	Kampong Krasaing Krom (L)	100	19	8	42.11	26	5	3		
57	Boeung Chhuk (L)	162	28	3	10.71	35	16	3		
58	Kampong Sambour (L)	84	31	4	12.90	53	15	3		
59	Chareuk (L)	43	19	2	10.53	27	8	10	19	8
60	Phlaov Kampong Krabei (R)	48	15	2	13.33	21	4	3		
61	Along Vil (R)	58	16	2	12.50	28	6	0		
62	Prek Takong (R)	60	31	3	9.68	43	8	0		
63	Koh Krasaing)R)	69	17	6	35.29	24	0	2		
64	Chey Chumnash (R)	449	47	5	10.64	56	24	0		
65	Kbal Romeas (R)	219	31	4	12.90	42	8	3		
66	Prek Chheutrav (R)	129	25	3	12.00	35	6	4		
67	Boeung Chhuk (R)	105	30	3	10.00	45	9	5		
Total		**8831**	**1512**	**223**	**14.75**	**3152**	**434**	**135**	**53**	**4158**

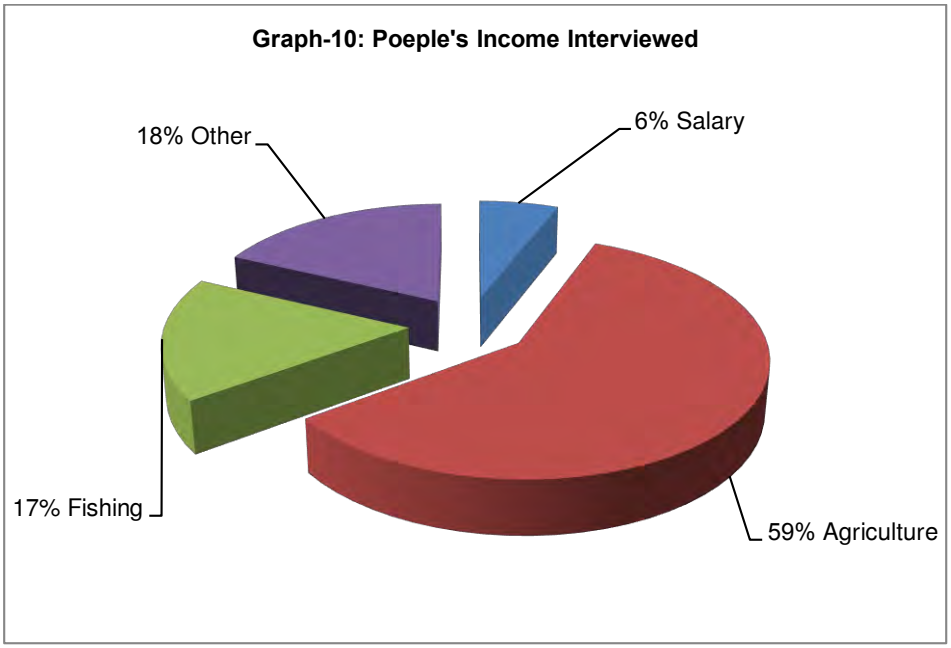
Source: Statistic of interview with the vice- chief of village and chief of commune/Sangkat, data recorder and fishermen, 2013. These Fishing instruments in the above table, its are total fishing instruments that the local people used in the village. These fishing instruments are not use in the fishing area for this study. R: Right, L: Left of Pursat River follow direction of water.

B.2 Incomes

There were 223 families, living along the Purtsat River, which interviewed for their income sources; however, working team found out 28 families of them were fishermen, then the result of fishing income for 223 fishing families showed in the table below:

Table 5-27: Income sources of 223 families working as farmers and fishermen interviewed during field survey from July 07, 2013 to Decemebr 25 2013

Number of Respondents	Income Sources									
223 families	Salary	%	Agriculture	%	Fishing	%	Other Income	%	Total Income	%
	73920000 (18480)	6	783405000 (195851.25)	59	229490000 (57372.50)	17	232030000 (58007.50)	18	1318845000 (329711.25)	100



Referring to table and graphic above, it indicated that 223 families interviewed, 28 families are fishermen, 18 families. It was 18 families and farmers were 177 families, that they were able to earn Riels 73,920,000 or US$18,480 per year, equaling to 6%. For other income sources as agriculture with 59%, it was Riels783,405,000 or US$195,851.25 per year, while Riels 229,490.00 or US$57,372.50 per year was from fihsing (17%). However, other 18% that their imcomes were Riels232,030.00 or US$48,007.00 from different sources such as selling labor on rice field, harvesting corn, rice mill worker, driver for transporting rice, motorbike driver, construction worker/carpenter, motorbike repairer, jeweler...etc. Anyway, the lowest income was US$ 40/month/family and the highest income was US$459/month/family. In average income, it was US$123/month/family or US$1,476/year/family. Moreover, there were 64 families or 28.70% earning only US$ 20/month/family, while 159 families or 71.30% were able to earn over US$21/month/family. In conclusion, source of the highest income was from agriculture with 59%.The last income source was from salary with 6% only.

B.3 Fish Catchment

According to field working and interviewed of working with fishermen by participating from representative of involvement villages in first fishing location (from Bridge of Damnak Ampil dam to Svay Meas village), there were 6 villages, in Second fishing location (from Koh village to Spean Thmor), there were 11 villages,the third location were 28 villages (from Bridge of Damnak Ampil dam to Kampong Krobei village) and the fourth it was 22 villages (from Svaylourng to Boeung Chhuk).

Based on study of fishing yield per yearin the project study area, it mentioned that the average fish yield in Pursat River was higher than other area; it is first location was 8,752Kg, after then it is fourth location was 3,645Kg, after then it is third location was 1,666Kg and the average fish yield per year was low than the second location was 1,535Kg/season. The reasons of that all fish can migrate to spillway and they found the way for migration to upstream and ‘whirlpool in the location. Fishing gears which fishermen used for fishing such as Gill net was 25%, fishing net was 21%, Landing net was 17%, fishing tackle was 12% and hook was 5%. For the fish yield in the fishing area shown in the table below:

Table 5-28 (A): Fish Yield in Pursat River of 4 locations studied in wet season (from 7 July to 7 August 2013)

1st fishing location		2nd fishing location		3rd fishing location		4th fishing location		**Total fish yield**	
Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
3212	**53**	**545**	**13**	**121**	**14**	**545**	**23**	**4424**	**100**

Table 5-28 (B): Fish Yield in Pursat River of 4 locations studied in dry season (from 25 November to 25 December 2013)

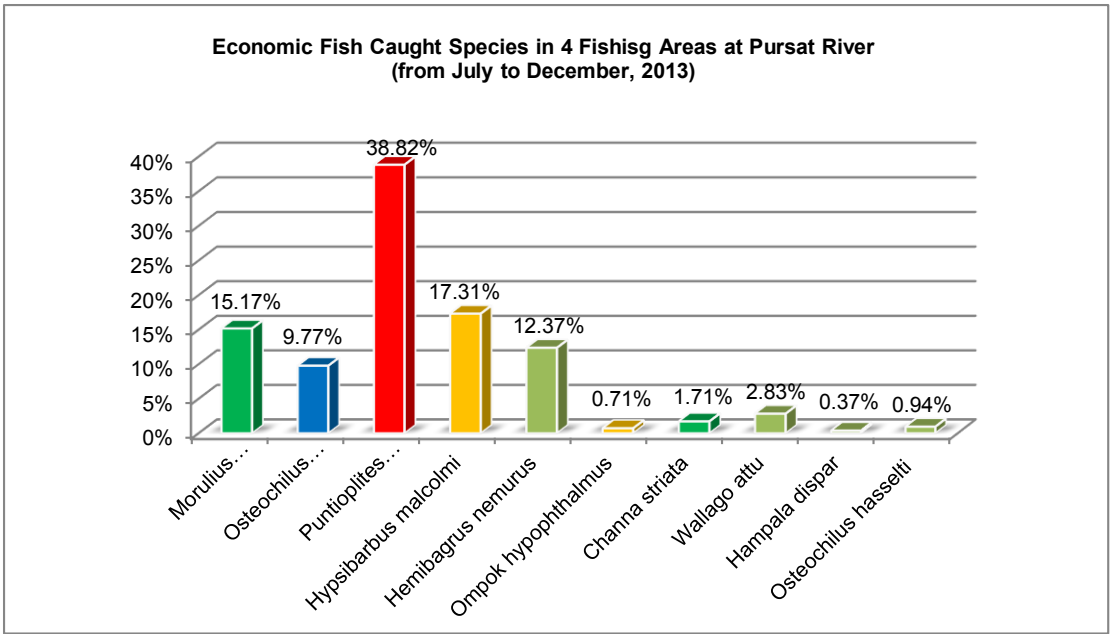
1st fishing location		2nd fishing location		3rd fishing location		4th fishing location		**Total fish yield**	
Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
6435	**85**	**990**	**9**	**1035**	**9**	**2700**	**24**	**11160**	**100**

Table 5-28 (C): Fish Yield in Pursat River of 4 locations studied per year (from 7 July to 25 December 2013)

1st fishing location		2nd fishing location		3rd fishing location		4th fishing location		Total fish yield	
Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
8752	**56**	**1535**	**10**	**1666**	**11**	**3645**	**23**	**15598**	**100**

Table 5-28 (D): Fish yield in Pursat River base on type of fish of location studied (from 7 July to 25 Dec. 2013)

Micronema bleekeri	*Morulius chrysophekadion*	*Osteochilus melanopleurus*	*Puntioplites proctozysron*	*Hypsibarbus malcolmi*	*Hemibagrus spilopterus*	*Ompok hypophthalmus*	*Channa striata*	*Wallago attu*	*Hampala dispar*
0.94%	15.17%	9.77%	38.82%	17.31%	12,37%	0.71%	1.71%	2.83%	0.37%



Note: Based on interviewed with Fishemen shown that the reason of catch fish yield decreases because there is a lot of illegal fishing such as the use of shock devices and Uy device (use mosquito nets to make pipe); these illegal fishing were from local police and high level of government officer standing behind. Farmers also used some pesticides and other chemical substances to kill insects, crabs, and grass in order to increase their rice yields. On the other hand, there are some factors caused by the construction of hydraulic structures as Charect damp and Khbal Hong damp in Pursat city that is the big barrier for fish migration to upstream in Pursat River. However, Tilapia is not the domestic fish species; however, this new species was running away from aquacultures into this River.



Main occupations of interviewed family head in and around project area

5.2.3.2 Career and Second occupation

Besides of the main occupation of the family heads, they also had another second occupation such as worker at the border of Cambodia- Thailand (harvesting corn, planting cassava, construction worker…), Sweden agriculture, raising chicken, duck, pig, cow… etc., these were the second occupations in order to get more income to support their family.

5.2.3.3 Income of People in Project Area

A. Yearly Income of People in Project Area

Gross Domestic Product (GDP) of Cambodia in 2012 was 12,861 million dollar, and the population was 14,676,591 people according to census data in 2013 of Ministry of Planning. Thus, GDP was US$931per capita/year (Statistic al Yearbook 2012, National Institute of Statistics, Ministry of Planning, Cambodia (http/www.nis.gov.kh) (([1])International Monetary Fund. Retrieved April 18, 2012); ([2]) Departments of Economic and Social Affairs Population Division, *Population Estimates and Projections Section.* 2011 revision. United Nations Retrieved 6 June 2012)).

Moreover, according to the field survey and interview with people, the results of monthly income of each family living in and around the project area were showed in Table below::

Table 5-29: Yearly income of family head living in and around the project area, field survey from July 1, 2013 to December 15, 2013

Income of interviewed villagers in and around the project area	Number of Interviewed Families	Number of the family members	Total of family members interviewed	Number of villagers over 18 years old	Income/person/ year
$4,280,711	734	4.5	3284	2351	$1,303.51



Second occupation of Interviewedfamily head

B.Salary impcome people's in the project area comparision

Based on the analysis of monthly income of per capita in communes which lacated along both side of the road and has found that income from $45 to $99 was 11 communes in which 8 communes in Pursat such as Tnot Chum, Boeung Kantaout, Sangkat Banteay Dei, Veal, Sangkat Svay Ath, Snam Preh, Trapaing Chorng, Sangkat Roleab and 3 other communes in Battambang like: Russey Kraing, PreySvay, Kampong Preahl. The main factors of the income were in this level came from:

- Farming of agriculture were in limit
- Lacking of irrigation system
- High spending in farming of agriculture such as fertilizers, Diessel, Gasoline are all in hight cost and the product of rice could not be balanced with spending.
- The cost of rice which bouthg by middle man was so cheap as expectation costof farmer
- There were only occupation and other income of supplementary was so less.

To the average income per capita from $104 upto $240 per month.There were 5communes in Pursat such as:Sangkat Prey Nhi, Sangkat Phtes Prey, O-Tapaong, Boeung Khna and Svay Daun Keo. Ohterwise in BattamBang were 7 communes such as: Kear, Moung, Prey Touch, Kampong Preang, O-Dambang-2 and Anlong Vil. The main factors of bring to have income in level were:

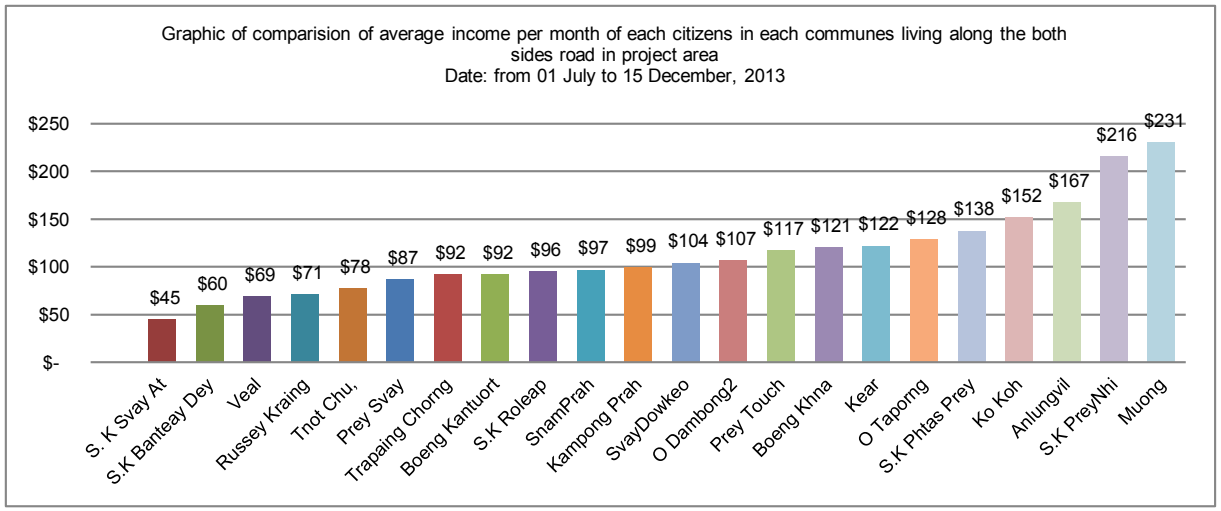
- Their supplementary occupation such as besides farming they can earn money from other sources such as fishing, growing crops, and migrated to Khmer-Thai border as workers or went to work as workers in Thailand becose they were able to earn more income.
- Anyway, they were able to sell their small production owing to it was market near their house and they were able to sell vegetation or other goods, workers and went to fishing at Riverside vegetation near Tonlesap in order to increase their daily living standard.

Note: *The income of each people per month as mentioned in table below were not the income of per capita represented to whole commune. It was average income of represented to people which living along national road No.5 setion from Thlear Ma' am to Battambang with total 23 communes, and in which 19% only living along road, Mostly high income were people living far from road.*

The comparison of income per capita in 23 communes along the road which interviewed households living along road of project area was illustrated in the table below:

Table 5-30:Comparison table of interviewed family income in the commune along the road, studied from July 01, 2013 to December 15, 2013

No.	Commune/Sangkat	# of Villages	# of interviewed families	Total income by commune	Total people	Income/ M/F)$US)	Income/capita) $US)	Remarks
1	Boeng Kantuot	2	14		56		92	PST
2	Tnoat Chhum	2	11		47		78	PST
3	Roleap Sangkat	2	24		37		96	PST
4	Prey Nhi Sangkat	3	26		107		216	PST
5	Phtaesh Prey Sangkat	2	19		90		138	PST
6	Banteay Dei Sangkat	2	7		35		60	PST
7	Veal	2	6		21		69	PST
8	Svay Ath Sangkat	1	6		30		45	PST
9	Snam Preah	7	35		158		97	PST
10	Trapeang Chong	7	56		243		92	PST
11	Boeng Khnar	5	49		213		121	PST
12	Ou Tapoang	2	17		71		128	PST
13	Svay Doun Kaev	3	32		152		104	PST
14	Ruessei Krang	2	43		208		71	BTB
15	Prey Svay	4	55		243		87	BTB
16	Kear	6	71		326		122	BTB
17	Moung	2	25		104		231	BTB
18	KaKaoh	1	13		63		152	BTB
19	Prey Touch	6	103		463		117	BTB
20	Kampong Preang	5	64		265		240	BTB
21	Kampong Preah	4	64		302		99	BTB
22	Ou Dambong Pir	2	3		19		107	BTB
23	Anlong Vil	2	7		31		167	BTB
	Total	**74**	**734**	**405141.1**	**3284**	**12226**	**2727**	



5.2.4 Land uses and Land occupation of the people in the COI area

According to field survey and public consultation meeting with local authorities such as provincial, district, commune, and village levels, they learnt that Right of Way of NR5 from section Thlear Ma'am to BattamBnag it was from PK 171to 282+200 is 30m from center line of bothsides with width 60m. But land acquision for rehabilitating and expanding was only 20m from the bothside of road axis and with 40m total. However, in the Corridor of Impact (COI: 20m) consisted of 307 households, 195 stalls, 8

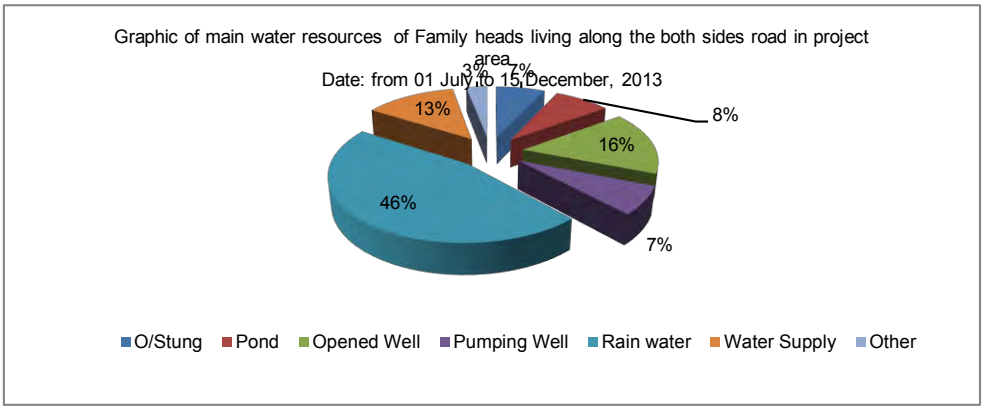
Restaurents, 676 small stalls, and 137 other constructions will be impacted by project. (Data quoted from Resettlement Plan July 2014).

5.2.5 Water supply

According to field survey, villagers living in and around the project area had different water resources for drinking, cooking, bathing, and washing in both dry and wet season. It was 7% from stream/river, 6% from lake/pond, 16% from digging well, 7% from tube well, 46% from rain water, 13% from water supply system and 3% from other sources. **Note**: For drinking water, most of villagers used water filter pot, showed below.

Table 5-31: Clean Water supply in and around the project area, studied from July 01, 2013 to December 15, 2013

No.	Number of interviewed family head	Total people from interviewed family	Total villages	Total communes	Total districts	stream / river	Lake and river	Pond, Digging well, Pool	Tube/ Pumping well	Rain water	water supply system	Others
1	734	3,284	84	23	6	7%	8%	16%	7%	46%	13%	3%



Note: each family can be used clean water from 1 to 2 or 3 sources



The main water resources of villagers in both dry and wet season

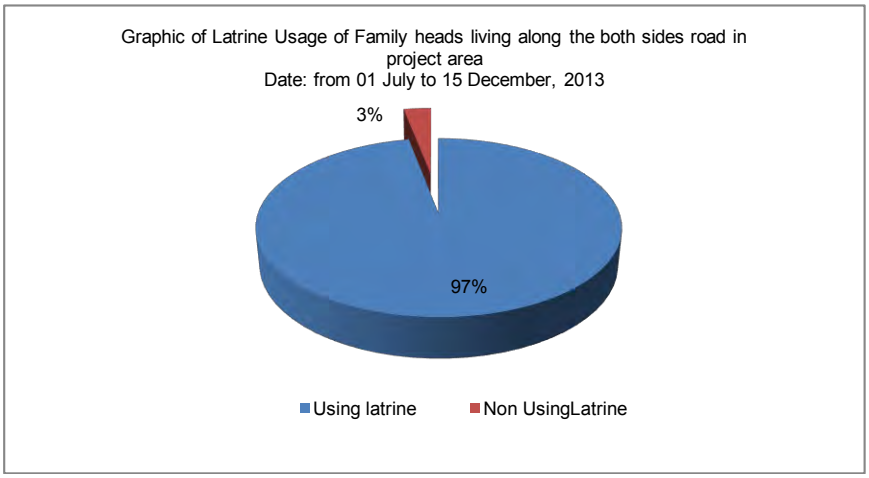
5.2.6 Sanitation

5.2.6.1 Toilet Uses

According to interview with family head of households living in and around the project area of 734 peope, it illustrated that 97% of interviewed family utilized toilet and other 3% didn't have toilets, those of them defecated by digging or at a field behind their house. The main reasons that they didn't have toilet were no money and low knowledge of hygiene, according to interview with them.

Table: 5-32: Utilization of toilet of family head in and around the project area, studied from July 01-December 15, 2013

No.	Number of interviewed family	Total number members of interviewed family	Total villages	Total Communes	Total Districts	Toilet Utilization (%)	No toilet (%)
1	734	3,284	84	23	6	97	3



5.2.6.2Solid waste collection service

Nowadays, solid waste is a big issue that the government has hightly paid attention on, especially, on waste management and collection. Anyway in the provinces which project pass though such as Pursat and BattamBang, the solid waste collection service was available in Pursat and BattamBang Towns only but it was not covered all in the towns.

Furthermore, villagers living at rural area which was far away from the collection point and collection area burned waste in front, back or free land next to their houses. For organic waste, some households transported these wastes to make compost fertilizer at their rice field



Solid waste collected to keep in dustbin and burned by villagers next to their house

A.Methodology of solid waste study

Working team decided to study on solid waste along the roadside, the selected sample were not over 10 locations. Moreover, working team divided dumpsite/landfill into two species: dumpsite/landfill with license (legal) and dumpsite/landfill without license (illegal). The legal dump side (with license) is a place allowed by Provincial Authority and managed by private company. Illegal dump side (without license) is a place that villagers send the waste to there without any authority permissions.

For the methodology of solid waste analysis at legal dump side, the survey team analyzed the waste at the dump site in Pursat and BattamBang towns. Therefore, at illegal dump site, the survey team analyzed the waste along the NR5 by choosing the pile of garbages was over 1 cube meter with 8 points.

The ways of solid waste survey are:

- First, the team chose 3 samples of a selected point in order to analyze. The size of each sample was 20cm^3 which was chosen by random.
- Then, each sample was divided into different waste species such as hazardous waste and non-hazardous waste (plastic, piece of broken glass, metal and putrid waste).
- After separating wastes by its type, survey team weighted them.
- However, the survey team picked up solid waste with volume 1m^3 or more than this from illegal dumpsite/landfill, including waste along the National Road No.5.



The picture of instrument for waste study

B.Legal Waste

Waste collection service in Pursat province is managed by private firm which is in possession of **Mrs. Pov Shitha**, contact number: (097) 611 1188. The coverage area of waste collection is from fork way of Leach to Mloup Svay Restaurant. There were 3 trucks transported waste, two big trucks (1.97m width x 3.6m length with 1.3m height) and another small truck (1.75m width x 2.8m length with1 m height). For collection service, trucks can deliver the waste 3 times per day which it loaded 25 tons of waste per time to dispose. So, there were 75 tons of wastes in total collected to dispose at dump side per day. It was 2,000 families (14%) only in some of Sangkats of Pursat Towm (the total pupolation in Pursat Town is 14,227 Families, data provided by Pursat Town Hall, 2013) that received garbage collection service, excepted two Sangkats only that are not received garbage collection service: (1) Sangkat Svay Aat, and (2) Sangkat Chamroeun Phal. The location of town dumpsite/landfill was between Kilometers Post (KP): 177-178 at the right side (direction from Phnom Penh to Battambang province). It turned at the gateway of **Koe Moni Odoum** pagoda; it was about 2km away from NR5 to the dumpsite/landfill, the area of dumpsite/landfill was 4 hectares, it belongs to company. The dumpsite/landfill surrounded by rice fields, no residential area; but some huts of waste collectors settled around this dumpsite/landfill.

Table-5.33 (A): Garbage Tariff services in Pursat Town

No.	Type of Building	Cost in Riels
1	Flat house E_0	4,000
2	Flat house E_1, E_2, E_3	3,000
3	Plot house	5,000
4	Exploitation flat house	5,000
5	Exploitation flat house (> two flats)	8,000
6	Motorbike-vehicle washing place	10,000
7	Restaurant (small size)	10,000
8	Hotel and Restaurant (big size)	40,000

9	Guesthouse	10,000
10	Exploitation plot house	8,000
11	Stall fish-cheese	20,000
12	Video-film theater	15,000
13	Handicraft	15,000
14	Clinic	50,000
15	Junk shop	20,000
16	Karaoke	15,000
17	Fuel station	20,000
18	Motorbike repairing stall	5,000
19	Garage vehicles	10,000
20	Metal- wooden handicrafts	10,000
21	Construction materials shop	20,000
22	Copy-printing documentation shop	10,000
23	Sand-gravel shop	10,000
24	Killing place (cow-pig)	20,000
25	Cloth tailor- hair cut stalls	5,000
26	Garbage collected bin (small size)	15,000
27	Garbage collected bin (big size)	40,000
28	Daily selling places along the road	100
29	Daily selling place outside the market	100

Source: data obtained from garbage Collection Company in Pursat Town

According to the waste study at dumpsite/landfill in Pursat province, it illustrated that 1 m³.of waste volume contained 309 Kg with different wastes, among of this waste there is hazardous waste such as (rubber shoes, old motorbike tires, batteries, medical bottles, syringes and needles, and lamps) it weighs is 33kg; putrid waste had consisting different species of waste (vegetable, paper, banana leaves, fruit peel, coconut peel, and sugar cane waste) it weighs is 141kg; plastic waste such as (plastic bag, plastic package of cakes and plastic drinking flexible straws...etc.) it weighs is 105kg; and other wastes such as (broken glass and bottles/particle mental wastes) it weighs is 30kg. (detail in table 5-34 (A) below:



The picture of consulting meeting with **Ms. Pov Shitha**, the Chief of Contractor Company for collecting cleaning and transporting solid waste from Pursat city



Landfill/dumpsite in Pursat Province







Company´s waste trucks in Pursat Provine

In Battambang province, CINTRI Company is the contractor for solid waste collection service. The boundary of waste collection area is from Anlong Vil commune in Sangkae district to Battambang city. There are 10 Sangkats in Battambang city. However, it is only 7 Sangkats receiving the waste collection service at the moment. The others 3 Sangkats were in the suburb area, thus the collection service was not access to there. Moreover, the company collects the waste without charge for waste in public place of city. The company has 6 waste trucks, five trucks with 4-ton load and other two trucks were 3.5-ton load and a bulldozer. There were 80 tons of wastes collected by CITRI to dispose at dumpsite per day. It is 60% of people in Battambang city that have received the waste collection service. The location of landfill/dumpsite of CINTRI Company is in Andong Buon village, Slakeat commune, Aek Phnum district, Battambang province. The area of landfill/dumpsite is about 8hectares, located 5Km away from provincial town. There was no residential area around the landfill/dumpsite, it was only rice fields. However, there was a NGO, called CAMPED (Cambodia Education and Waste Management Organization) has been managing one hectare of land next to this landfill/dumpsite. The CINTRI Company is responsible for collecting only kitchen waste; therefore, the company has cooperated with COMPED in order to make the organic waste into compost.

Table-5.33 (B): Garbage Tariff services in Battambang Town

No.	Type of Building	Cost in USD
A-Flat house		
1	Flat house E_0	1
2	Flat house from E_1 and upper	0.5
B-Exploitation flat house		
3	Exploitation flat house E_0	2
4	Exploitation flat house (> two flats)	5
5	Exploitation flat house as Company	10
6	Plot house	5
7	Plot house and rented to Foreigner	10
C-Restaurant		
8	Restaurant	20
9	Karaoke	20
10	Food stall	10
11	Cinema	10
12	Handicraft	10
13	Fuel station	10
14	Motorbike-vehicle washing place	10
15	Motorbike washing place	5
16	Vehicle parking	20
17	Vehicle parking of Company	20
D-Hotel		
18	Hotel less than 30 rooms	20
19	Hotel more than 30 rooms	50
20	Guesthouse less than 20 rooms	10
21	Guesthouse more than 20 rooms	20
22	Administration building	1
23	Government School	1
24	Private School	10
25	Private Clinic	10
26	Private Bank	10
27	National Bank	1
28	Commercial Company promotion (1 night)	30

Source: data obtained from the provincial cabinet in Battambang Town

Due to the study at landfill/dumpsite in Battambang province, there were 333 Kg for $1m^3$ of waste volume in average, among of this is consisting putrid wastes (vegetable, paper, banana leaves, fruit peel, coconut peel, and sugar cane waste) it weighs is 303kg; ; plastic waste (plastic bag, plastic packages of cake and plastic drinking flexible straw, etc.) it weighs is 23Kg; other waste such as (broken glass and bottle/particle mental wastes and broken plate/ceramic) it weighs is 7kg. (detail in table neow).

In conclusion, the wastes in average for $1m^3$ of volume in both Pursat and Battambang cities are 321kg by including 17kg of hazardous wastes, 222kg of putrid waste, 64kg of plastic waste, and 18kg of other waste such as (broken plate/ceramic/glass wastes, particle metal waste. Most of wastes in both Cities are putrid wastes and then plastic waste is the second one. Plastic wastes such plastic bag, plastic packages of cake and plastic drinking flexible straw...etc. were found in the landfills/dumpsite. However,

plastic bottles such as pure water bottles did not find because it was already collected by waste collectors to recycle or to sell at junk shop. Furthermore, for glass bottles watses as well as it found that only pieces of broken glass bottle, ceramic plate wastes presented in the landfill/dumpsite of these Cities. But the glass bottles with original shape have not seen at the area because they have already been collected by waste collectors. ***Note:*** In the dumpsite, there are many many waste buyers and collectors living in the landfill/dumpsite; they were waiting for the waste trucks in order to collect the recyclable wastes. Some hazardous wastes did not see in the landfill/dumpsite such as aluminum cans, electrical wire and other hazardous waste such as batteries, tires wastes there is no in the dumping site because these wastes can be done recycle by the buyer. So, there were most of putrid wastes found in the landfill/dumpsites.

Table 5-34 (A): Quantity of wastes at legal landfill/dumpsite, Studied from 01/07 to 10/08/2013

No.	Number of Kilometer Post	Direction from Phnom Penh to Battambang	GPS	Waste sampling weigh of $20cm^3$ (Kg)	Hazardous waste of $20cm^3$ (Kg)	Putrid waste of $20cm^3$ (Kg)	Plastic waste of $20cm^3$ (Kg)	Glass/metal/ plate/ceramic wastes of $20cm^3$ (Kg)
Pursat Province								
1	177-178	Right Side	X: 389509	6.00	0.50	2.50	2.00	1.00
1	177-178	Right Side	Y:1385793	6.50	1.20	2.90	2.30	0.10
1	177-178	Right Side		6.00	0.25	3.05	2.00	0.70
			Average volume of wastes	**6.17**	**0.65**	**2.82**	**2.10**	**0.60**
			$1m^3$ of volume waste	**309**	**33**	**141**	**105**	**30**
Battambang Province								
2		Right Side	X: 303734	7.00	0.00	6.00	1.00	0.00
2		Right Side	Y:1452884	6.00	0.00	5.30	0.30	0.40
2		Right Side		7.00	0.00	6.90	0.10	0.00
			Average volume of wastes	**6.67**	**0.00**	**6.07**	**0.47**	**0.13**
			$1m^3$ of volume waste	**333**	**0**	**303**	**23**	**7**
			1 m^3 of average volume of wastes	**321**	**17**	**222**	**64**	**18**



Landfill/dumpsite in Battambang province




Waste trucks of CINTRI Company in Battambang Province

C. Illegal Wastes

The working team chose 8 places of illegal wastes in order to study for analysis. The targeted locations of study were shown below:

- Targeted location No.1: it located in Andoung Sanbuor village, Snam Preah commune, Bakan district, Pursat province, sample volume of waste was 2m³.
- Targeted location No.2: it located in Ou Ta Paong village, Ou Ta Paong commune, Bakan district, Pursat Province sample volume of waste was 5 m³.
- Targeted location No.3: it located in Ou Daum village, Ou Ta Paong commune, Bakan district, Pursat Province, sample volume of waste was 3m³.
- Targeted location No.4: it located in Ou Ta Paong village, Ou Ta Paong commune, Bakan district, Pursat Province, sample volume of waste was 6m³.
- Targeted location No.5: it located in Ou Ta Paong village, Ou Ta Paong commune, Bakan district, Pursat Province, sample volume of waste was 5m³.
- Targeted location No.6: is located in Prey Svay village, Prey Svay commune, Moung Russei district, Battambang Province consisting 4 m³.
- Targeted location No.7: is located in Os Tuk village, Kampong Preang commune, Sangkae district, Battambang Province, sample volume of waste was 3 m³.
- Targeted location No.8: is located in Pou Pir village, Kear commune, Moung Russei district, Battambang Province, sample volume of waste was 4 m³.

Illegal waste disposal is the result of villagers' activities, because they live in the area without waste collection service. So, they disposed the waste along the road. Every half or a month in the dry, villagers collected wastes to burn and burry for some wastes which is not able to be burn. In wet season, the wastes were difficult to burn because the wastes were wet. Some kinds of waste such as aluminum cans, plastic bottles, hard rubbers, papers, metals, glass bottles, batteries, electrical wire, copper pots and aluminum pots were sold to waste buyers/junk shop.

In short, 1m³ in average volume of wastes of 8 targeted locations was 305Kg in total, among of this composing 7kg (2%) of hazardous wastes (electronic tools, lumps, shoes make from tires and medicine waste); 159kg (53%) of putrid waste (coconut peel, vegetable, fruit, leaf, paper, fruits peel); 83kg (27%) of plastic wastes (plastic bag, plastic packages of cake, plastic drinking flexible straw); 56kg (18%) other wastes such as (broken glass and bottle/particle mental wastes and broken plate/ceramic).

Table: 5-34 (B): Quantity of waste at the illegal landfill/dumpsite, Studied from 01/07 to 10/08/2013

No.	Number of Kilometer Post	Direction from Phnom Penh to Battambang	GPS	Wate sampling weigh of $20cm^3$ (Kg)	Hazardous waste of $20cm^3$ (Kg)	Putrid waste of $20cm^3$ (Kg)	Plastic waste of $20cm^3$ (Kg)	Glass/metal/ plate/ceramic wastes of $20cm^3$ (Kg)
1	194-195	Right Side	X: 375263	5	0	4	1	0
1	194-195	Right Side	Y: 1388949	7	0.1	4.5	2	0.4
1	194-195	Right Side		7	0	4.9	2	0.1
Number of average sample				**6.33**	**0.03**	**4.47**	**6.34**	**0.03**
Number of sample in $1m^3$				**319**	**2**	**224**	**84**	**9**
2	215-216	Right Side	X: 356588	5.5	0	3.2	2	0.3
2	215-216	Right Side	Y: 1399383	5	0.3	3.7	1	0
2	215-216	Right Side		6	0.3	3.2	1.5	1
Average volume of wastes				**5.50**	**0.20**	**3.37**	**5.5**	**0.2**
Waste volume in $1m^3$				**276**	**10**	**169**	**75**	**22**
3	214-215	Left Side	X: 357822	5.00	0.20	2.80	2.00	0.00
3	214-215	Left Side	Y: 1398768	6.00	0.50	2.35	2.00	1.15
3	214-215	Left Side		6.00	0.00	3.00	2.00	1.00
Average volume of wastes				**5.67**	**0.23**	**2.72**	**2.00**	**0.72**
Waste volume in $1m^3$				**284**	**12**	**136**	**100**	**36**
4	216-217	Right Side	X: 355825	6.00	0.00	0.50	2.00	3.50
4	216-217	Right Side	Y: 1399776	5.00	0.00	1.00	3.00	1.00
4	216-217	Right Side		6.00	0.00	3.50	2.00	0.50
Average volume of wastes				**5.67**	**0.00**	**1.67**	**2.33**	**1.67**
Waste volume in $1m^3$				**285**	**0**	**84**	**117**	**84**
5	216-217	Left Side	X: 355735	8.00	0.00	8.00	0.00	0.00
5	216-217	Left Side	Y: 1399799	9.00	0.00	8.90	0.10	0.00
5	216-217	Left Side		8.00	0.00	7.80	0.10	0.10
Average volume of wastes				**8.33**	**0.00**	**8.23**	**0.07**	**0.03**
Waste volume in $1m^3$				**418**	**0**	**412**	**4**	**2**
6	236-237	Right Side	X: 337571	5.00	0.00	2.00	2.00	1.00
6	236-237	Right Side	Y: 1406805	6.00	0.00	1.50	3.50	1.00
6	236-237	Right Side		5.00	0.10	2.88	2.00	0.02
Average volume of wastes				**5.33**	**0.03**	**2.13**	**2.50**	**0.67**
Waste volume in $1m^3$				**268**	**2**	**107**	**125**	**34**
7	268-269	Right Side	X: 320183	6.00	0.30	1.70	1.00	3.00
7	268-269	Right Side	Y: 1433231	6.50	0.50	1.00	1.50	3.50
7	268-269	Right Side		6.50	0.00	1.50	2.00	3.00
Average volume of wastes				**6.34**	**0.27**	**1.40**	**1.50**	**3.17**
Waste volume in $1m^3$				**318**	**14**	**70**	**75**	**159**
8	249-250	Right Side	X: 329168	6.00	0.00	2.10	1.00	2.50
8	248-249	Right Side	Y: 1416337	5.00	0.30	1.20	2.00	1.50

No.	Number of Kilometer Post	Direction from Phnom Penh to Battambang	GPS	Wate sampling weigh of $20cm^3$ (Kg)	Hazardous waste of $20cm^3$ (Kg)	Putrid waste of $20cm^3$ (Kg)	Plastic waste of $20cm^3$ (Kg)	Glass/metal/ plate/ceramic wastes of $20cm^3$ (Kg)
8	248-249	Right Side		5.50	0.50	1.00	2.00	2.00
Average volume of wastes				**5.37**	**0.27**	**1.43**	**1.67**	**2.00**
Waste volume in $1m^3$				**275**	**14**	**72**	**84**	**100**
The average volume of wastes of 8 targeted locations in $1m^3$				**305**	**7**	**159**	**83**	**56**



Study of wastes in targeted location No.1



Study of wastes intargeted location No.2



Study of wastes in targeted location No. 3



Study of wastes in targeted location No.4



Study of wastes in targeted location No.5



Study of wastes in targeted location No.6



Study of wastes in targeted location No.7



Study of wastes in targeted location No.8

5.2.6.3 Waste Buyer (Junk Shop)

Working team interviewed with 10 waste buyers (junk shops) (5 in Pursat province and 5 in Battambang province). As the result, they bought the species of non-hazardous wastes (aluminum cans, plastic bottle, rubbers, papers, metal, and glass bottles); and hazard wastes (batteries, electronic wire, copper pots, and aluminum pot). Then they sold these recyclable wastes to private company in Poi Pet. Lastly, this private company continuously transferred to Thailand and Vietnam.

Moreover, the Survey team interviewed with **Mr. Leng Phea**, junk-tire buyer. His contact number was (012) 404022, (088) 671 8188. He has bought all junk tiers in Pursat and Battambang province, then transporting them to Vietnam and Thailand. There were 3 tons of junk tires bought for only 3 days in order to transport to Vietnam. For price of junk tires, it was Rield 10,000 for a big junk tire, while Rield 5000 for small one.





Junk tires



Aluminum

cans bought by waste buyers/junk shops



Plastic bottles bought bywaste buyers/junk shops



Papers bought by waste buyers/junk shops



Metal bought by waste buyers/junk shops



Batteries bought by waste buyers/junk shops

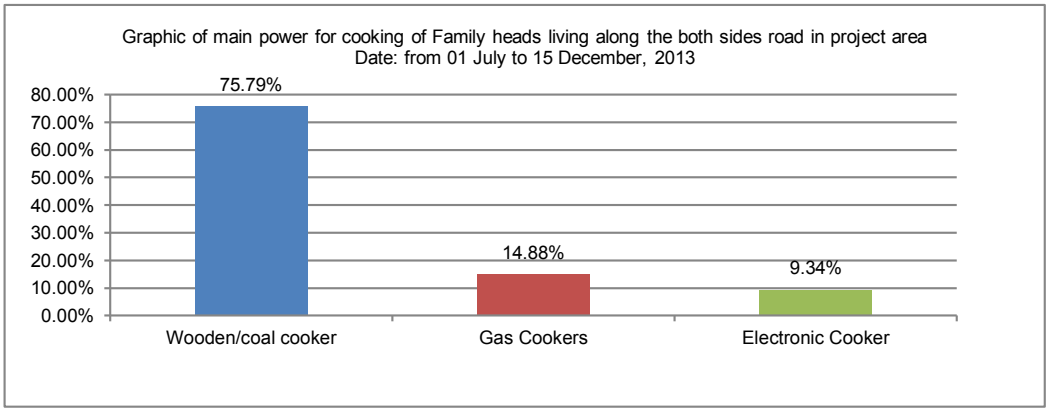
5.2.7 Usage of Energy

5.2.7.1 Energy for cooking

According to field survey and interview with family heads of households living in and around the project area, it illustrated that cooking stoves used wood and charcoal with 75.79%, gas stoves 14.88% and electrical stoves 9.34%. The species of energy used for cooking were shown in a table below:

Table 5-35: Usage of energy for cooking of family heads in and around project area, studied from July 01, 2013 to December 15, 2013

No.	Number of interviewed family	Total member of interviewed family	Total villages	Total communes	Burning wood and charcoal stoves (%)	Gas stoves (%)	Electrical stoves (%)
1	734	3,284	84	23	75.79	14.88	9.34



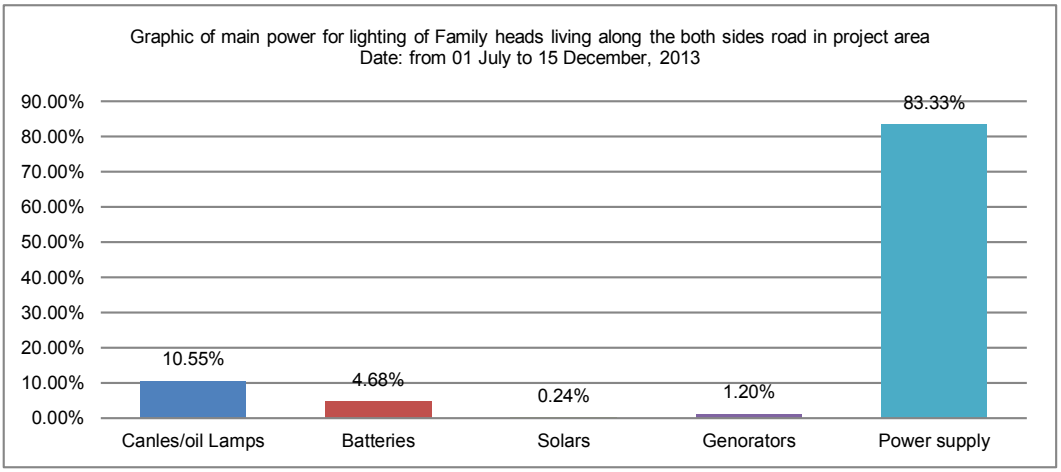
Note: A family may have one, two or three species of energy for cooking

5.2.7.2 Energy for illumination

According to interviewed with family head living in and around the project area about illumination, 10.55% of family used traditional lamps/candles for illuminations, batteries 4.68%, solar energy 0.24%, generators 1.2% and electrical network 83.33%. The type energy for illuminations showed in the table below:

Table 5-36: Energy for illuminations of family in and around the project area, studied July 01, 2013 to December 15, 2013

No.	Number of interviewed head family	Total member of interviewed family	Total village	Total commune	traditional lamp candle (%)	Batteries (%)	Solar energy (%)	Generators (%)	Electrical network (%)
1	734	3,284	84	23	10.55	4.68	0.24	1.2	83.33



Note: A family is able to use one or two power source.

5.2.8 Educational Sector and National Administration of Education

Giving all Cambodian children a chance to educate is the strategy plan of the government in order to reduce poverty and develop social economic. According to the article 65 of Cambodia Constitution, it illustrated that "the State shall protect and promote citizens' right to quality education at all levels and shall take all measures, step by step, to make quality education available to all citizens. The state shall pay attention to physical education and sports for the welfare of all Khmer citizens". It is the strategy plan of the government in order to reduce poverty and develop social economic. The government has to provide physical education for all Khmer citizens. Moreover, the state has to enhance curriculum and educational system in according the national standard and insure for freedom and educational principle. Especially, all citizens have to have equal chance to get employment and occupation.

According to interview with villagers living around and in the project area, it demonstrated that there were 641 classrooms, 24,240 students and 885 teachers in Primary School; while it was 186 classrooms with 5,988 students and 398 teachers in Secondary School. Also, there was a University with 24 classrooms, 290 students and 92 lecturers located next to the project area.

According to table below, it demonstrates that there were 734 families interviewed. The male family heads were 605 families (82.43 %) and other 93 family head were females (12.67%); they were able to read and write Khmer language (got education from grade 1 to 7). At percentage, literate family head were 95.46% in total of 84 villages. For illiterate family head, there were 24 males (3.27%) and 12 females (1.63%).

Table 5-37: Statistic of general knowledge school, students and teachers in and around the project area, studied July 01, 2013 to December 15, 2013

No.	Commune/ Sangkat	Primary School			Secondary School			High School			Remarks
		Number of Classrooms	Number of Students	Number of teacher	Number of Classrooms	Number of Students	Number of teacher	Number of Classrooms	Number of Students	Number of teacher	
1	Boeng Kantuot	21	840	22				15		64	
2	Tnoat Chum	52	2,004	50	6	265	18				
3	Roleap Sangkat	61	1,844	97	5	63	10				
4	Prey Nhi Sangkat	48	1,440	45	5	125	12				
5	Banteay Dei Sangkat	14	464	21	6	144	10				
6	Veal	25	485	20							
7	Phtaesh Prey Sangkat	55	2,243	89	55	1532	134				
8	Svay At Sangkat	6	136	11							
9	Snam Preah	68	2,990	80	10	203	18				
10	Trapeang Chong										
11	Boeng Khnar	40	1,200	55	10	300	20	5	150	15	
12	Ou Tapoang										

No.	Commune/ Sangkat	Primary School			Secondary School			High School			Remarks
		Number of Classrooms	Number of Students	Number of teacher	Number of Classrooms	Number of Students	Number of teacher	Number of Classrooms	Number of Students	Number of teacher	
13	Svay Doun Kaev	27	869	24	5	273	17				
14	Ruessei Krang	55	2,200	87	15	525					
15	Prey Svay										
16	Kear										
17	Moung	49	2,205	53	32	1120	65				
18	KaKaoh	24	1,080	54	10	350	45				
19	Prey Touch	40	1,800	57	10	400	25				
20	Kampong Preang	16	640	53	10	450		4	140	13	
21	Kampong Preah	40	1,800	67	7	238	24				
22	Ou Dambong Pir										
23	Anlong Vil										
	Total	668	25,931	929	180	5,844	388	24	290	92	



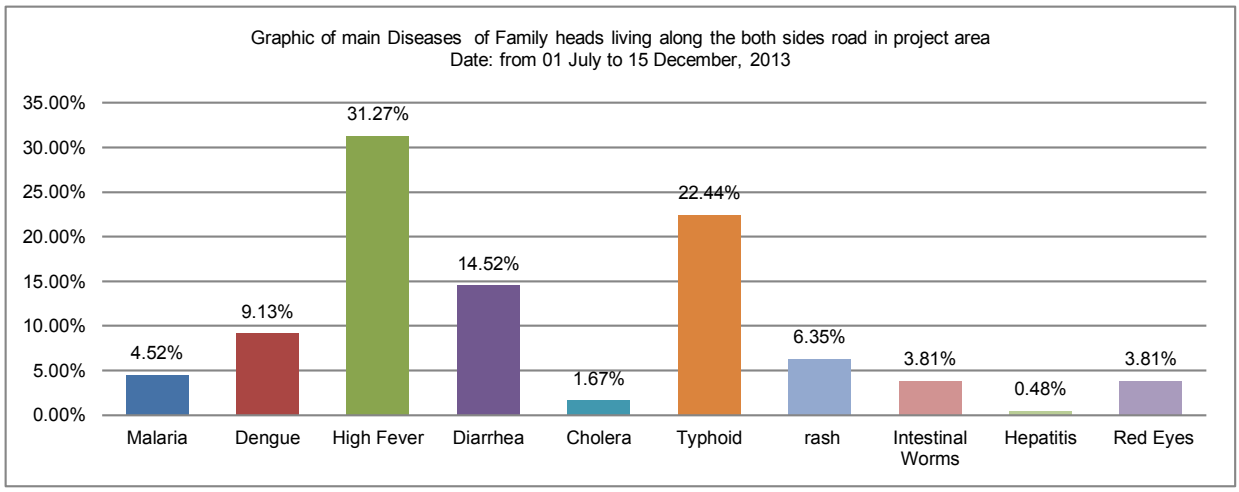
Primary and Secondary School in and around the project area

5.2.9Health and Health Conditions

According to the field survey and observation, there were provincial and district referral hospitals locating in/around the project area. Those referral hospitals had 26 buildings with 153 rooms and 88 doctors and nurses. When the villagers got serious diseases or simple diseases, they normally went to see the doctor at health center or provincial and district referral hospitals close to their houses. According to interview with family heads living both sides of the road in/around the project area with 84 villages, it showed that villagers normally got malaria 4.52%, dengue fever 9.13%, serious fever 31.27%, cholera 1.67%, diarrhea 14.52%, typhoid 22.44%, skin disease 6.35%, worms 3.81%, liver disease 0.48% and sore eyes disease 3.81%.

Table 5-38: Some diseases occurring in and by the project area, studied July 01, 2013 to December 15, 2013

No.	Number of interviewed head family	Total member of interviewed family	Total village	Total Com-mune	Malaria (%)	Dengue fever (%)	Serious fever (%)	Cholera (%)	Diarrhea (%)	Typhoid (%)	skin disease (%)	Worms disease (%)	Liver disease (%)	Sore eyes disease (%)
1	734	3,294	84	23	4.52	9.13	31.27	1.67	14.52	22.44	6.35	3.81	0.48	3.81



Note: A family is able to get over one case of diseases



Referral hospitals of Bakan District and Health Centers in Pursat province and Bakan

5.2.10 Religion and Cultural Heritages

5.2.10.1 Religion

According to the public consultation meeting with villagers and local authorities in and around the project area indicated, 98.88% of villagers were Buddhist, 1.17% of villager was Muslime and 0.03% of villager was Vietnamese. Therefore, there were 93 pagodas and 1,007 monks in total along the project area. **Note:** There were mosques or churches in some communes which project went across, but those mosques or churches located further than studied area.

Table 5-39 (A):Number of pagodas and monks in and around the project area, studied from July 01, 2013 to December 15 2013

No.	Commune/ Sangkat	Pagoda	Monk	Note
1	Boeng Kantuot	3	35	Krakor district, Pursat province
2	Tnoat Chum	6	45	Krakor district, Pursat province
3	Roleap Sangkat	8	45	Pursat city, Pursat province
4	Prey Nhi Sangkat	1	12	Pursat city, Pursat province
5	Phtaesh Prey Sangkat	1	65	Pursat city, Pursat province
6	Banteay Dei Sangkat	3	39	Pursat city, Pursat province
7	Veal			In Veal commune, there is no Pagoda
8	Svay At Sangkat	1	43	Pursat city, Pursat province

No.	Commune/ Sangkat	Pagoda	Monk	Note
9	Snam Preah	7	58	Bakan district, Pursat province
10	Trapeang Chong	7	74	Bakan district, Pursat province
11	Boeng Khnar	8	76	Bakan district, Pursat province
12	Ou Tapaong	5	40	Bakan district, Pursat province
13	Svay Doun Keo	3	47	Bakan district, Pursat province
14	Ruessei Krang	6	72	Moung Russei district, Battambang province
15	Prey Svay	4	28	Moung Russei district, Battambang province
16	Kear	7	35	Moung Russei district, Battambang province
17	Moung	5	62	Moung Russei district, Battambang province
18	KaKaoh	5	66	Moung Russei district, Battambang province
19	Prey Touch	3	35	Moung Russei district, Battambang province
20	Kampong Preang	2	17	Sangkae district, Battambang province
21	Kampong Preah	2	17	Sangkae district, Battambang province
22	Ou Dambong	4	15	Sangkae district, Battambang province
23	Anlong Vil	4	65	Sangkae district, Battambang province
	Total	**93**	**1,007**	

Note: Data obtained from Sangkat/commune, 2013



Pagodas located in project area in Pursat and Battambang Province

Table 5-39 (B):Number of Mosque and Christian in and around the project area, studied from July 01, 2013 to December 15 2013

No.	Commune Name	Mosque	# family Religion	Christian	# family Religion	Vietnam's Pagoda	# family Religion	Remarks
1	Banteay dei	2	193	1	NA			Pursat Town
2	Veal	1	60			1	7	Kandieang District
	Total	3	253	1		1	7	

Note: Data obtained from Sangkat/commune, 2013



Mosque in Veal Village

5.2.10.2 Cultural heritage

According to the field survey for project improvement of NR5, it was 15m from road axis, there is a gateway of palace of Phrea Batt Monivong, built in France colony which located in front of Bakan District and close to the NR5. It is able to be effected by this project. According to consult with **Mr. Rous Sammang**, sub director of Ministry of Culture and Art in Pursat and his colleagues on August 15, 2013 at 10:15mn, he said it is the gateway of palace of Phrea Batt Monivong, built from bricks and cements in France colony. This gateway has not been put in the Country Heritage List but it was been listed Historical Building by Ministry of Culture and Art. He suggested that the project owner should cooperate with the Ministry in order to mover the gateway to district hall and then keeps it as historical property.



The gateway of Royal Palace of Phrea Batt Monivong,

Built in France colony Regime

5.2.11 Tourism

As described abve, Pursat province located at the South West of Cambodia about 186km away from Phnom Penh capital city. There were three main transported roads crossing the province: National Road(NR5), Railway and waterway (Tonle Sab Lake). The area of this province is 12,692 square kilometers. The east border of this province is Kampong Chhnang province; while it is Battambang and Thailand at the west bounder with 80 Kilometers long, but it is Toenle Sab Lake at the North with 80 kilometers; and it is Kampong Speu and Koh Kong province at the South border. On the other hand, there are many resorts located in Pursat province such as Baktra resort, cardamom Mountains, floating houses at the Tonle Sab Lake, Kampong Luong resort, Leach village, O-dar resort, Bakla Mountain of Neakta Kleang Moeng, Phreak Steay Pagoda and Pursat River. Specially, Pursat province has good stone sculptures from natural marble. The resorts described above did not have many tourists to visit because road condition is difficult and those resorts located further from the project area. However, in the future the NR5 will become an Asean Road due to this improvement project, thus we expected that there will be a lot of international and national tourists visiting and the local people living standard will be improved as well.

However, Battambang Province is also the biggest province in Cambodia which has city called Battambang city since 11th century. This province also has enormous potential for tourism and tradesbetween Thailand and Vietnam. In the coming future, this province will become a crucial province

to increase tourism and economy contributing to enhance people living standard in the region in accord with poverty reduction policy of the government.

The conclusion of Socio-Economic condition:

After describing for detail above, it is able to be concluded as the following:

- There were 734 families with 3,284 people in total, consisting 84 villages, 22 communes; (50 villagesand 12 communes in Pursat province, but it was 4 villages that there are 3 villages passed by the project and other 1 village survey team did not interview because the villagers were busy in the rice fields. There were 34 villages of 10 communes in Battambang province.
- There are 1,860 families affected by the project (1,012 families in Pursat province (224 families on bypass) and 848 families in Battambang province). Among of these there are: 307 households, 195 stalls, 8 Restaurents, 676 small stalls,137 other constructions and economic trees are 4,817 as well.
- The main occupations of the household head interviewing were farmers with 368 families (46%), workers 11 families (1%), Sellers 159 families (22%), Government officers 68 families (9%), Private company staffs 8 families (1%), Old people/wifehouse 43 families (6%), handicraft 4 families (1%), Raising fish 4 families (1%), Craftsmen 53 families (7%), fisherman 1 family (0%), Buyer junks 2 families (0%) and others business 43 families (6%).
- For farming schedule, the villagers are able to plant rice only one time per year, because of many reasons as: lack of water and irrigation systems, low harvest yield, unacceptable price of unhusked rice in harvested season, high price of fertilizes, facing with drought at early wet season and insects. Some villagers kept their rice field abandoned or for rent and then they migrated for job at neighbor countries because they think that being a migrant workers can earn more money.
- Based on study of fishing yield per year in the project study area, it mentioned that the average fish yield in Pursat River was higher than other area; it is first location was 8,752Kg, after then it is fourth location was 3,645Kg, after then it is third location was 1,666Kg and the average fish yield per year was low than the second location was 1,535Kg/season.
- The water resources for drinking, cooking, bathing, and washing in both dry and wet season. It was 7% from stream/river, 6% from lake/pond, 16% from digging well, 7% from tube well, 46% from rain water, 13% from water supply system and 3% from other sources.
- There were 97% of people living along the project area utilized toilets while other 3% did not have toilets.
- Cleaning, collecting and transporting solid wastes were limited because there were some challenges such as lack of fund/budget and worker, high price of fuel/oil, number of waste trucks was not able to collect and transport solid waste to dispose the company was responsed to wastes collection on time and did not all transported from the Town (wastes collection serviced in Pursat is only 14% and in Battambang is only 60%). Moreover, the villagers' did not understand and participate in waste management in community; then waste collection areas were also far from urban and small road to reach the dumpsite.
- In conclusion, the wastes in average for $1m^3$ of volume in both Pursat and Battambang city are 321kg by including 16kg (5%) of hazardous wastes, 64kg (20%) of plasticl wastes. The waste un-hazardous is 222kg (69%) of organic wastes and the bottle wastes/particle of metal/glass of bottle and ceramic/broken plate wastes 18kg (6%). Most of waste is the organic waste and then plastic waste is the second one. Plastic wastes such plastic bag, plastic packages of cake and plastic drinking flexible straw...etc. were found in the landfills/dumpsite. However, plastic bottles, pure water bottles were not found because it was already collected by waste collectors to recycle or to sell at junk shop.
- It was wood and charcoal burning stoves with 75.79%, gas stoves 14.88% and electrical stoves 9.34%.
- There were many illumination used by family in the project area, it was 10.55% of family used traditional lamps/candles for illuminations, batteries 4.68%, solar energy 0.24%, generators 1.2% and electrical network 83.33%.
- According to interview with 734 families, the male family heads were 605 families (82.43%) and

other 93 family head were females (12.67%); they were able to read and write Khmer language (got education from grade 1 to 7). At percentage, literate family head were 95.1% in total of 84 villages. For illiterate family head, there were 24 males (3.27%) and 12 females (1.63%).

- According to interview with family heads living both sides of the road in/around the project area with 84 villages, it showed that villagers normally got malaria 4.52%, dengue fever 9.13%, serious fever 31.27%, cholera 1.67%, diarrhea 14.52%, typhoid 22.44%, skin disease 6.35%, worms 3.81%, liver disease 0.48% and sore eyes disease 3.81%.
- The 98.88% of villagers in the project area were Buddhist, 1.17% of villager was Muslime and 0.03% of villager was Vietnamese. Therefore, there were 93 pagodas and 1,007 monks in total along the project area
- According to the field survey for project improvement of NR5, it was 150m from road axis, there is a gateway of palace of Phrea Batt Monivong, built in France colony, by the National Road N.5. It is able to be effected by this project.
- For tourism, in the future in both provinces which project is passed while the project road improvement completed, the NR5 will become an Asean Road A-1 and this improvement project will provide a lot of benefits for tourism and economic development in whole country.

CHAPTER-6
PUBLIC CONSULTATIONS AND DISCUSSIONS

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PUBLIC CONSULTATIONS AND DISCUSSIONS

6.1 INTRODUCTION

Conducting public consultation meeting with the concerned people in the project area is very important to let concerned people aware about the project and to express their ideas, concerns and requests for supporting in project implementation more smoothly and efficiently.

Consultation meeting is extra mentioned of impact which will happen in the construction phase, The affected problems is to take fully analyse in the purpose of taking advantage from losing natural resources environment and socio-economic resources by project, and help to refrain from disaster will be happened eventually in the project.

Time period for public consultation and discussion with concerned from Entity, Provincial Departments, Institutions and relevant Local Authorities (Village, Commune, and District) and NGOs were taken from 10/07/2013 to 10/08/2013. ***Note:*** *We had not discussed with NGOs, because there is no NGO in the project area which has been working on this National Road No.5 (NR5) construction.*

This public consultation and discussion meeting have been organized to introduce and explain detail to concerned people in the project area to understand about the purpose of project development which will be improved their living standard in the future (contribution and participation with the Royal Government of Cambodia (RGC) in poverty reduction of the people living in the project area).

6.2 OBJECTIVE OF CONSULTATION

Objective of public consultation and discussion as below:

- To announce to the public people and all related people to understand about the purpose and implementation stage of this project;
- To find criticism idea, suggestion, argument problem, and correct method to improve project successful;
- To solve complexes by doing a meeting and discussion with concerned people and will have participation from local Authorities in the project area.

6.3 RECORD OF PUBLIC CONSULTATION AND DISCUSSIONS

The working group studied on Environmental and Social Impact Assessment (ESIA), has organized public consultation meeting with related the Provincial Department, Districts, Communes, Villages in the Provinces and people as shown below:

Phnom Penh:

- The representative of Tonle Sap Authority, Ministry of Water Resources and Meteorology

Pursat and Battambang Provinces:

- The representative of Provincial Cabinet, Pursat and Battambang provinces;
- The representative of Provincial Department of Agriculture (PDoA), Pursat and Battambang provinces;
- The representative of Khan Fishery Administration, Pursat and Battambang provinces;
- The representative of Khan Forestry Administration, Pursat and Battambang provinces;
- The representative of Tele-Communication Company, Pursat province;
- The representative of Provincial Department of Land Urban Management Planning and Construction (PDoLUMPC), Pursat and Battambang provinces;
- The representative of Provincial Department of Public Works and Transportation (PDoPWT), Pursat and Battambang provinces;
- The representative of Provincial Department of Tourism (PDoT), Pursat and Battambang provinces;
- The representative of Entity of Water Supply, Pursat province;

- The representative of Provincial Department of Water Resource and Meteorology (PDoWRAM), Pursat and Battambang provinces;
- The representative of Provincial Department of Industry Mines and Energy (PDoIME), Pursat and Battambang provinces;
- The representative of "Nareth Electricity Development Co.,Ltd", Pursat province;
- The representative of City Hall, Pursat and Battambang provinces;
- The representative of Provincial Department of Environment (PDoE), Pursat and Battambang provinces;
- The representative of Provincial Department of Culture, Fine and Arts (PDoCFA), Pursat province;
- The representative of SINTRY Company, Battambang province;
- The representative of Provincial Department of Tele-Communication and Post (PDoTP), Battambang province;
- The representative of Cambodia Electricity Authority, Battambang province;
- The representative of Krakor, Bakan and Kandieang Districts, Pursat province;
- The representative of Moung Russei, Sangkae and Thmor Kol Districts, Battambang province;
- The representative of 13 Communes, 51 Villages and villagers participations which located along the NR5 of the project, Pursat province;
- The representative of 10 Communes, 35 Villages and villagers participations which located along the NR5 of the project, Battambang province.

Results of consultation are detailed by ecclesiastical rank administration as follow:

6.3.1 Records of Consultations and Discussions Meeting with working group and Representative of Pursat Provincial Cabinet

Public discussion meeting between working team and **H.E. Koy Sokha**, Pursat Governor, dated on 15 August 2013, from 3:30 to 4:20 PM, the result as mentioned below:

- This National road No.5 improvement comes true to Cambodia economic status which it is progressing and come true while Cambodia will be intergraded to Asian economic in 2015 also;
- This project will link Cambodia economic with Asian countries are improving especially, are linking with Thailand and Vietnam due to this road network is connected between Thailand and Vietnam through Cambodia;
- To support fully for this project and to prepare for cooperating to this project;
- We should keep the reserved land in the Town is large as well as outside the Town that it is starting from now in order to make plan to improve the road in the future, to avoid for affects at the present;
- Should study on protected of central road for outside the Town;
- Should do protected of central road which it is suitable height as standard of MoPWT in the City-Town;
- This protected central road needs to keep space in between from 100m - 200m for traffic passing from an inside to another side in the City-Town;
- In case, there is no space in the City-Town, they should make passing road underground which it has roof for both sides to protect rainwater flows into this road;
- The buildings are constructed in the provincial Town along the National Road No.5 did not have plan construction approved, these constructions always encroached on the reserved land which determined of 30m for both sides from the central line of the road;
- Should do road improvement in the Pursat Town is large for beauty view and traffic safety;
- However, households affected on reserved land need to solve with fair for both parties;

- Should do by-pass for Pursat Town to ensure for transportation improvement between Thailand and Cambodia;
- The National road No.5 improvement is located in the part of Transition Zone of Tonle Sap Biosphere Reserve which managed by Tonle Sap Authority. But it is not prohibit area for any development as Buffer Zone or Core Zone of Tenle Sap Lake.
- This by-pass is located in the Government Economic Area, it is not affected or linked to protected area and Tonle Sap fishery resource conservation;
- These affected such as: Electricity Tower, Optic cable and water pipe systems need to discuss with relevant Ministries;
- The project needs to construct strong box culverts along the road where is in the City-Town, in order to avoid puddle water on the road cause to damage quality;
- The Commerce signboards, the provincial cabinet will plan to resettle where are locations do not affect for the project and do not allow to install a cross the road;
- The project has to prepare to install enough of traffic signboards, light stops and traffic lines and also has to prepare protection fence along the reserved land in the City-Town and where is curvedly road for safety;
- To solve for these above need to have a provincial committee which participated from relevant Ministries and the project owner.

Suggestions:

The project owner should have good cooperation with local Authority to solve all impacts by this project.

6.3.2 Record of Consultation and Discussion Meeting with working group and the representative Provincial Department of Agriculture, Pursat Province.

Public discussion meeting between working team and **Mr. Tith Sam Oeurn**, Director of Provincial Department of Agriculture (PDoA), dated on 15 July 2013 from 4:00 to 4:30 PM, the result as mentioned below:

- Fully support of 100% for this project, because this National Road No.5 rehabilitation is a priority of the Royal Government of Cambodia for the National Economic improvement;
- The project will have negative impact on some big buildings, people's households and some Government buildings in the provincial Town which located along this National Road No.5;
- For affected on Rice fields and some households people's outside the Town, it is not difficult to solve these problems because they were solved (advanced of step-1) for them in the period National Road No.5 constructed since 2004-2006;
- In this stage, for the National Road No.5 rehabilitation, in case in the provincial Town there was principle for Reserved Land it was only 4m for both sides of road in the previously. But at the end of 2012, the PDLMUP&C has registered of Land Title system following the new principle Reserved Land both sides of 30m from the central line, this event there were no people participated and consultation;
- This principle is opposite to Sub-Decree No. 197 ANK-BK dated on 23 November 2009, Chapter-3, Article-8 which required to extra determine of Right-way in the City-Town;
- Therefore, the existing NR5 improvement project needs to consider for suitable compensation to affected people; if there is not, the NR5 improvement project will not be running smoothly.

Suggestions:

- To ask to study for by-pass of the provincial Town, to ensure for security of traffic jam and to avoid on negative impacts to the people's household where is crowd people living along the NR5 in Pursat Town as well;
- To wish, to have suitable compensation on land for agriculture where is the project affected.

6.3.3 Record of Consultation and Discussion Meeting with working group and the representative of Khan Fishery Administration, Pursat Province.

Public discussion meeting between working team and **Mr. Phum Vimol**, Chief of Khan Fishery Administration, dated on 15 July 2013 from 4:30 to 5:00 PM, the result as mentioned below:

- Fully support for National Road No.5 rehabilitation, because the project will provide advantage for public traffic and National Economic in whole Country;
- The project implementation should work for big structure in dry season, to avoid of soil erosion which can be dried-up or shallow of Steung or natural creeks;
- Should have warehouse to store all materials and equipment, to keep bituminous and some of chemical elements in safe place, to have a good fuel management or need to have an Own fuel station, to protect environment of fishery resource located nearby the project;
- Should be not closed any waterways for road or bridge improvement, it will need to dig canal or install concrete rings much more where water can flow as normal speed, because it will affect to the fish movement in wet season;
- Should do by-pass of the provincial Town to reduce traffic accident and hard household's impact of the people and disturbance at night of goods transportation, because most of the big trucks are transported at night.

Suggestions: To wish, to have suitable compensation on what is affected by the project.

6.3.4 Record of Consultation and Discussion Meeting with working group and the representative Khan of Forestry Administration, Pursat Province

Public discussion meeting between working team and **Mr. Chhai Saratt**, Vice-Chief of Khan Forestry Administration (KFA) and **Mr. Moy Rotha**, Officer of KFA, dated on 15 July 2013 from 5:30 to 6:00 PM, the result as mentioned below:

- Fully supported for this Road Improvement project, because it will get great advantages of Economic Country;
- All trees located along the National Road No.5, some trees are grown by KFA such as Acacia Mangium (Acacia), Eucalyptus Camaldulensis (Preng Kchaol) and Cassia Siamea (Angkanh). Some other trees are grown by Pursat City Hall such as Peltophorum ferrugineum caesalpiniaceae (Trosek) and beauty combination trees. Other trees are grown by the people such as fruit trees and and beauty combination trees also;
- The study team should do counting all trees which grown by KFA located along the National Road No.5 then, need to do suitable compensation for National budget;
- For other trees which located along the National Road No.5 in the Town, study team needs to get information from Pursat City Hall and people that lived along this Road;
- The KFA is not planned to grow any tree along the National Road No.5 for next year;
- Forest vision is not required people to grow the tree along the National Road;
- The project should grow the tree which is medium height and strong along the slope of new road to protect flooded;
- The cost of tree with diameter >0.3m is 80,000Riels/m^3. For the small tree in the past grown costs of 1000Riels per tree.

Suggestions:

The project should grow the grass along the slope of road and regularly maintain planned.

6.3.5 Records of Consultations and Discussions Meeting with working group and the Representative of Tele-Communication, Pursat Province

Public discussion meeting between working team and **Mr. Hun Narith**, General Manager of Tele-Communication Company in Pursat province, dated on 16 July 2013 from 8:30 to 9:00 AM, the result as mentioned below:

- Fully support for this Road improvement, because the National Road No.5 is blood vessel Economic of Cambodia;

- Tele-Communication is Government's Company which had cable optic networks, along the National Road No.5 from Phnom Penh to Pursat province. The cable buried underground, located on the Right hand with depth from 0.7m to 1m, and it is far from the Right of-was about 0.5m;
- In case, the project is needed to clearance depth of 0.5m, then it can work over existing of cable optic, the life use of cable optic is over 50 years;
- In case, the project has planned to resettle the cable optic, project owner should inform in advance and need to have discussion with the Tele-Communication Company, to avoid all damaging;
- For the cable Optic on air, it is belonging to **CFONC**, Chinese Company. There is not office in Pursat province; they have office in Battambang province.

Suggestions:

To wish, to have good cooperation with Tele-Communication Company in case, resettle cable optic networks.

6.3.6 Record of Consultation and Discussion Meeting with working group and the representative of Provincial Department of Land Management, Urban Planning and Construction, Pursat Province

Public discussion meeting between working team and **Mr. Cheng Lai**, Director of Provincial Department of Land Management, Urban Planning and Construction, dated on 16 July 2013 from 9:00 to 10:00 AM, the result as mentioned below:

- Fully support for this Road improvement, because it is blood vessel Economic of Cambodia and Asian region;
- All people which are lived along the National Road No.5 in Pursat province had been registered Land Title system;
- Based on Sub-Decree No.197 ANK-BK, dated on 23 November 2009 on Management of Reserved Land, it had been done and inside this, in the provincial Town, there was registered Land Title system also; It was determined of Reserved Land for the National road No.5 is far 30m from the central line of Road;
- Sub-Decree No. 197 ANK-BK dated on 23 November 2009, Chapter-3, Article-8 which required to extra determine of Right-way in the City-Town;
- The Pursat Governor has decided primary determination on Reserved Land inside the provincial Town as the same outside the Town, because of we have circular No.6 for extra registration;
- In case the National Committee does evaluation on the Reserved Land in the Town and they are agreed in any limitation, then the PDoLUMPC will follow to circular No.6 to renew registration for the people;
- The distance of the Pursat Town is far about 3Km, it counts from intersection of Leach to Spean Ra;
- Is not to do by-pass, because the National Road No.5 in Pursat Town is straight and it is far about only 3Km, the project has less spending if comparison to by-pass. Moreover, the Road project improvement will make Pursat Town be beauty to the high level;
- The project has to re-construct of drainage systems, however it needs to determine distance from the Reserved Land at least is 2m. This work need to cooperate with Department to avoid complaint by the people;
- At the Provincial Town needs to install signboards for speed slowdown and light stop for road crossing;
- Should have protected fence for both sides along the Right of way in the Town and should build air bridge where are intersection Roads especially in provincial Town. It is also need to install a bridge for the people passing to other side.

Suggestions:

The project owner should have good cooperation; work in closed of this Road improvement with PDoLUMPC and the local authority in order to solve well on negative impact of public land, residence land and other land development.

6.3.7 Record of Consultation and Discussion Meeting with working group and the representative Provincial Department of Public Works and Transportation, Pursat Province

Public discussion meeting between working team and **Mr. Chinh Kuong**, Deputy Director Provincial Department of Public Works and Transportations, dated on 16 July 2013 from 10:30 to 11:00 AM, the result as mentioned below:

- Fully support for this NR5 project, because the National Road improvement is the first priority that the Royal Government of Cambodia pays attention with, in order to connect widely of transportation between Cambodia and Thailand;
- The project needs to install enough signboards and to reduce curvedly road in order to avoid accident along the road. To have well drainage systems, install the concrete rings and building high bridges to avoid of flooded that it is causes for road collapsed;
- To clarify on Corridor of Impact (COI) for road improvement and should keep natural waterways network and to save natural forest located along the Steung and Creek banks in order to protect erosion if possible;
- To have detail design plan in the provincial Town for safety;
- To have plan to build protected fences along the Reserved Land, and should build main air bridges for crossing in the Town, especially where is big market that located along the NR5;
- Do not grow any tree on the Reserved Land, because it will be many negative impacts;
- Electricity Tower has to install far of 25m from the central line of road;
- All public services construction such as Electricity post , Optic cable and water pipe systems need to ask permission from Ministry of Public Works and Transportations;
- In the provincial Town should have all strong box drainage with cover along the road and all waste water systems has to drain to the waste treatment plant first before let waste water outlet into Creek, Steung and River;
- Need to study Economic equilibrium between by-pass of provincial Town Road in Pursat, and NR5 improvement project in Pursat Town to comparison whether which one is advantage;

Suggestions:

Should do good cooperation; work in closed with PDoPWT in order to get well implementing of this NR5 improvement project.

6.3.8 Record of Consultation and Discussion Meeting with working group and the representative of Provincial Department of Tourism, Pursat Province

Public discussion meeting between working team and **Mr. NHeuv Song**, Director, and **Mr. Sam Khim**, Deputy Director of Provincial Department of Tourism, dated on 16 July 2013 from 2:20 to 2:45 PM, the result as mentioned below:

- Fully support this Road improvement, because Tourism development needs to have a better infrastructures as it is important;
- There is no any impact to Tourism sector, it is an opposite that this project will provide advantage to Tourism sector;
- Should do detail design plan focus on additional air bridge crossing where are main intersection roads and building safety protected fence ect., where are City-Town as standard in the developed country;
- Should do study on by-pass of Pursat Town, in order to avoid accident and mitigation on people's households affected. By-pass should be found further far from a cultural location of Neak Ta Khlaing Moeung.

Suggestions:

To ask for construction Air Bridge crossing where is main intersection roads in City-Town and building safety protected fence on Reserved Land.

6.3.9 Records of Consultations and Discussions Meeting with working group and the Representative of Water Supply Entity, Pursat Province

Public discussion meeting between working team and **Mr. Keo Sara**, Chief of Water Supply Entity, Pursat Province, dated on 16 July 2013, from 3:00 to 3:30 PM, the result as mentioned below:

- Fully supported for National Road No.5 improvement, because it will be high traffic between Cambodia and Thailand in the future;
- This project will affect to water pipes that located along the National Road No.5. The water pipes length is about 4Km and spread out closed with the Reserved Land along the road, it is a pipe line located in the middle of the road that constructed in decade 90th;
- The water pipe buried at depth from 0.6m to 1m with deferent diameter size is 63mm and 125mm;
- If there is resettle of water pipe system along the National Road No.5, the water supply Entity will assign technical staff to show where is located of water pipes.

Suggestions:

- The road construction company should work well follow the technical standard, to ensure for good quality and long life utilizing;
- The project Owner should do cooperation well with Water Pipe Entity in Pursat Province in case needed to dismantle of water pipes in Pursat province.

6.3.10 Record of Consultation and Discussion Meeting with working group and the representative Provincial Department of Water Resources and Meteorology, Pursat Province

Public discussion meeting between working team and **Mr. Chhieum Samorn**, Deputy Director of Provincial Department of Water Resources and Meteorology, dated on 17 July 2013 from 8:00 to 8:40 AM, the result as mentioned below:

- Fully support for this project, because National Road No.5 is a great Economic Road of Cambodia;
- There is no irrigation system closed of National Road No.5;
- For high pressure flood along the National Road No.5 in Pursat province, there are two places: (1) it is at O-Sdav bridge and (2) it is at Ra Bridge;
- Need to build strongly bridge and increase extra dimension water flow because flooded disaster is high from year to year.

Suggestions:

To wish to the project Owner which works on National Road No.5 improvement, to manage well for solid and liquid wastes, to avoid for water pollution near the project area then it will spread out into creek, Steung and other flooded area.

6.3.11 Record of Consultation and Discussion Meeting with working group and the representative Provincial Department of Industries Mine and Energy, Pursat Province

Public discussion meeting between working team and **Mr. Seng Bunthol**, Deputy Director and **Mr. Phal Vannak**, Acting Vice-Chief office of Power Supply, Provincial Department of Industries Mine and Energy, dated on 17 July 2013 from 9:00 to 9:20 AM, the result as mentioned below:

- Fully support for this project because it will make progressive of National Economic;
- Need to study on Electricity Tower affected and should do determine for new location for this Tower according to the Law and to avoid to resettle once again in the future;
- MIME/PDoIME does not have Law to determine to settle of Electricity Tower. The MoPWT is a institution that doing Law establishment and it is an implementer;

- Should construct by-pass of provincial Town, in order to avoid people's households affected, and it will create extent of the Provincial Town in the future;
- The project Owner should improve this National Road with good quality and ensure for along life utilizing as constructed.

Suggestions:

The project Owner should respect to Cambodia Law and whole contracts that had been agreed with the RGC.

6.3.12 Records of Consultations and Discussions Meeting with working group and the Representative of Nareth Electricity Development Co., Ltd, Pursat Province

Public discussion meeting between working team and **Mrs. Yim Nareth**, Director of "**Nareth Electricity Development**", and **Mr. Norng Kineam**, Chief of representative of Electricity Authority of Cambodia in Pursat province, dated on 17 July 2013, from 9:30 to 10:20 AM, the result as mentioned below:

- Fully support for this project, because National Road No.5 is a great Economic Road of Cambodia;
- The Electricity Towers constructed in 1992 in the provincial Town were located closely of National Road No.5 (started from Electricity Tower No.281 to Ra bridge);
- The Electricity Towers constructed in 2004-2006 were far in between 19m – 29m from the Reserved Land outside the provincial Town starts from Ra bridge to Vehicle Weighting station;
- Electricity Towers of "**Nareth Electricity Development**" are located on the left hand of direction from Phnom Penh to Pursat province;
- Electricity Towers of Cambodia Electricity Authority are located on the Right hand of direction from Phnom Penh to the end of intersection road to Leach, Pursat province;
- Electricity Tower of Cambodia Electricity Authority in the provincial Town is far about 25m to 28m both sides from the central line of the road;
- There are Electricity Towers outside the provincial Town is belong to the private company in each commune respectively;
- The Cambodia Electricity Authority has bury in the ground for optic cable follow to "**Nareth Electricity Development**" company in Pursat Town which started from intersection of Road to Leach to end of Century Hotel, the cost of this optic cable is 100$/m during implement stage;
- The depth of optic cable buried underground from 0.4m to 0.6, but in principle cable is laid at depth of 0.8m;
- The optic cable implemented in charge of Cambodia Electricity Authority in Phnom Penh.

Suggestions:

- The project owner, should do compensation for electricity Tower included labour (250$ per Tower with it is height 12m) in the past of construction;
- The project owner should inform and discuss with Cambodia Electricity about demolishment for this electricity Tower.

6.3.13 Records of Consultations and Discussions Meeting with working group and the Representative of Pursat City Hall, Pursat Province

Public discussion meeting between working team and the representative of Pursat City Hall are:

1. **Mr. Ngin Mean** Deputy Governor of Pursat City Hall;
2. **Mrs. Men Phally** Deputy Governor of Pursat City Hall;
3. **Mr. Long Seng** Chief office of Environment, Pursat City Hall;
4. **Mr. Ly Pak** The representative of office of Agriculture, Pursat City Hall;
5. **Mr. Da Sophally** The representative of office of Industry, Pursat City Hall;

6. **Mr. Aom Sakhoeun** The representative of office of Public Work and Transportations, Pursat City Hall;
7. **Mr. Hout Sam At** The representative of office of Land Management, Urban Planning and Construction, Pursat City Hall;

Dated on 17 July 2013, from 2:00 to 3:30 PM, the result as mentioned below:

- 100% supported for this project because the National Road No.5 improvement is a very important for the National Economic raised;
- The problem affected on Electricity Towers, Optic cables, water pipe systems and Light post, the project owner should inform and doing common discussion with the affected owner in order to have good cooperation for all resettle of facilities and move all these things to the correct locations and ensure to save for long time, to avoid for resettlement many times and lose of fund in the future;
- For the people's households need to depend on Law to solve this issue;
- Need to organize a provincial committee which participated from all local Authorities and relevant Department and the representative of affected people in order to solve this issue;
- The people's households affected need to do fair compensation;
- Should do reducing of Reserved Land in the provincial Town, it will decide by the provincial committee or National committee;
- Need to determine of Reserved Land as correctly distance for City-Town;
- Should do listed all households and public buildings that affected by the project in the provincial Town;
- For the Light post, the Pursat City Hall will remove by ourselves after the project owner is informed;
- The project needs to construct enough drainages system, bridges, culverts, traffic signboards and Light stop;
- Should mitigate of Corridor of Impact (COI) for NR5 improvement project to 12.5m far from the central line of road, in order to mitigate also for people's households and public buildings in the provincial Town;
- For the garbage collection status is a challenge due to there is no garbage collection company for whole province;
- Garbage collection is done only in the Market and some people's households and somewhere of public facility by the Market working Team;
- There is one dumping site located in Mkak village, Sangkat Roleab, it is size of 10ha at the present,
- The most remaining of people households for garbage collection are responsible by themselves.

Suggestions:

- The project owner, should do have good cooperation with all local Authorities in order to solve for all negative impacts by this project;
- The project owner, should invest a recycle Factory of garbage in Pursat province in order to mitigate of Environment impacts;
- The project owner should recruit people from the project location to be staff or workers in the project in order to improve their living;
- Should do study to comparison economic balance between provincial by pass and provincial Town road improvement.

6.3.14 Records of Consultations and Discussions Meeting with working group and the Representative Provincial Department of Environment, Pursat Province

Public discussion meeting between working team and **Mr. Thai Chantha**, Director of Provincial Department of Environment, dated on 17 July 2013, from 4:00 to 5:00 PM, the result as mentioned below:

- Fully supported for this project because the National Road No.5 improvement will rapid improve of National Economic in period shortly in the future;
- Should consider deeply on negative impacts such as Food (agriculture land), accident cause by high speed of vehicles after the Road has been improved and people's households affected in the City-Town during implementation phase;
- For stronger buildings which constructed before issued of Sub-Decree No.197 ANK-BK dated on 23 November 2009, how to solve?
- This Sub-Decree has stated for extra of Reserved Land in City-Town and District also;
- Need to determine clearly for Reserved Land? To be smoothly for existing Road improvement that it will pass to the provincial Town;
- To mitigate accident, sound and noise pollution, air pollution and people's households affected we should do by-pass construction outside the provincial Town;
- To construct by-pass need to study on people's Rice field and rice production per year, how much it costs?
- To construct bridge or expand of Road, do not close of water flow, should install concrete rings according to the size of water flow;
- Need to do well digging canals (outside the Town) and drainage system construction (in the Town) along the Road and do clearly of water flow direction (depend on natural land slope);
- For existing drainage systems in the provincial Town, need to re-construct and set on correctly locations to avoid re-construction again for the next future;
- Should do waste water treatment plant to treat waste water along the National Road No.5 in the provincial Town before outlet it to other water sources;
- The project should invest on garbage recycle and garbage collection facility;
- Should do protection fences on Reserved Land for both sides and should build air bridge to cross in each City-Town;
- Should organize for fuel station out of the Town in order to settle all fuel station are far from the National Road and make it easy to manage all risks;

Suggestions:

The project owner, should do well cooperation with the Provincial Department of Environment in order to solve effectiveness on negative impacts by the project.

6.3.15 Record of Consultation and Discussion Meeting with working group and the representative of Culture, Fine and Arts, Pursat Province

Public discussion meeting between working team and the representative of Provincial Department of Culture, Fine and Arts (PDOCFA), Pursat province, dated on 15 August 2013 from 10:50 to 11:30 AM, the result as mentioned below:

1. **Mr. Ros Samnang** Deputy Director of Department of Culture, Fine and Arts
2. **Mrs. Ouk Thavry** Chief office of Arts
3. **Mr. Khoun Vichit** Chief office of Movie
4. **Mr. Chom Sopheap** Vice-Chief of Movie
5. **Mr. Milia Sovathy** Officer of Department of Culture, Fine and Arts

- Fully supported on this project because the National Road No.5 improvement will make National Economic improvement;
- The ancient gateway in Bakan district is a gateway into Royal palace of Preah Bat Monivong, it was constructed in Colonial of French which located nearby the National road No.5;
- This ancient gateway is not made by mud-stone, it made by mortar and bricks;

- This ancient gateway is not registered in the National patrimony, the Department of Culture, Fine and Arts is registered into only History of construction;
- In order to keep this ancient gateway, the project should move it follow to the technical of construction movement by machine mechanical to new place which will be determined by the Provincial Department of Culture, Fine and Arts;
- This work, the project has to inform to Provincial Department of Culture, Fine and Arts (PDoCFA) in advance at least 1 month in order to PDoCFA will assign the representative to participate to show a new location this History of construction.

Suggestions:

The project owner should do well cooperation with Provincial Department of Culture, Fine and Arts for this movement of ancient gateway.

6.3.16 Record of Consultation and Discussion Meeting with working group and the representative of Krakor District, Pursat Province

Public discussion meeting between working team and **Mr. Teum Sarin**, Krakor District Governor, Pursat province, dated on 16 July 2013 from 5:00 to 5:45 PM, the result as mentioned below:

- Fully supported on this project because it will improve of National Economic;
- The people in Krakor District are known about the National Road No.5 improvement, they did not against it all;
- The people had ever facilitated by National Committee on their lands and households affected in the stage-1 of National Road No.5 reconstruction in 2004-2006;
- In this stage of Road improvement, there are some buildings will be affected because the people encroached to build for small shops and stalls continuously;
- Electricity Towers along the National Road No.5 in Krakor District are not high affected because they just installed recently; its are far about from 25m to 27m of central line of Road;
- For Optic cable, it will be affected because it located on the Reserved Land. Therefore, the Optic cable company has to operate with the project Road Owner to re-construct these;
- There is no problem for Signboards of trade which installed along the National Road No.5, they will demolish by themselves when the project Road owner inform to them;
- The project should construct enough of drainage systems, bridges, culverts, traffic signboards and Light stops.

Suggestions:

- Do not construct of concrete protected on central line of the Road where is main of intersection Road;
- Should respect to Cambodia Law and contracted with the RGC.

6.3.17 Record of Consultation and Discussion Meeting with working group and the representative of Bakan District, Pursat Province

Public discussion meeting between working team and **Mr. Sao Daroeun**, Bakan District Governor, Pursat province, dated on 20 July 2013 from 10:30 to 11:30 AM, the result as mentioned below:

- 100% supported on this project because the National Road No.5 improvement is a project that will improve to National Economic in period of short time near the future;
- The people are living along this National Road did not registered on Land Title system yet;
- The representative of District has been announced to the people about Reserved Land for the National Road, but for commune and district Town the people requested to save from 15m to 20m of central line of Road, and for outside the Town they agreed to save for 30m from the central line of Road according to the Sub-Decree No.197;
- Should have fair compensation on people's Lands and households when they found those things are affected by the project;
- The project should construct enough of drainage systems, bridges, culverts, traffic signboards and Light stops;

- Should organize this Road as a new standard that it will have protected fences along the Reserved Land and should build air bridge and underground bridge for the people passing in the Town;
- Electricity Towers in Bakan District had been installed far of 15m from central line of Road, and for Optic cable is located on left hand of direction Phnom Penh – Pursat closed to the Road;
- District Governor had agreement with the Electricity Tower construction company; they will move these Electricity Tower when we found it has been affected by the project;
- There is pipe line located on the Right hand of direction Phnom Penh – Pursat. This water pipe line is belong to **LAIM KHOUN**, businessman, the pipe is buried close to the Reserved Land;
- The project owner needs to discuss on all affects above with the affected people before making decision for either announcement.

Suggestions:

The project owner should do well cooperation with Bakan District in order to solve effectiveness for all negative impacts by the project.

6.3.18 Record of Consultation and Discussion Meeting with working group and the representative of Kan Deang District, Pursat Province

Public discussion meeting between working team and **Mr. Ky Kim No and Mr. Phay Leng**, Kan Deang District deputy Governors, Pursat province, dated on 22November 2013 from 9:15 to 9:40 AM, the result as mentioned below:

- 100% supported on this project;
- The project will be provided more profits to people living in/around project area such as they can sale their and transportation their products to market
- The cost of land will be high as well
- We have an ASEAN High Way like our neighbouring country that we have never had before
- District authority will do collaboration with project owner in case of necessary

Suggestions:

- Work Team should make detail study on all impact on people property like houses, land, crops,
- The project owner should provide compensation to affected people by standing on principle of negotiation between project owner and affected people.
- The project owner should do well cooperation with local authority.
- Working Team and project owner should spreading out all main information related to project

6.3.19 Record of Consultation and Discussion Meeting with working group and the representative of Boeung Kantaout commune, Pursat Province

Public discussion meeting between working team and **Mr. Keum Chem**, first Commune Councillor and **Mrs. Kim Sam Onn**, member of Commune Councillor of Boeung Kantaout Commune, Krakor District, Pursat province, Dated on 6 July, 2013; from 4:30 to 5:00 PM, the result as mentioned below:

- We are 100% supported for project;
- Since the past, we known about this project because there is announcement about NR5 improvement project starts from Prek Kdam to Theal Ma' am;
- We know this project for long time due to the working team has to drive poles on the Reserved Land that it is far of 30m from central line of Road, for both sides. However, Road improvement project is not serious impact because there is only temporary business stalls, it is easy to demolishing;
- If, there is wide road, it is easy to travel, less time and less spending to travel.

Suggestions:

- The Royal Government of Cambodia help people to solve as fair policy of compensation for business stall and other buildings while doing demolishment;
- The Royal Government of Cambodia as well as the project owner should do education about Traffic Law to the people who are living in Commune as well as whole province.

6.3.20 Record of Consultation and Discussion Meeting with working group and the representative of Thnaot Chum commune, Pursat Province

Public discussion meeting between working team and **Mr. Cheab Khem**, Thnaot Chum Commune Chief, and his Colleague, Krakor District, Pursat province, Dated on 6 July, 2013; from 8:05 to 9:00 AM, the result as mentioned below:

- It is very happy and 100% supported because it is National project;
- He knows this project for long time through the working team has been installed poles for the Reserved Land that it is far of 30m from central line of Road, for both sides;
- There is not serious impacts by this project;
- This National Road No.5 improvement will provide advantages to the people in the commune to travel due to it is wide Road and it can help to reduce of traffic accident;
- To reduce all expenses for transportation of the people and gain of time for travelling;
- It is easy to do trading between one province to another province and between Cambodia to the neighbour country.

Suggestions:

- The Royal Government of Cambodia and company should have compensation to the either people which are living along the Road, in case the study team has found them are affected people by the project;
- The Royal Government of Cambodia and company should do education about Traffic Law to the people which are living in Commune as well as whole province;
- The relevant institution should help to educate about sanitation especially, garbage disposal in the field and everywhere, it is not good manners along the Road, it is a bad view, because this Road will become to Asian Road in the future.

6.3.21 Record of Consultation and Discussion Meeting with working group and the representative of Sangkat Roleab, Pursat Province

Public discussion meeting between working team and **Mr. Sar Sareum**, Sangkat Roleab Chief, Pursat City Hall, Pursat province, Dated on 8 July, 2013; from 2:20 to 4:50 PM, the result as mentioned below:

- 100% supported for this project;
- For the Reserved Land (30m from central line of Road, for both sides), the Sangkat has announced about this problem to all villages which located along the National Road for every each meeting of Sangkat mandate;
- The Road improvement is also concerning about increasing of traffic accident by the people who is not clearly understanding about the traffic Law.

Suggestions:

- The working team should assist also to announce about this project to the people who are living along this road in Reas village, Sangkat Roleab.

6.3.22 Record of Consultation and Discussion Meeting with working group and the representative of Sangkat Prey Nhy, Pursat Province

Public discussion meeting between working team and **Mr. Tep Sambath**, Sangkat Prey Nhy Chief, Pursat City Hall, Pursat province, dated on 8 July, 2013; from 10:20 to 10:50 AM, the result as mentioned below:

- 100% supported for this project;

- If, there is NR improvement project in Sangkat Prey Nhy, then there will be serious affected on buildings on the reserved land;
- For the people's new buildings on the Reserved Land at the present, the local Authority does not recognized;
- The local Authority has announced about this road project to the people, especially the people who living along this NR5.

Suggestions:

- The working team should do cooperation with village Chief to announce about this project to the people who living along the NR let them clear understanding.

6.3.23 Record of Consultation and Discussion Meeting with working group and the representative of Sangkat Phtas Prey, Pursat Province

Public discussion meeting between working team and **Mrs. Soeung Sokleam**, Clerk of Sangkat Phtas Prey, Pursat City Hall, Pursat province, dated on 9 July, 2013; from 8:20 to 8:50 AM, the result as mentioned below:

- We are fully supported for this project due to it is our direction the Royal of Government;
- If, there is NR improvement project, this road will become to Asian road, it will be serious affected in our Sangkat Phtas Prey because it is Town and there are many hard buildings;
- It is concerning about people's lands and households built along this NR.

Suggestions:

- In case there is affected on people's land and households, should have clearly and fair compensation to the affected people.

6.3.24 Record of Consultation and Discussion Meeting with working group and the representative of Sangkat Svay At, Pursat Province

Public discussion meeting between working team and **Mr. Yous Sam At**, Sangkat Svay At Chief, Pursat City Hall, Pursat province, dated on 9 July, 2013; from 9:20 to 10:50 AM, the result as mentioned below:

- It is very happy and 100% supported because this project will make the country development and improvement;
- We did not know about this project but we see the working team to drive poles on the reserved land of 30m from the central line of road for both sides;
- For the business stall built on the reserved land, the local Authority has informed to them, but there is not difficult while the Government needs, they will demolish by themselves;
- It is concerning about traffic accident due to there is wide road and the people do not respect traffic law with high speed.

Suggestions:

- There should do installing of signboards for the reserved land and traffic, and to help for education on traffic law to the people because they are not well understanding about this problem;
- Should reinforce on traffic law and to punish to the driver who is drunk.

6.3.25 Record of Consultation and Discussion Meeting with working group and the representative of Snam Preah commune, Pursat Province

Public discussion meeting between working team and **Mr. Ouch Kheun**, Snam Preh Commune Chief, Bakan District, Pursat province, dated on 8 July, 2013; from 4:20 to 4:50 PM, the result as mentioned below:

- On behalf of the local Authority we are 100% supported for this project because, it provides advantage to the country and our commercial in Asian region;
- This Road will be beauty view and Cambodia will have wide Road that called High-way such as the neighbour country;

- For the business stalls located along the NR, the most of people do not require for high compensation due to they asked to the local Authority for temporary stall building, when the Government needs they agree to demolish by themselves;
- To reduce all expenses for transportation of the people and gain of time for travelling.

Suggestions:

- Should do installing traffic signboards in the Towns;
- If there is affected, the Government should have policy of compensation to solve fair to the affected people.

6.3.26 Record of Consultation and Discussion Meeting with working group and the representative of Trapaing Choung commune, Pursat Province

Public discussion meeting between working team and **Mr. Khon Sar**, Trapaing Choung Commune Chief, Bakan District, Pursat province, dated on 10 July, 2013; from 8:30 to 8:50 AM, the result as mentioned below:

- On behalf of the local Authority we are 100% supported for this project;
- The people are happy to participate work with the working team to study on these impacts;
- For land requirement of bridge and NR5 improvement, it become to Asian highway, there will be some affects such as households and business stalls, but it is not serious affects;
- This National Road No.5 improvement will provide advantages to the people in the commune to travel due to it is wide Road.

Suggestions:

- In case, there should install light poles along the road that is fine;
- Should install traffic signboards at the Towns such as school, health center, Pagoda.

6.3.27 Record of Consultation and Discussion Meeting with working group and the representative of Boeung Khna commune, Pursat Province

Public discussion meeting between working team and **Mr. Boeung Ben**, Boeung Khna Commune Chief, Bakan District, Pursat province, dated on 10 July, 2013; from 8:20 to 9:50 AM, the result as mentioned below:

- To support for this project because it provides advantage to our whole country;
- For land requirement to improve this road, it will affect on Boeung Khna Town, but however there is some people temporary constructions such as business stalls that are in the reserved land;
- For the existing culverts along the NR in each Town should do rehabilitation and re-study properly about water discharge in wet season and to determine clearly location to avoid re-demolish again that it causes to damage for the future;
- In case, there is affect on agriculture land, fruit trees and other buildings, should do have fair policy to these affects;
- Should do have traffic line to divide properly road and to reinforce on traffic law and to punish to the driver who did not respect to this law.

Suggestions:

- This project construction should be good quality and make sure to use for long life.

6.3.28 Record of Consultation and Discussion Meeting with working group and the representative of O-Tapaong commune, Pursat Province

Public discussion meeting between working team and **Mr. Yin Min**, Clerk of O-Tapaong Commune, Bakan District, Pursat province, dated on 10 July, 2013; from 11:20 to 11:40 AM, the result as mentioned below:

- We supported 100% for NR5 improvement project, it will become to Asian Highway, because it will provide important advantage for commercial communication between Thailand–Cambodia- Vietnam;

- There is Market in O-Tapaong Town, should do clear study to avoid for traffic jam and concrete rings installing or drainage system to avoid water remaining on road that it causes to damage road;
- Should install signboard about "to prohibit for garbage disposal" along the NR of the Town, to avoid for garbage dispose everywhere, it causes to bad aestheticism and bad smell;
- Should install enough traffic signboards in all Towns.

Suggestions:

- The project owner and relevant Departments should do well cooperation to operate and maintain for good quality this road.

6.3.29 Record of Consultation and Discussion Meeting with working group and the representative of Svay Daoun Keo commune, Pursat Province

Public discussion meeting between working team and **Mr. Leung Theang**, first Commune Councillor, Bakan District, Pursat province, dated on 17 July, 2013; from 9:20 to 10:15 AM, the result as mentioned below:

- To support for this NR improvement project, because this project will provide important gateway for Cambodia economic in the near future;
- The working team should study clearly on affected people by this project along the NR;
- Should announce about this project to the people to understand clearly on purposes improvement project to avoid misunderstanding for other problems.

Suggestions:

- The project owner should follow properly of technical specification; make sure that it can use for long life.

6.3.30 Record of Consultation and Discussion Meeting with working group and the representative of Veal Commune, Kandeang District, Pursat Province

Public discussion meeting between working team and **Mr. Ma Pheap**, member commune council and **Mr. Prak Noch, Commune Clerk,** Veal District, Pursat province, dated on 22 November, 2013; from10:05 **to** 10:40 AM, the result as mentioned below:

- 100% supported for this project, because it is national level project
- We worry about project will be affected to commune, post police, people houses, residential lands, trees, and public property
- Do they have compensation or not in case of the project affect to people's property?

Suggestions:

- Appropriate compensation should be provided to affected people by discussion between property owners and project owner.

6.3.31 Record of Consultation and Discussion Meeting with working group and the representative of Banteay Dei, Krong Pursat, Pursat Province

Public discussion meeting between working team and **Mr. Klouk Vurn**, Sangkat Banteay Dei Chief,and **Mr. Khlot LayKim**,Sangkat clerk, Krong Pursat, Pursat province, dated on 12 December, 2013; from 9:00 to 11:00 AM, the result as mentioned below:

- 100% supported for this project, because it is national level project
- We worry about project will be affected to people houses, residential lands, trees because all have
- Do they have compensation or not in case of the project affect to people's property?

Suggestions:

- Project owner should buy affected land from land owner by negotiation with them in appropriate cost.
- Project owner should build ASEAN national road as soon as possible.

6.3.32 Records of Consultations and Discussions Meeting with working group and Representative of Battambang Provincial Cabinet

Public discussion meeting between working team and **H.E. Ngoun Ratanak**, Vice-Governor of Battambnag province, dated on 21 August 2013; from 2:30 to 3:30 PM, the result as mentioned below:

- Fully supported for this project, because this National road No.5 improvement will extend and broad for transportation between Cambodia and Thailand;
- It is high impact on households for National road No.5 improvement project in Battambang Town if the project has be chosen;
- By-pass of Battambang Town is easy way to solve for all impacts;
- The project has to study on rice field affected and its price in advance, and also the project should has a measuring for the price to keep it stable when they do for compensation;
- In case there is serious household impact, the project should do plan for resettlement in order to facilitate to the affected people, for their life. Therefore, the project needs to have clear plan for resettlement;
- By-pass of Battambang Town will be not flooded if the project designs well for Bridge, culvert and drainage system by following to existing natural creek- Steung that its passed;
- Should build protected on the central of road where is the City-Town and need to have inflection light on the central of road in order to make easy attracting for the driver;
- Should have enough traffic signboards, light stop and traffic lines;
- Should install security camera for traffic monitoring along the road, in order to assist the policeman of traffic law implementing and also to attract for the drivers to respect the traffic law;
- Should have light poles along the National road No.5;
- The market investment plan should be done in order to move the small market (wax market) out from the existing site that located on reserved land and along the National road No.5 to the formal secure market and good environment;
- Should plan to construct enough and strong box culverts on the reserved land, to avoid puddle water on the road during wet season that it causes to damage of quality;
- The environment status is a difficulty due to dumping site is not a standard. The garbage collection activity is done by SINTRY Company but it is a limited, they collected only for Battambang Town.

Suggestions:

The project owner should do well cooperation with the provincial committee complex resolution, local Authority and relevant institution in order to solve effectiveness of impacts.

6.3.33 Records of Consultations and Discussions Meeting with working group and the representative Provincial Department of Public Works and Transportation, Battambang Province

Public discussion meeting between working team and **Mr. Khan Mane**, Director of Provincial Department of Public Works and Transportation, Battambang Province, dated on 18 July, 2013; from 3:00 to 4:00 PM, the result as mentioned below:

- 100% supported on this project because the National road No.5 improvement will increase on works and transportation with Thailand and will make National economic improvement;
- This project will strong affect on City-Town: Moung Russei district, Along Vil district and Battambang Town;
- Some affected such as Electricity towers, Cable Towers, Optic cable underground and water pipe lines, the project should inform date of demolishment for this road improvement;
- The project has to cooperate with MOBITEL company, TELECOM company, CFONC Optic company, Cambodia Electricity Authority and PDoIME (Entity of water supply) in order to demolish for above impacts;

- The PDoPWT has been studied on this road with the project owner from Battambang to Banteay Meanchey province in 2011 and 2012;
- The project will do by-pass of Battambang Town from PK-281 to PK-301 on the left side (direction from Phnom Penh to Battambang province) in order to avoid households affected in the Sangkae district and Battambang Town;
- The project has to do extra design plan to ensure that do not have traffic jam and need to build protected fence security along the reserved land, to construct air bridge, to construct strong box culverts along the reserved land and also should construct water treatment plant to treat waste water before outlet it to Steung etc.;
- The project has to install big box concrete along the creek follow the existing model in the National road No.5 of Battambang province;
- The project has to install enough of traffic signboards, traffic lights and traffic line and to be good view.

Suggestions:

- The project owner has to do well cooperation with PDoPWT in order to do common resolution all impacts and effectiveness;
- The project owner should do well on quality and ensure for long life according to the contract with the Royal Government;
- The project owner should provide some of materials and equipment for road maintenance to PDoPWT to continue use after completed of this National road improvement.

6.3.34 Records of Consultations and Discussions Meeting with working group and the representative of Khan Fishery Administration, Battambang province

Public discussion meeting between working team and **Mrs. Tat Rida**, Vice-Chief of Khan Administration Fishery and **Mr. Leng Sophanhara**, Vice-Chief of Khan Administration Fishery and **Mr. Soeung Chanthavong**, officer of Khan Administration Fishery, Battambang province, dated on 19 July, 2013; from 8:00 to 8:55 AM, the result as mentioned below:

- Fully supported on this project because the National road No.5 improvement will increase on works and transportation with Thailand;
- The project has to build warehouse to keep materials and equipment and it should have own fuel station where is located in save place;
- Should manage well chemical elements, rubber for road and fuel, to avoid affected around the project area;
- In the Camp of the staff-workers has to build properly latrines and its septic tank, to avoid pollution into creek- Steung that it causes to affect to people and animal;
- Should has cooperation with garbage collection Agency or garbage collection company in Battambang (SINTRY) to collect garbage regular from the Camp of staff-workers;
- Should not close of water way due to Bridge construction, the project has to do by-pass and install suitable the concrete rings according to the size of water flow;
- Should have canal along the road to keep water flow in wet season and need to plant grass on canal side to protect erosion;
- Should build high road and extra more concrete rings installation where are low places;

Suggestions:

- The project owner has to do extra design plan on road in the Town to ensure that do not have traffic jam and security;
- The project owner has to install enough of light pole in the central road, traffic signboards, traffic lights and traffic line;
- The project owner has to implement this project ensure for good quality and to be good view.

6.3.35 Records of Consultations and Discussions Meeting with working group and the representative of SINTRY Company, Battambang Province

Public discussion meeting between working team and **Mr. Seng Soriya**, General Manager of branch SINTRY Company of Battambang province, dated on 19 July, 2013; from 3:30 to 4:00 PM, the result as mentioned below:

- SINTRY Company branch of Battambang has permission to collect garbage for whole Town of Battambang;
- They have 9 vehicles: 7 trucks are stocked garbage for 5 Ton/Truck and each time, other 2 trucks are stocked garbage for 3.5 Ton/Truck and each time;
- The garbage collection has been done for 2-3 times per day which estimated in total about 50-60 Ton per day;
- The company has cooperated with COMPTE Organization to recycle from kitchen waste to composting;
- Disadvantage at the moment is the people participated and their knowledge on health and environment are limited;
- At the present, the people had participated only 60%, the remaining they have responsible for garbage by themselves;
- The company has cooperated with Development Office of Battambang City-Hall and local Authority to delivery information services of garbage collection for whole Town and many times, but expected that the people will participate more and more for near future.

Suggestions:

The project owner should make contract with SINTRY Company branch of Battambang for garbage collection from the Office and Camp of staff-workers project when the project is started.

6.3.36 Records of Consultations and Discussions Meeting with working group and the representative of Tele-Communication and Post, Battambang province

Public discussion meeting between working team and the representative of Provincial Department of Telecommunication and Post, Battambang province, dated on 22 July 2013 from 8:30 to 9:30 AM, the result as mentioned below:

1. **Mr. Chay Somech** Director of Department of Telecommunication and Post
2. **Mr. Sek Chanbon** Deputy Director of Department of Telecommunication and Post
3. **Mr. Sok Saro** Chief of Office of Telecommunication
4. **Mr. Heng Sovannaroth** Director of Camintel, Battambang province
5. **Mr. Kuch Kosal** Investor of Telecommunication, Battambang province
6. **Mr. Yon Bunna** The representative of CFONC Company
7. **Mr. Thaong Theng** The representative of CFONC Company

- 100% supported on the project because the National road No.5 is an important Economic road for Cambodia which it linkages with Thailand;
- The Optic cable of Camintel is buried at depth of 0.5m – 1m on reserved land of left hand direction from Phnom Penh to Battambang province, the cable is far from the central line of 5m – 10m;
- This Optic cable will whole affect if the project National road No.5 improvement by extending far from central line both sides of 10m and needed to keep for reserved land from the central line is 25m – 30m;
- Before to demolish this cable, the project has to discuss with Ministry of Telecommunication and Post in advance;
- The Department will assign Technicians to participate and cooperate to demolish this cable;

- Officer and staff of Department will not participate and work for this project on Saturday and Sunday, because it is day-off;
- The cable of CFONC Company is buried at depth of 0.8m – 1m and it is far from central line of 6m – 20m, it is located on the left hand direction from Phnom Penh to Poi Pet Town. It excepted only 2 places that required to bury on the Right hand, it is a part of the way in Pursat started from Pursat bridge to RA bridge with distance is 1Km and in Battambang started from Banan Hotel to Tela fuel station;

Suggestions:

- The project owner should organize a group discussion with the Ministry of Telecommunication and Post and inform to relevant parties which presented today in the meeting.

6.3.37 Records of Consultations and Discussions Meeting with working group and the representative of Department of Tourism, Battambang province

Public discussion meeting between working team and **Mr. Noun Tha**, Deputy Director of Department of Tourism, Battambnag province, dated on 22 July, 2013; from 9:30 to 10:00 AM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement will create Tourists to visit Battambang especially the guests from Thailand;
- This project is not affected on Heritage, Culture and Resort which located along the National road No.5;
- The project should install enough traffic signboards, traffic light and traffic lines;
- Should study clear on by-pass of Battambang Town and Town road improvement project.

Suggestions:

- The project owner has to implement this road with a good quality, security and beauty view;
- To wish this project to implement for next year, do not delay it.

6.3.38 Records of Consultations and Discussions Meeting with working group and the representative of Battambang City Hall, Battambang province

Public discussion meeting between working team and **Mr. Seang Em Vonshy**, Vice-Governor, **Mr. Thaong Ny**, Chief Office of Administration and Finance and **Mr. Song Soeung**, Chief Office of Public Works and Transportation, Battambang province, Dated on 22 July, 2013; from 10:30 to 11:40 AM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement is an important way to link on transportation with Thailand;
- The Battambang City-Hall has got information about the National road No.5 improvement project and we had meeting with the PDoPWT to discuss on impact of City-Town also;
- The project owner has organize meeting discuss with the Provincial Development Committee on By-pass of Battambang Town;
- The City-Hall of Battambang has idea to do By-pass because the Town will be high affected on public buildings and people's households;
- By-pass project is a way to extent of Battambang Town and it is parallel to population increasing in the future;
- If we do analysis on impact for Battambang Town, it will meet difficulty and it will get a challenge with the people. The project needs to modernize designs such as for: Air bridge construction, protected fences on reserved land, air bridge for the people pass from the market that located along this National road;
- Need to demolish of water pipe system, Optic cable, Electricity Towers and Telecommunication Cable Towers which buried on the reserved land;
- It is difficult to look for resettlement which it will require to study more detail on the problem for demolishing;
- Land title registration system has done only for 20% in provincial Town;

- The garbage collection service is implemented by the SINTRY Company which contracted with the Battambang City-Hall. The people participation is only 60%, the remaining 40% the people has to responsible by themselves due to SINTRY company has limited of Truck.

Suggestions:

The project owner should do well cooperation with the City-Hall of Battambang to solve all impacts together.

6.3.39 Records of Consultations and Discussions Meeting with working group and the representative of Department of Water Resource and Meteorology, Battambang province

Public discussion meeting between working team and **Mr. Khai Soda**, Deputy Director Department of Water Resource and Meteorology, Battambang province dated on 22 July, 2013; from 2:00 to 2:40 PM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement will increase works on transportation of Cambodia with Thailand;
- Do not close water way due to bridge construction, the project has to do by-pass and install concrete rings depend on the size of water flow;
- Should have plan to pump sediment soil or dig it out that it settled in the canal, creek and affected by the project;
- Should construct extra bridge where is high pressure of water on road distance from Kokoh commune to Prey Touch commune, Moung Russei district;
- Should plan to do by-pass of Battambang Town because the National road No.5 improvement project will high affect on public buildings and people's households;
- By-pass of Battambang Town will affect to the plan construction for Irrigation system of China that it starts from Kamping Pouy Dam. Should have discussion on master plan for both projects.

Suggestions:

The project owner should do cooperation with PDoWRAM in order to solve the problem will affect on Irrigation system;

6.3.40 Records of Consultations and Discussions Meeting with working group and the representative of Department of Industry Mines and Energy, Battambang province

Public discussion meeting between working team and **Mrs. Tith Linda**, Deputy Director of Department of Industry Mines and Energy, Battambang province, **Mrs. Thea Dany**, Chief Office of Staff-Administration, **Mr. Khon Narith**, Chief Office of Administration and **Mr. Bun Tong Borarith**, Chief Office of Technical Water Supply, dated on 22 July, 2013; from 3:00 to 3:40 PM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement is important road for Cambodia and Thailand;
- There is main water supply networks along the road, both sides with diameter of 250mm, length is 6Km of direction from Phnom Penh to Battambang province. It is far from the central line of road of 10 – 15m. The total water pipe distribution networks for both sides included main pipe is 12Km.
- There is a plan for water supply distribution network that supported by JICA for 2014 to extend to outside the Town, along the National road, it is 12Km of length and other water supply distribution network in Battambang Town is 15Km of length.
- In case, in Battambang Town needs to demolish water supply network, the project owner has to cooperate with Entity of water supply of Battambang province, this work needs to be done for one side first then another side for resettle to new line. The works to resettle of main pipe and new pipe distribution connection to household need to do at the same time, in order to avoid water cut off to the users for long time, this work has to work for day time and night time;
- The project has to do by-pass of Battambang Town in order to mitigate of people household affected and some public buildings in the provincial Town.

Suggestions:

The project owner should do well cooperation with PDoIME in order to solve all these affects on water pipe systems.

6.3.41 Records of Consultations and Discussions Meeting with working group and the representative of Department of Environment, Battambang province

Public discussion meeting between working team and **Mr. Choub Sarun**, Director and **Mr. Ean Kim Cheng**, Deputy Director of Department of Environment, Battambang province, dated on 23 July, 2013; from 8:00 to 9:00 AM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement is an important road for Cambodia Economic linkage to Thailand;
- The development project always has impact, but they need to do EIA for more detail and all parts such as: Socio-economic, physical environment, Biological and noise pollution and vibration;
- The garbage collection by SINTRY company is 60 Ton to 80 Ton per day from the public garden and from the people households in the provincial Town, totally collected is about 60% only;
- The garbage collection is challenge problem due to some people did not participate, they always throw the garbage on the public lands;
- The waste treatment plant in this province is old and it has less capacity, it cannot store big waste quantity which is increased everyday;
- The water of Creek-Steung is not good quality due to liquid waste flowing and solid waste disposed into these water sources;
- It may serious affected in provincial Town and Anlong Vil district Town because the people households are constructed too close the National road;
- Should construct by-pass of Battambang Town and Anlong Vil district Town, in order to mitigate these impacts;
- It may affect to people's health near the project area and travellers that they pass this road if the project is not often spraying water during the construction phase.

Suggestions:

- The project owner should do well cooperation with PDoE, in order to solve all affects on Environment in Battambang province;
- The project owner needs to help to prepare waste treatment plant in the Towns in order to defend of people health-animal which they are using water sources from Creek-Steung;
- The project owner should invest a recycle factory in Battambang province.

6.3.42 Records of Consultations and Discussions Meeting with working group and the representative of Department of Agriculture, Battambang province

Public discussion meeting between working team and **Mr. Long Phaorn**, Deputy Director of Department of Agriculture, Battambang province, dated on 23 July, 2013; from 9:30 to 10:00 AM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement will be increased of transportation between Cambodia and Thailand;
- It may have some affects on the people's rice fields but it not many by the National road No.5 improvement project;
- Should do compensation as Government policy, because it was solved this issue once in 2004-2006 in period of National road No.5 reconstruction;
- The study team has to record on size people's rice fields that affected and their ideas,
- The price of rice field in the by-pass area at the present is range from 5000$/ha - 10000$/ha;
- The rice production in the by-pass area is 2.5T/ha – 3T/ha but for rice product as farming is 4.5T/ha – 5T/ha;

- This study should analyze on foods and economic balance that affected by the project;
- It may be affected on Irrigation plan for 2014 if there is filling up of Creek, Canal or Prek ect.
- Do not close any water way by the project activity.

Suggestions:

- The project owner should do well cooperation with PDoA in order to solve all rice fields affected in Battambang province;
- The project owner should build enough of light road, traffic signboards, traffic lights and traffic lines.

6.3.43 Records of Consultations and Discussions Meeting with working group and the representative of PDoLUMPC, Battambang province

Public discussion meeting between working team and **Mr. Ou Dany**, Director of PDoLUMPC, Battambang province, dated on 23 July, 2013; from 3:00 to 4:00 PM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement will be increased of transportation between Cambodia and Thailand;
- The PDoLUMPC has approved on principle the management the reserved land along the National road No.5 in Battambang Town, as show low:

  From PK-288 + 500 to PK-290 + 100, reserved land is 20m from the central line, both sides

  From PK-290 + 100 to PK-293 + 800, reserved land is 20m from the central line, both sides

  From PK-293 + 800 to PK-297 + 500, reserved land is 25m from the central line, both sides

  From PK-297 + 500 to further, reserved land is 30m from the central line, both sides
- It may be difficult to solve on people's households affected which are located along the National road No.5 from New concrete bridge to traffic circle of Preah Noreay and in the district Town of Anlong Vil because most of people did not receive Land Tittle; excepted some people that they requested for house construction to PDoLUMPC. This Land Title the PDoLUMPC has determined for reserved land is 20m from central line, both sides;
- To solve above affected we have to follow the expropriatory law;
- The project should look for by-pass of Battambnag Town until outside of district Town of Anlong Vil, in order to avoid a serious affected on people households and public facilities;
- For this by-pass we also have to follow the expropriatory law but, for all payments on rice field and land outside the Town is lees and easy to solve its. Other hand we can easy make plan for City-Town extending in the future;
- Should do study to determine on rice field marketing and land outside the Town in order to avoid the land price is not normal by the middleman.

Suggestions:

- The project owner should do well cooperation with PDoLUMPC in order to solve all affected: rice fields, and public buildings together and effectiveness.

6.3.44 Records of Consultations and Discussions Meeting with working group and the representative of Khan Forestry Administration, Battambang province

Public discussion meeting between working team and **Mr. Ly Chou Beang**, Chief of Khan Forestry Administration, Battambang province, dated on 23 July, 2013; from 4:30 to 5:00 PM, the result as mentioned below:

- 100% supported this project because the National road No.5 is an important economic road between Cambodia and Thailand;
- There are few places that grown of trees along the National road, such as in Battambang Town, Sangkae district Town and Moung district Town;
- These trees are beauty view trees: Acassia fistula fabaciae (Leung Reach), Caesal Pinia Puecherrrima Fabaciae (Krangaok), Liagerstoremia Floribuda Lythracees (Trabek Prey) ect.,

these trees are which provided by Khan Forestry Adminstration to the people to grow trough local Authorities: Moung , Sangkea and Battambang Town;

- The National road No.5 improvement project is not affected to crop lands, forest or community forestry which were under management of Forestry Administration;
- These trees are already big grown along the road, the project owner should provide fund to the local Authority to move its to new places that its are near the people land;
- There is no by-pass for any wildlife and the project is not affected on wildlife also.

Suggestions:

- The project owner should install enough of light posts on middle road, traffic signboards, traffic light and traffic line;
- The project owner should do good quality road, good security and beauty view of road.

6.3.45 Records of Consultations and Discussions Meeting with working group and the representative of Cambodia Electricity Authority, Battambang province

Public discussion meeting between working team and the representative of Cambodia Electricity Entity, Battambang province, dated on 22 August 2013 from 8:30 to 9:50 AM, the result as mentioned below:

1. **Mr. Tiv Ravuth** Chief of Cambodia Electricity Entity, Battambang province
2. **Mr. Yan Bophai** Vice-chief Office in charge of electric network distribution
3. **Mr. Chea Samnang** Chief Office of Administration
4. **Mr. Pech Dararith** Chief Office of Planning
5. **Mr. Long Siravuth** Chief Office of electricity networks
6. **Mr. Sim Sarithon** Vice-chief Office of Planning

- 100% supported this project because the National road No.5 is an important road for Cambodia linkages with Thailand;
- The Cambodia electricity Entity is responsible for electricity network from Ansar Chambak commune, Kampong Chhnang province to Battambang province;
- The project will affect on electricity Towers and electric cable at Pursat Town and Battabnag Town;
- In order to avoid these affects, need to do by-pass from both provincial Towns, because these affects are not only on part of electricity, it is many affected such as people's households ect.;
- There are many affects on small Towns such as commune and district Towns especially, affected on electricity services that its running by the Servers in the commune and district;
- In general, Cambodia electricity Tower which constructed is far of 28m – 30m from the central line by following the guideline of MoPWT, excepted in the provincial Town there were far less than 28m for some towers. Therefore, for both sides of road improvement is not high impacts;
- The impacts on part of electricity, the Entity electricity has no budget to pay for demolishing of Electricity Towers and Electricity networks. The Entity electricity can help for this work is not over 20 of electricity Towers;
- The Entity electricity will organize Technician team to participate and to assist the project for moving out Tower to the new places;
- The Cambodia electricity network in Battambang is medium voltage networks that it has capacity of 22kV, and there is also the same voltage for the private Enterprise and Severs of electricity distributions;
- The Cambodia electricity has different height from 12m to 14m, it depend on the real situation;
- It is concerning that services of the private Enterprise and Severs of electricity distributions implemented and then when the project National road improvement require them to do as

standard MIME's for electricity cable and its height which will pass the road where are all in the small Towns, because they have limited of budget;

- For accident is created by road factor, most accident is happened at the intersection road, curvedly road, bus station on the reserved land or nearby the local market, lack of light, it is not enough o traffic signboard, no traffic light and traffic line;
- Should do cooperation with relevant ministries and the local Authority all levels to organize bus station and plan to move illegal market that is near the road to the safety market place.

Suggestions:

The project owner should discuss with Cambodia Electricity Authority and to inform to all relevant parties about Electricity Towers and Electricity Cable Networks distribution affected in advance for 3 months.

6.3.46 Records of Consultations and Discussions Meeting with working group and the representative of Moung Russei District, Battambang Province

Public discussion meeting between working team and **Mr. Out Kim Hoeung**, Vice-Governor and **Mr. Kun Sophaon**, Chief Office Administration of Moung Russei District, Battambang province, dated on 18 July, 2013; from 9:00 to 9:40 AM, the result as mentioned below:

- Fully supported this project because the National road No.5 is an important road for Commercial and transportation between Cambodia and Thailand;
- Moung Russei district Town is about 2 - 3Km along the National road No.5;
- The private sector affects are: Optic cable Tower (it is far about 17m from the central line), Trading signboards and Electricity Towers which constructed before year 2002 (its are far less than 23m from the central line);
- Electricity Towers which constructed after year 2002, its are not affected for the project road improvement because its are far from 25m – 28m from the central line;
- We seen that it will be affected on Government Optic cable buried underground (TeleCom), it is near and on the reserved land, it constructed before year 2002, it is before the Sub-Decree No.197 ANK-BK, dated on 23 November 2009 on the Management Land along the National Road;
- Therefore above affected needs to make discussion with above Companies in order to demolish. There are two Electricity private Enterprises: (1) **Sea Tec** Electricity Development Enterprise, in Moung Russein district, on the Right hand of direction Phnom Penh-Battambang province; (2) **You Danin** Electricity Development Enterprise, in Moung Russein district, on the left hand of direction Phnom Penh-Battambang province;
- The affected people has got compensation once already during the first National Road No.5 re-construction in 2004 2006 which determinate was 27m from central line of road;
- The project owner should do discussion with the people affected on the reserved land and has to cooperation with PDoLUMPC to solve this problem;
- To construct bridge or to extend the road should do not close the water way, it should open the water way by installing more and bigger of concrete rings as the same of water way dimension;
- The project should construct enough of culverts and drainage systems; and to install enough of traffic signboards and traffic light;
- After completion of road construction, the project should organize a maintenance Agency which it recognize by MoPWT, should handover materials for maintenance to district or PDoPWT to carry this work;
- It is difficult for garbage collection in Moung Russei district, at the moment there is a market contractor that he collects garbage from Moung Russei market and transport it to depose in a small dump site located in Phum-3 village, it is far about 6Km from district Town; for other garbage households the household owners are responsible by themselves;

Suggestions:

- The project owner should do well cooperation with district Authority in order to solve and effectiveness of affects;
- The project owner should recruit staff-workers from Cambodian;
- The project owner should do investment for recycle Factory and garbage collection in District.

6.3.47 Records of Consultations and Discussions Meeting with working group and the representative of Sangkae District, Battambang Province

Public discussion meeting between working team and **Mr. Choeung Sin**, Vice-Governor and **Mr. Sok Hoeun**, Chief Office Administration of Sangkae District, Battambang province, dated on 18 July, 2013; from 10:30 to 11:30 AM, the result as mentioned below:

- Fully supported this project because the National road No.5 improvement will be improved on National economic;
- There are 4 communes located along the National road No.5: Kampong Preang, Kampong Preah, O-Dambang and Anlong Vil communes. One of four is Anlong Vil commune did not register of Land Title system. Therefore they already got information, it is determined that the National road will keep distance for 30m from central line for both sides. It is not difficult to solve for these affects, it will do compensation to them as policy of Government was decided;
- It may be not affected on Electricity Towers which construct after year 2002, its were far about 25m 27m from the central line;
- It may be affected a little on water pipe system is in Anlong Vil district because this water pipe just connected from Battambang Town to Anlong Vil market only;
- It may be affected on Optic cable Tower and Optic cable underground because its located on the reserved land;
- The project should construct enough of culverts and drainage systems; and to install enough of traffic signboards and traffic light;
- It is difficult for garbage collection in Sangkae district because the people have a limit participated. It is only Anlong Vil that it has got service from SINTRY Company (Anlong Vil Market) and some households are closed to Battambang Town. For other households, the people have to responsible by themselves;

Suggestions:

- The project owner should do compensation in Anlong Vil commune as the same the people in Battambang Town;
- The project owner should do well cooperation with district Authority in order to solve and effectiveness of affects;
- The project owner should recruit staff-workers from Cambodian;

6.3.48 Records of Consultations and Discussions Meeting with working group and the representative of Thmor Kol District, Battambang Province

Public discussion meeting between working team and **Mr. Sa Em Setha**, Vice-Governor of Thmor Kol District, Battambang province, dated on 19 July, 2013; from 10:55 to 11:40 AM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement will be improved on National economic;
- The people in Thmor Kol district known about the National road No.5 improvement, they are already registered land title system, it was determined of 30m from the central line of road both sides. Moreover, the commune Chief is also made contract with the people on restrict of encroachment on the reserved land;
- It will be affected on Electricity Towers of **Samon** called **Ta Yan** Electricity Development Enterprise of Thor Kol district. These Electricity Towers are far about 15m from the central line, left hand of direction from Phnom Penh to Battambang province;

- It will be affected on Optic cable Towers of **Metfone** Company that its are far about 11m from the central line;
- It will be affected on Optic cable underground of **TeleCom** of Provincial Department of Communication and Post, its are far about 7m – 8m from the central line; and other Optic cable underground of **CFONC** of China, , its are far about 15m from the central line;
- Should have discussion to solve above affected then the project can be successfully implemented;
- The project can do road improvement and it is not to be tense with the affected parties in Thmor Kol district, because they are happy and agreed to have this project;
- To reduce of accident in maximize, the project has to build safety fence on reserved land and install enough traffic signboards, traffic lights where are intersection road in the City-Town;

Suggestions:

- The project owner should do well cooperation with Thmor Kol district Authority in order to solve together of affects;
- The project owner should recruit staff-workers from Cambodian;

6.3.49 Record of Consultation and Discussion Meeting with working group and the representative of Tonle Sap Authority

Public discussion meeting between working team and **H.E Lim Pouy**, Vice-Chairman of Tonle Sap Authority, Ministry of Water Resources and Meteorology, dated on 29 August, 2013; from 10:30 to 11:00 AM, the result as mentioned below:

- 100% supported this project because the National road No.5 improvement will improve of National Economic of Cambodia and it also will get better of people living condition;
- Tonle Sap Authority has a role-play and it is study Entity follow up and evaluate on Social-Economic and natural resources in Tonle Sap area and relevant areas;
- The main activity of Tonle Sap Authority is facilitating for management conservation and development around Tonle Sap Lake and relevant areas of 8 provinces around Tonle Sap Lake;
- The conservation area is divided into 3 zones: Transition zone, Buffer zone and core zone;
- By-pass of road of City-Towns along the National road No.5 improvement project can be affected on first zone; it is Transition zone. This zone is not forbid for any project development; but wishes to do only careful.

Suggestions:

The project owner should write an official letter to Tonle Sap Authority if needs for facilitation on affected area which management by Tonle Sap Authority or any data and documentation needed.

6.3.50 Records of Consultations and Discussions Meeting with working group and the representative of Russei Kraing Commune Council, Battambang Province

Public discussion meeting between working team and **Mr. Pouy Savorn**, Russei Kraing Commune Chief, Moung Russei District, Battambang province, dated on 22 July, 2013; from 8:20 to 8:45 AM, the result as mentioned below:

- To support 100% due to the NR5 improvement project will make Cambodia economic improvement and it will change people's life condition level as well;
- It will affect some business stalls and other hard buildings people's by the project, but the working team should do additional deeply study;
- In case, there are affects on agriculture land, fruit trees or other trees, the Government and the project owner should do cooperation with the commune level Authority and relevant Departments to solve properly on these issues;
- In the Thnaol Bat village, Russei Kraing commune there is curve road, therefore the project owner should install traffic signboard to avoid for traffic accident.

Suggestions:

- The project owner should construct good quality road, safety road with good aestheticism.

6.3.51 Records of Consultations and Discussions Meeting with working group and the representative of Prey Svay Commune Council, Battambang Province

Public discussion meeting between working team and **Mr. Neuv Vit**, Prey Svay Commune Chief, Moung Russei District, Battambang province, dated on 22 July, 2013; from 9:10 to 9:45 AM, the result as mentioned below:

- This project will be important gateway for commercial between Thailand-Cambodia-Vietnam, moreover cargos transportation people's in the province as well as District and commune level;
- The working team should do study clearly on infrastructures impacts especially, households and occupation people's;
- There is market in Prey Svay commune on front of Prey Svay commune office, it is Town and busy that the people passed road, should install traffic signboard;
- For the drainage system, should do study clearly because there is often flooded in wet season;
- Other important problem is garbage collection that it causes difficulty, due to there is no garbage collection Company. For the household's garbage collection the people can responsible by themselves.

Suggestions:

- The project owner should construct drainage system and install properly traffic signboards;
- Should do have policy of compensation to the affected people.

6.3.52 Records of Consultations and Discussions Meeting with working group and the representative of Kea Commune Council, Battambang Province

Public discussion meeting between working team and **Mr. Hean Kim Sour**, Clerk of Kea Commune, Moung Russei District, Battambang province, dated on 22 July, 2013; from 11:10 to 11:45 AM, the result as mentioned below:

- To supported 100% for this project because the NR5 improvement project will make Cambodia economic improvement;
- This project can help to discount due to cheaper cost of transportation;
- It concerning about traffic accident will be increased because the road is wide that it causes to some drivers are not respected on traffic law and they drunk then creating accidents to other people;
- In Po-3 village, there is flooded for every year in wet season, the project owner should study at this point clearly to avoid inundated road and it causes to damage road.

Suggestions:

- All relevant Authorities should do reinforce of traffic law and to punish to who break of law.

6.3.53 Records of Consultations and Discussions Meeting with working group and the representative of Moung Commune Council, Battambang Province

Public discussion meeting between working team and **Mr. Srey Samon**, Chief of Moung Commune, **Mr. Ber Ngil**, village Chief of Kanseng Banteay and **Mr. Keut Chhoeun**, village Chief of Moung, Moung Russei District, Battambang province, dated on 2 August, 2013; from 8:05 to 9:00 AM, the result as mentioned below:

- To support for this project because the NR5 improvement project will make more communication for commercial and transportation between Cambodia-Thailand-Vietnam;
- The people are happy due to there is wide road and good, easy the travelling;
- When this road in completed, the project owner should do cooperation with the local Authority to avoid for other inactivity that will be happened and it will barras of construction;

- For garbage collection is main problem in Moung commune due to there is a Town. If there is no measurement for the future, there will affect to aestheticism on this road.

Suggestions:

- Should install enough traffic signboards in the Towns because in the Moung commune are Health center, Schools and Pagoda.

6.3.54 Records of Consultations and Discussions Meeting with working group and the representative of Ko Koh Commune Council, Battambang Province

Public discussion meeting between working team and **Mr. Pal Chaom**, Chief of Ko Koh Commune, Moung Russei District, Battambang province, dated on 2 August, 2013; from 9:15 to 10:00 AM, the result as mentioned below:

- It is very happy and 100% supported for this project due to it will provide advantages for the people in this commune for travelling and wide road;
- The people are happy due to there is wide road and clean road because they never haven;
- The working team should discuss with the people are living along this road in order to know whether are they require which one of compensation?;

Suggestions:

- If there are affects legally on land use and households people's, the Government should do clear and properly compensation for them.

6.3.55 Records of Consultations and Discussions Meeting with working group and the representative of Prey Touch Commune Council, Battambang Province

Public discussion meeting between working team and **Mr. Chheang Chhat**, Chief of Prey Touch Commune, Sangkat District, Battambang province, dated on 2 August, 2013; from 10:20 to 11:00 AM, the result as mentioned below:

- This project is important gateway for commercial between Thailand-Cambodia-Vietnam. Moreover, cargos transportation people's in the province as well as commune;
- Should have concrete in the middle road to divide road into two sides, to avoid violation for diving;
- Should delivery on traffic law to the people, to let them know how to use for highway.

Suggestions:

- Should have fair policy for compensation to affected people.

6.3.56 Records of Consultations and Discussions Meeting with working group and the representative of Kampong Preang Sangkat Council, Battambang Province

Public discussion meeting between working team and **Mr. Nget Sea**, Chief of Kampong Preang Commune, Sangkat District, Battambang province, dated on 7 August, 2013; from 8:12 to 9:00 AM, the result as mentioned below:

- Fully support this project, because would like to develop the country fast as other neighbour country;
- This project will provide advantages for Cambodia and Cambodian to improve their living condition;
- The NR5 improvement project, should do fast construction and good quality;
- The project owner should install enough traffic signboards in Towns and should do clearly traffic lines;
- In order to have good road and aestheticism road, the relevant Departments that located on this new road should do cooperation with the local Authority to prevent for garbage disposal everywhere on this road;
- In case, there is affect on property people's, should do cooperation with local Authority in order to solve smoothly this issue.

Suggestions:

- Should have policy for compensation to affected people.

6.3.57 Records of Consultations and Discussions Meeting with working group and the representative of Kampong Preh Commune Council, Battambang Province

Public discussion meeting between working team and **Toun Savon**, Chief of Kampong Preh Commune, Sangkat District, Battambang province, dated on 7 August, 2013; from 9:30 to 10:00 AM, the result as mentioned below:

- It is very happy and 100% supported for this project;
- This National Road No.5 improvement will provide advantages to the people in the commune to travel due to it is wide Road;
- To reduce all expenses for transportation of the people and gain of time for travelling;
- It is easy to do trading between one province to another province and between Cambodia to the neighbour country;

Suggestions:

- Should do have traffic line and traveller line to pass in the Town and traffic signboard should be done as well;
- The project owner should organize for garbage collection Company because in the future population will be increased along this road.

6.3.58 Records of Consultations and Discussions Meeting with working group and the representative of O-Dambang Commune Council, Battambang Province

The working team did not meet and discussion with O-Dambang Commune Chief due to he was busy in his family, his father is died, he was busy in this ceremony.

6.3.59 Records of Consultations and Discussions Meeting with working group and the representative of Along Vile Commune Council, Battambang Province

Public discussion meeting between working team and **Mr. Touch Svan**, Chief of Along Vil Commune, Sangkat District, Battambang province, dated on 9 August, 2013; from 4:05 to 5:00 PM, the result as mentioned below:

- It is very happy and 100% supported for this project;
- This project is big project which it has never been before;
- The project owner, should do clear study about population affected people and should do have policy for resolution these affects;
- For garbage collection in the market, there is garbage collection Company, they collect it to dispose in the Dump site. For household garbage collection, the people can responsible by themselves.

Suggestions:

- The project owner should do construction this road according to the technical specification and concrete rings installation along the road for drain water out to avoid inundated road and damage road;
- Should do have suitable policy on affects such as crops, business stalls, agriculture land, and other trees that grown by the people.

6.4 SUMMARY ON SUGGESTIONS FROM ENTITIES AND RELEVANTL AUTHORITIES AND RESOLUTIONS FROM THE PROJECT ONWER

Table 6-1: Summary on suggestions from Entities and relevant Authorities and Resolutions from the project owner

Idea and problem raised up	Suggestion raised up	Project's Solutions
100% supported for this project because: - It will make economic improvement; - It will link with Thailand economic improvement; - It will increase of transportation with Thailand; - It will improve for communication of Thailand commercial and some Asian Countries ; - It will be safe of traffic and increase of Tourists; - It will provide fast transportation and good road utilizing.	Should implement this project soon in near future.	- The project owner will try to complete of study at the end of March 2014; - The project design will be improved base on Ideas and suggestions from the people on time.
There are no land title that registered for buildings in Pursat Town along the National road No.5.	Should do have suitable compensation for this project affected	- The project owner will discuss with the MoPWT on these impacts and will do cooperation with complaint resolution Committee at provincial level and others relevant person. - To prepare plan for resettlement of the project.
- It was only 4m for both sides of road in the past, in Pursat Town, in 2006 for National road No.5 improvement. But in 2012, the PDLUMPC has registered of Land Title system following the new principle of reserved land, both sides of 30m from the central line, this event there were no people participated and consultation. - This principle is opposite to Sub-Decree No. 197 ANK-BK dated on 23 November 2009, Chapter-3, and Article-8 which required to extra determining of reserved land in the City-Town.	The project owner, should do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve effectiveness on public land, residential households and others land development which it impacts by the project.	- The project owner will do detail study on these impacts in this provincial Town. - By-Pass of Pursat Town needs to select.
In case the National Committee does evaluation on the Reserved Land in the Town and they are agreed in any limitation, then the PDoLUMPC will follow to circular No.6 to renew registration for the people.		

Idea and problem raised up	Suggestion raised up	Project's Solutions
The some people living in Battanbang Town along the National road No.5, they are registered of land title. It has determined 20m from the central line of the reserved land. The people living along the National road No.5 in Krakor district Town, Bakan district Town, Provincial Pursat town and Sangkea district Town, Thmor Kol district Town, Provincial Battambang Town, all these are not registered for land title. Therefore, there should have suitable for compensation to them.	The project owner, should do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve effectiveness on public land, residential households and others land development which it impacts by the project.	- The project owner, will do detail study on affects in the provincial Town and will do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve effectiveness on public land, residential households and others land development which it impacts by the project. - By-Pass of Battambang province is already selected, it is no any problem.
Should do registration all people's households and public buildings which affected by the project in the provincial Town.	The study team should do a study on actual affects in order to determine and evaluation these affects by the project.	- The project owner, will do detail study on affected for people's households and public buildings; - To prepare plan for resettlement of the project.
Should study on cost of all types affects and it also should find a measurement to determine of these cost affects in order to avoid for cost change and difficult to solve these next.	The project owner, should do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to determine actual cost and making contract with them to keep stable these costs.	The project owner, will do study on cost that affected of the contract with the Royal Government of Cambodia and will do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to determine actual cost and making contract with them to keep stable these costs.
For affected on Rice fields and some households people's outside the Town, it is not difficult to solve these problems because they were solved (advanced of step-1) for them in the period National Road No.5 constructed since 2004-2006.	- The people request to have fair compensation for their agriculture land and households; - The project owner should do clear study on Agriculture land cost along the National road No.5; - Should have mean of investigation and protection measurement for illegal buildings on the reserved land after the project has been solved.	- The project will refer on resolution in the past (2004 2006) for a based and additional solution with the affected people if necessary; - The project will do studying and evaluation on this impact; - The project will establish monitoring Agency and it will protect on illegal buildings on the reserved land after the project has been solved with MoPWT.
Should have suitable compensation for un-hard people's buildings affected for business stalls along the National road No.5.	The project owner, should do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve effectiveness for this impact.	- The project owner, will do well cooperation with the local Authority to solve effectiveness for this impact. - To prepare plan for resettlement of the project.

Idea and problem raised up	Suggestion raised up	Project's Solutions
For the people households affected in the Town should do depend on law to solve these.	The project owner, should do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve for this impact.	The project owner, will do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve for this impact follow to Cambodia Law.
Should decrease the reserved land of NR5 improvement project to 12.5m – 20m from the central line of road in order to reduce people's households and public buildings affected in the Town.		The project owner will do cooperation with relevant Provincial Departments to study for decreasing this reserved land of project into minimize as possible.
Should establish a provincial committee which it comes from local Authorities all level, relevant departments and people affected in order to solve these affects.		- It stated in action plan of resettlement of project; - To solve for affected of project implementation by Inter-ministry (IRC)
Should have suitable compensation for trees along the road which grown by Khan of Forest Administration, Pursat province.	Should grow extending grass along the slope of road including regular maintain to protect erosion.	- It stated in action plan of resettlement of project; - To solve for affected of project implementation by Inter-ministry (IRC)
The project should grow trees which its have medium height and its are strong types along the slope of road to protect flood and erosions.		
The cost of tree with diameter >0.3m is 80,000Riels/m^3. For the small tree in the past grown costs of 1000Riels per tree.		
For the trees grown by the Pursat City Hall, it will be removed by us after the project owner is informed.		- By-Pass of Pursat Town need to select; - The project owner will inform to Pursat City-Hall about date of project implementation and date to ask to remove trees out, in case making decision for NR5 improvement crossing this road.
For the trees grown by the people, it will be removed by them after the project owner is informed and should have fair compensation for them.	Should do resolution on impact base on Cambodia Law.	- It stated in action plan of resettlement of project; - To solve for affected of project implementation by Inter-ministry (IRC)
The problem affected on Electricity Towers, Optic cables, water pipe systems and Light post which its are far about 6m – 15m from the central line of road in the Commune Town, District Town and relevant provincial Town, the project owner should discuss with the Ministry and relevant parties.	The project owner, should do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve effectiveness for this impact.	The project owner will do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve effectiveness for this impact.

Idea and problem raised up	Suggestion raised up	Project's Solutions
- Tele-Communication is Government's Company which had cable optic networks buried underground; - For the cable Optic on air, it is belonging to **CFONC**, Chinese Company, (Office in Banteay Meanchey province).	The project owner, should do well cooperation with the Provincial complex resolutions committee and relevant Ministry and people affected in order to solve for this impact.	The project owner will do well cooperation with relevant Ministry and people affected in order to solve effectiveness for this impact.
In case, the project is needed to clearance depth of 0.5m, then it can work over existing of cable optic, the life use of cable optic is over 50 years.		The project owner will do well cooperation with relevant Ministry and people affected in order to solve effectiveness for this impact.
In case, the project has planned to resettle the cable optic, project owner should inform in advance and need to have discussion with relevant parties, to avoid all damaging because it is costly.	The project owner, should do well cooperation with relevant Ministry and parties affected in order to demolish for this impact.	The project owner will do well cooperation with relevant Ministry and other parties in order to demolish for this impact.
- This project will affect to water pipe systems underground, along the road, it belong to Pursat Water Supply. - In Battambang, it will affect to water pipe systems underground, along the road in the provincial Town; there is also will affect on pipe system for Server private in the Commune Town and district Town, along the National road No.5.	The project owner, should do well cooperation with Water Supply Entity of Pursat province, Btattambang proving and the Server water supply of private sectors of Commune/district in order to demolish these pipe lines.	The project owner will do well cooperation with relevant Ministry and other parties in order to demolish for this impact.
It will affects to Electricity Towers of Server of combination Government and private Entrepreneur.	- The "**Nareth Electricity Development**" company in Pursat Town asked to the project owner to do compensation for electricity Tower included labour (250$ per Tower with it is height 12m) in the past of construction; - The project owner should inform and discuss with Cambodia Electricity about demolishment for this electricity Tower. - Should do have discussion with the Ministry and relevant parties about this impact.	The project owner will do well cooperation with relevant Ministry and other parties in order to solve effectiveness for this impact.
It may be not affect to Cambodia Electricity Towers which its are far 25m - 28m from the central line of road.		The project will do not make any affect on either electricity Tower which it is far from 25m to 28m from the central line of road, due to the requirement for road improvement is

Idea and problem raised up	Suggestion raised up	Project's Solutions
		20m from the central line.
To avoid all affects such as noise, vibration, air and water pollutions, residential houses, electricity Towers, optic cables, water pipes and other buildings, and to ensure that it will increase of transportation services between Cambodia and Thailand, the project owner should construct on by-pass for provincial Battambang Town and Pursat Town.		- The project will do detail study on this provincial Town and it will also do detail study on by-pass of provincial Town in order to consider for common advantage in the future; - By-Pass of Pursat Town needs to select; - By-Pass of Battambang Town is already selected.
At the same time the project owner should extend in large for Pursat Town road improvement.		
To construct by-pass, the project owner should study on rice field loose and how much food product loose per year?		The project will insert data rice field loose and food product per year loose into economic analysis.
There is only one idea raised from PDoLUMPC in Pursat province: should do not construct by-pass for provincial Pursat Town because the National road No.5 in Town is about 3Km length and straight, the project may has pays less for this. Moreover, the Pursat Town road improvement is creating beauty view and more better for Pursat Town.	Should do comparison of economic balance between by-pass of the provincial Town and the provincial Town road improvement.	The project will do detail study on this provincial Town and it will also do detail study on by-pass of provincial Town in order to consider for common advantage in the future.
The project owner should construct strong box drainage with cover along the reserved land, where Town to avoid puddle water that it is cause to damage of road quality.		- The project owner with discuss with MoPWT; - The project will do detail study on design plan and this road improvement.
Should be active strongly implement project in dry season to avoid erosion and it causes to shallow of Steung, Creek and Natural channel.		The project will try hard for project plan implementation that it is a priority action before wet season.
Do not allow to install for any trading signboards (Pano) a cross the National road No.5 in Pursat Town. The Pursat City Hall will remove by own-self after the project owner is informed.		The project will inform to Pursat City-Hall about date to demolish for this Trading signboards, in case the project owner decided to select on existing National road No.5 improvement in the provincial Pursat Town.

Idea and problem raised up	Suggestion raised up	Project's Solutions
The project should prepare to have enough: traffic signboards and traffic lights and traffic lines.	- The project owner should work well follow the technical standard, to ensure for good quality and long life utilizing; - Should have good cooperation; work in closed with PDoPWT in order to get well implementing of this Road improvement project.	- The project owner will discuss with MoWPT to install enough traffic signboards, traffic lights, traffic lines and other facilities to reduce accident; - The project owner will work well follow the technical standard, to ensure for good quality and long life utilizing according to Government's contracted; - The project will do additional detail study on design plan of this road improvement.
Should build safety fence along the reserved land in the Towns and where are hump roads.		
Should do protected of central road which it is suitable height as standard of MoPWT in the City-Town.		
The protected central road needs to keep space in between from 100m - 200m for traffic passing from an inside to another side in the City-Town.		
In case, there is no space in the City-Town, they should make passing road underground.		
The project should re-construct culvert systems and determine this line is far from the land property people's at least 2m.		
Should build protection fences on the reserved land for both sides and where the hump roads are and should build air bridge to cross in each big City-Town. In the provincial town and district Town should build crossing bridge for pedestrian.		
Should study on protected of central road outside the Town.		
Should have suitable drainages systems, install the concrete rings and to build high bridge to avoid flood causes to damage road.		
Should do clear determine on the reserved land for road improvement, to keep for natural water networks, keep for forest along the Steung, creek to protect soil erosion.		
Should do detail for design plan of traffic safety in the Town.		
The PDoPWT does not allow growing any trees along the reserved land because it will get more negative impacts.		
The project has to build warehouse to keep materials and equipment, and to keep safe for bituminous and chemical elements. Should also well manage for fuel leakage or its	- The project owner should manage well both solid and solid wastes to avoid its pollute into near/close water sources: creek, Steung and	- The project will organize staff-workers house and to build warehouse to keep materials and equipment

Idea and problem raised up	Suggestion raised up	Project's Solutions
disposal.	other flooded areas; - The project owner, should do well cooperation with the Provincial Department of Environment in order to solve effectiveness on negative impacts by the project together.	and there will be a good fuel storage and gas. - All solid and liquid wastes will be good managed to avoid it pollution into water sources near the Creek, Steung and others flood areas.
Should build properly latrines and its septic tank for staff-workers to avoid pollution into creek- Steung that it causes to affect to people and animal.		
SINTRY Company in Battambang has a limit of capacity, because it has a Dump site and it is not a standard yet. For garbage collection in Pursat and other commune/district Town are difficulties because there is no garbage collection Company, the people has to responsible by themselves.		
The project should add to invest on recycle of garbage for these Towns.		
It may affect to people's health near the project area and travellers that they pass this road if the project is not often spraying water during the construction phase.		
Do not close any waterways due to road extending, should dig canal or install concrete rings let water flows as normal in wet season.		The project will not close any waterways due to for bridge construction. The project will do by-pass in order to open space for normal traffic and install concrete rings according to the water discharge as actual yearly.
The National road No.5 improvement is located in the part of Transition Zone of Tonle Sap Biosphere Reserve which managed by Tonle Sap Authority. But it is not prohibit area for any development as Buffer Zone or Core Zone of Tonle Sap Lake.	The project owner should write an official letter to Tonle Sap Authority if needs for facilitation on affected area which management by Tonle Sap Authority or any data and documentation needed.	The project will be not doing to negative impact on Natural resources of these 3 zones.
Should study on water flood level and should construct strong bridge and increase dimension of water flow because the flood disaster is high from year to year.	The project owner should do cooperation with PDoWRAM.	The project owner is studying and additional study on level this flood to ensure that to get good quality of road.
It will affect on the ancient gateway in Bakan district. it is a gateway into Royal palace of **Preah Bat Monivong**, it was constructed in Colonial of French which located nearby the National road No.5	The project owner should do well cooperation with Provincial Department of Culture, Fine and Arts for this movement of ancient gateway.	The project owner will inform about this and will do cooperation with Provincial Department of Culture, Fine and Arts, in Pursat province for this movement of ancient gateway.
In order to keep this ancient gateway, the project should move it follow to the technical of construction movement by machine mechanical to new place which will be determined by the		

Idea and problem raised up	Suggestion raised up	Project's Solutions
Provincial Department of Culture, Fine and Arts.		
Should organize a maintenance Agency which it recognizes by MoPWT after completion of road construction.	The project owner should do well cooperation with PDoPWT in order to maintain for this road.	The project owner will do well cooperation with PDoPWT (Pursat and Battambang provinces) in order to maintain well for this road.
The project owner should provide some of materials and equipment for road maintenance to PDoPWT (Pursat and Battambang) to continue use after completed of this National road improvement project.		The project will provide some materials and equipment and machines to PDoPWT in order to maintain continue for this road.
Should provide more jobs to Cambodia people in order to assist for poverty reduction.	The construction Company should recruit the local people for staff-workers in the project in order to raise their living condition.	The project will provide jobs to staff-workers of Cambodia more than foreigner people.

6.5 CONCLUSION OF PUBLIC CONSULTATION

Based on consultations and discussions conducted, it found that some negative impacts by the project. These impacts are described below:

- It can be occurred flood a part upstream of the project area and it causes to erosion for road mamages due to did not well done of design plan focussed on drainages;
- It may be occurred of flood if the project has fill up on natural creeks and Steung in period of road construction phase;
- At the present, drainage systems along the road has been filled up by the people; and any where is big building construction that they did not install concrete rings along the road, it causes to block of waterways or it causes to have flood, road inundation in the Towns, it will damage of road;
- It can be low quality due to it is not based on technical road standard which it makes not sure for operation on time based on contracted; it is not well operationa and maintenance;
- It can be occurred accident if the project has not enough installed of traffic signboards, traffic lights and it is not done on hump roads; it is not make protection fence on reserved land where are Towns and at the point of hump roads as standard of MoPWT;
- It may be affected to people's life if there is no suitable resolution to compensate for their households or rice field;
- Cambodia will not get experience, it will not increase human resources for work on International road construction; if the project can not provide for jobs to Cambodian for staff-workers in this project;
- Staff-workers will be not got well health or they will get accident for works if the company is not consider on safety first works for them;
- It will destroy to people's and public properties, especially networks of Optic cable underground, Optic Towers, water pipes, School fences, Pogoda gates ect., if the project owner is not well cooperation with the local Authorities and relevant Institutions to resettle all facilities;
- It will be got complaints from the people due to their householdes, business stalls and crops, fruits ect., affected, in case the project owner is not well cooperation with the local Authorities and relevant Institutions to prevant these activities that it will be occurred; unless there is once solved as well;
- It will be polluted on water sources (Creek, Steung ect.,) and rice fields if the project onwer is not have warehouse to keep properly of tools and equipment, own fuel station and good management;
- It may affect to people's health near the project area and travellers that they pass this road if the project is not often spraying water during the construction phase.

Photos of Public Consultation with Involved Institutions (Pursat Province)



Meeting with **H.E. Khoy Sokha**, Governor of, Pursat Province, Dated: 15 July 2013



Meeting with **Mr. Tith Sam Oeun**, Director of Department of Agriculture, Pursat Province Dated: 15 July 2013



Meeting with **Mr.Phum Vimol**, Chief of Khan Fishery Administration, Pursat Province Dated: 15 July 2013



Meeting with **Mr. Chhai Saratt**, Chief and **Mr. Mouy Rotha**, Staff of Khan Forestry Administration, Pursat Province. Dated: 15 July 2013



Meeting with **Mr. Hun Narith**, Manager and **Mr. Sorn Vaon**, Technician of TeleCom Department, Pursat Province. Dated: 16 July 2013



Meeting with **Mr. Phen Lai**, Director of PDoLMPC, Pursat Province. Dated: 16 July 2013

Photos of Public Consultation with Involved Institutions (Pursat Province)



Meeting with **Mr. Chinh Kuong**, Deputy Director of PDoPWT, Pursat Province. Dated: 16 July 2013



Meeting with **Mr. Nheuv Song**, Director and **Mr. Sam Khim**, Deputy Director of Department of Tourism, Pursat Province. Dated: 16 July 2013



Meeting with **Mr. Keo Sara**, Director of Water Supply Entity, Pursat Province. Dated: 16 July 2013



Meeting with **Mr. Teum Saraon**, Governor of Krakor District, Pursat Province
Dated: 16 July 2013



Meeting with **Mr. Chheum Samaon**, Deputy Director of DoWRAM, Pursat Province
Dated: 17 July 2013



Meeting with **Mr. Seng Bun Thaon**, Deputy Director of PDoIME, Pursat Province
Dated: 17 July 2013

Photos of Public Consultation with Involved Institutions (Pursat Province)



Meeting with **Mrs. Yim Naret**, Director of Naret Enterprise Electric Development Co,. Ltd, Pursat Province. Dated: 17 July 2013



Meeting with **Mr. Ngin Mean**, Deputy Governor, **Mrs. Men Phally**, Deputy Governor and few theirs Colleagues of Pursat Town, Pursat Province, Dated: 17 July 2013



Meeting with **Mr. Thai Chantha**, Director of Department of Environment, Pursat Province Dated: 17 July 2013



Meeting with **Mr. Sao Daroeun**, Governor of Bakan District, Pursat Province, Dated: 20 July 2013



Meeting with **Mr. Ros Samnang**, Vice-Director of Department of Culture, Fine and Arts, Pursat Province, Dated: 15 August 2013



Meeting with **Mr. Cheab Khem**, Chief of Prek Tnaot Commune, Pursat Province. Dated: 6 July 2013

Photos of Public Consultation with Involved Institutions (Pursat Province)



Meeting with **Mr. Sar Saroem**, Chief of Sangkat Roleap, Pursat Province. Dated: 8 July 2013



Meeting with **Mr. Tep Sambath**, Vice-Chief of Sangkat Prey Nhi, Pursat Province, Dated: 8 July 2013



Meeting with **Mr. Yous Sam At**, Chief of Sangkat Svay Aat, Pursat Province. Dated: 8 July 2013



Meeting with **Mr. Soeung Sok Leam**, Clerk of Sangkat Phtas Prey, Pursat Province, Dated: 9 July 2013



Meeting with **Mr. Khon Sar**, Clerk of Trapaing Choung commune, Pursat Province Dated: 10 July 2013



Meeting with **Mr. Ouch Khoeun**, Chief of Snam Preh Commune, Pursat Province, Dated: 8 July 2013

Photos of Public Consultation with Involved Institutions (Pursat Province)



Meeting with **Mr. Yin Min**, Commune Clerk O Taporng , Pursat Province. Dated: 10 July 2013



Meeting with **Mr. Boeung Ben**, Chief of Boeung Khna commune, Pursat Province, Dated: 10 July 2013



Meeting with **Mr. Ky KimNo and Mr. Phay Leng**, Kandeang District Deputy Governor, Pursat Province, Dated: 22 December 2013



Meeting with **Mr. Tep Sambat**, First Vice-Chief of Sangkat Prey Nhy, Pursat Province, Dated: 8 July 2013



Meeting with **Mr. Khlouk Vun**, Chief of Sangkat Banteay Dei, Pursat Province. Dated:12December 2013



Meeting with **Mr. Mar Phearb**, Council Commune Member of Veal, Pursat Province. Dated: 8 July 2013

Photos of Public Consultation with Involved Institutions (Battambang Province)



Meeting with **H.E. Nhoun Ratanak**, Deputy Governor of Battambang Province.
Dated: 21 August 2013



Meeting with **Mr. Khan Malr**, Director of PDoPWT, Battambang Province. Dated: 18 July 2013



Meeting with **Mr. Chhay Somet**, Director of PD of TeleCommunication and Post and their Colleagues, Battambang Province. Dated: 22 July 2013



Meeting with **Mr. Sam Khim**, Deputy Director of Department of Tourism, Battambang Province.
Dated: 22 July 2013



Meeting with **Mr. Sean Em Von Shi**, Deputy Governor and few theirs Colleagues of Battambang Town, Battambang Province.
Dated: 22 July 2013



Meeting with **Mr. Khai Soda**, Deputy Director of DoWRAM, Battambang Province
Dated: 22 July 2013

Photos of Public Consultation with Involved Institutions (Battambang Province)



Meeting with **Mrs. Tith Linda**, Deputy Director of PDoIME, Battambang and Her Colleagues Province. Dated: 22 July 2013



Meeting with **Mr. Choup Sarun**, Director and **Mr. Ean Kim Eng**, Deputy of Department of Environment, Battambang Province Dated: 23 July 2013



Meeting with **Mr. Long Phaon**, Deputy Director of Department of Agriculture, Battambang Province. Dated: 23 July 2013



Meeting with **Mr. Ou Dary**, Director of PDoLMPC, Battambang Province. Dated: 23 July 2013



Meeting with **Mr. Ly Chou Beang** of Chief Khan Forestry Administration, Battambang Province. Dated: 23 July 2013



Meeting with **Mrs. Tak Rida**,Vice- Chief of Khan Fishery Administration, Battambang Province Dated: 19 July 2013

Photos of Public Consultation with Involved Institutions (Battambang Province)



Meeting with **Mr. Tiv Ravuth**, Director of Cambodia Electricity Authority, Battambang province and Colleagues Province. Dated: 22 August 2013



Meeting with **Mrs. Oun Kimheun**, Deputy Governor of Moung District, Battambang Province, Dated: 18 July 2013



Meeting with **Mr. Choeung Sin**, Deputy Governor of Sangkae District, Battambang Province, Dated: 18 July 2013



Meeting with **Mr. Sa Em Sethda**, Deputy Governor of Thmor Kol District, Battambang Province, Dated: 19 July 2013



Meeting with **Mr. Seng Soriya**, General Manager of SinTry Company, Battambang Province Dated: 19 July 2013



Meeting with **H.E. Lim Pouy**, Deputy Director of Tonle Sap Authority. Dated: 29 July 2013

Photos of Public Consultation with Involved Institutions (Battambang Province)



Meeting with **Mr. Poy Savon**, Chief of Russei Kraing commune, Battambang Province
Dated: 22 July 2013



Meeting with **Mr. Nov Vit**, Chief of Prey Svay commune, Battambang Province. Dated: 22 July 2013



Meeting with **Mrs. Hean Kim Sour**, Clerk of Kea commune, Battambang Province. Dated: 22 July 2013



Meeting with **Mr. Srey Samon**, Chief of Moung Russei commune, **Mr. Ber Ngil** and **Mr. Keut Chhean**, BTB Province. Dated: 2 Aug. 2013



Meeting with **Mr. Pal Chaom**, Chief of Ko Koh commune, Battambang Province. Dated: 2 Aug. 2013



Meeting with **Mr. Chheang Chhat**, Chief of Prey Touch commune, Battambang Province. Dated: 2 Aug. 2013

Photos of Public Consultation with Involved Institutions (Battambang Province)



Meeting with **Mr. Nhet Sea**, Chief of Kampong Preang commune, Battambang Province. Dated: 7 Aug. 2013



Meeting with **Mr. Toun Savon**, Chief of Kampong Preh commune, Battambang Province. Dated: 7 Aug. 2013



Meeting with **Mr. Touch Svan**, Chief of Anlong Vil commune, Battambang Province. Dated: 9 Aug. 2013

CHAPTER-7

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

CHAPTER-7

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Introduction

The environmental study of the project is based on the requirement of sub-decree on environmental impact assessment process which signed date 11 August 1999 by Prime Minister Samdech **HUN SEN**. The National Road No.5 (NR5) Improvement project of MoPWT was studying and preparing the report of Environmental and Social Impact Assessment (ESIA) from 01st July 2013 to 30 July 2014.

The ESIA is the environmental study to find out and determine environmental impact on the natural and social in project design phase (before construction), construction phase (before operation), operation phase and project closure phase. All the environmental impacts were mitigated to the minimum for the negative impacts and environmental management planning (EMP) for whole project stage were prepared which will carry out by project owner in cooperation with professional institution concerns such as Provincial Department of Environment (PDoE), Provincial Department of Water Resource & Meteorology (PDoWRAM), Provincial Department of Agriculture (PDoA), Provincial Department of Land Management Urban Planning & Construction (PDLMUC) and all level of local authorities due to manage under line of MoE, MoWRAM, MoAFF.

The working team used checklist to study on Environmental and Social Impact Assessment of road project which based on "JICA Guidelines for Environmental and Social Considerations, 2010 and Prakas of guideline No. 376 ប្រកា បស្ដ. date on 2 September 2009 on report preparation for IESIA and ESIA of MoE in order to determine degree of impacts, small medium and high, on each natural and social environmental items and then selected mitigation measures of negative impacts for reduction of those potential environmental impacts will be fell in minimum degree (see checklist below).

Note: *A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent. C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses) D: No impact is expected.*

Checklist JICA for determination degree of impact for NR5 Improvement project (Scoping Results)

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
Pollution				
1	Air pollution	B-	B±	**Before Construction Phase:** - Air polluted by dust because the road is not strong enough caused it easy to damage - Road is small, traffic is slow speed caused less smoke many sites. If the road is large, good the traffic is fast speed, there is less air pollution **Construction Phase:** - Dust occur and exhaust gas from vehicles; - Traffic congestion in construction site will cause increase in exhaust gas from vehicles; - Dust will occur in borrow pit and quarry site. **Operation Phase:** - Operation of construction equipment will generate dust and emission gas; - However, because of improved traffic efficiency, the amount may be reduced compared to without project.

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
2	Water pollution	B-	B-	**Before Construction Phase:** - Water polluted by illegal disposing garbage in the culverts and other waterways - Road rehabilitation, there will good and putting signboard "Restrict garbage disposal", there will reduce of water pollution. **Construction Phase:** - Turbid water caused by construction works is likely to affect existing surface water resources in the project area; - Accidental massive leaking of fuel or oil, water pollution including ground water may occur; - In case of inadequate management in borrow pit and quarry site, turbid water from borrow pit and quarry site by rainfall may cause surface water contamination; - Some cases there lack of management or there is not well management on solid and liquid wastes. **Operation Phase:** - Accidental massive leaking of fuel or oil, water pollution including ground water may occur; - In case of inadequate management or recovery in borrow pit and quarry site, turbid water from borrow pit and quarry site by rainfall may cause surface water contamination in the project area.
3	Wastes	B-	B-	**Before Construction Phase:** - Illegal waste is along the road before project construction - Road rehabilitation, there will good and putting signboard "Restrict garbage disposal", there will reduce of waste pollution. **Construction Phase:** - Solid and liquid wastes caused by construction works and general waste from construction office, staff-workers projects will be generated. **Operation Phase:** - Illegal dumping of solid waste may increase along the newly constructed bypass.
4	Soil pollution	B-	B-	**Before Construction Phase:** - Soil polluted by illegal garbage disposal along the road - Road rehabilitation, there will good and putting signboard "Restrict garbage disposal",

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
				there will reduce of soil pollution **Construction Phase:** - Soil pollution caused by construction works, earth works, concrete works ect.; - Soil pollution caused by massive leaking of fuel at parking car or in the vehicles workshop of this project; - Accidental massive leaking of fuel or oil, soil pollution may occur from heavy trucks. **Operation Phase:** - Illegal dumping of solid waste may increase along the newly constructed bypass; - Because the target road mostly passes through agricultural land, leaking of fuel, oil and harmful cargo by traffic accident is likely to cause agricultural soil pollution.
5	Noise and vibration	B-	B-	**Before Construction Phase:** - Noise and vibration occurred along the road by vehicles movement, low speed, wave vibration - Road rehabilitation, road will be larged expected to reduce its **Construction Phase:** - Construction works is likely to increase in the noise and vibration level; - Noise and vibration will occur in borrow pit and quarry site. **Operation Phase:** - To enlarge of road, noise level caused by vehicle driving will increase. However, because right of way will be widened, the level on road side may be reduced and noise, vibration increase surrounding of people house compared to without project.
6	Ground subsidence	B-	B-	**Before Construction Phase:** - The same as soil pollution **Construction Phase:** - Subsidence near the road due to added soil weight may occur. - There are soft ground areas along the proposed bypass. Subsidence near the road due to the soil weight filled on the rice field may occur. **Operation Phase:** - To enlarge of road, pressure of loading on road will be low including vibration level caused by subsidence near this area due to the soil weight may occur.

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
7	Offensive odors	B-	B-	**Before Construction Phase:** - The same as waste pollution **Construction Phase:** - Offensive odors caused by construction works, especially operation of ill-serviced construction equipment and asphalt mixing plant will be generated. **Operation Phase:** - Exhaust gas from vehicles with incomplete combustion may cause offensive odors.
8	Bottom sediment	B-	B-	**Before Construction Phase:** - Sediments blocked on front most of culverts **Construction Phase:** - Filled soil may be eroded by rain water and flow into rivers or streams, and be accumulated at the bottom of rivers or streams. Such soil can finally flow into Tonle Sap Lake. **Operation Phase:** - In case of inadequate management or recovery in borrow pit and quarry site, erosion from borrow pit and quarry site by rainfall may cause sedimentation on riverbed.
Natural Environment				
9	Protected area/Protected forestry	B-	B-	**Construction Phase:** - The NR5 is a border of Tonle Sap Biosphere Resave and By-pass is located in Inter-zone which it is zone can develop but make careful and ensure for environment sustainability. **Operation Phase:** By-Pass of Town of the target this road passes cause to extend of households that it is not consider in advance, it causes Impact on some components of the inter-zone may occur.
10	Ecosystem	B-	B-	**Construction Phase:** - It may impact by clearing on trees and inundated forest that re-glowed along the road about 10.13ha in COI: 20m (total of 40m); - It may some impacts on wildlife such as snake, frog that it lives in the COI: 20m (total of 40m); - It may some impacts on fish by bridges, culverts construction along the Steung, Canals as described above; - Pursat by-Pass is crossing Tonle Sap Biosphere Resave zone that there is

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
				flooded area in wet season and the fingerling come from Tonle Sap Lake to live here and going back. **Operation Phase:** - It may impact on snake such as Chequered Keelback, Radiated Ratsnake, *Sunbeam Snake*, Rainbow Water Snake, frog, crab ect., while they creep, jump to pass the road then they dead by vehicle rolling.
11	Hydrology	B-	B-	**Before Construction Phase:** - Sediments blocked on front most of culverts **Construction Phase:** - It may impact (temporary) due to water flow in the river or stream may be altered during construction works. However, there is not enough concrete rings installation, it causes flooded on part upstream of road such as location from PK-247 to PK-248, there is no concrete ring; - Road extended can fill up on drainages along the road it causes to block water flow and flooded in that area; - By-Pass of Town is crossing Tonle Sap Biosphere Resave zone that there is flooded area, it high pressure of water can impact on dimension of water flow. **Operation Phase:** - It might blocks of culvert that located crossing the road by rubbish and algae. - Pursat Town by-Pass is crossing Tonle Sap Biosphere Resave zone that is some year it high pressure of water can break road or impact on dimension of water flow such as creek, canal. Moreover, rainwater can be inundated this Town because this road takes role of protection Dam.
12	Geographical features	B-	D	**Construction Phase:** - Topography will be changed and impact on soil formation by soil and stone digging for road construction; - Topography will be changed also due to Town by-Pass construction such as road raising. **Operation Phase:** - There is not Impact anymore because the road has been constructed.
Social Environment				
13	Resettlement/ Land Acquisition	A-	D	**Pre-Construction Phase:** - There is some people living on the reserved land in the project area of COI:

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
				20m (total 40m) 1,860 Families, 307HHs and 1,016 other immovable property. Need to solve for compensation in order to get land for road construction through resettlement plan. **Construction Phase:** - Temporal lease of land and additional small scale resettlement will be required, such as need some land for stone, materials of construction and concrete site. **Operation Phase:** - There is not Impact anymore because the road has been constructed.
14	Poor people	B-	B-	**Before Construction Phase:** - There are 312 vulnerable families in the project area (COI: 20m) that they affected, it causes to them will be poor and poor. Do plan for compensation for them, in order to get land for road construction through resettlement plan including cash supplement and should do have program to improve their income. **Construction Phase:** - Some of the poor people who do not have their own land living within Right of Way and selling something for their life in COI: 20m (total of 40m), if the project is not consider for them they will fall into poor and poor. **Operation Phase:** - In case there is no resolution for the poor people who has no own their own land living within Right of Way and selling something for their life in COI: 20m (total of 40m) then, they will fall into poor and poor.
15	Ethnic minorities and indigenous peoples	B-	B±	**Before Construction Phase:** There are Cham and Vietnames families that they affected by the project. Do plan for compensation for them, in order to get land for road construction through resettlement plan including cash supplement and should do have program to improve their income **Construction Phase:** There are 3 villages located on Pursat By-pass alignment: Islam village, Bandos Sandek (Banteay Dey commune) and Prolay Thom village (Veal commune) which they are Ethnic minority (Cham) people living and cultivated rice here and they affected by this project. **Operation Phase:** - Positive impact by the project due to the project created new road; the people who have land remaining or who has land along this road they will improve through socio-

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
				economic development and the land value is high cost; - In case the project was not to be solved, the poor people which they loosed of land for this project, they will fall into the poorest.
16	Local economies, such as employment, livelihood, etc.	B±	B±	**Pre-Construction Phase:** - Land acquisition and resettlement may cause livelihood degradation of Project Affected Persons (PAPs). - In any Towns, there is electricity Tower, Optic cable Tower, Optic cable underground, water pipe system need to demolish out from COI:20m (total of 40m) which caused livelihood degradation of Project Affected Persons (PAPs). **Construction Phase:** - It is positive impact by the project created job opportunities for the local people living in the project area; - Bridge construction works a cross of Steung Pursat may have some impacts on local fishery in the project area. **Operation Phase:** - It is positive impact by the project due to reduction of travel time, less expense for transportation, contribute to local economies and promote National and International tourists. - Change of access to local resources may widen gap in local economy.
17	Land use and utilization of local resources	B-	B+	**Construction Phase:** - Bypass sections will require change of land use such as agriculture land can transfer to residential house or Town along the road ect., **Operation Phase:** - Especially in bypass sections, land use along NR5 will be changed and be developed economically and socially; - Road transportation improvement will continue based on effectiveness economic.
18	Water usage	B-	B-	**Before Construction Phase:** There is Agriculture Canal along the road, and in the Town there are water pipes network, these things need to move from (COI: 20m) area before project construction. **Construction Phase:** - Existing agricultural cannels along the road will be affected by bridges, culverts

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
				construction works; - It may affect on water pipe lines along the road in the Towns. **Operation Phase:** - Newly culvert constructed not properly or blocked by rubbish or algae along the by-Pass may lose water discharge of these canals, creeks.
19	Existing social infrastructures and services	B-	B-	**Pre-Construction Phase:** - In any Towns, there is electricity Tower, Optic cable Tower, Optic cable underground, water pipe system need to demolish out from COI:20m (total of 40m) which caused livelihood degradation of Project Affected Persons (PAPs). **Construction Phase:** - Temporary traffic congestion in construction site including NR 5 and other rural roads by cut-off for will occur. **Operation Phase:** - Access to social services will be improved after road rehabilitated. - Spilt of local communities or widening disparity may occur in bypass section.
20	Social institutions such as social infrastructure and local decision-making institutions	D	B-	**Construction Phase:** - It will be not affected for this section. **Operation Phase:** Spilt of local communities or widening disparity may occur in bypass section.
21	Misdistribution of benefits and damages	D	B-	**Construction Phase:** - It will be not affected for this section. **Operation Phase:** - There will be some shops along existing NR 5 (old route) will lose their business opportunity, while shops set up along bypass will make profit.
22	Local conflicts of interest	D	D	**Construction Phase:** - It will be not affected for this section. **Operation Phase:** - It will be not affected for this section.
23	Cultural heritage	B-	D	**Pre-Construction Phase:** - The ancient gateway on front of Bakan district is a gateway into Royal palace of Preah Bat Monivong, it was constructed in Colonial of French which located nearby the NR5, it will affect on this by the project. **Construction Phase:**

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
				- In case, it is not be moved it, there will affect on ancient gateway. **Operation Phase:** - It will be not affected for this section.
24	Landscape	B-	B-	**Construction Phase:** - Vegetation at existing roadside including high trees will be lost by widening works, and cause change of landscape in COI area. **Operation Phase:** - Land use around this by-Pass of Town will be lost by widening works, and cause change of landscape in the by-Pass area.
25	Gender	B-	B-	**Before Construction Phase:** In the area (COI: 20m, total 40m) there are 1,860 families. They are women and children, especially there is school is along the road as well. **Construction Phase:** - It will be un-equality both sex for workers recruitment and works during project construction. **Operation Phase:** - There is most women can be venders on existing road in the Town lose their profit while there is new venders created on by-Pass of the Town.
26	Children's rights	D	B±	**Before Construction Phase:** In the area (COI: 20m, total 40m) there are 1,860 families. They are women and children, especially there is school is along the road as well. **Construction Phase:** - It might get accident to the children, because they come into the construction site to visit something. **Operation Phase:** - Traffic venerable people including children can be separated safely from main vehicle lane. - Road improvement may cause traffic accident of children due to more traffic volume and faster vehicle speed.
27	Infectious diseases such as HIV/AIDS	B-	D	**Construction Phase:** Infection risks of HIV/AIDS may be increased among construction workers and local business offering food and entertainment ect., **Operation Phase:**

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction and Construction Phase	Operation Phase	
				- It will be not affected for this section.
28	Working conditions (including occupational safety)	B-	B-	**Construction Phase:** - Dust and emission gas caused by construction works, materials construction transportation may affect staff-workers, people health in the project area; - Accident may occur to staff-workers by careless of them and Employer is not provided for safety materials enough to them based on these jobs. **Operation Phase:** - It will be accident occurred along the road due to road is wide and busy of traffics.
29	Accidents	B-	B±	**Construction Phase:** - Traffic accidents may occur at intersection road of By-pass and at the river site of Steung Pursat, both sides during operation phase. Therefore, should consider for bridge cross design this Steung, ensure is high over pass these two lines or to install light stop or cycle construction ect,. **Operation Phase:** - Traffic safety including pedestrians will be improved by road widening and vehicle separation - Traffic accident due to more traffic volume and faster vehicle speed may increase ratio of traffic accident
30	Trans-boundary impacts or climate change	B-	B±	**Construction Phase:** - Trans-boundary impacts including climate change will not occur. - Operation of construction equipment will generate CO2. **Operation Phase:** - The positive impact will be safe because of improved traffic efficiency; the amount may be reduced compared to without project. - In the future, total amount of CO2 emission from vehicles will increase.

7.2 Negative Environmental Impacts and Mitigation Measures

The NR5 improvement project (Thlear Ma' am Pursat – Battambang) of MoPWT is length of 112,8Km included Pursat By-pass with 8.8Km . It starts from KP171 to KP282+200. A part of this road is passed two provinces, Pursat and Battambang. Inside the Pursat province there are two districts (Krakor and Bakan) and one provincial Town of Pursat. A part of Pursat province, the road is passed throgh 13 Communes and 51 Villages (included 15 villages of By-pass). A part of Battambnag province, the road is passed throgh 10 Communes and 35 Villages, included two districts (Moung Russei and Sangkae).

The NR5 improvement project is rural area with total width surface of 23m, in the Town the width surface of 28m; it required Corridor of Impact (COI:20m, total width is 40m), see detail in Chapter-4, on project description.

Detail impacts by the project and its mitigation measurement as described below:

7.2.1 Project Design Phase (Before construction Phase)

In the project design stage, there are not main harmful activities. In this stage, there are the professional study teams doing the research or investigation for preparing project design properly in the project area. However, this stage is so important if project design preparing is not in planning to solve the problem on environment impact; it is caused harmful to environmental and social impacts. The negative environmental impacts to physical and social resources are described as following:

A. Physical Resource:

A-1 Hydrology System

- Negative impacts

Based on consultation and discussion with the local village Authority and villagers in Moung village Moung Commune shown that in between PK247 to PK248 of this road there is no any culvert. Moreover, the drainage canal along the road was filled up by the people without concrete pipes installed. It causes flooded in this village in wet season when it was heavy rain.



Flooded in Moung Village in between PK-247 to KP-248, left hand of direction Pursat – Battambang, dated on 13 September 2013

Moreover, Pursat bypass is crossed Pursat River and O-Sdao that it will affect to water discharge of this River.

- Mitigation Measures

The detail project design of this road improvement has to consider for additional concrete rings installation at between PK247 – KP248 of this road. It plans to dig canal on both sides to regulate water flow of flood out from the village and agriculture land use along the road.

At Pursat River, there will plan to construct a large bridge, it will be not blocked water discharge and this bridge will pass over the road and turn following the River as well.

Note: O-Sdao in the dry season is dried up but it is not for all places, such as pond and somewhere the place along the O is also no water.

A-2 Erosion and Soil Quality

- Negative impacts

Soil erosion might have at the borrow pit, quarry site, and road slope which raised at high level in case the project has not considered about this problem.

- Mitigation measure

The detail project design of this road improvement has to insert procurement document project construction on soil erosion measure at the borrow pit (should have slope based on type of soil and to excavate straight), quarry site and to plant grass on road slope.

A-3 Air Pollution

- Negative impacts

There is air pollution by road damage some places, DBST floor is easy damage, road is not large, dust blows from this road because the project is not started and enlarged.

- Mitigation measure

In order to reduce air pollution, it needs to have this project by enlarging road for rural area is 23m of width and at the Town it will be increased up to 28m of width and paved asphalt concrete to reduce dust.

B. Biological Resources:

B-1 Area/Forest Protected

- Negative impacts

In case, project design for by-Pass of Pursat Town is not deeply consider, it might affects on Tonle Sap biosphere reserve zone, because when the road project is completed and there is increasing households due to un-expected further to create a Town. There is no plan in advance for waste water system and other infrastructures, it causes to affect to ecology zone and lead to pollution in Buffer zone which is located nearby.

- Mitigation Measures

In case project design for by-Pass of Pursat Town are six options: by-Pass at South of road (up road) and by-Pass at North of road (down road) that located in Tonle Sap biosphere reserve zone then, to do comparison of cost economic included also cost environment, and identify N-1 located at North of road is the best (see detail in table 4-2 (B), in Charpter-4).

B-2 Forest Resource and Wildlife Habitat

- Negative impacts

The NR5 improvement project a part from Thlea Ma' am Pursat – Battambang in Corridor of Impact (COI: 20m, total 40m) is not forestry but there are trees and fruit trees that planted by Khan Forestry Administration and people. These crops are not habit of wildlife for endangered species, critically endangered species and vulnerable species. Moreover, this area is high activities such as traffic busy on this road that it causes of big wildlife cannot come close.

Another hand, along this road of COI in between KP177+177 to KP177+263, PK178+484 to PK255+121 is river side vegetation (creek, canal, and pond) about 10.13ha. This vegetation will do clearance for extending road. Moreover, at both sides along the road there are 30 types of crops, total is 5,210 trees (diameter from 10Cm to 62Cm) which planted by the people and Khan Forest Administration. There are fruit trees planted by the people of 4,817 trees and these trees are affected by the project road extenstion. The data these trees see in Chapter-5, point: 5.1.2.

- Mitigation Measures

Before project construction phase needs to study, investigation on impact of crops, trees, households that located in COI, and including resettlement plan by insert fund to solve these impacts and fund to re-plant trees along the road. The project owner should do cooperation with relevant Ministries which there are inter-ministries (IRC) for successful of project plan implementation.

C. Socio-Economic Resources

C-1 Land use/Relocation

- Negative impacts

There is some people lived on (COI: 20m, total of 40m) about 1,860 families, 307 HHs, 195 business stalls, 8 Restaurents, 676 other small stalls and other constructions (well, fence, gate, funeral, grave, washing car place, Toilet, paddy store, drainage, Corola place, platform ect.,) total is 137 that need to demolish by this project. The new Town by-pass construction is affected on rice field of 269,026.85m^2, residential land in total is 1,079.67m^2 and commercial land is 5,962.56m^2 (belong to 224 people's families) see table below.

Table 7-1 (A): Total Number Families Affected, Study from September 2013 to January 2014

Province	District	Affected Households by section	Affected Households by	Remarks

			pass (in Pursat)	
PST	Krakor	29		Vulnerable 5 HHs
	Pursat City	37	175	Vulnerable 47 HHs
	Kandieng		49	Vulnerable 18 HHs
	Bakan	722		Vulnerable 128 HHs
BTB	Moung Reussei	633		Vulnerable 09 HHs
	Sangke	215		Vulnerable 24 HHs
Total		**1636**	**224**	**312 HHs**

Note: Data provided by working Grou (B), "Impact Resolution Group"; PST: Pursat Province, BTB: Battambang Province

Table 7-2 (B): Total Number Households and Immovable Properties Affected, Study from September 2013 to January 2014

Province	District	AHs According to Type of Structure					
		House	House-Shop	Shop/ Restaurant	Shelter	Other Structures	Total
BTB	Moung Reussei	104	70	2	242	64	482
	Sangke	23	40	1	101	12	177
	Subtotal (BTB)	**127**	**110**	**3**	**343**	**76**	**659**
PST	Bakan	148	81	4	299	53	585
	Krakor	6	2	0	15	0	23
	Pursat	10	2	0	16	5	33
	Subtotal (PST)	**164**	**85**	**4**	**330**	**58**	**641**
PSBP	Kandieng	7	0	0	2	0	9
	Pursat	9	0	1	1	3	14
	Subtotal (PSBP)	**16**	**0**	**1**	**3**	**3**	**23**
Total Thlea Maám-BB		**307**	**195**	**8**	**676**	**137**	**1323**

Note: PST: Pursat Province, BTB: Battambang, PSBP: Pursat Bypass, 4,817 trees affected by the project and among of this 612 trees are on the bypass.

➢ Mitigation Measures

Before the project construction phase, there will be created Inter-Ministry Committee and Provincial Sub-Committee, need to study, investigation on impacts: crops, fruit trees, households that located in COI, and including all things suitable registration that affected by the project. Deadline of registration on impacts such as houses, buildings, crops is 2 September 2013; for existing road and Pursat by-pass is dated on 30 December 2013, and resettlement plan is prepared fund for compensation, support to vulnerable people (Old head household, disable people, widow, poor people that they get income less than 20$/M), support to the people landless (people live in COI), support to affected people land use of family is over 20%, there is reserve fund for new program of temporary income and fund for tree planting along the road as well. The total budget for social impact resolution is USD 8,059,913.55 (included resettlement for 2 sites in Bakan district and Moung Russei district for these sections and other one O-Chrov district for road section of Sri Sophorn to Poipet, see detail resettlement plan of NR5 improvement road project from Thlea Ma' am to Battambang and other section from Sri Sophorn to Poipet). ***Note:*** *resettlement plan for this project has been intergrated for both sections (Thlea Ma' am to Battambang section and Sophorn to Poipet section).*

C-2 Poverty

➢ Negative impacts

In the COI area, there are vulnerable head housholds (the family that get income less than 20$/M, landless family, old head household, disable people, widow) totally is 312 families. The NR5 improvement project will affect on these people, it causes to them become poor and poor.

➢ Mitigation Measures

In order to mitigation for these problems, the project owner should prepare resettlement plan due to do compensation on houses, buildings, crops and fruit trees affected based on market price, including supplementation fund to these families such as money supports for impacts, money supports for

transportations, money supports for family who loaned land, money supports for vulnerable Head households and money supports for new program of temporary income to affected people land use of family is over 20%. For the landless of 53 families the project owner will look for land and do resettlement them (there are 2 sites: one site in Bakan district to be supported for 39 families and other site in Moung Russei district to be supported for 14 families), but this resettlement has to construct social infrastructures look like existing they lived or better than there. Detail description is stated in resettlement plan of the project.

C-3 Economic and living of Community in/around Project Site

- Negative impacts

In the COI area, there are total of 1,860 families affected by the project, inside this affected people landless is 53 families and 259 families of vulnerable Head household (old head household, disable people, widow) that they get income is less than 20$/month. The NR5 improvement project will affect on their poor living.

- Mitigation Measures

The method to mitigate on affected among this, it is mitigation measurement the same at point C-2. It is project plan for resettlement. However, the project needs to recruit workers by providing priority to affected people and the people who living in the project site in order to improve their living condition in the project construction phase. Should be achieved resettlement plan before the project construction phase started.

C-4 Land used and Resource used in the Project Site

- Negative impacts

Total land acquisition for road construction of Pursat bypass is 296,069.07m^2, among of this there is rice field is 269,026.84m^2, commercial land is 5,962.56m^2 and risidencial land is 21,079.67m^2. See detail in table below:

Pursat Province	Rice Field		Commercial Land		Residencial Land	
	# Family Affected	m^2	# Family Affected	m^2	# Family Affected	m^2
Kandieng district	34	42,202.20	0	0	14	4,395.54
Pursat Town	148	226,824.64	2	5,962.56	49	16,684.13
Total	**182**	**269,026.84**	**2**	**5,962.56**	**63**	**21,079.67**

Note: Data provided by working Grou (B), "Impact Resolution Group"

- Mitigation Measures

The resolution is that the project should make a plan to solve these affects by compensation cost of land based on market price, due to have a plan for affected resolution that it will implement by ths Inter-Ministry Committee (IRC) and related Provincial Sub-Committee due to have Ministry of Economic and Finance is a Chairman. See detail settlement plan of the project.

C-5 Existing Social Infrastructures and Services in the project site

- Negative impacts

In the COI area, there are social infrastructures such as: electricity Towers, Cable poles, Optic cable Towers, Optic cable underground, electric cable underground, waste water drainages, water pipes underground such as water supply pipes in Pursat Town on the COI area that started from KP183+940 to KP190+855; for Trapaing Choung and Boeung Khna communes started from KP200+600 to KP212+958; for Moung and Kea communes started from KP243+430 to KP245+939; these water pipes are affected by this road extended.

- Mitigation Measures

Before the project construction, the project owner should inform to these infrastructures owners in advance and should do cooperation relevant institutions to demolish and move its to the new locations where are safe places, to avoid re-demolish again in the future that it is costly.

Moreover, the project owner should select the second alternative of Pursat by-pass that starts from KP183+00 to KP190+200 in order to pass where are there many infrastructures and residential houses.

C-6 Culture and Traditional

- Negative impacts

In the COI area, there are two old constructions: (1) it is brick fence and (2) it is an ancient gateway of Royal Palace of Preah Bat Monivong; it was constructed in Colonial of French. Both are located on front of Bakan district and Office of Social Affairs Labor Vocational Training and Youth Rehabilitation, Bakan district, Pursat province. It will affect by the project road extended. Moreover, there are some gateways and fences along the road will be affected also.





Moreover, Pursat new by-pass construction affected on rice field of Ethnic minority of Cham and it is also affected to their Culture and traditional.

- Mitigation Measures

Before the project construction, the project owner should do bypass design plan due to keep ancient gateway of Preah Bat Monivon as hystoric of culture and discuss with Provincial Authority, Provincial Department of Culture, Fine and Acts about it conservation as well. For other gateway and Pagoda fence, the project owner should discuss with Provincial Authority, Provincial Department of Religions and Cults and relevant Pagoda Committees to do compensation; all these need to be solved whatever is far from the reserved land to avoid impact again for the future.

The project owner should identify plan of the project contractor to educate staff-workers to respect traditional Cham's that they to be religious disciple of Muslim. Moreover, the project owner should allow them for jobs as workers, if they apply for job; do not to be a racist.

C-7 Accidents

- Negative impacts

There is no impact, because the project owner is not started any activities. But, Pursat By-pass construction should consider on bridge design to pass Steung Pursat, because along this Steung both sides there are two pavement roads. To remind that the road construction is a highway road which it is use for high speed and causes to have accident at the intersection road between this by-pass and both Steung sides.

- Mitigation Measures

The bridge design to pass Pursat Steung should consider about alternatives, in case the bridge construction is high over of both road lines or to install traffic light or roundabout intersection ect,.. Should chose which one case is a better than other to reduce for accident based on highway standard as well.

7.2.2 Project Construction Phase

The project construction has 3 years period. Many infrastructures construction activities such as: earth work for constructing access road into the buildings, offices, staff-workers houses ect., These construction activities may cause negative impacts as following:

A. <u>Physical Resources</u>

A-1 Morphology and Topography

- Negative impacts

It may change the morphology and topography in the COI area, borrow pit and quarry sites of the project due to land clearing and earth work activities for base road arranging/constructing. Moreover, there will be changed in the Pursat Town by-Pass due to land clearance and earth work activities, filling up soil of road surface, earth excavation for culvert and bridge construction in all places that road passed ect.,

Note: the construction site, borrow pit of soil, stone and laterite soil cannot identify detail because the project owner has not recruited the technical consultant for project detail design due to the technical consultant has to identify about quality of soil, stone and laterite soil for a standard highway and during the project detail design it will indicate clear in the project report.

- Mitigation Measures

The project owner has technical Expert for monitoring of this construction such as earth compacting, concrete bed bridge and culvert making, slope of borrow pit and quarry site making, grass planting along road slope ect.,

Moreover, at along the by-Pass will build drainage along the road to protect soil erosion, grass planting along road slope in order to avoid soil sliding as well.

In addition to, construction work will start in dry season to protect soil erosion that might affect topography in rainy season.

A-2 Hydrological System

- Negative impacts

In the project construction phase, water discharge of Creek and Steung might be affected due they close waterway for road extending or new construction of bridge, culvert that it will block waterway in wet season;

In addition, Pursat Town by-Pass construction activities can be done soil filling on canal, Creek or other waterways for this road construction; it leads to inundate water on Pursat Town or agriculture land, water is low capacity flow out; it causes to the road under construction will break and this soil will make canal, creek and Steung in/around the project area become shallow.

Moreover, soil erosion at the borrow pit and quarry site by excavating of soil and stone that it is not properly slope as standard of earth and quarry works, there will lead to break the wall of borrow pit or mountain wall. There is also occurring to create soil sediment at the bottom and make shallow of canal, creek, Steung in/around the project area.

On the other hand, this road construction will affect on water quality by construction activity such as stone cleaning, vehicles washing, soil erosion from the wall of borrow pit or quarry site that it is high turbid water.

However, there will affect to the water quality by disposing of solid and liquid wastes from the living places such as: it is from toilets of staff- workers house, fuel/oil from vehicles used in the field and washing bodies of staff-workers; all these will pollute water and it causes to decrease water quality level.

- Mitigation Measures

The project construction activity such as big earth works, it will work in dry season in order to avoid soil erosion and water polluted reduction. Moreover, at the site of road extending, culvert, bridge constructions, should do by-Pass and install concrete rings to lead water flow out from the construction site with suitable dimension to drain water to downstream as normal flow in wet season; do this in order to avoid inundated water at upstream or it occurs to break the dam by water pressure into the construction site. For big bridge constructions such as Steug Pursat, Steung Svay Daun Keo ect., should use steel pipe as suitable technical condition to encircle of bridge base in the water which it can protect water flow or serious water pollution.

For by-Pass of Pursat Town construction, should construct bridge and install enough of concrete rings where are water locations or water passed sites with suitable dimension to drain water out including canals of both sides.

Should plant grass on slope road and shoulder to avoid soil erosion of wall road.

Should have vehicle washing place and workshop, warehouse to stock construction materials and fuel at suitable level, to avoid spilling fuel/oil that finally pollute into water source in the project area.

At the field, Staff-workers Camps, workshop, warehouse to store construction materials, should have garbage site, the project owner should require to the contractor to contact to garbage collection Server such as in Pursat province there is POV SETHA Company and in Battambang province there is SINTRY Company. For oil waste, can sell to who asks for buying it to assist their fire kiln; for old tires, can sell to the middleman that they collect its transport to Vietnam (information about garbage data and shop buying of waste is described in Chapter-5, point 5.2.6.3. Moreover, the project owner should consider enough on latrine and its septic tank construction base on number of staff-workers.

A-3 Soil Erosion and water quality

- Negative impacts

Soil erosion in the borrow pit, quarry site and along slope road which it will raise high, in case the project owner is not consider about the problem.

Moreover, soil filling on road in the field in wet season, it leads to soil erosion to cover of rice field and it will lose soil quality in there.

- Mitigation Measures

In construct phase, the project owner should observe regularly the contractor for slope road based on contract document works and should order to excavate straight at quarry site and should plant grass along slope road and shoulder also.

Most activities of the project road extending are implementing in dry season that there will less impact.

A-4 Water Pollution (Surface/Groundwater)

- Negative impacts

In the project construction phase, it will affect for water pollution by making turbid water due to construction activity works such as earth works (poor management works on borrow pit, quarry site), concrete works, foundation works ect., it may affect to surface water in the project area.

Surface water and groundwater pollutions, it occurred from accident of trucks which it leakages oil/fuel to the ground and go into the shallow water source and continue flows to surface water in the project area.

In case, there is not well solid waste management (waste soil, waste of rubber floor road etc.,) and liquid waste (waste water outlet from the toilet and kitchen ect.,) in the field works, Staff-workers houses, workshop, warehouse then there will be polluted water in the project area. See detail in Chapter-4, point 4.3.7 waste management plan.

- Mitigation Measures

In construct phase, the project owner should observe regularly the contractor for slope road based on contract document works and should order to excavate straight at quarry site and should plant grass along slope road and shoulder also. Moreover, should control concrete mixing site, stone cleaning site to ensure that in the project area is no water quality pollution.

Waste soil, waste of rubber floor road, the project owner will contact to the local Authority to transport it to fill on the rural road and do well compacting it, do not dispose it into water sources.

In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.

The project owner should educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. The project owner should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. Other hand, for oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle (see detail in Chapter-5 , point 5.2.6.3. Should well manage on solid and liquid wastes, do not let its polluted into the water sources.

In the field works, Staff-workers houses, workshop, warehouse, it is important to have enough and properly for latrines equipped with septic tank of 2-3 blocks and bath rooms. It is proportional to the number people uses.

A-5 Air Pollution

- Negative impacts

Air pollution is creating due to dusty and exhausting gas from vehicles which its are constructing; its will impact to the travelers and the people living in/around the project area.

Other hand, air pollution may be occurred due to traffic jam in the project area, there will increase emission gas from vehicles.

As well as air pollution causes from dusty in borrow pit and quarry site, there are many trucks are transporting its to the site, along the road that it will affect to the travelers and the people living in/around the project area.

Moreover, air pollution is creating by bad odor from spilling oil/fuel of old engines where is workshop, dump site, waste water site of staff-workers house ect.,

- Mitigation Measures

In the project construction phase, the project owner should use good quality of vehicles and machines with lowest air pollution will be used to assure air quality in the project area. Especially, new vehicles and Engines are useful because its exhaust low gas and strong for works.

At the project site, should have technical staff to operate traffic in order to avoid of traffic jam. Moreover, should do extending reserved land first and let the people use temporary on existing road.

From the borrow pit and quarry site to project site, need to spraying water regularly in each construction site especially at the Town area, school, district Hospital or health center or clinic, pagoda ect., in order to reduce dust swirling up to the travelers, students, ill people and the people living around the project area.

The project owner will properly manage in the workshop, dump site and staff-workers house; to advise them to dispose in cask wastes, and oil/fuel wastes will keep in safe place to avoid its spilling on the ground. Moreover, these wastes will sell the middleman and selling waste shop for their wastes recycle as described in Chapter of Mitigation Environment Measures.

A-6 Soil Pollution

- Negative impacts

As well as air pollution, in the project construction phase, there is some soil pollution by construction work activities such as earth works (it is not well management for borrow pit and quarry site), concrete works, base works such as cement and liquid cement spilling ect., that it spilled on the ground and it causes soil pollution in the project area.

In case lack of well wastes management in the staff-workers houses, workshop, warehouse that it causes soil pollution in the project area.

Soil pollution causes from serious accident of vehicles by spilling oil/fuel on the project area.

- Mitigation Measures

In the project construction phase, the project owner has to control regularly to the contractor construction for slope road as standard of contract works document works and should order to excavate straight at quarry site and should plant grass along slope and shoulder road. Moreover, should control in concrete mixing site, stone cleaning to ensure that in the project area is no soil pollution.

In case, there is serious fuel spilling (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.

The project owner should educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. The project owner should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. Other hand, for oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle (see detail in Chapter-5 , point 5.2.6.3. Should well manage on solid and liquid wastes, do not let its polluted into the water sources.

A-7 Noise and Vibration

- Negative impacts

In the infrastructure construction of the project, it might disturb to the people living in/around project area because of sound, noise and vibration from construction machineries are operating on earth works, concrete works, base works, transport works and repairing works ect.,

It might disturb to the people living around borrow pit and quarry site because of sound, noise and vibration from construction activity works such as soil excavating, transportation of (soil and stone), and breaking stone ect.,

- Mitigation Measures

Machineries and transport vehicles which are low noise shall be used in the project area;

The project owner should assign working day for daytime only, stating in the morning from 7:30am to 12:00am and afternoon from 1:30pm to 5:00pm in order to reduce disturbance to the people in the project area espercially, at the Town area, School, District health center, Clinic, and Pagoda ect.,

B. <u>Ecological Resource</u>

B-1 Aquatic life/Fishery

- Negative impacts

In the project construct phase, fishes and other aquatic life might be affected to water sources (Creek, Prek or Steung) because of turbidity of water from cleaning rock and project construction including solid and liquid wastes and other case from infrastructures of the project such as constructions: bridge, culvert crossing Steung Pursat, Steung Svay Daun Keo, Steung Moung Russei, Steung Chork and steung O-Samdan ect.,.

Moreover, by-Pass of Pursat Town project can fill up soil on creeks or cut-off of flat area, it can cut of Aquatic life/fishery systems in the project area.

- Mitigation Measures

The project owner should look to buy clean gravel to avoid for gravel cleaning in the concrete mixing site; Bridge and culvert construction should construct in dry season and should use steel mould for bridge column, do not make a dam cross the River. Moreover, during doing extend culvert on existing culvert, should look for by-Pass and install concrete rings depend on dimension of water flow of Creek, and these canals to avoid block and low flow especially may impact on fish movement in wet season.

Moreover, the project owner will avoid to outlet waste water out from vehicle washing place, concrete washing place, material and waste of concrete and waste oil direct into the water sources that existed in the project area, due to use a private site of vehicle washing service instead.

During by-Pass of Town construction, the project owner should not fill up soil on water channels that road project passed. Should do installing concrete rings for all existing channels; there should make drainage system for both sites along the road to let water drain out to low area.

In the field works, Staff-workers houses, workshop, warehouse, it is important to have enough and properly for latrines equipped with septic tank of 2-3 blocks and bath rooms. It is proportional to the number people uses; and make sure there is not affect to Aquatic life/fishery systems in the project area.

Solid and liquid wastes management will be educated to staff-workers in project area to avoid spilling fuel/oil on the ground in the project site.

Should educate staff-workers about solid and liquid disposal, especially do not spill fuel, oil on the ground and in the water in the project area. Moreover, the project owner should do well management on all wastes, such as solid wastes: can, plastic bottle, glass bottle, battery, oil used, old tires; boxes should separately keep for middleman buying for waste recycles. For other remaining wastes: old lumps, plastic bags, vegetable waste ect., should contact to garbage collection Company to transport its to Dump site.

B-2 Protected Area/Protected Forestry

- Negative impacts

Pursat Town By-Pass construction affected on Tonle Sap Biosphere Reserve zone because, the road is crossing 8.8Km length, there will be affected some on Ecological zones by the project construction activities.

- Mitigation measures

This by-Pass construction should be careful construct such as earth works, concrete works, based works need to follow the technical standard and the construction should be done in dry season only.

Moreover, during the By-pass construction, should do bridge and culvert constructions first, after these completed then starting for road construction, to avoid having water blocked and fish movement.

Should organize properly for solid and liquid wastes; keep in safe places especially to avoid environment polluting in conservation area.

B-3 Forest Resources and Wildlife Habitat

- Negative impacts

The NR5 improvement project from Thlea Ma' am to Battembang is needed Corridor of Impact of 20m (COI: 20m, total is 40m). In the COI: 20m area, there is crops, fruits 4,817 trees (see detail in Chapter of Resettlement Plan) which grown by the people. The fruit trees that grown on the reserved land are 30 types and total is 5,210 tree (diameter from 10Cm to 130Cm. The river side vegetation that re-grows is 10.13ha; there is 36 species (detail in Chapter-5, point 5.1.2.1 Forestry; data of forest see in Chapter-5, point 5.1.2). Its will affect by this project, these some trees are wildlife habitats that described in point 5.1.2.2. ***Note:*** *for Mammal: Small Asiun Mongoose, Lyle's Flying-fox; Birds: Asian Openbill, Barn Owl, Lyle's Flying-fox, Grey Nightjar, Yellow-breasted Bunting, Large-billed Crow, Common Snipe, Common Kingfisher; and for Reptiles and Amphibian there have some that they lived in the COI area, to say that they just only pass this area only.*

- Mitigation Measures

In the project construct phase, the project owner should do cooperation with relevant Ministries and local Authorities especially, Khan Forest Administration to plant small trees which is planning to re-grow along the road such as Krongaok tree, Koki tree, and Chan Kiri tree in order to change to green environment, protection erosion and prevented vehicle to fall out of road and crash to people household ect.,

B-4 Biological Wildlife

- Negative impacts

In the project construction phase, it will affect to a little wildlife such as snake (Chequered Keelback, Striped Kukri Snake, *Sunbeam Snake,* Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spadefoot frog, Frog) that they are living in the COI area.

Moreover, staff-workers of the project can eat wildlife meat that it causes to increase for wildlife hunting near this project area such as protection area or protection forest ect.,.

- Mitigation Measures

In the project construction phase, the project owner should do cooperation with MoE and local Authorities, especially closed work with PDoE and Khan Forest Administration to educate and guide to staff-workers of project, do not hunting them while they presented in the project area. ***Note:*** they are species not Rare species and Vulnerable species.

The project owner should assign working day for daytime to reduce disturbance to the people and wildlife by noise or vibration in the project area.

The project owner should do cooperation with MoE and Forest Administration to train about wildlife conservation and wildlife punishment case to the staff-workers project's.

C. Socio-Economic

C-1 Land use/Relocation

- Negative impacts

In the project construction, may be required some land for small resettlement such as land for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect.,

- Mitigation Measures

The project owner will do cooperation with IRC to look for land rental for temporary for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect., due to there is not affect serious to resettlement site.

Moreover, to settle between construction building for the staff-workers and store for materials of construction should be far at least 500m from the residencial household of the people.

C-2 Poverty

- Negative impacts

There are vulnerable families (poor, Old people, unable people, widow and landless family) of 312 families, that affected by the project and they are living and they have business on this reserved land or they will move to the resettlement site that created by the project. In case the project is not considered and monitoring about them they will get poor and poor.

- Mitigation Measures

In the project construction phase, the people are landless or affected all their land, in case the project owner looks for land resettlement for them including access for infrastructures as the same they ever got or better than before, the project owner should do monitoring on their life condition due to identify that 312 families have a better life without this project.

C-3 Economic and living of Community in/around Project Site

- Negative impacts

Bridge construction that crossing Steung such as Steung Pursat can be less affected to fisherman in the project area by water pollution and poor turbidity.

- Mitigation Measures

The method to mitigation this impact is in Chapter of Mitigation Impact Measures at point A-2, A-3 and A-5; the project owner should not make a dam cross the River for bridge construction, should use pipe surrounding the Bridge column for base and Bridge column construction.

The project owner will motivate and provide priority to fisherman in/downstream/close in the project to become project workers.

C-4 Land used and Resource used in Project Site

- Negative impacts

In the project construction phase, the by-Pass of Pursat Town will be changed of land use such as agriculture land can change to residential house along the road or become to Town ect.,

- Mitigation Measures

The project owner should do cooperation with MoLUMPC to do master plan for by-Pass development, doing plan before of infrastructures such as in/out site, drainage water waste system, waste water storage site, especially waste water treatment plant site before outlet to the Steung ect., there should have signboard show development site as well.

C-5 Water use

- Negative impacts

In the project construction phase, it will affect some on water agriculture use of canal along the road by bridge extending of construction project. Moreover, at the site of by-pass will be affected on 6 of agriculture canals: Suy Sem canal, Prey Nhy canal, Kambot canal, Cham Chamhaor canal, Boeung Yeay canal, Mao Chaouy canal and Kbal Hong canal.

Moreover, in the COI area at some Town, there is water pipe system such as in Pursat Town is started from KP190+200 to KP190+855, Trapaing Choung commune and Boeung Khna commune started from KP200+600 to KP-212+958, Moung commune and Kea commune started from KP243+430 to KP245+939, these water pipes will affect by the NR5 improvement project.

- Mitigation Measures

The project owner should do cooperation with MoWRAM to extend bridge and culverts and low-down new concrete rings all these 6 canals that its are irrigation systems, to make sure irrigation system is normal use, never blocked and do not affect to the farmers.

Moreover, The project owner should inform to PDoIME, local Authorities: commune and water supply Companies that they have own pipes buried on the COI area to demolish its and move to the new safe

places (on reserved land) to avoid re-demolish for many times, it causes to lose money in the future while there will be road improvement again.

C-6 Traffic and Services in the project site

- Negative impacts

In the project construction phase, it will get traffic jam for temporary along the NR5 and on the intersection road that connect to the rural road by cutting-off of these roads during construction.

- Mitigation Measures

In case during extending road construction on paved road or rural road, the project owner should do on this site faster, if there is not finished on time the project owner should do traffic facilitate to avoid traffic jam. Moreover, should install traffic signboards and working group for monitoring and provide traffic service during the construction phase.

C-7 Culture and Traditional

- Negative impacts

On front of Bakan district and Office of Social Affairs Labor Vocational Training and Youth Rehabilitation, Bakan district, Pursat province, in the COI area, there are two old constructions: (1) it is brick fence and (2) it is an ancient gateway of Royal Palace of Preah Bat Monivong; it was constructed in Colonial of French. Both are located and affect by the project road extended, in case of project design phase the project owner is not solve this problem.

During this phase, may be affected to traditional and custom Cham's ethnic minority which they have agriculture land or they are living in/around the project area affected by the Pursat Town by-pass construction.

- Mitigation Measures

The project owner should discuss with Provincial Authority, Provincial Department of Culture, Fine and Acts in advance, whether need to move ancient gateway of Preah Bat Monivong from COI of road or how to solve before the project construction.

The project owner should require to the contractor to educate their own staff-workers to respect Cham's traditional and custom, should allow them to work as project workers if they apply for job, do not to be a racist.

C-8 Aestheticism

- Negative impacts

In the project construction phase, the Aestheticism will be changed in COI area for temporary by clearance of vegetation, crops and trees in order to do extending road especially a lot of dust and mud while there is raining.

- Mitigation Measures

The project owner should ask the contractor to do regularly spaying water to reduce dusty and should do compacting soil immediately in that site after soil landed from the truck.

Moreover, at the road site that is enough of level needed for new road, there should plant grass and small trees along the slope road in order to correct Aestheticism to be green site.

C-9 Gender

- Negative impacts

In the project construction phase, there can be recruited workers not equality and also is not promotional to sex for works.

- Mitigation Measures

The project owner should ask to the contractor to recruit workers is not to side with one's sex, and should divide for labor depend on sex (male or female) and the wage should be equality.

C-10 Children's Rights

- Negative impacts

In the project construction phase, there will have some children come and see the site, it causes to get accident to them such as traffic accident, soil erosion falls to them, something hard fall down on them. Moreover, in the borrow pit or quarry site is deep excavated then during the raining there is inundated water and the children can be died by drowning.

- Mitigation Measures

In the project construction site should build barrier, it shows as project site and do not allow in and out excepted staff-workers of the project, surrounding should organize the guard to regular control, even though during time break, to make sure that there is no children come in to the project site.

When the borrow pit is completely finished, this borrow pit should do well sloping and smoothly and install signboard shows picture of borrow pit, be careful for children, do not allow for swimming including delivery information to local Authorities: Commune and village to assist announcement to every people to prohibit their children to come for swimming in this place. In case, the borrow pit is nearby the villager household should do as above described including the fence protection as well.

C-11 Infectious Diseases such as HIV/AIDS, Liver Diseases

- Negative impacts

In the project construction phase, it can occur infection HIV disease for staff-workers of project and other disease such as liver, lust disease, tuberculosis and other infection diseases ect., from staff-workers, food sellers and the server of sexual services.

- Mitigation Measures

In the project site, should organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred.

The project owner should do cooperation with PDoH and Hospital to educate on sanitation and hygiene to treat for staff-workers in order to prevent these infection diseases to the people in the project area. Should contact any Hospital if while there is accident that can be occurred.

C-12 Safety and Public Health

- Negative impacts

It might affect on health people's in the project site to staff-workers by pollution of dust or materials transportation. Moreover, there will have Opium use and trading it.

It might get accident works to staff-workers due to they are careless, the project owner and Contractors are not provide enough safety tools or materials of construction works to them based on these type of works.

- Mitigation Measures

In this project construction, should keep safety first for daily working including technical training to the workers. The project owner should ask the contractor to provide mask to protect dust and helmets, boots, gloves to workers; should do spaying water regularly on this road construction.

It the project site should build fair Camp to the staff-workers including enough water supply and latrines, and education program on health and safety first for the staff-workers.

In the project site should organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred.

The project owner should do cooperation with the local Authority and relevant institutions to protect Opium and people trading. Moreover, the project owner should do cooperation with Health institution in this project area to prevent other infection diseases that its can be occurred.

C-13 Accidents

- Negative impacts

In the project construction phase, it might occur some accidents in/around the project site such as accident works (rope cut-off or breaking of crane machine, crushing, something hard to scatter down, fire caused by careless such as short circuit, welding, do not careful use power caused to fire of fuel station and materials ect.,

➢ Mitigation Measures

The project owner should ask to the contractor to train staff-workers about safety first, provide mask to protect dust and helmets, boots, gloves to workers of the project. Moreover, the project owner will provide building to stay with facility of water supply, to train on technical training and provide tools for safety work to the staff-workers.

In the project site should organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred.

Moreover, the project owner should require to the contractor to buy accident insurance for work certificate for the project staff-workers in order to make easy to solve when there is accident occur for anytime. In additional, it makes warmly for staff-workers and trust to the project.

In the project site, at the staying place, warehouse, and fuel station should have extinguisher, sand pile, axe to repress or to extinguish fire when there will be occurred.

C-14 Trans-boundary Impacts or Climate Change

➢ Negative impacts

Trans-boundary impacts or climate change will not occur because the existing NR5 is the project improvement only.

In the project construction phase, the amount of CO_2 emission from vehicles and machines will increase in the project site.

➢ Mitigation Measures

In this construction phase, should use vehicles and machines that its are low of CO_2 emission in order to reduce air pollution in this area; especially should use new vehicles that its are low of CO2 emission.

C-15 Assemble of Impacts

➢ Negative impacts

At the present, along the Pursat River there is irrigation construction that it completed construction for 3 sites: (1) it located at upstream (compare to Spean Thmar of Pursat River, (Bridge 47)), it is Damnak Ampil Dam that it is far about 17Km (measured along the River) located in Sangkat Rolok Sar, Pursat Town. (2) at downstream, it is Kbal Hong construction and it is far about 1,7Km located in Veal commune, Kandieang Reay district. (3) it is Chareuk Dam, it is far about 17Km from Br47 located in Sya commune, Kandieang Reay district. Moreover, along the sub-River upstream of Pursat River there are two irrigation constructions, its just completed of construction in 2014. (1) it is Pursat Dam no.3. It is far about 85Km and located in Rokat commune and Samrong commune, Kravanh district. (2) Pursat Dam no.5. It is far about 80Km from the Br47 located in Rokat commune, Kravanh district.

In the construction phase, if consider about assembly impacts there is only one point focus on water pollution and it is not big scale because all irrigation projects are completed construction, the impact on water quality in the site of bridge construction of Pursat River as showed at point A-5 above already, because all Dams are located far, the turbidity has been reduced by speed of water is slow down to these Dams especially Damnak Ampli Dam and Kbal Hong Dam.

➢ Mitigation Measures

Mitigation measurement on water pollution as stated at point A-5 above already.

7.2.3 Project Operation and Maintenance Phase

In the operation and maintenance phase, it is very long term after completely finished of construction works. Within this phase, some activities may give negative impacts to environment as follow:

A. <u>Physical Resources</u>

A-1 Hydrological System

➢ Negative impacts

In the Operation and Maintenance phase, it might have blocked by garbage and algae at/in the canal on front of culvert which it makes low water discharge from upstream. Other hand, it blocks by illegal

garbage disposing along the road. ***Note:*** *The study team has surveyed, investigated on garbage that the people disposed along the road for 8 sites, the result of this study see in Chapter-5, at point-2 (illegal wastes).*

By-Pass of Pursat Town is passed Tonle Sap Biosphere Reserve which there is some year can be flooded and it causes to damage of road or affect to water discharge also. By-pass construction at down Pursat Town, it takes role as Dam, it causes to have inundated on rice field, residential house ect,. And for the future water inundated will become to waste water and polluted environment in Town along the by-pass road as well.



Garbage is on front of culvert at PK-253+600



Algae is on front of culvert at PK-293+980



Garbage is on front of culvert at PK-224+700





Garbage disposes everywhere into Steung Pursat which it pollutes to Tonle Sap Lake Environment

➢ Mitigation Measures

The project owner should do regularly monitoring on part by-Pass of Pursat Town in wet season, to make sure to maintain well this road for long life. Moreover, if there are some places puddles of water along by-pass road should do additional install concrete rings and excavation suitable drainage to outlet from this site, ensure that do not occur to inundate for any other place.

The MoPWT through the PDoPWT should responsible for maintain and rehabilitation of culverts along the road, do not to have garbage or soil filling up on front of culverts, to do announcement to local Authorities: Commune and village about soil filling up that caused to block water discharge of culvert and drainage system along the road. Moreover, the project owner should do cooperation with MoE through the PDoE to install environment signboards: to prohibit for garbage disposed along the road and should look for violable people and to do penalize to them, do not let them to dispose wastes everywhere again.





A-2 Soil Erosion and Water Quality

➢ Negative impacts

In the Operation and Maintenance phase, in case the project owner is not consider to follow up on borrow pit or quarry site, to make sure there is good slope that it cause soil erosion by rainfall. As well as it might have erosion at the slope of road that there is no grass because of it is not well grow causes by mud covered.

In this phase, there is widely road and traffic is increasing, it causes of weight loaded and vibrated on the road and nearby will be compacted; it causes to be low quality of soil as well.

➢ Mitigation Measures

The project owner should do follow up on borrow pit and quarry site, make sure that it is good slope, grass planting according to the technical standard that can be accepted for this result from the contractor or not?.

The project owner should install of traffic loading signboard and maximum speed of vehicles that allowed driving on this road, should having weight station for heavy vehicles and making sure that weight is properly control based on standard and do not allow overload vehicle to pass on this road.

A-3 Water Pollution (Surface/Groundwater)

➢ Negative impacts

In this phase, it might affects of water pollution by turbidity that it causes erosion from borrow pit and quarry site; it is affected to water quality in the project area.

The water surface and groundwater polluted by serious accident of traffic from oil/fuel leakages on the ground and it floes to the shallow water sources and further flows to surface water in the project area.

There can be illegal disposed garbage along the road and during wet season it pollutes into the water in the project area.

➢ Mitigation Measures

The project owner should do follow up on borrow pit and quarry site, make sure that it is good slope according to the standard that can be accepted for this result from the contractor.

In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.

The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to inform to local Authority: commune, village about garbage disposal along the road and installing many signboards: prohibit garbage disposing, and should do urgently for violator.

A-4 Air Pollution

➢ Negative impacts

Air pollution is created from dust and other soil, sand fallen down during transportation and also it is emission gas from vehicles along the road; it affects to the travelers and people living around the project area.

Moreover, air polluted due to bad smell from oil/fuel leakages of vehicles or oil/fuel smell from the vehicles that remained fire, including bad smell of cargos transportation ect., ***Note:*** *but air pollution was lower when this project is not existed.*

➢ Mitigation Measures

Soil/sand and cargos transportation that its have bad smell, is needed well to cover or put in the packet, do not allow smell to spread out.

A-5 Soil Pollution

➢ Negative impacts

In the Operation and Maintenance phase, soil is polluted by serious accident of traffic from oil/fuel spilling on the ground, in the project area.

Other hand, there is soil pollution by illegal disposed garbage along the road.

➢ Mitigation Measures

In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.

The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to inform to local Authority: commune, village about garbage disposal along the road and installing many signboards: prohibit garbage disposing.

A-6 Noise and Vibration

- Negative impacts

In this phase, there is widely road and traffic is increasing, it is creating some noises and vibrations. Other hand, road widely extending, it causes the right of way is remaining small, noise and vibration are creating higher at surrounding of residential houses if comparison to without construction this road.

- Mitigation Measures

The MoPWT through the PDoPWT, especially to do cooperation with local Authority: commune, village to inform to people along this road about people's living condition on the righ of way and they should do for house construction far away from the right of way to avoid disturbance by this noise and vibration.

B. <u>Ecological Resources</u>

B-1 Aquatic Life/Fishery

- Negative impacts

In the Operation and Maintenance phase, it might affects on Aquatic life and fishes by illegal garbage disposed along the road that it causes water pollution of creek, natural small stream, Prek, Steung and affects to fishes and Aquatic life of road.

Moreover, at the by-pass of Pursat Town, there will be new building creating, it causes lack of garbage collection and liquid waste and may be water pollution, affected to aquatic life and fish along the road.

- Mitigation Measures

The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to install many signboards: prohibit garbage disposing and should do cooperation with local Authority: commune, village hard management to violated people.

The project owner should do cooperation with MDoLUMPC through PDoLUMPC to do master plan for development zone along the road in advance including waste water drainage system for in/out entry ect., Moreover, at the by-Pass should install big signboard about zone development plan after this project is completed.

B-2 Protected Area/Protected Forestry

- Negative impacts

By-Pass of Pursat Town construction is affect on Tonle Sap Biosphere Reserve zone because, the road is crossing 8.8Km length, there will be affected some on Ecological zones by the project construction. By-pass construction at down Pursat Town, it takes role for Dam protection, it causes to have inundated on rice field, residential house ect,. And for the future water inundated will become to waste water and polluted environment in Town along the by-pass road as well.

- Mitigation Measures

The project owner should do cooperation with MDoLUMPC through PDoLUMPC to do master plan for development zone along this by-pass be careful in advance including waste water drainage system for in/out entry ect., Moreover, at the by-Pass should install big signboard about zone development plan after this project is completed.

B-3 Forest Resources and Wildlife Habitat

In the Operation and Maintenance phase, it is not affected but the project owner should do cooperation with relevant Ministries and local Authorities, especially with Khan Forest Administration to re-plant the trees such as Kngaok tree, Chankiri tree and Koik tree ect., along the road in order to transfer this area to be green environment, erosion and vehicle protected to fall down or crash to household people's.

B-4 Biological Wildlife

- Negative impacts

In this phase, there is some affects to wildlife such as snake (Chequered Keelback, Striped Kukri Snake, *Sunbeam Snake,* Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spadefoot frog, Frog) that they are passing road and died by vehicle run over them.

- Mitigation Measures

In this phase, the project owner should do cooperation with MoE and local Authority especially PDoE and Khan Forest Administration to introduce and regularly educate people living along the road on prohibition hunting of species where is conservation them in the project area. ***Note:*** they are species not Rare species and Vulnerable species

C. Social Environment

C-1 Poverty

- Negative impacts

There are vulnerable families (poor, Old people, unable people, widow and landless family) of 312 families, that affected by the project and they are living and they have business on this reserved land or they will move to the resettlement site that created by the project. In case the project is not considered and monitoring about them they will get poor and poor.

- Mitigation Measures

In the project operation and maintenance phase, the project owner should do monitoring on their life condition due to identify that 312 families have a better life without this project. In case for any family got un-normal living, the project owner should help them to re-improve their life on time.

C-2 Land used and Resource used in/around Project Site

- Negative impacts

In this phase, at the by-Pass of Pursat Town, there will be changed of type land use such as agriculture land can change to residential house along the road or become to the Town ect., that it causes on environmental pollution by solid and liquid wastes outlet in there.

- Mitigation Measures

The project owner should do cooperation with MDoLUMPC through PDoLUMPC to do master plan for development zone of this by-Pass in advance including waste water drainage system, especially water treatment plant to treat it first before let out to Steung ect., and should install big Architecture design signboard about zone development as well.

C-3 Water use

- Negative impacts

In this phase, can be affected to water agriculture use along the canal and road because concrete ring installed may be small or blocked by the rubbish and algae (dry up).

- Mitigation Measures

The project owner, should do follow up regularly along the existing canal in wet season and to make sure to maintain and repair well for long life, do not in there block of water by water agriculture used.

The MoPWT through PDoPWT will responsible for repair and maintain for all culverts along the road, do not allow rubbish or algae or soil filling on front of culverts, to do announcement to the local Authorities: commune, village about prohibit soil filling to block water on front of culvert and drainages along the road. Moreover, the project owner should do cooperation with MoE through PDoE to install environment signboards, prohibit to dispose garbage along the road.

C-4 Existing Social Infrastructures and Services in/around the project site

- Negative impacts

To enlarge and by-pass roads construction which it has median road divided cause to make different to cross the road especially mid-Town and Town;

Moreover, in this operation phase can be divided or made different completely view of community base at the by-Pass of Pursat Town.

- Mitigation Measures

In this phase, the project owner should do discussion with the community base in order to solve fair of facility such as sky bridge construction for traveler ect,.

C-5 Social Institutional and Executive Institutional in the project site

- Negative impacts

In this phase, can be divided or made different completely view of community base at the by-Pass of Pursat Town.

- Mitigation Measures

In this phase, the project owner should do discussion with the community base in order to solve fair of facility.

C-6 Improperly Advantage Allocating and Damaging

- Negative impacts

In this phase, can be some small business on existing road in Pursat Town, it will be loose income and there can be others new business creating along the by-Pass.

- Mitigation Measures

The formed existing road that it is crossed Pursat town is not closed, it uses as provincial road and allow using as normal, and this road can be managed and decided by the project owner..

C-7 Aestheticism

- Negative impacts

In this phase, at the by-Pass of Pursat Town, there will be changed of Aestheticism such as land use around by-Pass due to rice field is became to small Town or Town ect., there can be affected on environment pollution by solid and liquid wastes outlet in this area.

- Mitigation Measures

The project owner should do cooperation with MDoLUMPC to do master plan for development zone of this bypass in the future, should do design plan in advance of public infrastructures such as: road in/out to the site, wastewater drainage system, inlet wastewater drainage system especially to keep for reserve place for water treatment plant to treat this wastewater before outlet to River ect., and should install big architectural design signboard for project development as well in order to the people to keep the place as design plan that shown on the big architectural design signboard because at the present, within this area is no strongly development activity yet.

Moreover, the project owner should do cooperation with relevant Ministries and local Authority especially Khan Forest Administration to re-plant trees along the road, in order to become this area to be green forever.

C-8 Gender

- Negative impacts

In this phase, can be affected some women business, because on the existing road there mostly women are lose their income by the by-Pass of Pursat Town, and then there also will be created new business on the by-Pass.

- Mitigation Measures

The formed existing road that it is crossed Pursat town is not closed, it uses as provincial road and allow using as normal, this road can be managed and decided by the project owner.

C-9 Children's Rights

- Negative impacts

In this phase, can be affected for children accident when they pass the road, due to of wide road and good it causes for vehicles use high speed and there is busy road as well.

- Mitigation Measures

The project owner should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect., including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down.

The project owner should do cooperation with Ministry of Education Youth and Sport to insert traffic program for the students, in order to reduce for traffic accident along the road, because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle as well..

C-10 Working Conditions (including Occupational Safety and Public Health

- Negative impacts

In this phase, can be occurred accident along the road because there is wide road and good it causes for vehicles use high speed and there is busy road as well.

- Mitigation Measures

The project owner should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect.. including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down.

Moreover, the project owner should do cooperation with local Authority of commune to delivery and educate people about traffic law and traffic light of vehicle because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle and especially animal husbandry (cow, buffalo, dog, goat ect..) do not allow to walk everywhere along the National road.

C-11 Accidents

- Negative impacts

In this phase, it will be traffic accident because of traffic increasing, high speed use and good and wide road. Moreover, because of center divider newly installed, cars running counter to traffic way may increase and cause accidents.

- Mitigation Measures

The project owner should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect.. including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down.

The project owner should do cooperation with local Authority of commune to delivery and educate people about traffic law and traffic light of vehicle because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle and especially animal husbandry (cow, buffalo, dog, goat ect..) do not allow to walk everywhere along the National road.

C-12 Trans-Boundary Impacts or Climate Change

- Negative impacts

In the future at this phase, due to vehicle are increased, its caused for high emission gas as well.

- Mitigation Measures

The Royal of Government should consider for second hand vehicle import which these vehicles are used and very old in their country and then these engines are not well fired including high emission gas also.

7.2.4 Project Closure Phase

In project closure phase, it is after MoPWT planned for NR5 improvement project. Therefore, within this phase, it is not any affects to Social environment.

7.3 Summary of Environmental Impact Assessment and Mitigation Measure

Table-7.1: Environmental Impact Checklist and Mitigation Measure

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
1. Impact Environment before project operation phase						
1.1 Before project construction phase						
A. Physical Resources						
A-1 Hydrology	- Based on consultation and discussion with the local village Authority and villagers in Moung village shown that in between PK-247 to PK-248 of this road there is no any culvert. Moreover, the drainage canal along the road was filled up by the people without concrete pipes installed. It causes flooded in this village in wet season when it was heavy rain. - Pursat bypass is crossed Pursat River and O-Sdao that it will affect to water discharge of this River.		✓		- The detail project design of this road improvement has to consider for additional concrete rings installation at between PK-247 – KP-248 of this road. It plans to dig canal on both sides to regulate water flow of flood out from the village and agriculture land use along the road. - At Pursat River, there will plan to construct a large bridge, it will be not blocked water discharge and this bridge will pass over the road and turn following the River as well. ***Note:*** O-Sdao in the dry season is dried up but it is not for all places, such as pond and somewhere the place along the O is also no water.	
A-2 Erosion and Soil Quality	- Soil erosion might have at the borrow pit, quarry site, and road slope which raised at high level in case the project has not considered about this problem.		✓		- The detail project design of this road improvement has to insert procurement document project construction on soil erosion measure at the borrow pit (should have slope based on type of soil and to excavate straight), quarry site and to plant grass on road slope.	
A-3 Air Pollution	- There is air pollution by road damage some places, DBST floor is easy damage, road is not large, dust blows from this road because the project is not started and enlarged.		✓		- It needs to have this project by enlarging road for rural area is 23m of width and at the Town it will be increased up to 28m of width and paved asphalt concrete to reduce dust.	
B. Biological Resources						
B-1 Area/Forest Protected	- Project design for by-Pass of Pursat Town is not deeply consider, it might affects on Tonle Sap biosphere reserve zone, because when the road project is completed and there is increasing households due to un-expected further to create a Town. There is no plan in advance for waste water system and other infrastructures, it causes to affect to ecology zone and lead to pollution in Buffer zone which is located nearby.		✓		- In case project design for by-Pass of Pursat Town are two options: (1) by-Pass at South of road (up road) and (2) by-Pass at North of road (down road) that located in Tonle Sap biosphere reserve zone then, to do comparison of cost economic included also cost environment, and identify which the by-pass at North of road is the best	
B-2 Forest and Wildlife Habitat	- The NR5 improvement project a part from Thlea Ma' am Pursat – Battambang in Corridor of Impact (COI: 20m, total 40m) is not forestry but there are trees and fruit trees that planted by Khan Forestry Administration and people. These crops are not habit of wildlife for endangered species, critically endangered species and vulnerable species.			✓	- Needs to study, investigation on impact of crops, trees, households that located in COI, and including resettlement plan by insert fund to solve these impacts and fund to re-plant trees along the road. The project owner should do cooperation with relevant Ministries for successful of project plan implementation.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
	Moreover, this area is high activities such as traffic busy on this road that it causes of big wildlife cannot come close. - Along this road of COI in between KP177+177 to KP177+263, PK178+484 to PK255+121 is river side vegetation (creek, canal, and pond) about 10.13ha. This vegetation will do clearance for extending road. Moreover, at both sides along the road there are 30 types of crops, total is 4,858 trees (diameter from 10Cm to 62Cm) which planted by the people and Khan Forest Administration. There are fruit trees planted by the people of 4,831 trees and these trees are affected by the project.					
C. Social-Economy Resources						
C-1 Land use/Relocation	There is some people lived on (COI: 20m, total of 40m) about 1,860 families, 307 HHs, 195 business stalls, 8 Restaurants, 676 other small stalls and other constructions (well, fence, gate, funeral, grave, washing car place, Toilet, paddy store, drainage, Corola place, platform ect.,) total is 137 that need to demolish by thi project. The new Town by-pass construction is affected on rice field of 269,026.85m^2, residential land in total is 1,079.67m^2 and commercial land is 5,962.56m^2(belong to 224 people families).			✓	- Before the project construction phase there will be created Inter-Ministry Committee and Provincial Sub-Committee, need to study, investigation on impacts: crops, fruit trees, households that located in COI, and including all things suitable registration that affected by the project. - Deadline of registration on impacts such as houses, buildings, crops is 2 September 2013; for existing road and Pursat by-pass is dated on 30 December 2013, and resettlement plan is prepared fund for compensation, support to vulnerable people (Old head household, disable people, widow, poor people that they get income less than 20$/M), support to the people landless (people live in COI), support to affected people land use of family is over 20%, there is reserve fund for new program of temporary income and fund for tree planting along the road as well. The total budget for social impact resolution is USD 8,059,913.55 (included resettlement for 2 sites in Bakan district and Moung Russein district for this project and other one O-Chrov district for road section of Sri Sophorn to Poipet.	
C-2 Poverty	There are vulnerable Head households they get income less than 20$/M, landless family, old head household, disable people, widow) totally is 312 families. The NR5 improvement project will affect on these people, it causes to them become poor and poor.			✓	Should prepare resettlement plan due to do compensation on houses, buildings, crops and fruit trees affected based on market price, including supplementation fund to these families such as money supports for impacts, money supports for transportations, money supports for family who loaned land, money supports for vulnerable Head households and money supports for new program of temporary income to affected people land use of family is over 20%. For the landless of 53 families the project owner will look for land and do resettlement them (there are 2 sites: one site in Bakan district to be supported for 39 families and other site in Moung Russei district to be supported for 14 families), but this resettlement has to construct social infrastructures look like existing they lived or better than there. Detail description is stated in resettlement plan of the project.	
C-3 Economic and living of Community in/around Project Site	In the COI area, there are total of 1,860 families affected by the project, inside this affected people landless is 53 families and other 259 families of vulnerable Head household (old head household, disable people, widow) that they get income is less than 20$/month. The NR5 improvement project will affect on their poor living.			✓	- It is project plan for resettlement. However, the project needs to recruit workers by providing priority to affected people and the people who living in the project site in order to improve their living condition in the project construction phase. Should be achieved resettlement plan before the project construction phase started.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-4 Land used and Resource used in the Project Site	- Total land acquisition for road construction of Pursat bypass is 296,069.07m^2, among of this there is rice field is 269,026.84m^2, commercial land is 5,962.56m^2 and residential land is 21,079.67m^2.		✓		- The project should make a plan to solve these affects by compensation cost of land based on market price, due to have a plan for affected resolution that it will implement by ths Inter- Ministry Committee (IRC) and related Provincial Sub-Committee due to have Ministry of Economic and Finance is a Chairman. See detail settlement plan of the project.	
C-5 Existing Social Infrastructures and Services in the project site	- There are social infrastructures such as: electricity Towers, Cable poles, Optic cable Towers, Optic cable underground, electric cable underground, waste water drainages, water pipes underground such as water supply pipes in Pursat Town on the COI area that started from KP183+940 to KP190+855; for Trapaing Choung and Boeung Khna communes started from KP200+600 to KP212+958; for Moung and Kea communes started from KP243+430 to KP245+939; these water pipes are affected by this road extended.			✓	- The project construction, the project owner should inform to these infrastructures owners in advance and should do cooperation relevant institutions to demolish and move its to the new locations where are safe places, to avoid re-demolish again in the future that it is costly. - The project owner should select the second alternative of Pursat by-pass that starts from KP183+00 to KP190+200 in order to pass where are there many infrastructures and residential houses	
C-6 Culture and Traditional	There are two old constructions: (1) it is brick fence and (2) it is an ancient gateway of Royal Palace of Preah Bat Monivong; it was constructed in Colonial of French. Both are located on front of Bakan district and Office of Social Affairs Labor Vocational Training and Youth Rehabilitation, Bakan district, Pursat province. It will affect by the project road extended. Moreover, there are some gateways and fences along the road will be affected also. Moreover, Pursat new by-pass construction affected on rice field of Ethnic minority of Cham and it is also affected to their Culture and traditional.		✓		- the project owner should do bypass design plan due to keep ancient gateway of Preah Bat Monivon as hystoric of culture and discuss with Provincial Authority, Provincial Department of Culture, Fine and Acts about it conservation as well. For other gateway and Pagoda fence, the project owner should discuss with Provincial Authority, Provincial Department of Religions and Cults and relevant Pagoda Committees to do compensation; all these need to be solved whatever is far from the reserved land to avoid impact again for the future. - The project owner should identify plan of the project contractor to educate staff-workers to respect traditional Cham's that they to be religious disciple of Muslim. Moreover, the project owner should allow them for jobs as workers, if they apply for job; do not to be a racist.	
C-7 Accidents	- Pursat By-pass construction should consider on bridge design to pass Steung Pursat, because along this Steung both sides there are two pavement roads. To remind that the road construction is a highway road which it is use for high speed and causes to have accident at the intersection road between this by-pass and both Steung sides.		✓		- The bridge design to pass Pursat Steung should consider about alternatives, in case the bridge construction is high over of both road lines or to install traffic light or roundabout intersection ect,.. Should chose which one case is a better than other to reduce for accident based on highway standard as well.	
1.2 Project Construction						
A. Physical Resources						
A-1 Morphology and Topography	- It may change the morphology and topography in the COI area, borrow pit and quarry sites of the project due to land clearing and earth work activities for base road				- Has technical Expert for monitoring of this construction such as earth compacting, concrete bed bridge and culvert making, slope of borrow pit and quarry site making, grass planting along road slope ect.,	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Mediu m	High		
	arranging/constructing. Moreover, there will be changed in the Pursat Town by-Pass due to land clearance and earth work activities, filling up soil of road surface, earth excavation for culvert and bridge construction in all places that road passed ect., *Note: the construction site, borrow pit of soil, stone and laterite soil cannot identify detail because the project owner has not recruited the technical consultant for project detail design due to the technical consultant has to identify about quality of soil, stone and laterite soil for a standard highway and during the project detail design it will indicate clear in the project report.*		✓		- At along the by-Pass will build drainage along the road to protect soil erosion, grass planting along road slope in order to avoid soil sliding as well. - Construction work will start in dry season to protect soil erosion that might affect topography in rainy season.	
A-2Hydrological System	- Water discharge of Creek and Steung might be affected due they close waterway for road extending or new construction of bridge, culvert that it will block waterway in wet season; - Bypass construction activities can be done soil filling on canal, Creek or other waterways for this road construction; it leads to inundate water on Pursat Town or agriculture land, water is low capacity flow out; it causes to road under construction will break and this soil will make canal, creek and Steung in/around the project area become shallow. - Soil erosion at the borrow pit and quarry site by excavating of soil and stone that it is not properly slope as standard of earth and quarry works, there will lead to break the wall of borrow pit or mountain wall. There is also occurring to create soil sediment at the bottom and make shallow of canal, creek, Steung in/around the project area. - This road construction will affect on water quality by construction activity such as stone cleaning, vehicles washing, soil erosion from the wall of borrow pit or quarry site that it is high turbid water. - There will affect to the water quality by disposing of solid and liquid wastes from the living places such as: it is from toilets of staff- workers house, fuel/oil from vehicles used in the field and washing bodies of staff-workers; all these will pollute water and it causes to decrease water quality level.		✓		- The project construction activity such as big earth works, it will work in dry season in order to avoid soil erosion and water polluted reduction. Moreover, at the site of road extending, culvert, bridge constructions, should do by-Pass and install concrete rings to lead water flow out from the construction site with suitable dimension to drain water to downstream as normal flow in wet season; do this in order to avoid inundated water at upstream or it occurs to break the dam by water pressure into the construction site. For big bridge constructions such as Steug Pursat, Steung Svay Daun Keo ect., should use steel pipe as suitable technical condition to encircle of bridge base in the water which it can protect water flow or serious water pollution - For by-Pass of Pursat Town construction, should construct bridge and install enough of concrete rings where are water locations or water passed sites with suitable dimension to drain water out including canals of both sides. - Should plant grass on slope road and shoulder to avoid soil erosion of wall road. - Should have vehicle washing place and workshop, warehouse to stock construction materials and fuel at suitable level, to avoid spilling fuel/oil that finally pollute into water source in the project area. - At the field, Staff-workers Camps, workshop, warehouse to store construction materials, should have garbage site, the project owner should require to the contractor to contact to garbage collection Servers such as in Pursat province there is POV SETHA Company and in Battambang province there is SINTRY Company. For oil waste, can sell to who asks for buying it to assist their fire kiln; for old tires, can sell to the middleman that they collect its transport to Vietnam (information about garbage data and shop buying of waste. Moreover, the project owner should consider enough on latrine and its septic tank construction base on number of staff-workers.	
A-3 Soil Erosion and water quality	- Soil erosion in the borrow pit, quarry site and along slope road which it will raise high, in case the project owner is not consider about the problem. - Soil filling on road in the field in wet season, it leads to soil erosion to cover of rice field and it will lose soil quality in there.		✓		- Should observe regularly the contractor for slope road based on contract document works and should order to excavate straight at quarry site and should plant grass along slope road and shoulder also. - Most activities of the project road extending are implementing in dry season that there will less impact.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
A-4 Water Pollution	- It will affect for water pollution by making turbid water due to construction activity works such as earth works (poor management works on borrow pit, quarry site), concrete works, foundation works ect., it may affect to surface water in the project area. - Surface water and groundwater pollutions, it occurred from accident of trucks which it leakages oil/fuel to the ground and go into the shallow water source and continue flows to surface water in the project area. - There is not well **SO**lid waste management (waste soil, waste of rubber floor road etc.,) and liquid waste (waste water outlet from the toilet and kitchen ect.,) in the field works, Staff-workers houses, workshop, warehouse then there will be polluted water in the project area		✓		- Should observe regularly the contractor for slope road based on contract document works and should order to excavate straight at quarry site and should plant grass along slope road and shoulder also. Moreover, should control concrete mixing site, stone cleaning site to ensure that in the project area is no water quality pollution. - Waste soil, waste of rubber floor road, the project owner will contact to the local Authority to transport it to fill on the rural road and do well compacting it, do not dispose it into water sources. - In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources. - Should educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. The project owner should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. Other hand, for oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle. Should well manage on solid and liquid wastes, do not let its polluted into the water sources. - In the field works, Staff-workers houses, workshop, warehouse, it is important to have enough and properly for latrines equipped with septic tank of 2-3 blocks and bath rooms. It is proportional to the number people uses.	
A-5 Air Pollution	- Air pollution is creating due to dusty and exhausting gas from vehicles which its are constructing; its will impact to the travelers and the people living in/around the project area. - Air pollution may be occurred due to traffic jam in the project area, there will increase emission gas from vehicles. - As well as air pollution causes from dusty in borrow pit and quarry site, there are many trucks are transporting its to the site, along the road that it will affect to the travelers and the people living in/around the project area. - Air pollution is creating by bad odor from spilling oil/fuel of old engines where is workshop, dump site, waste water site of staff-workers house ect.,		✓		- Should use good quality of vehicles and machines with lowest air pollution will be used to assure air quality in the project area. Especially, new vehicles and Engines are useful because its exhaust low gas and strong for works. - Should have technical staff to operate traffic in order to avoid of traffic jam. Moreover, should do extending reserved land first and let the people use temporary on existing road. - From the borrow pit and quarry site to project site, need to spraying water regularly in each construction site especially at the Town area, school, district Hospital or health center or clinic, pagoda ect., in order to reduce dust swirling up to the travelers, students, ill people and the people living around the project area. - Will properly manage in the workshop, dump site and staff-workers house; to advise them to dispose in cask wastes, and oil/fuel wastes will keep in safe place to avoid its spilling on the ground. Moreover, these wastes will sell the middleman and selling waste shop for their wastes recycle as described in chapter of Mitigation Environment Measures.	
A-6 Soil Pollution	- There is some soil pollution by construction work activities such as earth works (it is not well management for borrow pit and quarry site), concrete works, base works; such as cement spilling, liquid cement ect., that spilled on the ground and it causes soil pollution in the project area.				- Has to control regularly to the contractor construction for slope road as standard of contract works document works and should order to excavate straight at quarry site and should plant grass along slope and shoulder road. Moreover, should control in concrete mixing site, stone cleaning to ensure that in the project area is no soil pollution.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
	- In case lack of well wastes management in the staff-workers houses, workshop, warehouse that it causes soil pollution in the project area. - Soil pollution causes from serious accident of vehicles by spilling oil/fuel on the project area.		✓		- In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources. - Should educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. The project owner should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. Other hand, for oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle. Should well manage on solid and liquid wastes, do not let its polluted into the water sources.	
A-7 Noise and Vibration	- In the infrastructure construction of the project, it might disturb to the people living in/around project area because of sound, noise and vibration from construction machineries are operating on earth works, concrete works, base works, transport works and repairing works ect., - It might disturb to the people living around borrow pit and quarry site because of sound, noise and vibration from construction activity works such as soil excavating, transportation of (soil and stone), and breaking stone ect.,		✓		- Machineries and transport vehicles which are low noise shall be used in the project area - Should assign working day for daytime only, stating in the morning from 7:30am to 12:00am and afternoon from 1:30pm to 5:00pm in order to reduce disturbance to the people in the project area	
B. Ecological Resources						
B-1 Aquatic life/Fishery	- Fishes and other aquatic life might be affected to water sources (Creek, Prek or Steung) because of turbidity of water from cleaning rock and project construction including solid and liquid wastes and other case from infrastructures of the project such as constructions: bridge, culvert crossing Steung Pursat, Steung Svay Daun Keo, Steung Moung Russei, Steung Chork and steung O-Samdan ect.,. - By-Pass of Pursat Town project can fill up soil on creeks or cut-off of flat area; it can cut of Aquatic life/fishery systems in the project area.		✓		- should look to buy clean gravel to avoid for gravel cleaning in the concrete mixing site; Bridge and culvert construction should construct in dry season and should use steel mould for bridge column, do not make a dam cross the River. Moreover, during doing extend culvert on existing culvert, should look for by-Pass and install concrete rings depend on dimension of water flow of Creek, and these canals to avoid block and low flow especially may impact on fish movement in wet season. - The project owner will avoid to outlet waste water out from vehicle washing place, concrete washing place, material and waste of concrete and waste oil direct into the water sources that existed in the project area, due to use a private site of vehicle washing service instead. - Should not fill up soil on water channels that road project passed. Should do installing concrete rings for all existing channels; there should make drainage system for both sites along the road to let water drain out to low area. - In the field works, Staff-workers houses, workshop, warehouse, it is important to have enough and properly for latrines equipped with septic tank of 2-3 blocks and bath rooms. It is proportional to the number people uses; and make sure there is not affect to Aquatic life/fishery systems in the project area. - Solid and liquid wastes management will be educated to staff-workers in project area to avoid spilling fuel/oil on the ground in the project site.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Mediu m	High		
					- Should educate staff-workers about solid and liquid disposal, especially do not spill fuel, oil on the ground and in the water in the project area. Moreover, the project owner Should do well management on all wastes, such as solid wastes: can, plastic bottle, glass bottle, battery, oil used, old tires; boxes should separately keep for middleman buying for waste recycles. For other remaining wastes: old lumps, plastic bags, vegetable waste ect., should contact to garbage collection Company to transport its to Dump site.	
B-2 Protected Area/ Protected Forestry	- By-Pass of Pursat Town construction is affected on Tonle Sap Biosphere Reserve zone because, the road is crossing 8.8 Km length, there will be affected some on Ecological zones by the project construction activies.		✓		- This by-Pass construction should be careful construct such as earth works, concrete works, based works need to follow the technical standard and the construction should be done in dry season only. - By-pass construction, should do bridge and culvert constructions first, after these completed then starting for road construction, to avoid having water blocked and fish movement. - Should organize properly for solid and liquid wastes; keep in safe places especially to avoid environment polluting in conservation area.	
B-3 Forest Resources and Wildlife Habitat	- The NR5 improvement project from Thlea Ma' am to Battembang is needed Corridor of Impact of 20m (COI: 20m, total is 40m). In the COI: 20m area, there is crops, fruits 4,817 trees which grown by the people. The fruit trees that grown on the reserved land are 30 types and total is 5,210 tree (diameter from 10Cm to 130Cm. The Riverside vegetation that re-grows is 10.13ha, there is 36 species. Its will affect by this project, these some trees are wildlife habitats. ***Note***: *for Mammal: Small Asiun Mongoose, Lyle's Flying-fox; Birds: Asian Openbill, Barn Owl, Lyle's Flying-fox, Grey Nightjar, Yellow-breasted Bunting, Large-billed Crow, Common Snipe, Common Kingfisher; and for Reptiles and Amphibian there have some that they lived in the COI area, to say that they just only pass this area only*.		✓		- Should do cooperation with relevant Ministries and local Authorities especially, Khan Forest Administration to plant small trees which is planning to re-grow along the road such as Krongaok tree, Koki tree, and Chan Kiri tree in order to change to green environment, protection erosion and prevented vehicle to fall out of road and crash to people household ect.,	
B-4 Biological Wildlife	- It might affected to wildlife, such as snake (Chequered Keelback, Striped Kukri Snake, Sunbeam Snake, Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spadefoot frog, Frog) that they are living in the COI area. - The staff-workers of the project can eat wildlife meat that it causes to increase for wildlife hunting near this project area such as protection area or protection forest ect.,.		✓		- Should do cooperation with MoE and local Authorities, especially closed work with PDoE and Khan Forest Administration to educate and guide to staff-workers of project, do not hunting them while they presented in the project area. ***Note:*** *they are species not Rare species and Vulnerable species*. - Should assign working day for daytime to reduce disturbance to the people and wildlife by noise or vibration in the project area. - The project owner should do cooperation with MoE and Forest Administration to train about wildlife conservation and wildlife punishment case to the staff-workers project's.	
C. Social-Economic						
C-1Land use/Relocation	- May be required some land for small resettlement such as			✓	- Will do cooperation with IRC to look for land rental for temporary for construction site,	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Mediu m	High		
	land for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect.,				land for stone, soil, materials of construction, warehouse and concrete mixing site ect. Due to there is not affect serious to resettlement site. - To settle between construction building for the staff-workers and store for materials of construction should be far at least 500m from the residencial household of the people.	
C-2 Poverty	There are vulnerable families (poor, Old people, unable people, widow and landless family) of 312 families, and 53 families landless or affected for all their land that affected by the project and they are living and they have business on this reserved land or they will move to the resettlement site that created by the project. In case the project is not considered about them they will get poor and poor.		✓		- The people are landless or affected all their land, in case the project owner looks for land resettlement for them including access for infrastructures as the same they ever got or better than before, the project owner should do monitoring on their life condition due to identify that 312 families have a better life without this project.	
C-3 Economic and living of Community in/around Project Site	- Bridge construction that crossing Steung such as Steung Pursat can be less affected to fisherman in the project area by water pollution and poor turbidity.		✓		- The method to mitigation this impact is in Chapter of Mitigation Impact Measures at point A-2, A-3 and A-5; the project owner should not make a dam cross the River forcbridge construction, should use pipe surrounding the Bridge column for base and Bridge column construction. - Will motivate and provide priority to fisherman in/downstream/close in the project to become project workers.	
C-4 Land used and Resource used in/ around Project Site	- The by-Pass of Pursat Town will be changed of land use such as agriculture land can change to residential house along the road or become to Town ect.,		✓		- Should do cooperation with MoLUMPC to do master plan for by-Pass development, doing plan before of infrastructures such as in/out site, drainage water waste system, waste water storage site, especially waste water treatment plant site before outlet to the Steung ect., there should have signboard show development site as well.	
C-5 Water use	- It will affect some on water agriculture use of canal along the road by bridge extending of construction project. At the site of by-pass will be affected on 6 of agriculture canals: Suy Sem canal, Prey Nhy canal, Kambot canal, Cham Chamhaor canal, Boeung Yeay canal, Mao Chaouy canal and Kbal Hong canal. - In the COI area at some Town, there is water pipe system such as in Pursat Town is started from KP-183+940 to KP-190+855, Trapaing Choung commune and Boeung Khna commune started from KP-200+600 to KP-212+958, Moung commune and Kea commune started from KP-243+430 to KP-245+939, these water pipes will affect by the NR5 improvement project.		✓		- Should do cooperation with MoWRAM to extend bridge and culvert and low-down new concrete pipes all these 6 canals that its are irrigation systems, to make sure irrigation system is normal use, never blocked and do not affect to the farmers. - Should inform to PDoIME, local Authorities: commune and water supply Companies that they have own pipes buried on the COI area to demolish its and move to the new safe places (on reserved land) to avoid re-demolish for many times, it causes to lose money in the future while there will be road improvement again.	
C-6 Traffic and Services in the project site	- It will get traffic jam for temporary along the NR5 and on the intersection road that connect to the rural road by cutting-off of these roads during construction.		✓		- In case during extending road construction on paved road or rural road, the project owner should do on this site faster, if there is not finished on time the project owner should do traffic facilitate to avoid traffic jam. Should install traffic signboards and working group for monitoring and provide traffic service during the construction phase.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-7 Conflicts of Interest in the project site	- On front of Bakan district and Office of Social Affairs Labor Vocational Training and Youth Rehabilitation, Bakan district, Pursat province, in the COI area, there are two old constructions: (1) it is brick fence and (2) it is an ancient gateway of Royal Palace of Preah Bat Monivong; it was constructed in Colonial of French. Both are located and affect by the project road extended, in case of project design phase the project owner is not solve this problem. - May be affected to traditional and custom Cham's ethnic minority which they have agriculture land or they are living in/around the project area affected by the Pursat Town by-pass construction.		✓		- Should discuss with Provincial Authority, Provincial Department of Culture, Fine and Acts in advance, whether need to move ancient gateway of Preah Bat Monivong from COI of road or how to solve before the project construction. - The project owner should require to the contractor to educate their own staff-workers to respect Cham's traditional and custom, should allow them to work as project workers if they apply for job, do not to be a racist.	
C-8 Aestheticism	- The Aestheticism will be changed in COI area for temporary by clearance of vegetation, crops and trees in order to do extending road especially a lot of dust and mud while there is raining.		✓		- Should ask the contractor to do regularly spaying water to reduce dusty and should do compacting soil immediately in that site after soil landed from the truck. - At the road site that is enough of level needed for new road, there should plant grass and small trees along the slope road in order to correct Aestheticism to be green site.	
C-9 Gender	- There can be recruited workers not equality and also is not promotional to sex for works.		✓		- Should ask to the contractor to recruit workers is not to side with one's sex, and should divide for labor depend on sex (male or female) and the wage should be equality.	
C-10 Children's Rights	- There will have some children come and see the site, it causes to get accident to them such as traffic accident, soil erosion falls to them, something hard fall down on them. Moreover, in the borrow pit or quarry site is deep excavated then during the raining there is inundated water and the children can be died by drowning.		✓		- Should build barrier, it shows as project site and do not allow in and out excepted staff-workers of the project, surrounding should organize the guard to regular control, even though during time break, to make sure that there is no children come in to the project site. - When the borrow pit is completely finished, this borrow pit should do well sloping and smoothly and install signboard shows picture of borrow pit, be careful for children, do not allow for swimming including delivery information to local Authorities: Commune and village to assist announcement to every people to prohibit their children to come for swimming in this place. In case, the borrow pit is nearby the villager household should do as above described including the fence protection as well.	
C-11 Infectious Diseases such as HIV/AIDS, Liver Diseases	- It can occur infection HIV disease for staff-workers of project and other disease such as liver, lust disease, tuberculosis and other infection diseases ect., from staff-workers, food sellers and the server of sexual services.		✓		- Should organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred. - Should do cooperation with PDoH and Hospital to educate on sanitation and hygiene to treat for staff-workers in order to prevent these infection diseases to the people in the project area. Should contact any Hospital if while there is accident that can be occurred.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-12 Safety and Public Health	- It might affect on health people's in the project site to staff-workers by pollution of dust or materials transportation. Moreover, there will have Opium use and trading it. - It might get accident works to staff-workers due to they are careless and the Employer is not provide enough safety tools or materials of construction works to them based on these type of works.		✓		- Should keep safety first for daily working. The project owner should ask the contractor to provide mask to protect dust and helmets, boots, gloves to workers; should do spaying water regularly on this road construction. - It the project site should build fair Camp to the staff-workers including enough water supply and latrines, and education program on safety first for the staff-workers. - Should ask to the contractor to organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred. - Should do cooperation with the local Authority and relevant institutions to protect Opium and people trading. Moreover, the project owner should do cooperation with Health institution in this project area to prevent other infection diseases that its can be occurred.	
C-13 Accidents	- It might occur some accidents in/around the project site such as accident works (rope cut-off or breaking of crane machine, crushing, something hard to scatter down, fire caused by careless such as short circuit, welding, do not careful use power caused to fire of fuel station and materials ect.,		✓		- Should ask to the contractor to train staff-workers about safety first, provide mask to protect dust and helmets, boots, gloves to workers of the project. The project owner will provide building to stay with facility of water supply, to train on technical training and provide tools for safety work to the staff-workers. - Should ask to the contractor to organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred. - The project owner should require to the contractor to buy accident insurance for work certificate for the project staff-workers in order to make easy to solve when there is accident occur for anytime. In additional, it makes warmly for staff-workers and trust to the project. - In the project site, at the staying place, warehouse, and fuel station should have extinguisher, sand pile, axe to repress or to extinguish fire when there will be occurred.	
C-14 Trans-boundary Impacts or Climate Change	- Trans-boundary impacts or climate change will not occur because the existing NR5 is the project improvement only. - In the project construction phase, the amount of CO_2 emission from vehicles and machines will increase in the project site.		✓		- Should use vehicles and machines that its are low of CO_2 emission in order to reduce air pollution in this area; especially should use new vehicles that its are low of CO_2 emission.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-15 Assemble of Impacts	- At the present, along the Pursat River there is irrigation construction that it completed construction for 3 sites: (1) it located at upstream (compare to Spean Thmar of Pursat River, (Bridge 47)), it is Damnak Ampil Dam that it is far about 17Km (measured along the River) located in Sangkat Rolok Sar, Pursat Town. (2) at downstream, it is Kbal Hong construction and it is far about 1,7Km located in Veal commune, Kandieang Reay district. (3) it is Chareuk Dam, it is far about 17Km from Br47 located in Sya commune, Kandieang Reay district. Moreover, along the sub-River upstream of Pursat River there are two irrigation constructions, its just completed of construction in 2014. (1) it is Pursat Dam no.3. It is far about 85Km and located in Rokat commune and Samrong commune, Kravanh district. (2) Pursat Dam no.5. It is far about 80Km from the Br47 located in Rokat commune, Kravanh district. - In the construction phase, if consider about assembly impacts there is only one point focus on water pollution and it is not big scale because all irrigation projects are completed construction, the impact on water quality in the site of bridge construction of Pursat River as showed at point A-5 above already, because all Dams are located far, the turbidity has been reduced by speed of water is slow down to these Dams especially Damnak Ampli Dam and Kbal Hong Dam.		✓		- Mitigation measurement on water pollution as stated at point A-5 above already.	
2. Project Operation & Maintenance Phase						
A. Physical Resources						
A-1 Hydrological System	- It might have blocked by garbage and algae at/in the canal on front of culvert which it makes low water discharge from upstream. Other hand, it blocks by illegal garbage disposing along the road. ***Note:*** The study team has surveyed, investigated on garbage that the people disposed along the road for 8 sites. - By-Pass of Pursat Town is passed Tonle Sap Biosphere Reserve which there is some year can be flooded and it causes to damage of road or affect to water discharge also. - By-pass construction at down Pursat Town, it takes role as Dam, it causes to have inundated on rice field, residential house ect,. And for the future water inundated will become to waste water and polluted environment in Town along the by-		✓		- Should do regularly monitoring on part by-Pass of Pursat Town in wet season, to make sure to maintain well this road for long life. - Should do additional install concrete pipes and excavation suitable drainage to outlet from this site, ensure that do not occur to inundate for any other place. - The MoPWT through the PDoPWT should responsible for maintain and rehabilitation of culverts along the road, do not to have garbage or soil filling up on front of culverts, to do announcement to local Authorities: Commune and village about soil filling up that caused to block water discharge of culvert and drainage system along the road. Moreover, the project owner should do cooperation with MoE through the PDoE to install environment signboards: to prohibit for garbage disposed along the road and should look for violable people and to do penalize to them, do not let them to dispose wastes everywhere again.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
	pass road as well.					
A-2 Soil Erosion and Water Quality	- In case the project owner is not consider to follow up on borrow pit or quarry site, to make sure there is good slope that it cause soil erosion by rainfall. As well as it might have erosion at the slope of road that there is no grass because of it is not well grow causes by mud covered.		✓		- Should do follow up on borrow pit and quarry site, make sure that it is good slope according to the standard that can be accepted for this result from the contractor or not? - The project owner should install of traffic loading signboard and maximum speed of vehicles that allowed driving on this road, should having weight station for heavy vehicles and making sure that weight is properly control based on standard and do not allow overload vehicle to pass on this road.	
A-3 Water Pollution (Surface/Groundwater)	- It might affects of water pollution by turbidity that it causes erosion from borrow pit and quarry site; it is affected to water quality in the project area. - The water surface and groundwater polluted by serious accident of traffic from oil/fuel leakages on the ground and it flows to the shallow water sources and further flows to surface water in the project area. - There can be illegal disposed garbage along the road and during wet season it pollutes into the water in the project area.		✓		- Should do follow up on borrow pit and quarry site, make sure that it is good slope according to the standard that can be accepted for this result from the contractor. - In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources. - The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to inform to local Authority: commune, village about garbage disposal along the road and installing many signboards: prohibit garbage disposing, and should do urgently for violator.	
A-4 Air Pollution	- Air pollution is created from dust and other soil, sand fallen down during transportation and also it is emission gas from vehicles along the road; it affects to the travelers and people living around the project area. - Air polluted due to bad smell from oil/fuel leakages of vehicles or oil/fuel smell from the vehicles that remained fire, including bad smell of cargos transportation ect., ***Note:*** *but air pollution was lower when this project is not existed.*		✓		- Soil/sand and cargos transportation that its have bad smell, is needed well to cover or put in the packet, do not allow smell to spread out.	
A-5 Soil Pollution	- Some soil polluted by serious accident of traffic from oil/fuel spilling on the ground, in the project area. - There is soil pollution by illegal disposed garbage along the road.		✓		- There is a serious fuel leakage (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources. - The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to inform to local Authority: commune, village about garbage disposal along the road and installing many signboards: prohibit garbage disposing.	
A-6 Noise and Vibration	- There is widely road and traffic is increasing, it is creating some noises and vibrations. Other hand, road widely extending, it causes the right of way is remaining small, noise and vibration are creating higher at surrounding of residential houses if comparison to without construction this road.		✓		- The MoPWT through the PDoPWT, especially to do cooperation with local Authority: commune, village to inform to people along this road about people's living condition on the righ of way and they should do for house construction far away from the right of way to avoid disturbance by this noise and vibration.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
B. Ecological Resources						
B-1 Aquatic Life/Fisher	- It might affects on Aquatic life and fishes by illegal garbage disposed along the road that it causes water pollution of creek, natural small stream, Prek, Steung and affects to fishes and Aquatic life of road. - At the by-pass of Pursat Town, there will be new building creating, it causes lack of garbage collection and liquid waste and may be water pollution, affected to aquatic life and fish along the road.		✓		- The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to install many signboards: prohibit garbage disposing and should do cooperation with local Authority: commune, village hard management to violated people. - Should do cooperation with MDoLUMPC through PDoLUMPC to do master plan for development zone along the road in advance including waste water drainage system for in/out entry ect., Moreover, at the by-Pass should install big signboard about zone development plan after this project is completed.	
B-2 Protected Area/ Protected Forestry	- By-Pass of Pursat Town construction is affect on Tonle Sap Biosphere Reserve zone because, the road is crossing 8.8Km length, there will be affected some on Ecological zones by the project construction. - By-pass construction at down Pursat Town, it takes role for Dam protection, it causes to have inundated on rice field, residential house ect,. And for the future water inundated will become to waste water and polluted environment in Town along the by-pass road as well.		✓		- Should do cooperation with MDoLUMPC through PDoLUMPC to do master plan for development zone along this by-pass be careful in advance including waste water drainage system for in/out entry ect., Moreover, at the by-Pass should install big signboard about zone development plan after this project is completed.	
B-3 Forest Resources and Wildlife Habitat	- It is not affected but the project owner should do cooperation with relevant Ministries and local Authorities, especially with Khan Forest Administration to re-plant the trees along the road in order to transfer this area to be green environment, erosion and vehicle protected to fall down or crash to household people's.					
B-4 Biological Wildlife	– There is some affects to wildlife such as snake (Chequered Keelback, Striped Kukri Snake, *Sunbeam Snake,* Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spadefoot frog, Frog) that they are passing road and died by vehicle run over them.		✓		– In this phase, the project owner should do cooperation with MoE and local Authority especially PDoE and Khan Forest Administration to introduce and regularly educate people living along the road on prohibition hunting of species where is conservation them in the project area. ***Note:*** *they are species not Rare species and Vulnerable species*	
C. Social Environment						
C-1 Poverty	There are vulnerable families (poor, Old people, unable people, widow and landless family) of 312 families, that affected by the project and they are living and they have business on this reserved land or they will move to the resettlement site that created by the project. In case the project is not considered about them they will get poor and poor.		✓		- Should do monitoring on their life condition due to identify that 312 families have a better life without this project. In case for any family got un-normal living, the project owner should help them to re-improve their life on time.	
C-2 Land used and Resource used in/around Project Site	- At the by-Pass of Pursat Town, there will be changed of type land use such as agriculture land can change to residential house along the road or become to the Town ect.,				- Should do cooperation with MDoLUMPC through PDoLUMPC to do master plan for development zone of this by-Pass in advance including waste water drainage system, especially water treatment plant to treat it first before let out to Steung ect. and should install big signboard about zone development as well.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-3 Water use	- Can be affected to water agriculture use along the canal and road because concrete ring installed may be small or blocked by the rubbish and algae (dry up).		✓		- Should do follow up regularly along the existing canal in wet season and to make sure to maintain and repair well for long life, do not in there block of water by water agriculture used. - The MoPWT through PDoPWT will responsible for repair and maintain for all culverts along the road, do not allow rubbish or algae or soil filling on front of culverts, to do announcement to the local Authorities: commune, village about prohibit soil filling to block water on front of culvert and drainages along the road. Moreover, the project owner should do cooperation with MoE through PDoE to install environment signboards, prohibit to dispose garbage along the road.	
C-4 Existing Social Infrastructures and Services in/around the project site	- To enlarge and by-pass roads construction which it has median road divided cause to make different to cross the road especially mid-Town and Town. - Can be divided or made different completely view of community base at the by-Pass of Pursat Town.		✓		- Should do discussion with the community base in order to solve fair of facility such as sky bridge construction for traveler ect,.	
C-5 Social Institutional and Executive Institutional in the project site	- Can be divided or made different completely view of community base at the by-Pass of Pursat Town.		✓		- Should do discussion with the community base in order to solve fair of facility.	
C-6 Improperly Advantage Allocating and Damaging	- Can be some small business on existing road in Pursat Town, it will be loose income and there can be others new business creating along the by-Pass.		✓		- The formed existing road that it is crossed Pursat town is not closed, it uses as provincial road and allow using as normal, and this road can be managed and decided by the project owner.	
C-7 Aestheticism	- At the by-Pass of Pursat Town, there will be changed of Aestheticism such as land use around by-Pass due to rice field is became to small Town or Town ect., there can be affected on environment pollution by solid and liquid wastes outlet in this area.		✓		- Should do cooperation with MDoLUMPC to do master plan for development zone of this bypass in the future, should do design plan in advance of public infrastructures such as: road in/out to the site, wastewater drainage system, inlet wastewater drainage system especially to keep for reserve place for water treatment plant to treat this wastewater before outlet to River ect., and should install big architectural design signboard for project development as well in order to the people to keep the place as design plan that shown on the big architectural design signboard because at the present, within this area is no strongly development activity yet. - Should do cooperation with relevant Ministries and local Authority especially Khan Forest Administration to re-plant trees along the road, in order to become this area to be green forever.	
C-8 Gender	- Can be affected some women business, because on the existing road there mostly women are lose their income by the by-Pass of Pursat Town, and then there also will be created new business on the by-Pass.		✓		- The formed existing road that it is crossed Pursat town is not closed, it uses as provincial road and allow using as normal, and this road can be managed and decided by the project owner.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-9 Children's Rights	- Can be affected for children accident when they pass the road, due to of wide road and good it causes for vehicles use high speed and there is busy road as well.		✓		- Should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect.. including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down. - Should do cooperation with Ministry of Education Youth and Sport to insert traffic program for the students, in order to reduce for traffic accident along the road, because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle as well.	
C-10 Working Conditions (including Occupational Safety and Public Health	- Can be occurred accident along the road because there is wide road and good it causes for vehicles use high speed and there is busy road as well.		✓		- Should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect.. including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down. - Should do cooperation with local Authority of commune to delivery and educate people about traffic law and traffic light of vehicle because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle and especially animal husbandry (cow, buffalo, dog, goat ect..) do not allow to walk everywhere along the National road.	
C-11 Accidents	- It will be traffic accident because of traffic increasing, high speed use and good and wide road. Moreover, because of center divider newly installed, cars running counter to traffic way may increase and cause accidents.		✓		- Should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect.. including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down. - Should do cooperation with local Authority of commune to delivery and educate people about traffic law and traffic light of vehicle because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle and especially animal husbandry (cow, buffalo, dog, goat ect..) do not allow to walk everywhere along the National road.	
C-12 Trans-Boundary Impacts or Climate Change	- Due to vehicle are increased, its caused for high emission gas as well.		✓		- The Royal of Government should consider for second hand vehicle import which these vehicles are used and very old in their country and then these engines are not well fired including high emission gas also.	
3. Project Closure Phase						
In project closure phase, it is after MoPWT planned for NR5 improvement project. Therefore, within this phase, it is not any affects to Social environment.						

7.4 POSITIVE ENVIRONMENTAL IMPACT

7.4.1 Physical and Ecological Resources

- ✓ **Air Pollution**

If they do comparison of air pollution before the project improvement, they will see that the air pollution by dust is much more than after the project improvement (the result air quality test before the project improvement see in Chapter-5, point: 5.1.13) because after the project improvement, the road is width 20.5m, paved road is Asphalt Concrete (AC), strong and less of maintenance (before the project improvement width road is 9m to 10m, paved road is DBST, it is easy to damage by weight and busy of traffic).

- ✓ **Forest Resource**

Although, the NR5 improvement project a part from Thlea Ma' am to Battambang is affected on some river side vegetation and trees along the road, the project is planned budget for trees planting along the road in order to change this location to green environment and good view for additional on part of this road, expected to plant these trees will be better than before the project improvement.

7.4.2 Socio-Economic Resources

- ✓ **Road and Transportation**

If we have the road, we will have hope for developing local community and in country because road is the blood vessel to bring economic based. People can transport their agricultural production or crops to markets easily and fast to avoid spoiling. On the other hand, villagers or local people can go to hospital on time whenever they get urgent at night or day time such as: delivering baby and other accidences in family etc. the common say is: to have a good road, it will help to reduce for expenses of travelling and transportation of the people, it is an effectiveness for poverty reduction.

- ✓ **National Economic Development**

The NR improvement project, it will give services such as: agriculture, tourism, especially handicraft and industry which are the important base to develop national economy. Moreover, this project might help villagers, people in the project area to save their money from less spending of travelling, access to target on time and there will be increased of National and International Tourists that it will help for getting high income to National and social aspect also.

On the other hand, the NR5 is an Asian Highway A-1 of this road project; it is a honor of the Royal Government as well as whole Cambodia in Asian Community because, in year 2015 Cambodia will integrate into Asian Economic.

Moreover, this project will do communication commercial Cambodia with Thailand and other countries such as Vietnam, Malaysia, Singapore and Lao in the near future.

Through this project, it will be high trust and solidarity from Japan that can be shown and confidential to Japan's investors to invest in Cambodia.

- ✓ **Land Use/Land Cost and Tourism**

Because of Influence of project development, there can be changed along this road, especially in the area of by-Pass of Pursat Town will change to commercial zone, Industrial zone, Town zone which at the present (2013) at some places is not well developed. Due to paved road and extended, it can attract to International Tourists come from Thailand to visit tourism places in Cambodia in the future, it will help people along the road to get more income from tourism services as well.

- ✓ **Employment and Increase Living Standard**

The project will provide jobs to Cambodia people especially the people in the project site during the project construction phase trough staff-workers recruitment.

Moreover, at along the by-Pass of Pursat Town, there can be more created small business shops that it will help many women to get income, because based on field investigation the sellers are women.

Cambodia will have more human resource on road improvement trough this project. Moreover, road maintenance is Cambodia experts from MoPWT.

CHAPTER-8
ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER-8

ENVIRONMENTAL MANAGEMENT PLAN

8.1 INTRODUCTION

The chapter is described the environmental management plan (EMP) which implement throughout each of the project phases especially, construction phase, operation and maintenance phase, and closure phase.

The implementation EMP is a task of project owner under control of integrated team that participated from relevant offices, department, and Ministries which will be organized by the project owner with MoE. This team will monitor the environmental protection measures under monitoring and following up regularly by the Ministry of Environment (MoE) and direct cooperation from the project owner.

8.2 OBIJECTIE AND PURPOSED OF ENVIRONMENT MANAGEMENT PLAN

The environmental management plan (EMP) is established and implemented for the NR5 improvement project part from Thlea Ma' am to Battambang and by-Pass of Pursat Town, including monitoring and follow-up of implementation plan from relevant Ministries and other institutions for important purposed of this EMP. It is purposed of monitoring and follow-up of implementation to mitigate environment impact which is described in Chapter-7.

The EMP is an important document among the all those documents included bidding document for this road improvement project. It is required to update, correction and regularly additional fill-up according to each phase of the project activity.

8.3 MONITORING TEAM ON ENVIRONMENTAL PROTECTION MEASURES

The monitoring team consists of members from various relevant institutions as follows:

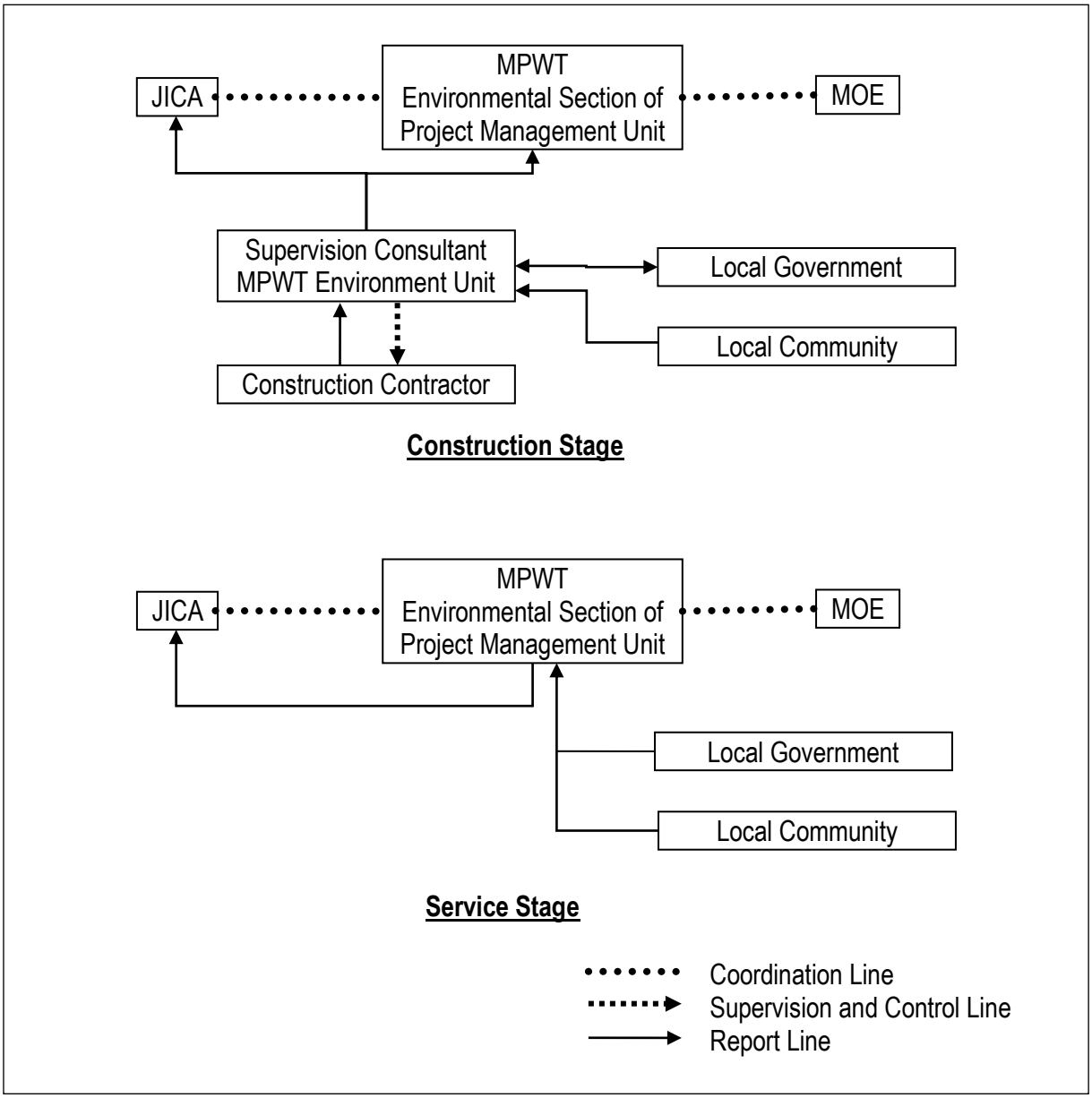
1. Ministry of Environment including Representative of EIA Department, Representative of Department of Control pollution and related Departments;
2. Representative of Ministry Public Work & Transport;
3. Representative of Ministry of Economy and Finance;
4. Representative of Forestry Administration, Pursat and Battambang Provinces;
5. Representative of Department of Environment, Pursat and Battambang Provinces;
6. Representative of Department Public Work & Transport, Pursat and Battambang Provinces;
7. Representative of PDoWRAM, Pursat and Battambang Provinces;
8. Representative of Provincial Department of Agriculture, Forestry and Fisheries, Pursat and Battambang Provinces;
9. Representative Department of Land Management, Urban Planning and Construction, Pursat and Battambang Provinces;
10. Representative of Department of Health, Pursat and Battambang Provinces;
11. Representative of Provincial of Tourism, Pursat and Battambang Provinces;
12. Local Authorities, Pursat and Battambang Provinces;

All members as mentioned above are directly and indirectly take responsibility in order to orientate and improve of any insufficient of the project owner for implementing procedure protection of environment project.

Note: All representatives will have roles and responsibilities are under designation of MoE and the project owner (MoPWT).

Moreover, the project manager has to manage for every relevant people according to each phase of the project, due to have person to responsible clearly of section and all these people should do cooperation closely with the working team to monitor and follow-up of this project.

ORGANIZATION CHART OF PROJECT MANAGEMENT and E.M.P IMPLEMENTATION



Note: *MPWT – Ministry of Public Works and Transport, JICA – Japan International Cooperation Agency, MOE– Ministry of Environment*

8.4 SIGNIFICANT MEASURES FOR ENVIRONMENTAL PROTECTION

In accordance with, sub-decree on environmental impact assessment (EIA), and the result of Environmental and social impact assessment which all activities has occurred in project, it described in chapter-7, the project owner will prepare some important mitigation measure to protect and reduce all negative environmental impact and to ensure good management on environment resources, according to technical and environmental standards for sustainable development. The company has to:

- Organize unit or team is directly responsible for the project implementation plan such as assigning for the project manager;
- Recruit technical Experts and contractors, assigning Engineer to follow-up the contractors;
- Discuss with Engineering project Unit for detail plan management based on mitigation of negative impact measures;
- Prepare for emergency response plan;
- Clarify schedule for environment protection tasks;
- Provide equipments/tools and other facilities for health protecting and work safety and use new modern machines according to technical plan;

- Protect and prevent disease infection or transmitting due to have emergency save and ambulance;
- Manage solid and liquid wastes, and keeping hazardous waste in safety place;
- Promote for trees plantation in public land and at shoulder road;
- Cooperate with related institutes for technical site inspection, and review or correction as required from expert;
- To install enough traffic signboards and traffic lights at the village people area, in Town and in the City;
- To delivery and introduce about traffic law, traffic signboard, traffic light and vehicle light to the people living along this National road;
- Health and Sanitation protection awareness and work safety to be done;
- Prepare budget for implementing the environmental management plan (EMP) including resettlement plan.

Note: *The project owner should prepare a packet of budget US$172,550 (One hundred seventy two thousand and five hundred and fifty US Dollars)*

Table below is summary of Mitigation Measurement on Negative Impact

Table-8.1: Significant Measurement for Mitigation on Negative Impact Environment for NR5 Improvement Project, Part from Thlea Ma' am to Battambang

No.	Project Activities	Environmental Impact	Proposed Mitigation Measures	Institutional Responsibilities		Remarks
				Implementer	Supervisor	
A.. Project Design Phase (Before Construction Phase)						
1	The procurement project study and prepare other documents such as Resettlement plan and ESIA report ect.,	- There is not negative impact		JICA working Team and Local Consultants	JICA, MPWT, PMU, MoE, MEF and relevant Institutions	
2	Looking for land to extend for this road (COI: 20m bothsites) and other land for by-Pass.	- There is 1,860 families and 307 of HHs living in the COI area; included corps and fruit of 4,817 trees and there are 5,210 trees that grown on shoulder road and affected; - In the COI area are infrastructures suchas: Electricity Towers, Telphone cable, water pipes, Optic cable underground ect.,.	- To inform to people affacted by the project about date of COI area clearance; - The resolution is needed to follow as resettlement plan project	MEF, MPWT, MoE, relevant Ministries and local Authorities	JICA, and NGOs	
B.. Project Construction Phase						
1	Camp building for staff-workers to stay.	- Garbage and other wastes - Defecation, Sanitation and Hygiene - Fire un-intention	- There is rubbish busket and dump site (as decribed in wastes management below); - To build bathroom and latrines according to propotion of number users included septic tank 2-3 blocks; - To floow accident management plan below.	Contractor	Supervisoion Consultant, PMU and Technical Experts	
2	To build fuel staion, warehouse and worshop.	- Garbage and other wastes - Oil/fuel spilling causes to environment pollution; - Fire un-intention; - Traffic jam causes to accident at in/out entry gate.	- To floow wastes management plan below; - Should construct platform for all places and required for fuel tank; - To floow accident management plan below; - Install signboard say: Attention	Contractor	Supervisoion Consultant, PMU and Technical Experts	

No.	Project Activities	Environmental Impact	Proposed Mitigation Measures	Institutional Responsibilities		Remarks
				Implementer	Supervisor	
			at in/out entry gate.			
3	Looking for land to keep soil, stone mixer and other machineries of concrete, concrete column for bridge, conrete ring ect.,	- Traffic jam can occur accident by something lived on the existing road; - It impacts on people land use.	- Do not keep these things on existing road that it is small road; - To rent for free land people's with suitable price; - Install signboard say: Attention at in/out entry gate.	Contractor	Supervisoion Consultant, PMU and Technical Experts	
4	Staff-workers training	- There in no affected.	-	Contractor	Supervisoion Consultant, PMU and Technical Experts	
5	Earth works such as bad soil clearance, soil excavation, soil dgging, soil tranportation, land clearance.	- There is soil pile along the road collasped to the people land use; - Soil collasped at the borrow pit and quarry site; - Dusty; - Air pollution by emission gas from engines; - Muddy; - Traffic jam and can be accident; - Affected on trees grown in between slope shoulder road; - Affectd on Riverside vegetation.	- Bad soil has to take out and put it at illegal site; - To excavate slope of borrow pit and quarry site; - To spray water regularly on paved road and road cleaning. To cover on materials construction during transportation; - Well and regular of road maintained, to avoid muddy; - To use new vehicles and regularly maintained; - Install signboard say: Attention at the project site and person opertion of traffic.	Contractor	Supervisoion Consultant, PMU and Technical Experts	
6	Earth fill up, base road and sloping road for bothsides	- There is soil pile along the road collasped to the people land use; - Soil erosion along slope road and soil filled up; - Dusty and spread out of small part of stone; - Soil filled up on drainage system along the road; - Road cut-off by by-Pass of Pursat Town construction; - Traffic jam and can be accident.	- To plane and bring out of pile soil that fallen to the shoulder road; - To plant grass on slope road bothsides; - To spray water regularly on paved road and road cleaning. To cover on materials construction during transportation; - Install new concrete rings where there are canal and creeks; - To use new vehicles and regularly maintained; - To plane and compact for soil that spilledon the ground; - Install signboard say: Attention at the project site and person opertion of traffic.	Contractor	Supervisoion Consultant, PMU and Technical Experts	
7	Base pit digging work or bridge column construction or new culvert construction and foundation works.	- There is soil pile along the road collasped to the people land use; - Soil collasped of borrow pit that can be accident to people; - Air pollution by emission gas from engines; - Blocked of water way and fish; - Desturbance by noise and vibration; - Waste concrete and other	- To take that soil from the borrow pit or transport it to keep where is safe place; - To istall temporary something to protect wall soil falling down; - To floow accident management plan below; - To use new vehicles and regularly maintained; - To transmit of water direction by by-Pass and install concrete rings as suitable of water dimension at that site. Do not	Contractor	Supervisoion Consultant, PMU and Technical Experts	

No.	Project Activities	Environmental Impact	Proposed Mitigation Measures	Institutional Responsibilities		Remarks
				Implementer	Supervisor	
		wastes.	close the Steung to construct column of bridge, there should use G.I pipe surrounding of column for construction; - To work in dry season and determined for daytime works; - To floow wastes management plan below.			
8	Concrete mould installation at the project site	- Desturbance by noise and vibration; - Accident; - Garbage and other wastes.	- To work in dry season and determined for daytime works; - To floow accident management plan below; - To floow wastes management plan below.	Contractor	Supervisoion Consultant, PMU and Technical Experts	
9	Concrete work	- Environment poluution by spilling cement, stone washing, liquid cement spilling on the ground or in to the water; - Accident; - Garbage and other wastes.	- To work in dry season and determined for daytime works and make carefull for something spilling; - To floow accident management plan below; - To floow wastes management plan below.	Contractor	Supervisoion Consultant, PMU and Technical Experts	
10	Bituminous paved work	- Traffic jam and can be accident; - Air pollution by bad smell from bituminous; - Accident.	- Install signboard say: Attention at the project site and person opertion of traffic; - To work in dry season and during concrete transportation should be covered; - To floow accident management plan below.	Contractor	Supervisoion Consultant, PMU and Technical Experts	
11	Sowing small trees and plant the trees for good aestheticism along the road	- Traffic jam and can be accident.	- Install signboard say: Attention at the project site and person opertion of traffic.	Provincial Authority and Khan Forest Administration	MPWT, PMO/PMU and MAFF	
C.. Project Operation and Maintenance Phase						
1	Garbage disposed along the road and illegal dump site	- Environment pollution along the road at station bus, taxi and illegal dump site; - Affectd to aestheticism along this Asian way; - These garbages will block to waterway which crosses of road.	- To do cooperation with village and commune Authorities to manage for garbage collection to dump site and should install signboard say: prohibit garbage disposed along the road; - To detain and penalize to violator; - Follow up and regular garbage cleaning on front of culvert and drainage along the road.	PDPWT, PdoE and village and commune Authorities	MPWT and MoE	
2	To plant the trees for good aestheticism along the road and good maintained.	- Traffic jam and can be accident.	- Install signboard say: Attention at the project site and person opertion of traffic.	PDPWT, Khan Forest Administration and provincial Authority	MPWT, MoE and MAFF	
3	Traffic signboard and traffic light installation	- Can be occured traffic accident.	- Install signboard say: Attention at the project site.	PDPWT	MPWT and MoE	
4	To propare a master plan for by-Pass road of Pursat Town development and install big signboard for this project plan.	- Can be occured traffic accident.	- Install signboard say: Attention at the project site.	PDLUMPC, PDPWT, PdoE and Provincial Authority	MPWT, MLUMPC and MoE	
5	Operation and Maintenance	- Traffic jam and can be accident.	- Install signboard say: Attention at the project site and person opertion of traffic.	PDPWT	MPWT and MoE	

8.5 URGENT RESPONSE TO THE PROBLEM WHICH OCCURRED

The NR5 improvement project part from Theal Ma' am to Battambnag will occur some accidents and risks as described below:

A. Accident

The accident can be occurred by the project, it will affect to health of staff-workers as well as the people living near/close the project site (can be died), it caused from:

- Fire can be occurred by careless or electricity short circuit, welding metal from power using, fire fuel station, warehouse ect.,;
- Accident occurs from careless or cut-off of cable of crane or moulds bridge;
- Accident occurs from careless of works such as sliding, fall down from high construct places, soil collapsed, crushing or hard thing fallen down, hitting of pieces from high pressure ect.,.
- Accident occurs from oil/fuel spilling over 1,000L;

To mitigate or manage for this accident in case there will be happened, the construction Contractor should prepare plan as below:

- Measurement of fire accident in the Camps or in each buildings, there should prepare extinguisher fire, fire water head, sand piles including axe in the in/out gate of office and warehouse. Moreover, the construction Contractor should do cooperation with the provincial fire entity in order to get guideline about safety of fire;
- Measurement of work accident for every staff-workers, should do training about safety first and to provide clothes, helmet, protected glasses, gloves, boots, metal mask, dusty musk ect.,. Moreover, there should organize emergency room treatment including ambulance to transport sick-people to the province or Phnom Penh City, for budget to expend for accident works is responsible by the contractors or the Project Management Unit (PMU);
- Measurement for oils/fuel spilling over 1,000L, all relevant the provincial Departments should do cooperation with the traffic Police unit, extinguishing fire Police unit and provincial Health Center to transport victim to the Hospital. In case, there is fuel fired should use extinguishing fire vehicle and cleaning where oil/fuel spilling and bring all oil/fuel polluted on soil to dispose into the safe pit far from the water sources.

B. Risks

Risk can be occurred to the project, it is rain, storm, flood, earthquake, war, terror, rebellion, insurrection which there cannot manage and it causes to damage this road as well.

To manage and preventing this risk, the detail design and Supervisor Consultant should prepare a plan as below:

- Project design plan should include calculation of earthquake pressure for bridge base ect.,;
- While there is flooded and inundated on road or water is raised up exceeded of maximum level that it causes to damage road, the PMU should inform immediately to relevant local Authorities trough announcement about this event and then do not allow heavy vehicle (weight over 10 tones) to drive on this road, because it might be serious damage and it will spend more of National budget for rehabilitation;
- For the earthquake in Cambodia is never happened since the past of century;
- For terror, rebellion and insurrection, the PMU should do cooperation with all level local Authorities and relevant Ministries included all army to solve and look for mean to urgent preventing.

8.6 MONITORING PROGRAM FOR IMPLEMENTATION OF ENVIRONMENTAL PROTECTION MEASURES

Monitoring program for implementation of environmental protection measures (mitigation measures for environmental impacts has been clarified in chapter-7 or determination of the scopes of negative impacts and its mitigation measures) is also to define tasks and activities to be monitored in the project. In addition, this program is to follow up and monitor the activities implemented by the project owner throughout each of project phase. This program is described in the table below:

Table 8-2: Environmental Monitoring Program

No.	Environment resources	Inspection and Monitoring Activities	Evaluator	Periodic
A..Physical Resources				
1	Geomorphology and topography	- Check at borrow pit and quarry site whether, is there properly doing slope to protect soil erosion or not? - Check for outside the COI area whethter any agriculture land people's afected or not?	Supervision Consultant, PMU and MoE	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure.
2	Hydrology system	- Check on vary water flow of Steung, prek, creek that passed on thid road; - Check for duration project construction whethter there is some blocks of waterway or not? - Check for duration project operation whethter there is some blocks of water flow by rubbish or trees on front of culvert or not?	Supervision Consultant, PMU, MoE and MoWRAM	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure; - Once for 6 monyhs in project Operation stage.
3	Erosion and Soil Quality	- Check at borrow pit and quarry site whether, is there properly doing slope to protect soil erosion or not? - Check for outside the COI area whethter any agriculture land people's afected or not? - Check for soil quality at materials stock, fuel station and workshop whethter is there clean and properly management or not? - Check for grass planting along the shoulder road, is there can be well soil protected? - Check for vehicles parking palce, workshop, fuel station and chemical element, is there any element spilled on the ground? - Check for garbage and other wastes at the staying place, warehouse, vehicle parking place, construction site, is there properly management or not?	Supervision Consultant, PMU, MoE and MAFF	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure.
4	Surface water and groundwater quality	- Check on borrow pit and quarry site, is there soil erosion and can be affected on water quality or not? - Check on water quality nearbt water source of satying place, vehicle parking, workshop, fuel storage, warehouse, bridge and culvert construction site; - Check for garbage and other wastes at the staying place, warehouse, vehicle parking place, construction site, is there properly management or not? - Check in duration operation stage whether waste water outlet system at by-Pass road is there water pollution or not? - Water quality test done for 6 locations and tested for 5 parameters as dicribed in Chapter-5, point 2 is about surface water quality test.	Supervision Consultant, PMU, MoE and MoWRAM	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure; - Once for 6 monyhs in project Operation stage. ***Note:*** *Water quality test should be done twice per year during the construction stage which year is busy and hard works, once in dry season and once again in wet season.*
5	Air Pollution	- Check for air quality in the construction site during construction work such as dust at borrow pit, quarry site and sand site. On the road, whether water sraying in regularly to protect dust or not? - Check for garbage and other wastes at the staying place,	Supervision Consultant, PMU and MoE	- Once of Starting project implementation; - Every 3 months in project construction stage;

No.	Environment resources	Inspection and Monitoring Activities	Evaluator	Periodic
		warehouse, vehicle parking place, construction site, is there properly management or not? Is there bad smell spreading out? - Air quality test done for 6 locations and tested for 4 parameters as dicribed in Chapter-5, point 1 is about air quality test in the projetc area and then to do comparision of result whether how much exceeed rate or not? ***Note:*** *Water quality test should be done twice per year during the construction stage which year is busy and hard works, once in dry season and once again in wet season.*		- Once in project closure; - Once for 6 monyhs in project Operation stage.
6	Noise and Vibration	- Check for working day time of the project, depend on situation people's living there, do not working at night; - Check for noise, vibration and air quality that emission gas spreaded out from the vehicle and machines; - Noise and vibration test done for 3 locations as dicribed in Chapter-5, point 2 is about noise and vibration quality test in the projetc area and then to do comparision of result whether how much exceeed rate or not? - Note: noise and vibration test in the project construction stage is done twice in the year that it most busy and hard activity, it will do test in dry and wet seasons.	Supervision Consultant, PMU and MoE	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure; - Once for 6 monyhs in project Operation stage.
B..Biological Resources				
1	Aqualtic and fish	- Survet and follow up at Steung, Prek that road passed whethter there is fish died or not? - Check during project construction whethter there is water blocked that it causes for fish cannot pass to upstream; - Check for duration project operation whethter there is some blocks of water flow by rubbish or trees on front of culvert or not? That it causes for fish cannot pass to upstream.	Supervision Consultant, PMU, MoE and MAFF	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
2	Tenle Sap Biosphere Reserved zone	- By-Pass construction passed of Tonle Sap Biosphere Reserved zone can make some changes of land use such as agriculture land becomes to Town that it causes there is polluted due to lack of soild and liquid wastes management. Therefore, should check be carefull and follow up on master plan of development area and to check whether there is installed big signboard of this project plan or not.	Supervision Consultant, PMU, MoE, MAFF, MLUMPC and Provincial Authority	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
3	Forestry and wildlife shelter	- Check for trees plantation along the road whether there is planted or not? While this road is completed construction; - Check for trees planted whether these trees are well grown.	Supervision Consultant, PMU, MoE and MAFF	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
4	Biological wildlife	- Check for that, is there education and delivery message about wildlife protection including threatened species (fish) to the village-commune and the people or not?	MoE and MAFF	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
C..Economic and Social Resources				
1	Lang Use/Resettlement	- Check for compensation on impact by the project, is there fair solution for them based on resettlement plan or not? - Check for grievance complaint from the people, is there remaining or not?	Supervision Consultant, PMU, MoE, MLUMPC, Provincial Authority and NGOs	- Once of Starting project implementation; - Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
2	Living and job of community	- Check for staff recruitment of Contractor (provide priority for the villager living around the project area and the affected people who are male and fimale); - Check for wage rate of Contractor, is there suitable wage based on market price and is there provide regularly salary for the staff or not?	Supervision Consultant, PMU, MoE, MEF and village and commune Authorities	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.

No.	Environment resources	Inspection and Monitoring Activities	Evaluator	Periodic
3	Culture and religion	- Check for gateway of Royal palace of Preah Bat Monivong, is there problem solved or not? - Chech for fence and gateway of Pagoda, is there re-constructed that it far from the reserved land? - Check and follow up for violation of the Contractor on Culture and Traditional of the vllagers.	Supervision Consultant, PMU, MEF, MLUMPC, Provincial Authority and NGOs	- Once of Starting project implementation; - Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
4	Water Supply	- Check for water canal use for agriculture that the road is passed, is there block caused to lose some discharge for irrigation or not? - Check for resolution for water supply pipe affected by the project on the COI area and these pipes removed from the reserved land or not?	Supervision Consultant, PMU, MEF, MLUMPC, MoWRAM and village and commune Authorities and NGOs	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
5	Road and Traffic	- Check for operation and maintenance of this road construction; - Check for traffic in the construction site and repairing site of this road; - Check for traffic signboard, traffic light, is there properly installation or not? - Check for weight vehicle, is there proeperly weight? Should clarify that do not any vehicle is over laoded that passed this weight station.	Supervision Consultant, PMU, MoE and Provincial Authority	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
6	Public Health	- Check for safety takecare during the project construction stage; - Check for health takecare of staff-workers projec's; - Check for other diseases infection protected in the project area; - Check for prevented of Opium and people trading along this road.	Supervision Consultant, PMU, MoE, MoH, MoI and Provincial Authority	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
7	Aestheticism	- Check for quality of construction whether doing as planned or not?; - Check for illegal disposed of garbage along the road and at the bus station, taxi station ect.,	Supervision Consultant, PMU, MoE and village and commune Authorities	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
8	Risks	- Check and follow up for flooded that it causes to inudate and damage on road; - Check and takecare for security and safety on fire and explosives.	Supervision Consultant, PMU, MoE and village, commune, provincial Authorities	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.

Table 8-3: Environmental Quality Monitoring Form

Project Construction Phase:

Item	Location	Parameter/ Means of Monitoring	Result (Average / Max / Total, etc.)	Standard (Legal / International Standard)	Frequency	Remarks
Air quality	Construction site	Visual inspection of mechanical condition and exhaust gas			Every day before working	
	Construction site	Visual observation of dust			Every day	
	Storage facilities for dust generating materials					
	Boundary of ROW nearest to	SPM10		0.05 mg/m^3 (WHO, average	2 times in dry season and 2	

Item	Location	Parameter/ Means of Monitoring	Result (Average / Max / Total, etc.)	Standard (Legal / International Standard)	Frequency	Remarks
	construction site			24h)	times in rainy season during construction period	
		SPM2.5		0.02 mg/m^3 (WHO, average 24h)		
		SO_2		0.30 mg/m^3 (MOE, average 24h)		
		NO_2		0.10 mg/m^3 (MOE, average 24h)		
Water Quality	Rivers including Pursat, Steung, agriculture canals, streams and other public water bodies where construction works are executed.	Visual observation			Every day	
		Analysis using potable pH and turbidity meter			Every week	
		pH		6.5-8.5 (MOE)	When any pollution is suspected	
		TSS		25-100 (mg/l) (MOE)		
		BOD		1-10 (mg/l) (MOE)		
		COD		1-8 (mg/l) (MOE)		
		Other items (as required)				
Noise	Boundary of land plot nearest to the construction site	Noise Level		60dB (06:00-18:00) 50dB (18:00-22:00) 45dB(22:00-06:00) (MOE, residential area)	- When noise/vibration level exceeding the Cambodian standards is suspected - When local residents complain	
Vibration		Vibration Level		65Hz (05:00-17:00) 60Hz (17:00-05:00) (Lab. MOE)		

Project Operation and Maintenance Phase

Item	Location		Parameter/ Means of Monitoring	Result (Average / Max / Total, etc.)	Standard	Frequency	Remarks
Air quality	Pursat bypass section	Road side	SPM10		0.05 mg/m^3 (WHO, average 24h)	1 time in dry season and 1 time in rainy season per year for 2 years	
		200m away from road side					
	Pou Mouy village, Moung Russei district	Road side					
		200m away from road side					
	Dambouk Khpos village, Sangkae district	Road side					
		200m away from road side					
	Pursat bypass section	Road side	SPM2.5		0.02 mg/m^3 (WHO, average 24h)		
		200m away from road side					
	Pou Mouy village, Moung Russei district	Road side					
		200m away from road side					

Item	Location		Parameter/ Means of Monitoring	Result (Average / Max / Total, etc.)	Standard	Frequency	Remarks
	Dambouk Khpos village, Sangkae district	Road side					
		200m away from road side					
	Pursat bypass section	Road side	SO_2		0.30 mg/m^3 (MOE, average 24h)		
		200m away from road side					
	Pou Mouy village, Moung Russei district	Road side					
		200m away from road side					
	Dambouk Khpos village, Sangkae district	Road side					
		200m away from road side					
	Pursat bypass section	Road side	NO_2		0.10 mg/m^3 (MOE, average 24h)		
		200m away from road side					
	Pou Mouy village, Moung Russei district	road side					
		200m away from road side					
	Dambouk Khpos village, Sangkae district	Road side					
		200m away from road side					
Noise	Pursat bypass section, ROW boundary		Noise Level		60dB (06:00-18:00) 50dB (18:00-22:00) 45dB(22:00-06:00) (MOE, residential area)		
	Pou Mouy village, Moung Russei district, ROW boundary						
	Dambouk Khpos village, Sangkae district, ROW boundary						
Vibration	Pursat bypass section, ROW boundary		Vibration Level		65Hz (05:00-17:00) 60Hz (17:00-05:00) (Lab. MOE)		
	Pou Mouy village, Moung Russei district, ROW boundary						
	Dambouk Khpos village, Sangkae district, ROW boundary						

WHO: World Health Organization, MOE: Ministry of Environment (Cambodia)

***Remarks; Past trend and current status including remedial measures if necessary*

8.7 TRAINING PROGRAM

Training program is an important factor in the EMP that needs to take into account and put in the master plan of the project for ensures successfully implementation. Moreover, in order to promote sustainable development and successful of the project is needed human resource with adequate capacity for improvement work and perfective both technical and environmental working skilled. Therefore, the project owner will organize or provide training courses to staffs-workers project's such as:

- Technical skills for operating the machines in the project construction and operation
- Providing knowledge to staffs/workers on safety work in construction project;

- Training on technical skill, law and procedures that related to the project activities to prevent for accidentally, in case of it will occur by the project activities on the Natural and social resources;
- Educate and campaign on methodology of preventing social disease, especially HIV/AID, BT ect.;
- Provide training course to staff-workers on solid and liquid wastes management and educate them on how to operation and maintenance of latrine and bathroom including Septic tank;
- Educate on important Environmental resources in the project area for social requirement such as: water, land, air, forestry, wildlife especially Natural resource in the project area
- Educate on method for environment protection in/around project area and knowledge on project study related with quantity and quality existing environment that it will affect by project activities;
- Educate to workers on raw materials management that it is chemical elements use for product chain of the project;
- The project owner will recruit the Consultant with high capacity from Japan to work for design plan and technical monitoring of this road including to help for staff-Khmer workers training in relevant institutions and in this project;
- Hope that through this project, the Japan Government will share experience each other between Japan technician and Cambodia due to invitation delegator to visit/study in this country as well.

8.8 COST ESTIMATION OF EMP

The cost estimation for EMP such as environmental monitoring cost and training coast is shown in Table below:

Table 8-4: Environmental Quality Monitoring Form (Draft)

No	Description	Unit	Quantity	Unit Rate	Total Cost Estimate in US$
I. Environmental Quality Monitoring					
1	Air quality (Construction Phase)	Sample	4	1,400	5,600
2	Air quality (Operation and Maintenance Phase)	Sample	12	1,400	16,800
3	Water Quality (Construction Phase)	Sample	4	700	2,800
4	Potable pH Meter	LS	1	100	100
5	Potable Turbidity Meter	LS	1	1,900	1,900
6	Noise and Vibration (Construction Phase)	Sample	4	800	3,200
7	Noise and Vibration (Operation and Maintenance Phase)	Sample	12	800	9,600
				Sub-Total	40,000
II. Mitigation Activity					
1	Sowing small trees and plant trees for good aestheticism along the road (Construction Phase)	LS	1	29,000	29,000
2	Garbage disposed along the road and illegal dump site	LS	1	35,800	35,800
3	To plant the trees for good aestheticism along the road and good maintained (Operation and Maintenance Phase)	LS	1	37,700	37,700
4	To prepare a master plan for by-Pass road of Pursat Town development and install big signboard for this project plan	LS	1	21,500	21,500
				Sub-Total	124,000
III. Training Fee					
1	Training course on environmental management and field practice	Course	1	1,500	1,500
2	Training course on site monitoring	Course	1	1,500	1,500

No	Description	Unit	Quantity	Unit Rate	Total Cost Estimate in US$
	and field practice				
3	Training course on general site management	Course	1	1,500	1,500
4	Transportation for the field practices	Time	3	400	1,200
5	Training materials and snacks for all the courses	Lump Sum	1	450	450
				Sub-Total	6,150
III. Training Allowance					
-	-	-	-	Daily Stipend Allowance (US$)	-
1	Engineers from the MPWT	Man-Day	4	100 x 4 Days	1,600
2	Engineers from the MOE	Man-Day	2	100 x 4 Days	800
				Sub-Total	2,400
				Grand Total	**172,550**

Note: Daily stipend allowance included food, accommodation and transportation. Venue fee is included for the training courses.

Source: JICA working group

CHAPTER-9
ECONOMIC ANALYSIS

CHAPTER-9
ECONOMIC ANALYSIS

9.1 PROJECT EVALUATION OF ROAD AND VEHICLE UNTILIZATION

Economic cost is a monetary expression of goods and services to be actually consumed for implementation of the Project. Also, economic cost is converted from financial cost by deducting tax portions and applying the standard conversion factor to the non-trade. Road user cost needs to estimate the travel costs in order to the Project. This project evaluation is taking to account for only two section of NR5 improvement from Thea Ma Am to Battambang and another from Sri Sophorn to Poipet. Travel costs consist of two components;

- Vehicle operating costs (VOC), is the physical costs of operating a vehicle such as consumption of fuel, lubricants, spare parts, deprecation, crew costs, and so on
- Travel time costs (TTC), is the value of time spent in travelling that could be used in the other activities.

(1) Vehicle Operating Cost (VOC)

The VOC, estimated in "the Preparatory Survey for National Road No. 5 (South Section) Improvement Project in the Kingdom of Cambodia" implemented by JICA in 2012-2013, was used as the basic reference for this survey. The VOC in this Survey was estimated considering consumer price index in 2013. Inputs for vehicle operating costs required for calculating the VOC are as follows.

(a) Shadow wage rate (SWR)

The shadow wage rate (SWR) is an estimate of the economic price of labor. The labor divided into two categories: skilled and unskilled corresponding on degrees of scarcity. The SWRs as shown below are applied.

Table 9-1: Shadow Wage Rate

	Skilled	Unskilled
Shadow Wage Rate	1.00	0.50

Source: Cost-Benefit Analysis for development a practical Guide 2013

(b) Vehicle Price

The vehicle price is estimated on the basis of average prices for new vehicles purchased from car dealer ships. Most of vehicles are imported to Cambodia as second hand reconditioned vehicles. However, as second hand price is uncertain and depends on the frequency of use, a new vehicle prices are used in this Survey. For the purpose of calculating the economic price of each vehicle taxes and import duties have been subtracted from the retail price. The resulting economic price includes elements of Cost Insurance and Freight (CIF) price, retailer's margin.

Table 9-2: Vehicle Prices and Characteristics

Type		Fuel Type*	Km per driven (Annual Km)	Service Life	Financial Price (US$)	Economic Price (US$)
Motor Cycle	Honda Dream 110	P	10,000	10	1,500	936
Sedan Car	Camry 2000	P	30,000	10	40,000	23,250
Pick-Up	Toyota Hilux	P	30,000	10	30,000	21,360
Mini Bus	Toyota Hiace Commuter	P	30,000	10	47,500	33,428
Big Bus	Hyundai Bus for 45Pax	D	70,000	10	83,000	58,420
Light Truck	Isuzu NPR 55 E	D	60,000	10	32,000	22,535
Medium Truck	Isuzu FSR 33	D	100,000	12	85,000	59,808
Heavy Truck	Isuzu CYR 80	D	100,000	12	108,000	75,988

Fuel Type: P: Petrol D: Diesel
Source: Car dealerships

(c) Tire Cost

The economic costs of tires are assessed in the same way as vehicle prices. Suppliers in Phnom Penh were surveyed to assess general prices of different types (motor cycle, passenger car, bus and truck) of tire. New tires are subject to import duty and VAT, whose rates vary depending on the type of tire. Custom import duty is principally charged at 15% of the CIF value of the tire. The rate of VAT and special tax are 25% and 15% for all types of tire. Special tax (zero) is applied for motor cycle tire. For the purpose of calculating the economic price of each vehicle tire, taxes and import are subtracted from the retail price. The resulting economic price includes elements of CIF price and retailer's margin.

Table 9-3: Tire Cost

Type	Tire Size	No. of Tire	Financial Price (US$)	Economic Price (US$)
Motor Cycle	100/17	2	44.0	35.9
Sedan Car	185/70-14	4	224.0	149.3
Small Bus	195/70-14	4	292.0	194.7
Large Bus	11.00-20	6	2,280.0	1,520.0
Light Truck	7.50-16	4	700.0	466.7
Medium Truck	8.25-16	6	1,770.0	1,180.0
Heavy Truck	11.00-20	10	3,800.0	2,533.3

Source: Retail shop

(d) Fuel and Lubrications

Fuel and lubricants prices are estimated based on a survey of market prices. There are a number of suppliers in Cambodia operating competitively. Fuels are subject to import duty, special tax and VAT. For the purpose of calculating the economic price of fuel and lubricants, these taxes and import duty are subtracted from the retail price. The resulting economic price includes elements of CIF price, customs import duty, value added tax and retailer's margin.

Table 9-4: Fuel and Tire Cost

Type	Financial Price (US$) / liter	Economic Price (US$) / liter
Gasoline Regular	1.28	1.04
Diesel	1.23	1.00
Lubricant (motorcycle)	3.60	2.93 (0.8ℓ)
Lubricant (4 wheels or more)	7.50	6.11

Source: Retail shop

(*e) Spare Parts Cost*

Spare parts costs are assumed to be 1% of the vehicle price.

(f) Maintenance Labor Cost

The maintenance costs estimated based on a survey of the average monthly cost of skilled supervisors and mechanics. Average working hours applied 200 hours per month.

Table 9-5: Maintenance Labor Cost

	Motor Cycle	Sedan Car	Pick-up	Mini Bus	Large Bus	Light Truck	Medium Truck	Heavy Truck
Wages per month (US$)								
Supervisor	600	600	600	600	600	600	600	600
Mechanic	300	300	300	300	300	300	300	300
Owner	0	0	0	0	0	0	0	0
Maintained by (%)								

Supervisor	10	25	25	25	50	25	50	50
Mechanic	40	50	50	50	50	50	50	50
Owner	50	25	25	25	0	25	0	0
Maintenance hours per year	40	70	70	250	300	250	300	350
Average hourly rate for services (US$)	36.0	105.0	105.0	375.0	675.0	375.0	675.0	787.5
Shadow wage rate factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Economic Price (US$)	36.0	105.0	105.0	375.0	675.0	375.0	675.0	787.5

(g) Crew Cost

Crew cost of a vehicle per km is calculated over certain time period (hours) and divided by the distance (km) traveled during this time period. The crew costs per unit of vehicle are estimated based on a survey of drivers and conductors or assistants. In Cambodia, unit costs for drivers are estimated at around US$150 to $300 per driver per month, depending on the type of vehicle, while unit cost for conductors or assistants are estimated to be one half of the average monthly cost of skilled supervisor and semi-skilled worker, respectively.

Table 9-6 Crew Cost

	Motor Cycle	Sedan Car	Pick-up	Mini Bus	Large Bus	Light Truck	Medium Truck	Heavy Truck
Number of drivers	0.01	0.1	0.1	1	1	1	1	1
Average monthly wage rate	150	200	200	250	300	250	300	300
Working Hour	200	200	200	200	200	200	200	200
Average hourly rate for driver	0.008	0.100	0.100	1.250	1.500	1.250	1.500	1.500
Skilled wage factor – Semi - skilled	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driver cost (Economic)	0.008	0.100	0.100	1.250	1.500	1.250	1.500	1.500
Number of conductors	0	0	0	0.5	1	1	1	1
Average monthly wage rate	0	0	0	125	150	125	150	150
Working Hour	200	200	200	200	200	200	200	200
Average hourly rate for conductor	0.000	0.000	0.000	0.313	0.750	0.625	0.750	0.750
Skilled wage factor – Unskilled	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Conductor cost (Economic)	0.000	0.000	0.000	0.156	0.375	0.313	0.375	0.375
Total Crew Cost	0.008	0.100	0.100	1.406	1.875	1.563	1.875	1.875

(h) Depreciation

Depreciation cost can be expressed as a percent of new vehicle cost and is given by the following formula:

Vehicle per 1,000 veh-km = DEP/ New vehicle prices

A vehicle is a medium-term asset. The purchase cost represents an investment which yields services over several years. The market value of the asset declines with both the passage of time and with amount and type of usage. It is this loss of market value that represents vehicle depreciation. The vehicle depreciation per km is a function of the average annual depreciation and annual utilization.

DEP = ADEP/AKM

Where: ADEP: Average annual depreciation, expressed as % of average new vehicle cost
ADEP: (1 / LIFE)*100
LIF is average vehicle service life
AKM: Average number of kilometers driven per vehicle per year

(i) Insurance Cost

Insurance cost was assumed to be 1% or 3% of vehicle price.

(j) Overhead Cost

Overhead cost was calculated at 10% of the sub-total of the VOC. Based on the above mentioned discussion and estimations the basic vehicle operating costs are calculated and are shown in Table 9-7.

Table 9-7: Vehicle Operating Cost by Vehicle Type

Unit US$

Type	Item	Motor Cycle	Sedan Car	Pick-up	Mini Bus	Large Bus	Light Truck	Medium Truck	Heavy Truck
Distance related VOC	Fuel cost	311.7	3,116.7	3,116.7	4,051.7	13,974.1	10,181.1	19,963.0	32,938.9
	Lubricant cost	5.9	73.3	91.7	122.2	1604.2	366.7	1833.3	1833.3
	Tire cost	17.9	112.0	112.0	146.0	2128.0	560.0	2360.0	5066.7
	Maintenance cost	9.4	232.5	213.6	334.3	584.2	225.3	598.1	759.9
	Depreciation cost	0.6	14.4	13.2	20.6	36.1	13.9	30.8	39.1
	Sub total	345.4	3,548.9	3,547.1	4,674.8	18,326.5	11,347.0	24,785.2	40,637.9
	Overhead cost	0.0	0.0	354.7	467.5	1,832.7	1,134.7	2,478.5	4,063.8
	Total	345.4	3,548.9	3,901.8	5,142.3	20,159.2	12,481.7	27,263.7	44,701.7
Time related VOC	Crew cost	4.5	75.0	75.0	2,250.0	3,375.0	2,500.0	3,750.0	4,500.0
	Maintenance cost	36.0	105.0	105.0	375.0	675.0	375.0	675.0	787.5
	Insurance cost	28.1	697.5	640.8	334.3	584.2	225.3	598.1	759.9
	Depreciation cost	0.3	7.7	7.1	11.1	19.4	7.5	16.6	21.1
	Sub total	68.9	885.2	827.9	2,970.4	4,653.6	3,107.8	5,039.7	6,068.4
	Overhead cost	0.0	0.0	82.8	297.0	465.4	310.8	504.0	606.8
	Total	68.9	885.2	910.7	3,267.4	5,119.0	3,418.6	5,543.6	6,675.3
Total		414.3	4,434.1	4,812.5	8,409.7	25,278.1	15,900.4	32,807.3	51,376.9
VOC /1000 km		41.4	147.8	160.4	280.3	361.1	265.0	328.1	513.8

(2) Travel Time Cost (TTC)

Travel time cost (TTC) is the cost of time spent on transport/travel. It includes various factors such as the following:

(i) Value of time spent on going to or coming back from to office (passenger car).

(ii) Cost of the crews of trucks/buses.

(iii) Income of trucks/buses obtained by transporting cargo/passenger car.

However, the results of the roadside interview survey, asked to truck drivers, showed that the truck drivers are not aware of the three items above. Thus, item (iii) is not considered for the trucks here. If the alternative activity can have monetary value assigned to it, this can be used as a part of road user cost in the economic appraisal of the projects, particularly road improvement projects.

In order to estimate the travel time costs, the average wage approach method is adopted. The time travel cost of a vehicle is calculated based wage level of a passenger/driver and occupancy ratio of each vehicle type. Time value of a passenger/driver is assessed for working time and non-working time as shown in Table 9-8.

Table 9-8 Estimation of Travel Time Cost

Vehicle Type	Travel Time Value (US$/hour)	Trip Purpose Composition	Weighted Average Value	Average No. of	Time Value by Vehicle

	Work	Non-Work	Work	Non-Work	(US$/hr/person)	Passengers	Type (US$/hr)
Motorcycle	1.27	0.42	31.0%	69.0%	0.38	1.80	0.68
Light Vehicle	9.93	3.28	57.0%	43.0%	2.02	3.50	7.07
Bus	7.09	2.34	69.0%	31.0%	0.31	18.00	5.61
Truck	1.31	0.43	95.0%	5.0%	0.63	2.00	1.27

TTC in 2018, 2023 and 2033 were calculated with 2014value value derived from estimation growth rate of per capita GDP. Future results are shown in table below:

Table 9-9 Forecast of Time Value per Vehicle

Unit: US$/ hour

Year	Motorcycle	Light Vehicle	Bus	Truck
2014	0.68	7.07	5.61	1.27
2018	0.99	10.23	8.12	1.84
2023	1.28	13.25	10.52	2.38
2033	1.63	16.84	13.37	3.02

The benefit is regarded as various desirable effects given to the national economy when the project is implemented, and the cost is regarded as all national economical expenditure required for the project implementation concerned.

(3) Construction Cost, Maintenance Cost and Land Acquisition Cost

The cost of construction, maintenance and land acquisition presented in Chapter 12 and Chapter 13 are used in the economic evaluation. Maintenance costs are classified into annual routine maintenance cost and periodic maintenance cost. Periodic maintenance costs are assumed to be expended each 10 years. Some basic presumptions adopted in the economic analysis are as follows:

- Escalation factor: Price escalation is not taken into account for construction cost, maintenance cost and land acquisition cost.
- Tax and import duty: Value added tax and import duty are excluded from cost.
- Land acquisition cost: Land acquisition cost is included.

9.2 Economic Evaluation

9.2.1 Methodology

Economic evaluation is conducted in terms of comparative analysis between benefits and costs. Benefits contain i) time saving benefit and ii) vehicle operating cost saving benefit, while costs consist of construction cost, land acquisition cost and operation/maintenance cost. Indicators adopted for economic evaluation are the conventional "economic internal rate of return (EIRR)", "benefit-cost ratio (B/C ratio)" and "net present value (NPV)". Evaluation was conducted on the basis of transport demand forecast.

In order to evaluate the road projects from an economic view point, the following economic indicator were considered:

- The net present value (NPV) of a given cost-flow is obtained by subtracting the present value of the costs from the present value of the future benefits. The benefits as well as the costs are discounted at the opportunity cost of capital. The investment is viable if the NPV is positive.
- The economic internal rate of return (EIRR) of a given project is defined as the discount rate at which the present value of benefits and the present value of costs are equal. It is a measure of the marginal efficiency of capital. For a project to be viable, the EIRR has to be greater than the opportunity cost of capital rate. Normally the NPV and EIRR will give the same indications of viability and priority ranking between projects.
- The benefit cost ratio (B/C ratio) refers to the ratio of the present value of the economic benefits stream to the present value of the economic cost stream. The investment is viable for the project if the B/C ratio is greater than 1.0.

(1) Implementation Plan of the Project and Evaluation Period

The evaluation period is assumed to be 30 years from 2020 to 2049 taking the service life of the Project into account.

Table 9-10 Project Implementation Schedule for Economic Analysis

	2015	2016	2017	2018	2019	2020	2021	2049
Detailed Design								
Tender Process								
Land Acquisition / Resettlement								
Construction								
Middle Section								
Pursat Bypass								
Sri Ssopone – Poipet Section								
Operation and Maintenance								

(2) Evaluation Period and Daily Factor

Evaluation period is set as 30 years after opening to traffic. The annualized factor of the daily benefits is assumed to be 340 days per year taking into consideration the weekly variation in the volume of traffic on the roads.

(3) Social Discount Rate

The social discount rate of 12% is assumed.

(4) Residual Value and Inflation

Residential value and inflation are not considered in this economic evaluation

(5) Standard Conversion Factor (SCF)

The standard conversion factor (SCF) is a standard method for adjusting domestic prices which are considered to be distorted in the domestic market price. SCF used 0.90 in this Survey.

$$\text{Standard Conversion Factor (SCF)} = \frac{\text{(Import +Export)}}{\text{(Import + Import Custom) +(Export – Export Custom)}}$$

Table 9-11: Calculation of SCF

Unit: US$ million

	2008	2009	2010	2011	2012
CIF	5,076.6	4,489.9	5,466.0	5,219.5	6015.7
FOB	3,492.3	2,995.7	3,884.3	6,709.5	7964.9
Import Custom	1,123.8	1,080.8	1,444.0	1,378.9*	1,589*
Export Custom	76.6	78.1	130.9	226*	268*
SCF	0.891	0.882	0.877	0.912	0.914
Average					0.90

Source: Key Indicators for Asia and the Pacific 2013, ADB

** Estimation of Study Team*

(6) Cost Benefit Analysis

The result of the economic analysis is shown in table 9-12. The economic analysis is based on the annual user's benefit and VOC shown in the above table. The result analysis shows EIRR of 17% which is usually considered to be sufficient.

Table 9-12 Cost Benefit Stream of the Project

Unit: US$

SQ	Year	Project Cost	Maintenance Cost	Total Cost	Benefit	Net Benefit	Discount Cash Flow (at 12%)		
							Cost	Benefit	Net Benefit
	2015	135,933		135,933		-135,933.1	135,933.1	0.0	-135,933.1
	2016	12,054,233		12,054,233		-12,054,232.8	10,762,707.8	0.0	-10,762,707.8
	2017	52,943,918		52,943,918		-52,943,917.6	42,206,567.0	0.0	-42,206,567.0
	2018	121,338,718		121,338,718		-121,338,718.4	86,366,503.1	0.0	-86,366,503.1
	2019	110,767,373		110,767,373		-110,767,373.3	70,394,668.3	0.0	-70,394,668.3
1	2020	60,572,619	435,825	61,008,444	7,748,444.8	-53,259,999.6	34,617,829.8	4,396,675.7	-30,221,154.1
2	2021	126,021	435,825	561,846	13,148,329.6	12,586,483.5	284,648.7	6,661,353.0	6,376,704.2
3	2022		435,825	435,825	15,021,131.0	14,585,306.0	197,145.1	6,794,796.8	6,597,651.7
4	2023		435,825	435,825	19,965,205.6	19,529,380.6	176,022.4	8,063,611.7	7,887,589.3
5	2024		435,825	435,825	23,570,385.6	23,134,560.6	157,162.9	8,499,717.3	8,342,554.5
6	2025		435,825	435,825	27,603,937.5	27,168,112.5	140,324.0	8,887,729.1	8,747,405.1
7	2026		435,825	435,825	32,109,789.9	31,673,964.9	125,289.3	9,230,797.3	9,105,508.0
8	2027		435,825	435,825	37,136,381.9	36,700,556.9	111,865.4	9,531,984.3	9,420,118.9
9	2028		435,825	435,825	54,296,530.9	53,860,705.9	99,879.8	12,443,363.5	12,343,483.6
10	2029		31,121,025	31,121,025	71,284,778.2	40,163,753.2	6,367,978.3	14,586,277.9	8,218,299.6
11	2030		435,825	435,825	90,348,278.6	89,912,453.6	79,623.6	16,506,292.7	16,426,669.1
12	2031		435,825	435,825	111,691,848.3	111,256,023.3	71,092.5	18,219,359.9	18,148,267.4
13	2032		435,825	435,825	135,538,689.6	135,102,864.6	63,475.4	19,740,443.1	19,676,967.7
14	2033		435,825	435,825	200,917,932.9	200,482,107.9	56,674.5	26,127,285.6	26,070,611.1
15	2034		435,825	435,825	213,192,076.4	212,756,251.4	50,602.2	24,753,044.9	24,702,442.6
16	2035		435,825	435,825	226,221,731.1	225,785,906.1	45,180.6	23,451,675.1	23,406,494.5
17	2036		435,825	435,825	240,037,097.3	239,601,272.3	40,339.8	22,217,740.5	22,177,400.7
18	2037		435,825	435,825	254,715,865.4	254,280,040.4	36,017.7	21,050,358.6	21,014,340.9
19	2038		435,825	435,825	341,621,422.8	341,185,597.8	32,158.6	25,207,546.4	25,175,387.8
20	2039		31,121,025	31,121,025	362,481,625.0	331,360,600.0	2,050,318.6	23,881,051.9	21,830,733.3
21	2040		435,825	435,825	384,614,771.2	384,178,946.2	25,636.7	22,624,312.6	22,598,675.9
22	2041		435,825	435,825	408,098,512.7	407,662,687.7	22,889.9	21,433,664.2	21,410,774.3
23	2042		435,825	435,825	433,015,236.8	432,579,411.8	20,437.4	20,305,634.6	20,285,197.2
24	2043		435,825	435,825	553,582,333.5	553,146,508.5	18,247.7	23,178,086.9	23,159,839.3
25	2044		435,825	435,825	587,374,518.9	586,938,693.9	16,292.6	21,957,983.0	21,941,690.5
26	2045		435,825	435,825	617,387,593.6	616,951,768.6	14,546.9	20,607,116.1	20,592,569.2
27	2046		435,825	435,825	648,827,481.5	648,391,656.5	12,988.3	19,336,173.5	19,323,185.1
28	2047		435,825	435,825	681,940,029.4	681,504,204.4	11,596.7	18,145,521.7	18,133,925.0
29	2048		435,825	435,825	716,741,504.4	716,305,679.4	10,354.2	17,028,163.3	17,017,809.1
30	2049		31,121,025	31,121,025	587,601,001.8	556,479,976.8	660,147.7	12,464,353.5	11,804,205.8
	Total	357,938,816	105,130,350	463,069,166	8,097,834,466.2	7,634,765,300.5	255,483,146.6	507,332,114.6	251,848,968.0

EIRR	16.6%
B/C	1.99
NPV	251.85

(7) Sensitive Analysis

A sensitivity analysis is conducted to see the influence of fluctuation of benefit and construction cost. Sensitivity analysis is made on the cases with +10% in the cost and -10% in the cost and benefit, respectively. These changes in cost and benefit are supposed to represent favorable and unfavorable scenarios. The results of the sensitivity analysis are shown in Table 9-13.

As the results of sensitivity analysis, even if the worst case which the benefits are decreased in 10 % and the project costs are increased in 10 % is occurred, the project EIRR of the all cases exceeds the opportunity of capital in Cambodia of 12 %. The implementation of the project is economically feasible from view point of national economy.

Table 9-13 Results of the Sensitivity Analysis

Case		Economic Indicator	Benefits		
			-10%	Base Case	10%
Costs	-10%	NPV (US$ million)	202.43	247.73	293.02
		B/C	1.99	2.21	2.43
		EIRR (%)	16.6%	17.4%	18.1%
	Base Case	NPV (US$ million)	179.62	251.85	270.22
		B/C	1.79	1.99	2.18

		EIRR (%)	15.9%	16.6%	17.3%
	10%	NPV (US$ million)	156.82	202.12	220.89
		B/C	1.63	1.81	1.99
		EIRR (%)	15.2%	15.9%	16.6%

8) Conclusion

The benefit of the project is summarized as the reduction of transport cost, reduction of travel time. Environmental conservation and increase job opportunities for the local people have also considered as indirect benefit which are not taken into consideration the above economic analysis.

Project roads serve as the most important freight transport road for Cambodia and Thailand. It is also, the majority of domestic product from western provinces which need to be transported through NR5. The project influential area has a high development potential for Cambodia.

One last thing, the number of fatalities by traffic accidents also recorded the highest at NR 5 compared to other 1-digit trunk roads. Therefore, development of NR 5 will not only promote ASEAN connectivity, international and domestic economic development but also traffic safety in Cambodia.

CHAPTER-10
CONCLUSIONS AND RECOMMENDATIONS

CHAPTER-10

CONCLUSIONS AND RECOMMENDATIONS

10.1 CONCLUSIONS ON NR5 IMPROVEMENT PROJECT SECTION FROM THLEA MA'S AM TO BATTAMBANG

The environmental and Social Impact Assessment (ESIA) on NR5 improvement project section from Thlea Ma' am to Battambang, Ministry of Public Works and Transport (MPWT), could be drawn conclusion as follow:

- This project will be improved road and new road with length is 112.8Km. Among of these, it is new road with 8.8Km of Pursat bypass of length, starts from PK171 to Kp-282+200. The width of Town road is 28 meters, paved of AC that it is four lines (3.5m X 4), additional road for vehicle parking (2.5m X 2) and for traveler both sides (3m X2); it is 3m median of central line road. For the width of rural road is 23 meters, paved of AC that it is four lines (3.5m X 4). The NR5 improvement project from Thlea Ma' am to Battambang required extending 28 bridges, construction new 2 bridges (Pursat River and O-Sdav), 63 culverts (one row to 4 rows of concrete ring) and 35 box-culverts construction where there are on canal and some streams and creeks.
- Total land requirement is 451.2ha for project road construction (40 m x 112.8Km), the land both sides from the central road are 40m (COI: 20m for one side).
- According to inventory forest in project area by trees counting on the slope road from Thlea Ma' am to Battambang is 5,210 trees; it is 2,621 trees on the right hand and it is 2,589 trees on the left hand; its were 30 species which affected by the project. Moreover, there are 4,817 of economic tree people's that will be affected by this project.
- The NR5 improvement project from Thlea Ma' am to Battambang will be less affect on River side vegetation that re-grows along the road located in few communes: Boeung Kantaout, Prey Nhy, Boeung Khna, Snam Preah, Ko Koh, and Kear in totally 10.13ha in totally with 36 species.
- The ESIA study team determined for the study area on environmental resource 150m of width from the central line road totally is 300m with 3,384ha area. Within this area the working teams found that total wildlife are: **5** species of mammals, 34 species of birds, 28 species of reptiles and 114 species of freshwater fishes.
- Polluting in surface water such as (Stream, Creek) in the project area (in wet and dry seasons) by human activities is not seriously. Base on water quality tested of 5 parameters which collected from Steung Pursat, Steung O-Tapaong, Steung Svay Daun Keo, Steung Moung, Steung Chork and Steung Sangkea shown that it is only Total Coliform which is a little bit high the standard of water drinking of MIME; and as well as TSS in 6 water sources above is high the water quality in public resources for maintaining of biodiversity of MoE. For pH in Steung O-Tapaong, Steung Moung and Steung Chork is also high standard of both Ministries. Therefore, the result of water quality test that collected from 6 water sources we can concluded that these water sources cannot use for purposed of drinking, if the people are not trying to boil it or to treat it or to use chemical treatment.
- Air quality in the project area that tested for 6 locations and road site and further far more than 100m for the road site, before the project construction found that there are two parameters: NO_2 and SO_2 were low than standard of MoE in wet and dry seasons.
- Noise quality in the project area that tested for 3 locations and road site, before the project construction, started from 6:00am to 11:00pm was low than standard of MoE in wet and dry seasons. But started from 11:00pm to 6:00am was a little high than standard of MoE in between 9.9dB to 11.6dB.
- The same as Noise, vibration quality in the project area that tested for 3 locations and road site, before the project construction found that there was low than standard of MoE in wet and dry seasons.
- The social economic people's along the road before project construction was studied and the study team has determined n/N≥ 10% (people was interviewed 18.27%) of 83 villages, 17 communes, 5 Sangkats, 4 District and 2 Towns: 1 in Pursat province and other 1 in

Battambang province. The total pupolation within 83 villages is 23,051 families, among of 4,378 families equal 19% are living along the project road.

Note: *All these families that living along the road, they are not all affected by the project.*

- There are 1,860 families, 307 HHs, 195 business stalls, 8 Restaurents, 676 other small stalls and other immovable property of 137 in the COI area of this project, these things will impact by the NR5 improvement from Thlea Ma' am to Battambang. This project has planned to establish two resettlement sites for 53 families from affected area to Bakan and Moung Russei districts (39 families to Bakan and other 14 families to Moung Russei). The total budget for social impact resolution and resettlement plan implementation is USD 8,059,913.55 for both projects; it is thisproject and other road improvement of section from Sri Sophorn to Poipet.

Jump to conclusion, this project is not serious impact on Social and Environment, if the project owner strongly follows the environmental mitigation measures in Chapter-7 and also following to the environmental management plan in Chapter-8. In addition, the project owner recruited Technical Experts and the Contractors of construction from Japan which they have high experiences in project design, construction monitoring for this project. For example: protection and mitigation measures summary for wastes that it is fuel and chemical elements or wastes. For other wastes the project owner will require to the contractor to manage properly based on technical waste condition. Moreover, the project owner will require to the contractor to build septic tank of 2-3 blocks to treat wastewater with adequate capacity to treat base on outlet of this project. The project owner will do cooperation with MoE and relevant institutions to do monitoring and recommendation regularly on solid and liquid wastes management activity, especially illegal garbage disposal along the road during the operation and maintenance phase.

Moreover, there is get income to the National budget through this project, because the contractor used fuel and materials of construction which the company imported or bought. The company will pay on Tax, VAT and others Tax for fuel or other materials of construction used for construction.

At the same time, the negative impact on natural resources and some social environment, the project will provide advantages to the local people and whole society such as:

The whole project construction is take for 3 years; the project will increase income to the people of Cambodia through providing jobs to them especially, many local people in the project construction phase.

The project will recruit Cambodia Technician, Engineer to assist foreigner Experts in the project design, construction monitoring, and project construction which it causes of Cambodia Technician and Engineer to get experiences of construction of highway from the Japan's Engineers and Experts.

Other hand, through the Japan's Experts and Cambodia Officer of MoPWT will get new experiences and knowledge on survey, calculation, project design plan, monitoring, ESIA study as well.

Due to influence of road extending, there will become a Asian highway A-1, it will increase income to the people in the community through National and International Tourists come to Cambodia especially, the people come from the provinces which they pass on this road.

The NR5 improvement project is serving for many sectors such as: public works and transportation, Agriculture, Enterprise, and Industrial which it is based for National Economic development. Moreover, this project can assist to facilitate of travelling, access on time, less payment to the local people and also the Tourists.

10.2 RECOMMENDATIONS ON NR5 IMPROVEMENT PROJECT SECTION FROM THLEA MA'S AM TO BATTAMBANG

To be smoothly for this project implementation and strengthening of responsibility for economic development sustainable on natural resources and social safety, the working team would like to give recommendations as below related to IESIA:

- The project owner should study on project design of whole elements project's which to be sure better according to the technical highway, to avoid occuring damages by accident to the people life and animal; it is also damage on environment in/around the prject area; should do additional calculation for local earthquake. The detail project design of whole elements project's should do whatever to consider for new culverts construction for all crossing road in between PK247 to KP248 including canal digging to drain water out along this road.

- Infrastructure design for new bridge to pass the Pursat River should consider about traffic accident at the intersection road of by-pass and the road on both sides of Pursat River, to construct sky-bridge or traffic circle,...
- The project owner (MoPWT) and provincial Authority should do cooperation together to delivery on traffic law and sefety including traffic light vehicle to the people living in/near the projetc area, let them clearly understanding on that and to delivery information on technical wastes management.
- The project owner should solve for compensation to the affected people on the reserved land that the project required COI area about 451.2ha for road improvement in davence before the project construction starting.
- Every phase of project, the relevant companies which the project owner selected for this project implementation should follow the relevant law of Cambodia in order to get project success and sustainability.
- To reduce traffic accident in effectiveness the Government should insert traffic law and traffic light vehicle into the program education for high school.
- The MoPWT and Provincial/Town authorities should do announcement to the people who tried to fill up soil on canal, drainage systems along the road; should do installing concrete ring with diameter proportion to water capacity which it can be released water out to avoid water blocks or inudated on the road caused to road damaged and loose of national advantage.
- Sameness, the project owner should require to business enterprises for sand and soil selling, concrete mixing factory, place trasferring cargos or big stores ect,..which there are big trucks in/out, they should spend their own money to connstruct a strong road on front of their locations to avoid road damaged that it was laoned from ODA of Japan for the Nation and then it destroyed by the private sector (merchant).

Finally, on be half of MoPWT and JICA working Team which they are studied project for the NR5 improvement project middle section Thlea Ma' am to Battambang which it is a part of main NR5 and it is a Asian Highway-1, it is blood vessel of National economic, economic zone and connect to International also, to propose to MoE and relevant Minitries to authorize and acknowledge report of EIA.

Phnom Penh, October 02, 2014
Project Study Team: Jica Study Team
Team Leader/Road Traffic Plan

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Phnom Penh, September 29, 2014
EIA Study Team: SAWAC Consultants
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Phnom Penh, October 07, 2014
Project Owner: **Ministry of Public Works and Transport**
Director of Department of International Cooperation,
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CHHEUM PHALLA

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ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

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ឯកឧត្តមរដ្ឋមន្ត្រី ក្រសួងសាធារណការ និងដឹកជញ្ជូន

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យោង ៖ - ព្រះរាជក្រមលេខ នស/រកម/១២៩៦/៣៦ ចុះថ្ងៃទី២៤ ខែធ្នូ ឆ្នាំ១៩៩៦ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីកិច្ចការពារបរិស្ថាន និងការគ្រប់គ្រងធនធានធម្មជាតិ
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សេចក្តីដូចមានចែងក្នុងកម្មវត្ថុ និងយោងខាងលើ ខ្ញុំសូមគោរពជម្រាបជូន **ឯកឧត្តមរដ្ឋមន្ត្រី** មេត្តាជ្រាបថា ក្រសួងបរិស្ថានឯកភាពលើរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមពេញលេញ (ESIA) សម្រាប់គម្រោងធ្វើឱ្យប្រសើរឡើងវិញនូវកំណាត់ផ្លូវជាតិលេខ៥ ចាប់ពីឆ្នាមួម-បាត់ដំបង និង សិរីសោភ័ណ-ប៉ោយប៉ែត ដែលមានទីតាំងស្ថិតនៅក្នុងភូមិសាស្ត្រខេត្តពោធិ៍សាត់ ខេត្តបាត់ដំបង និង ខេត្តបន្ទាយមានជ័យ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន (ម្ចាស់គម្រោង) ដោយម្ចាស់គម្រោងត្រូវគោរពតាមកិច្ចសន្យាការពារបរិស្ថានលេខ ៣៩០៩ សក ចុះថ្ងៃទី១៦ ខែតុលា ឆ្នាំ២០១៤ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន។

អាស្រ័យដូចបានគោរពជម្រាបជូនខាងលើ សូម **ឯកឧត្តមរដ្ឋមន្ត្រី** មេត្តាទទួលអនុវត្ត និងចាត់ចែងតាមការគួរ។

សូម **ឯកឧត្តមរដ្ឋមន្ត្រី** មេត្តាទទួលនូវសេចក្តីគោរពពីខ្ញុំបាទ។

រដ្ឋមន្ត្រី

សាយ សំអាល់

ចម្លងជូន៖
- ទីស្តីការគណៈរដ្ឋមន្ត្រី
- ក្រសួងសេដ្ឋកិច្ច និងហិរញ្ញវត្ថុ
- ក្រសួងរៀបចំដែនដី នគរូបនីយកម្ម និងសំណង់
- សាលាខេត្តពោធិ៍សាត់ ខេត្តបាត់ដំបង និងខេត្តបន្ទាយមានជ័យ
- មន្ទីរបរិស្ថានខេត្តពោធិ៍សាត់ ខេត្តបាត់ដំបង និងខេត្តបន្ទាយមានជ័យ
- ឯកសារ កាលប្បវត្តិ

Kingdom of Cambodia

Nation Religion King

ꕥ

Ministry of Environment

Ref. No.778 MoE

Phnom Penh, 17 October 2014

Attention to

H.E Minister of Public Works and Transport

Subject: Response to the request for review and comments on the full Environmental and Social Impact Assessment (ESIA) for the National Road No.5 Improvement Project: Prek Kdam – Thlea Ma'am Section and Sri Sophorn – Poipet

Reference: -Royal Krom with Ref. No. NS.RKM 1296/36 dated December 24, 1996 to issue the Law on Environment and Natural Resource Protection
-Sub Decree with Ref. No. 72 ONKr.BK dated August 11, 1999 to issue the Environmental Impact Assessment
-MPWT's letter with Ref.No.3091 dated August 15, 2014
-MPWT's letter with Ref.No.721 dated October 3, 2014
-MPWT's letter with Ref.No.3802 SK dated October 7, 2014

With the above captioned subject and reference, I would like to inform **Your Excellency** that the Ministry of Environment (MoE) has no objection on the full ESIA for the National Road No.5 Improvement Project: Prek Kdam – Thlea Ma'am Section and Sri Sophorn – Poipet. The Project is geographically located in Pursat, Battambang and Bantey Meanchey. The MPWT, who is the Executing Agency, must respect the MPWT's Pledge on environmental protection with Ref. No. 3909 SK dated October 16, 2014.

Please, Your Excellency, take action and proceed your works with the above contents properly.
Please, Your Excellency, accept my best regard.

Minister of Environment

(Signed & Sealed)

Say Sam Al

cc: -Ministers of Council
-Ministry of Economy and Finance
-Ministry of Land Management, Urban Planning and Construction
-Provincial Hall of Pursat, Battambang and Bantey Meanchey
-Provincial Department of Environment of Pursat, Battambang and Bantey Meanchey
-Archives

Unofficial Translation

KINGDOM OF CAMBODIA
Nation Religion King

Ministry of Public Works and Transport

Report on Environmental and Social Impact Assessment (ESIA)

NATIONAL ROAD No. 5 IMPROVEMENT PROJECT

(SECTION: THLEA MA'AM TO BATTAMBANG AND SRI-SOPHORN TO POIPET)

(VOLUME 2)



With assistance of:
Katahira & Engineers International
Central East Building, 1-14-1, Shintomi, Chuo-ku, Tokyo
and
SAWAC Consultants (Cambodia) Co.,Ltd
#36c, Street 476, Toul Tumpong II, Chamcamon, Phnom Penh

Under Sponsorship of:
Japan International Cooperation Agency

JULY 2014

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CHAPTER-1
INTRODUCTION

CHAPTER-1
INTRODUCTION

1.1 INTRODUCTION

Cambodia has rehabilitated and reformed of economic and its sequence improvement after civil war over 30 years is completed including there was a stable of political situation.

At present situation, all kinds of investments are very important to develop Cambodia, for instance, investment in product cargos for export, investment in the construction of infrastructures, agricultural or industrial, agro-industrial sector, be in the search attractive source of tourism, services and road construction, all fields are very important potential for socio-economic development of Cambodia.

The transpotation of cargos and other materials peopole's are utilizing road, especially roadway is more than waterway and airway. The roadways in Cambodia were most whole destroyed during the war in decade of 70 to 80. Presently, the Royal Government is trying hard to rehabilitate and construct road (roadway, railway) waterway and airway due to look for assistance and loan from friendlship countries such as Japan, China United State, Australia, Asian Development Bank (ADB) and World Bank ect., in order to rehabilitate and re-develop of road systems.

The National road No.5 (NR5) is an important National economic road among other roads of Cambodia. At the present, this road is connected from Phnom Penh City to Bangkok, Thailand which assigned Asian Highway A-1 (AH-1) or it is a gate of Souther Economic Corridor of GNS. Therefore, the Royal Government is decided to improve the NR5 to be wide with four traffic lines; it is two traffic lines go and two traffic lines back included right of way for pedestrian and for bycicle of bothsides.

According to master plan which prepared by JICA in 2006 of Cambodia road networks development shows that the NR5 is Double Bituminous Surface Treatment (DBST) road which surface paved road of bituminous, it is not for long life utility, easy to damage and it also includes faster increasing of traffics on this road. Therefore, the Ministry of Public Works and Transport (MoPWT) has discussed with relevant Institutions especially JICA furhter to achieve an agreement of study on this road improvement since November 2010. To respond on time, JICA has assigned Technician team to study on: data and information collection, researching, investigation, topography survey on this road, in that year.

The study of NR5 improvement project is a study looking for data and information collection which it is important to determine and estimate on loan from Japan. This study are: initial project design, cost estimation of project plan implementation and it will do on Environmental and Social Impact Assessement (ESIA) included cost estimation of compensation to affected people by the project as well. In order to facilitate for this study JICA team has devided this study as portions following:

- Portion road from Prek Kdam bridge to Thlea Ma' am Pursat (ESIA studied);
- Portion road from Thlea Ma' am Pursat to Battambang Province (it is this ESIA report);
- Portion road from Battambang Province to Sri Sophorn Town (ESIA studied);
- Portion road Sri Sophorn Town to Poipet Town (it is Studying ESIA).

1.2 OBJECTIVES OF STUDY AND EVALUATION

In contribution of sustainable development of the country under the Royal Government of Cambodia Rectangular strategy including Water, Road, Electricity, and Human resources are main factors for Cambodia in a new stage.

Road is blood vessel of economic network of Cambodia and the Cambodia is also neccessary needed to serve on country developemnt sector. Therefore, Cambodia is trying hard to collect for National finance, looks for assistant and loan included to open for companies to invest on infrastructure of roads construction sector.But, all development projects must be conducted Environmental and Social Impact Assessment (ESIA) first and then they will be reached to project implementation base on Law on Environmental Protection and Natural Resource Management included Sub-Decree on Environmental Impact Assessment of Ministry of Environment of Kingdom of Cambodia. The study on ESIA of the project has following objectives:

- Detailed study , understand and determine the existing environmental resources in the area;

- Detailed study on Socio-Economic of project area, evaluate project development area and surrounding area that may be directly or indirectly affected by the project activities, included assembly of common affected with other projects if neccessary;
- Screen and determine potential environmental impact, both negative and positive, caused by project activities, using checklist sheet of JICA and MoE of Cambodia;
- Cite the useful recommendations and receive suggestions from project stakeholders including local people, local authority and NGOs whom live and working in the project area to find out the properly way for minimize the environment impact;
- Evaluate and predict the degree of impact on natural and social resources caused by project design, construction, operation, maintenance, and closure;
- Analyze Cost Economic on negative impact of the project, to identify that cost environment rehabilitation is enough, loose or get benefit in the operation and maintenance phase; especially it make forestry and fishery resources is rehabilitated for in any period or the company has to increase additional environmental cost;
- Analyze Cost Economic of the project included all damages of natural resources environment, biological and Social in order to find for project benefit;
- Minimally determine/set mitigation measures to negative environmental impacts, especially on natural and social resources;
- Determine of environmental protection plan of the project in the future;
- Conclude and make main recommendations to the project owner and other institution which is responsible has smoothly and sustainable for project implementation.

The Environmental and Social Impact Assessement (ESIA) report on the National road No.5 improvement project is prepare reffer to Prakas on guideline in the ESIA No.376 ប្រកប.ស្ដ dated on 2 September 2009 of MoE and guideline of JICA, dated on April 2002. This ESIA report consisted 10 Chapters:

(1).General, (2) Methodology of Study, (3) Relevant Law and Regulations, (4) Project Description, (5) Contest of Existing Environment in the project, (6) Public Consultations and Discussions in the Project Area, (7) Potential Environmental Impact and Mitigation Measures, (8) Environmental Management Plan, (9) Economic Analysis and Environmental Cost, (10) Recommendations and Conclusions.

CHAPTER-2
METHODOLOGY OF THE STUDY

CHAPTER-2

METHODOLOGY OF THE STUDY

2.1INTRODUCTION

The main points of methodology for the ESIA study on the NR5 improvement project of MoPWT has a mechanical methodology to study three Environmental resources: Physical Environment, Biological Environment and Social Environment; these are described below:

- Collect data and information related to the project concerning with Institution and Stakeholder in Phnom Penh, such as Ministry of Agriculture Forestry and Fishery (MAFF), Ministry of Environment (MoE), Ministry of Water Resource and Meteorology (MoWRAM), Ministry of Public Works and Transport (MoPWT), Ministry of Planning (MoP) and other concerned Institutions;
- Collect data in the project area and organize public consultation meeting with local people and Local authorities: (Villager, village Chief, Commune Chief, District Governor/Town, Provincial Cabinet) and institutional linkaged such as: (Provincial Department of Public Works and Transport (PDoPWT), Provincial Department of Agriculture (PDoA), Provincial Department of Environment (PDoE), Provincial Department of Water Resources and Meteorology (PDoWRAM), Provincial Department of Land Urban Management Planing and Construction (PDoLUMPC), Provincial Department of Industry, Mines Energy (PDoIME), Khan of Forestry Administration, Khan of Fishery Administration and other NGOs (see Chapter-6);
- Field investigation on natural environment at project area such as: Hydrology, Soil, Geology, Forest, Wildlife, Fish ect., by mention from villagers who lived in/around project area;
- Field investigation on people's land use in the project area;
- Meet the affected and non-affected people in the project area in order to interview and understanding on their living condition before the project development; and also looking for a common idea and others suggestions which concerned to the project in order to guide the project is running smoothly;
- Taking water samplings and test of water quality sources: Surface water (see table of water quality tested at the field in annex-2) in order to identify of water quality before the project development;
- Taking samplings and test of Air quality, Noise and Vibration in the field (see table of Air, Noise and Vibration tested at the field in annex-2) in order to identify these qualities before the project development;
- Study on Ecology system (dry ans wet season) in the project area;
- Study on fishery in Steung Sri Sophorn (dry and wet season);
- Analysis all data that collected from the field and related institutions, and to describe on existing natural and social environment situation, and then predict the environmental impact may/will be happened before project Operation (in project design and project construction phases), operation and maintenance phase and disclosure phase;
- Review and modify the project master plan/relevant document;
- Determine negative and positive affected caused by project activities. Develop mitigation measure for reducing negative impact to minimum degree and increasing positive impact to maximum degree, by quoted from public consultation meeting with people and other suggestions from people, local authority, Institutional linkage in the project area;
- Prepare Environmental Management Plan (EMP) and Monitoring Program for project construction phase, project Operation and Maintenance phase. The floowing detail of methodology studies: Physical Environment resources, Biological and Socio-economic Environmental resources as below:

2.2 ENVIRONMENT RESOURCE STUDY

2.2.1Meteorology and Hydrogeology Study

2.2.1.1 Meteorology Study

This study is very important in order to analyze on data base to calculating dimension of project infrastructures such as Culvert, Bridge, height road level, ect.,

The study team has contacted to the Director of Department Meteorology of MoWRAM and the Director of PDoWRAM to collect data on Meteorology that concerned in the these provinces such as: Rainfall, Temperature, Wind speed and Wind direction, Humidity, Sunshine, Evaporation ect., to analyze in order to determine data base as described in Chapter-5. Moreover, if data of Meteorology is not available in the province of the project area, then data of Meteorology is closely that province, can be analyzed for data base of the project as well. Other hand, data of meteorology is not available in the country or in the region; then data of meteorology is closely that country can be analyzed for data base to calculate dimension of infrastructure of the project as well. To analyze this data the team will operate Excel in the Microsoft Office program of computer.

2.2.1.2 Hydrogeology Study

The working Team has devided in 3 main parts for this study:

(1) River and Drainage Systems in the project area:

It is description about water sources name which passed on this road by using map of Department of Geography that produced by JICA in 2003. It takes Themes: River 99 to use in ArcMap 10 program then doing Overlay with map of the project location and then it creates Themes: River in the project area which it is clear with the name of each Creek and Steung. In additional, study team has shown this map to local Authorities (District, Commune and Village) in order to clarify name these water sources. Moreover, study team went to field to meet the people are living in permanent along the road in the project area asked them to identify these water sources names that they use in the project area. Some names of water sources that the people used and it is diffident from the map name, the team has noted and wrote down on the map as well (see map No.1).

Note: *GPS has been used and marked on waterways that recorded and inserted these points into the computer and operated with MapSource program, Excel and ArcMap 10.*

(2) Hydrology of Steung:

The Irrigation Engineer is the person implemented of this study; this point is collected from final report of Northwest Irrigation system project in annexes of hydrology calculation of hydrology. This calculation they have to do probability of rainfall and modeling in SWAT computer program that they used for the project (TA ADB No.3758-CAM), (see result in Chapter-5).

(3) Surface Water Quality Test:

JICA working team has selected for only one location of water surface source to study, it is only Steung Sri Sophon. The study on water quality is twice, once is in wet season in July and second is in dry season in December 2013. The water supply Engineer is the person in charge of this study. He sent water samplings to Laboratory, MoE to test its. The water sampling is important thing; it is not for every person can be done for this. The result of water quality test we have to see table of water test in the field attached in annex-2. The result both seasons of water quality study will be done by Water supply and Environment Engineer to analyze and conclude in Chapter-5. The tools and equipment of water quality test in the field is shown photo below.



Photo of Water Quality Test Equipments

2.2.2 Topography, Soil Type and Geology Study

2.2.2.1 Soil Study

Study team has determined on soil study by using map of Department of Geography that produced by JICA in 2003. It takes Themes: Soil type of Mr. Crocker, 1963, scale 1:1,000,000 to use in ArcMap 10 program then doing Overlay with map of the project locations and then it creates Themes Soil type which it has clear area in each of soil type. The study team leader has determined the study locations and made detail study. According to analyzing by program computer and then transferred Attribute data of coordination X and Y by UTM systems using Datum Indian 1960 to Excel file. The file is transferred to Dbase file then using DNR program computer and insert the file into Dbase in GPS Garmin 76CSX in order to look for all locations that we need to study in the field. The team has used tools and equipment and document in the field study as below:

- GPS Garmin 76CSX;
- Hand Auger (3m), drilling tools;
- Tape meter (10m and 50m);
- Shovel, Hoe, Spanner, Knife, Axe, digging hoe ect.;
- Red paint spray;
- Canon and Olympus Cameras;
- Map which has prepared and notebook;
- Book of soil type for paddy crop in Cambodia, 1997;
- Book of soil symbol of Mr. Crocker, 1963: Les sols du Cambodge et Leur potentialite TRAN CANH, 1997.

The Civil Construction Engineer has recorded data of soil element that drilled or dug at depth of 1m - 1.3m and re-marked in GPS where location of the study; and then he also noted on notebook, took a picture as well. The soil interpretation is described in Chapter-5.



Photo of Tools and Equipment Soil Test

2.2.2.2 Geology and Mine Study

Study team has determined on Geology study using map of Department of Geography that produced by JICA in 2003. It takes Themes: Geology to use in ArcMap 10 program then doing Overlay with map of the project location and then it creates Themes: Geology in the project area which it is clear area according to each occasion of rock and soil formation created.

2.2.3 Biological Resources Study

2.2.3.1 Ecology System Study

A. <u>Map creating of Land use type in the project area</u>

Study team has determined on study area for 150m both sides of road (width of 30m), at point started from KP366+250 to KP402 which it area sized is 1,074ha according to map of forest Administration (GIS Datasets FA 2002 and 2006, scale 1:1,000,000). It found that in the project area is not forest or protected area. Moreover, this study is taken air photo which it is resolution 1m to 3m year 2008 to identify clearly location on land use map. Land uses in this project area are:

- Residential area is normal household which it is not Town;
- Residential area of 50% is Town;
- Residential area is Town;
- Rice field area;
- River side vegetationt which it is re-grow in inundated are along the road;
- Water area such as Lake, pond, Creek, Steung ect.,

Study on Ecology system in the project area will be done twice: (1) in wet season in August and (2) in dry season in December 2013. The result this study is described in Chapter-5, point 5.1.2.4.

B. <u>Wildlife, Mammal, Bird, Reptile and Fish</u>

Wildlife studying (mammal, bird, reptile and fish) is applied by using photos of Checklist in the Cambodia extracts from wildlife book identification for strengthening Law practices by Department of forestry, 2002. Bird book of Cambodia published by MoE, 1999 to some people and concerned Authorities in Banteay Meachey province.

At field study, along the road for some communes, study team selected people representative 1 to 2 person and 1 Commune Councilor which they clearly known wildlife in and surrounding the project area. They are: Mr. **Duch Ra**, 57 years old, he is Teuk Thla Sangkat Councilor; Mr. **Chap Saraon**, 63 years old, he is a Village Chief of Teuk Thla and Mrs. **Vean Sary**, 43 years old, she is fishery women in Banoy village, Teuk Thla Sangkat (recruited for Group-1). The Group-2 consisted: Mr. **Chey Cheum**, 73 years old, he is a Village Chief of Kob Chheung; Mr. **Say Ny**, 52 years old, he is a Villager in Yeang Thmey, Kob commune and Mr. **Inn Rith**, 73 year old, he is a commune Chief of Bob. The Group-3 is consisted:

Mr. **Ronn Try**, 67 years old, he is villager of Nimit-2 village, Mr. **Kim Sath**, 58 year old, he is a Vice-Chief of Nimit-2 village and Mr. **Ly Saroeun**, 49years old, he is a Clerk of Nimit Sangkat.

Later then, working Team had guided them on how to define by showing the photos of wildlife and how to put a tick, each group can be put a tick only one mammal/fish species. Later than, working Team had collected result from each Group in order to do analyzing to count number of wildlife or fish according to method 2/3 of chosen picture of wildlife was ticked by these 3 Groups (it means that we had to check for each picture, for example, Group-1 ticked one species of wildlife in the project site and the third Group also ticked this species, but the second Group did not tick; all of these showed that this area has this species. This process was done still completed). However, the team had went to the field and doing investigation of wildlife and took some pictures wildlife and died wildlifes.

C. Wildlife threatened species and Rare species

According to document of Cites;

- According to Sub-Decree No.123 ANK-BK, dated on 12 August 2009 on species results, fisheries products which is suffering dangerous (for fish and reptile);
- Actual study in the project area.

2.2.3.2 Fishery Resources Study in the project Area

Fish study in the project area, the JICA study team has determined for detail study in Steung Sisophon. The study on fish in this Steung, it started from Teuk Thla bridge to downstream of Preah Ponlea bridge which it is far about 11Km, both seasons of study in wet season (August and September) and in dry season (November and December) in year 2013.

A. Objective of the study

- Household number of fisherman (professional fishing and non-professional fishing), type and number of fishing tools;
- Technical information fishing;
- Quantity of fish catchment base on type of fishing tools which they doing fishing part upstream of project area, in the project area and part downstream of project area before the project implementation phase;
- Vary of quantity fish catchment before the project implementation phase;
- Type of fish catchment part of upstream project area, in the project area and part of downstream project area before the project implementation phase;
- Fish movement in the study area in this Steung Sri Sophon.

B. Methodology of the Study

The study in this Steung Sri Sophon, the team has divided into two zones: zone-1, it is started from Teuk Thla village to Pro Hoth village, along the Steung which it is far about 7Km and zone-2, it is from Rong Machine village to Prek Russei village which it is far about 5Km.

Method of this study is an actual practice by using interview with the Fisherman selected random of 12.86% (based on condition of $n/N \geq 0.1$, (n) is number of family need to be interviewed, (N) is total number of fisherman in the study area) for 2013 and selected 2 person are recorders, they are fishermen in the study area. To say that: 1 person is in the project area, other 1 person is at downstream the project area, it is started from Teuk Thla village to Pro Hoth village and another 1 person is the villager responsible from Rong Machine village to Prek Russei village. All of them have to fill on checklist, data recording for 2 months (1 month in dry season and other 1 month in wet season) and later then the fishery specialist has interviewed and doing analysis this data as below:

- Introduce about objective of study;
- Meeting and interview with fisherman for 53HHs equal 12.86% of total fisherman of 412 HHs, in order to collect about technical fishing information and notice type of fish in these 2 project areas;
- Fish product is recorded on the day of number fisherman that selected, and also recorded on number day fisherman's which they were in the site pointed, and calculation daily for total fish catchment following to formula below:

$$Y = \sum_{i=1}^{b} Ybi \times \frac{B}{b}$$

Y Total fish catchment quantity per day;

Ybi Total fish catchment quantity of fisherman recorded per day;

B Total number of fisherman at port boat or in village;

b Each number of fisherman which recorded per day.

Total fish catchment quantity per month calculation following the formula

$$Y' = \sum_{i=1}^{d} Yi \times \frac{D}{d}$$

Y Total fish catchment quantity per month;

Ybi Total fish catchment quantity of fisherman recorded per day;

D Number of day for fishing per month;

d Number of day that recorded;

Yearly fish catchment quantity is monthly fish catchment quantity plus together.

2.2.4 Socio-Economic Environment Resources Study

Interviewer sampling is selected by method Participatory Rural Appraisal (PRA), diagram and SWOT (Strengths Weaknesses Opportunities and Threats). This method will use during the meeting and discussion with the local Authorities: District, Commune and Village. First, the working team has to make appointment with above local Authority, due to showing map and project location to District representative Authority. After then, the team has introduced and shown each commune location in the project area. Later on, the team is done the same that is the team has made appointment to meet relevant commune Authority in order to look for any villages that located in the project area. In the relevant villages, the village Chief or his representative or community representative has to be interviewed and consulted. Next day, the working team has asked to the village/commune representatives that they know well project locations and the people are living along the NR5 for interviewing with our team.

For measurement, investigation and information collecting from affected people's by the project, JICA study team has organized a new team, it is a working group (B) to determine for Corridor of Impact (COI) by the project. It is 20m from the central line of road, totally is 40m width. This team has cooperated with Facilitator of MoPWT included Office of Complex Resolutions of MoFE. They went to field for meeting to delivery information and opening for public consultation in Banteay Meanchey province on 8 August 2013.. The meeting is determinate for date of immovable property registration and crops and specieswhich affected by the project, it determinates from 2 September 2013. It means that, if anybody has a right to do construction or growing the species on Corridor of Impact (COI) after the date (2 September 2013).

Based on introduction from the village representative and these immovable property owner's, it shown that the house owner's name, immovable property owner's (house, business stall, paddy store, fence ect.,), people/public crops in the project area, the team had interviewed them at their households. In case they are not house in the village (it is far or in others area) of the project area, the team will ask them to meet at the village Chief house for interviewing. When the study team was in the field for data collection and interviewing there were also village/commune Authorities had participated as well. The study team has used checklist and questionnaires to ask to the people in the field. The team found some affects it will be occurred by this project development. The team has recorded these affects for documentation and doing socio-economic analysis as well.

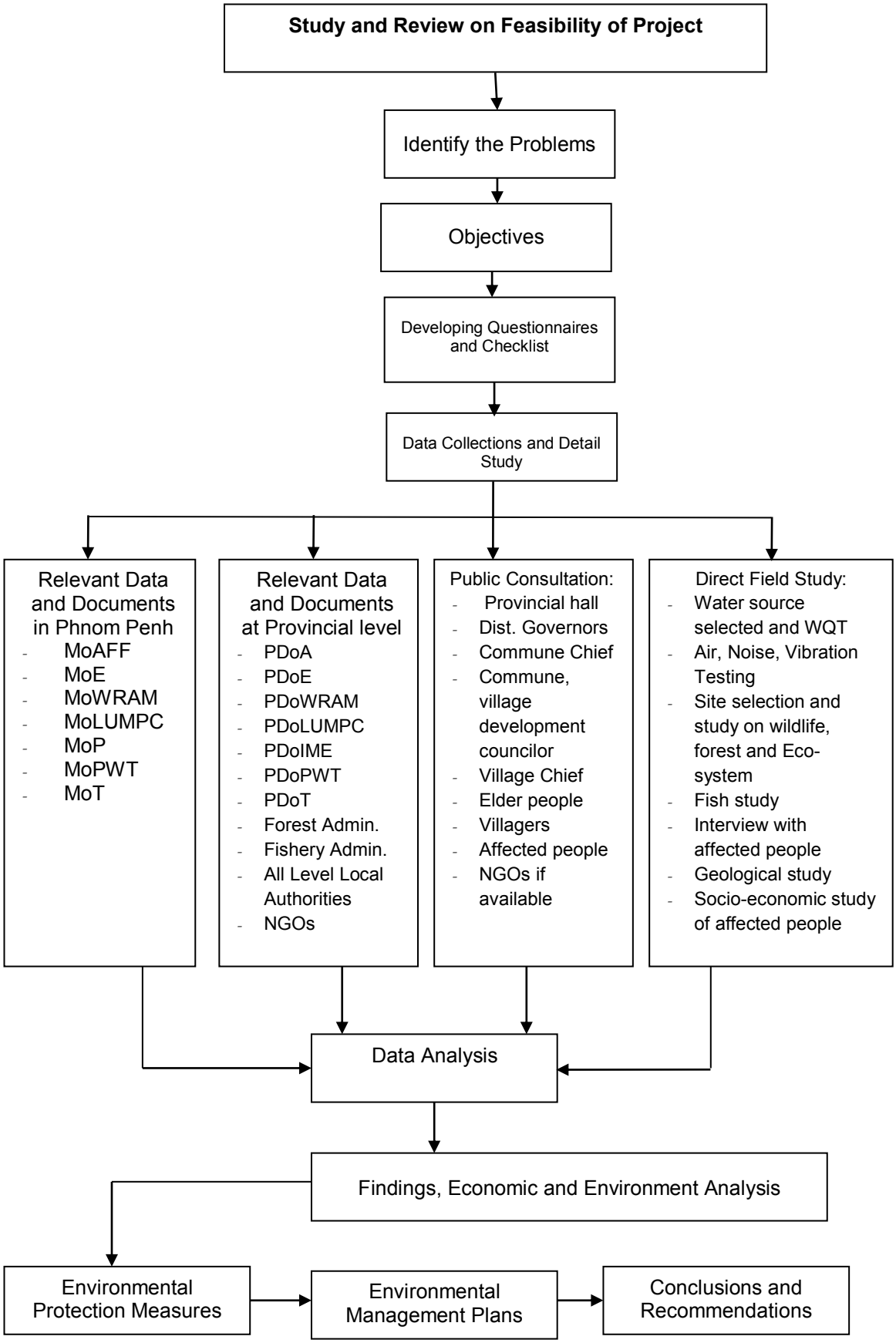
Moreover, the meeting with the people that they are not affected by the project (who are living both sides along the road), it made to introducing about project's objective, result expectation of the project activity, especially, to find out number supporter of the project and criticism ideas for environmental mitigation measures, due to they have opportunity to participate in the meeting for question and answer with the

study team. In general, sampling for the people interviewing is at least 10% to 20% selected, it depend on number of the people more or less (for rich-man: big house, villa, flat house; for medium: tile house, wooden house, zinc house; for the poor: thatch house. Example, if in one village, there are people lives along the road from 1 HH to 150 HHs, it has to select 20% for interviewing. If in other one village, there are people lives along the road more than 150HHs, it has to select 25 HHs for interviewing based on condition of $n/N \geq 0.1$, (n) is number family need to be interviewed and (N) is total number family living along the road.

The Environment and Social Impact Assessment (ESIA) of the NR5 improvement project, it is implemented in the real field from August to December 2013. The result of interviewing with the people is shown in detail in Chapter-5, point 5.2 of Social Status and in Chapter-6 of Public consultation and Discussions in/around the project area.

Data analysis has been done by Socio-economic Expert of working team. Data collected from the field interviewing has inserted to Excel program computer, then doing analysis graphs and Pivot Table.

DIAGRAM OF METHODOLOGY OF ESIA PROJECT STUDY



CHAPTER-3
RELEVANT LAW AND REGULATIONS

CHAPTER-3

RELEVANT LAW AND REGULATIONS

3.1 LAW ON CONSTITUTION OF THE KINGDOM OF CAMBODIA, 1993

This law was adopted by the Charter of National Assembly of the Kingdom of Cambodia, and promulgated on September 21, 1993 related to the project as follow:

- ***Article 2:*** The territorial integrity of the Kingdom of Cambodia shall be absolutely inviolable within its borders as defined in the 1/100,000 scale map made between the years 1933-1953, and internationally recognized between the years 1963 - 1969.
- ***Article 4:*** The Kingdom of Cambodia is an indivisible State.
- ***Article 5:*** The official language and script are those in Khmer.
- ***Article 58:*** State property notably consists of land, underground, mountains, sea, sea-bed, undersea-bed, coastline, airspace, islands, rivers, canals, streams, lakes, forests, natural resources, economic and cultural centers, national defense bases, other building facilities belonging to the State.

  The administration, the utilization and the assignment of State's properties shall be determined by the law.
- ***Article 59:*** The State shall preserve and protect the environment and the balance of natural resources, by organizing a precise planning for the management, especially of the land, water, atmosphere, air, geology, ecological systems, mines, energy, petroleum and gas, rocks, sand, gems, forests and forest by-products, wildlife, fish and aquatic resources.

3.2 LAW ON ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES MANAGEMENT, 1996

Law on environmental protection and natural resource management was adopted by national assembly and declared to use a Preah Reach -1296/36 Enacted on December 24, 1996. This law has an objective as following:

- To protect and upgrade the environment quality and public health by means of prevention, mitigation and Control of pollution;
- To assess the environmental impacts of all proposed projects prior to the issuance of decision by the Royal Government;
- To ensure the rational and sustainable preservation, development, management and the use of the natural Resources of the Kingdom of Cambodia;
- To encourage, and provide possibility to public to participate in the protection of environment and- the management of the natural resources; and
- To suppress any acts this may affect to environment.

Relevant to law on natural resource management that it has required to all the firms have to prepare the report on initiative environmental impact assessment (IEIA) or the report environmental impact assessment (EIA). Rely on this law is showing that in article 6 and 7 of chapter 3 as following:

- ***Article 6:*** An environmental impacts assessment shall be carried out on every project and activity of either private or public and shall be examined and evaluated by the Ministry of Environment before it is submitted to the Royal Government for decision. This assessment shall also be applicable for those existing activities and those which are being under process and which their environmental impacts have yet not been assessed. Procedure for the environmental impact assessment shall be determined by Sub-decree following a proposal of the Ministry of Environment. Nature and size of the proposed projects as well as the existing activities and activities under process of both private and public which are subject to assessment of their environmental impacts, shall be determined by Sub-decree following a proposal of the Ministry of Environment.
- ***Article 7:*** Every Investment Project Application and proposed project which are submitted by the State, shall enclose with them a preliminary environmental impact assessment (IEIA) or environmental impact assessment (EIA) as stated the article 6 of this law. The Ministry of

Environment shall consider and make recommendations on the preliminary Environmental Impact Assessment or Environmental Impact Assessment to relevant competent bodies within a period as determined in the Law on Investment of the Kingdom of Cambodia

3.3 LAW ON ROAD, 2014

The Law on Road adopted by the National Assembly on 3 April 2014 at the second ordinary session of the five legislatures and approved by the Senate to its entire form and legality on 11 April 2014 at its extraordinary session of legislature and includes the following provisions:

- ***Article-1:*** This law has objective to management, development of roads infrastructure sector and to ensure the road traffic safety in the Kingdom of Cambodia.
- ***Article-2:*** This law has the following aims:
  - To protection of public property, protection and enhance of roads quality, maintaining orders, facilitate of the roads traffic and roads transportation.
  - To determine the policy, strategy, and developing plan for the construction, repair, and maintenance of roads infrastructure including to set up measures and technical regulations
  - To promoted and encourage the private sector to participant in the construction, repair, maintenance, and developing of roads infrastructure
  - To promoted cooperation and integrations of the nation, region, sub-region, and worlds on the roads infrastructure sector
  - To encourage for conduct research program on roads technique and to transfer of new technique for the roads infrastructure development in the Kingdom of Cambodia
  - To development of human resources in roads infrastructure sector in the Kingdom of Cambodia.

- ***Article-3:*** The scope of this law shall be applied to all the activities relevant with roads infrastructure sector in the Kingdom of Cambodia.

- ***Article-10:*** The competent authorities of road management shall develop a road master plan development, project design and prioritize projects for road construction, rehabilitation, improvement, upgrading, expansion, and maintenance as well as for other roads infrastructure development activities to propose the approval from the Royal Government.

Formalities and methodology for the road development planning, project designing and project prioritization shall be determined by a Join-Prakas of the Minister of the Ministry of Public Works and Transport and the Minister of the Ministry of Rural Development.

- ***Article-11:*** All the road construction, road expansion, interchange, intersection, overlap roads, bridges, overhead space above, overpass bridges, underground or tunnels, culverts, ground water, road ground or overhead railroad, and particularly road within daily traffic congestion, a public dissemination and draft construction project plan shall be made available to relevant competent authorities. In this case, if the legal ownerships are affected by the planned road construction or expansion project, owners may receive fair and just compensation as provide for in the law on expropriation.

3.4 LAW ON EXPROPRIATION, 2010

The Law on Expropriation adopted by the National Assembly on 29 December 2009 at the third ordinary session of the four legislatures and approved by the Senate to its entire form and legality on 12 March 2010 at its extraordinary session of legislature and includes the following provisions:

- ***Article-1:*** This law aims to define an expropriation in the kingdom of Cambodia by defining the principle, mechanism, procedures of expropriation and fair and just compensation for any construction and rehabilitation, and public physical infrastructure expansion project for the public and national interest and development of Cambodia.
- ***Article-2:*** This law primarily aims to:
  - Ensure just and fair deprivation of legal right to private property,

- Ensure a fair and just compensation in advance,
- Serve the nation and public interest, and
- Develop public physical infrastructures.

- ***Article-7:*** The state is the only party who carries out expropriation for public and national interest purpose. The expropriation is applied to complete the requirements for public interests, and for national, economic, and social development.

  The expropriation can be carried out only if it is for implementing a project as set out in Article 5 of this law.

- ***Article-9:*** The expropriated immovable property shall be used for the anticipated purposes as declared on expropriation for public interest or for the requirements for national interests only, and shall not be left unused without reasons or transferred to a third party for private interest purposes.

  The owner or rightful owner shall be given priority to buy the rest of the required immovable property with the compensation rate. If the owner or rightful owner refuses to accept the rest of the required immovable property, it shall be kept as state property.

- ***Article-11:*** Before exercising any expropriation, the government shall prepare enough annual budgets, and grant credit fully and timely to the Expropriation Committee in according to the proposal submitted by Ministry of Economy and Finance for payment of compensation to the immovable property's owner or rightful owner affected by the expropriation.

3.5 WATER RESOURCE MANAGEMENT LAW OF KINGDOM OF CAMBODIA, 2007

This law was adopted on May22, 2007 by the National Assembly of the Kingdom of Cambodia during the 6th session of its third legislature, and promulgated on June 29, 2007:

- ***Article 1:*** The general purpose of this Law shall be to foster the effective management of the water resources of the Kingdom of Cambodia to attain socio-economic development and the welfare of the people,

This law shall determine:

- The rights and obligations of water users,
- The fundamental principles of water resources management,
- The participation of users and their associations in the sustainable development of water resources.

- ***Article 2:*** In this Law, unless the context otherwise requires,
  - **"Water" and "water resources,"** means surface, underground and atmospheric water;
  - "**Water resources**" means sea, river, tributary, stream, waterfalls, canal, lake and swamp, pond, reservoirs or storage.
  - **"Groundwater"** means water held within a saturated soil, rock medium, fractures or other cavities within the ground;
  - **"Aquifer"** means a geological formation where underground water accumulates;
  - **"Basin"** means a geographical area determined by the watershed limits of the system of waters, including surface and underground waters;
  - **"Sub-basin"** means part of a basin;
  - **"International rivers"** means rivers geographically situated in the territory of two or more states;
  - **"Banks"** of a river, stream, canal, lake and reservoir shall mean the land normally inundated by the water contained in such river, stream, canal, lake or reservoir, together with such soil, rock or any other material immediately adjacent thereto, but does not include any land beyond that land, soil, rock or other materials, which" is occasionally inundated by such water;

- **"Shore"** of sea, river, tributaries means the land covered with sand or soil, and declining towards the water in a body of water, occasionally inundated by such water;
- **"Beds"** means the portion of land delimited by the banks of a river, stream, lake, canal or reservoir, and normally covered by water;
- **"Public purpose"** refers to urban and rural water supply, food production, hydro-power generation, navigation, industrial development and the maintenance of minimum flows for ecological, cultural and religious purposes and the preservation of aquatic life;
- **"Waterworks"** means dams, weirs, canals, drains, reservoirs, tanks, cisterns, intakes, dykes, embankments, wells, boreholes, tunnels, conduits, pipes, sluices, plants, pumps, and such other structures or installations as are constructed, or used for the purpose of diverting, storing, conveying, abstracting, using, conserving and protecting water resources, for land drainage purposes, or for the prevention and mitigation of the effects of floods, and of other water-related emergency situations.
- **"license"** means the permit document which confers to a person the right to use water and water resources;
- **"Person"** means any physical or juridical person, whether private or public

- ***Article 3:*** All water and water resources are owned by the State.
- ***Article 4:*** Water and water resources shall be managed and developed based on an integrated water resources management (IWRM).

  The IWRM shall take into account:

  - all aspects of water resources;
  - linkages between water resources and other components of the natural environment;
  - Requirement for an effective and sustainable water use for human being, environment and other sectors.

The implementation of the IWRM shall be carried out jointly and within a cooperation framework of all relevant agencies.

- ***Article 5:*** The MOWRAM is mandated to manage, lead and supervise the implementation of the present law. The MOWRAM shall conduct consultation with other concerned ministries. In case of need, the Royal Government of Cambodia shall set up a joint commission for addressing and coordinating works and activities among the Ministries concerned.
- ***Article 11:*** Every person has the right to use water resources for his/her vital human need including drinking, washing, bathing and other domestic purposes including watering for animal husbandry, fishing and the irrigation of domestic gardens and orchards, in a manner that will not affect other legal right of others. Amount not exceeding that necessary to the fore-mentioned uses are not subject to the licensing.
- ***Article 12:*** The diversion, abstraction and use of water resources for purposes other than those mentioned in Article 11, and the construction of the waterworks relating thereto, are subject to a license or permit.

The formality for license application shall be provided for by the Government sub-decree.

The extraction of sand, soil, stones, gravel, petroleum and gas from the beds and banks of watercourses, lakes, canals and reservoirs is also subject to licensing. The technical hydrological formality shall be detailed in the Government sub-decree. .

The filling of river, tributary, stream, natural lakes, canal, and reservoirs shall subject to license or written authorization. Its formality shall be provided for in the Government sub-decree.

The diversion of water from the Kingdom of Cambodia territory shall be permitted and agreed by the Royal Government of Cambodia with due ratification by the legislative bodies.

- ***Article 14:*** Prior to granting water use license to any person, the MOWRAM shall consult with the other agencies and the local authorities concerned on the water utilization and the construction of waterworks proposed by the applicant.

- ***Article 22:*** The discharge, disposal or deposit of polluting substances which are likely to deteriorate the quality of water and to endanger human, animal and plant health shall be subject to water license or authorization.

The fore-mentioned polluting substances and the technical standards for handling them shall be determined by the Government Sub Decree.

In performing this Article, the MOWRAM shall consult with the concerned ministries.

- ***Article 23:*** The MOWRAM may declare contingency or protected "water use" zones in the following cases:
  - when surface or underground water sources seriously affect their quantity, quality or ecological balance;
  - when watershed is degraded by human activities or natural cause;
  - When water is hazardous to the people health.

The geographical scope of such zones shall be established on a case-by-case basis by way of the MOWRAM regulations.

- ***Article 32:*** All disputes relating to the establishment and operation of servitude in water use shall be mediated by the MOWRAM, and other Ministries concerned and Local Authorities.
- ***Article 35:*** The Royal Government may grant a reward or incentives to those who engage in research on, or the development of, new technologies, installations of modern equipment, that will contribute to the reduction of waste and improvement in water quality, and increase water use efficiency.

The criteria and modalities for the granting of rewards or incentives shall be defined by the MOWRAM regulations.

- ***Article 38:*** In addition to the provisions in the preceding Articles, the perpetrator shall remove all kinds of works constructed in violation of this Law, and to repair and restore the status quo of the sites, and all equipments and machinery will be confiscated as the state property.
- ***Article 40:*** All legal provisions inconsistent with this Law are hereby repealed.

3.6 LAW ON FISHERY, 2006

This law was adopted on March 30, 1997 by the National Assembly of the Kingdom of Cambodia during the 4th session of its third legislature, and promulgated due to Preah Reachrom no. ns/ rkm /0208/007, Enacted on February 15, 2008 which related to the project as below:

- ***Article 1:*** This law aims to ensure fisheries and fishery resource management, enhance aquaculture development, the management of production and processing, and to promotion the livelihood of people in local communities for the social-economic and environmental benefits, include the sustainability of the conservation of biodiversity and natural culture heritages in the Kingdom of Cambodia.
- ***Article 2:*** This law extends the implementation to all fisheries whether it is natural, artificial and aquaculture.

The state ensures the rights on traditional use of fishery resources for local communities under the regulations of this law or other related law.

- ***Article 3:*** The fishery management shall be under the jurisdiction of the Ministry of Agriculture, Forestry and fisheries.

The management of Riverside vegetation and mangrove forest which cohere to lifecycle of fishery resources shall be under the extent of this law.

The state provides the management rights of natural protected areas to the Ministry of Environment under regulations of the law on the establishment and delimitation of natural protected areas, and the law on environmental protection and natural resources management and other legislative norms.

The Ministry of Agriculture, Forestry and Fisheries has right to cooperate in law enforcement to all illegal fishing activities, which happened in natural protected areas by coordinating with the Ministry of Environment according to the regulation stipulated in chapter 14 of this law. These activities will not

affect the management competency of the Ministry of Environment as stipulated in the law on environment protection and natural resource management.

- ***Article 4:*** Fishery resources include inter alias any freshwater and marine organisms, living or non-living fauna and flora for example fish, mollusk, amphibian, insect, reptile, mammal and other invertebrate that get fertilized in water, plankton, seaweed, sea grass, coral reef, Riverside vegetation including mangrove etc.
- ***Article 22:*** Disposing, discharging, dumping or littering toxic substances (solid or liquid) in fishery domain, which were determined by law and other juridical legislations of the Kingdom of Cambodia, and Conventions or agreements, or any activities that cause toxic or harm to aquatic animals shall be prohibited.

3.7 LAW ON TRAFFIC, 2006

The law is adopted by the National Assembly of the Kingdom of Cambodia on 20th December 2006 on the fifth National Assembly Meeting session of the third legislature, and promulgated:

- ***Article 1:*** Driving of all kinds of vehicles in the Kingdom of Cambodia has to be adhered to the right- and side.

All vehicles, which are moving along the roads, MUST have drivers.

- ***Article 5****:* In order to carry out the traffic law, the following terms have to be defined:
  - The word “Road” refers to the whole size of the trunk/torso of the road and the roadsides
  - The word “Trunk of the road” is part of the road left for all kinds of vehicles to traffic.
  - Roadsides are parts of both sides of the trunk of the road located outside the cities and towns (densely populated area) and that it can be parked if necessary
  - Sidewalks are the roadsides in cities or towns, which are prepared for pedestrians. The sidewalks are not allowed for vehicles to park.
  - The word “Traffic lane” is part of the road separated by dotted or long lines along the road, with enough width for all kinds of vehicles to traffic in one row.
  - The word “Town” refers to the place where buildings or houses are closely constructed with each other, and that the exit or entrance there are placed with the signs or names of cities or towns to show the entry or the name of cities or towns with the red lines to show the exit from cities or towns via roads and with many people trafficking.
  - The word “junctions” refers to the places where two or more roads are converged with one flat and are not defined by the angle of the axis of the road. The junctions have different shapes such as **+, X, T, Y or roundabout** etc.
  - The word “Roundabout” refers to the junctions of two or more roads, and that in the central part, it has the terrace or sculpture or other monuments and has one-way road surrounded with arrow signs for traffic direction.
  - The word “public road” refers to the roads offer for public trafficking.
  - The word “private road” is the road built by private, which is divided into two following species:
    a) The private road for public traffic is the road, which is open for general traffic and isbuilt or repaired by the private in accordance with the contract with the state.
    b) The private road, which is not open for public traffic, is the road preserved for the work in any compounds of the house, factory, enterprise, building, or square.
  - The word “trail” refers to the land road connecting national/provincial roads to villages or communes in rural areas
  - The word “Stop” refers to the state of motionlessness of vehicles on the road for a necessary moment in which the driver is still in or nearby the vehicle in order that the passengers or other vehicles pass by or stop for loading and unloading goods or passengers.
  - The word “Parking” refers to the leaving of vehicle in the state of motionlessness in long or short period in which the driver can leave the vehicle alone.

- The word “Driver” refers to the person who commands vehicle including the animal rider, animal carrier on the road.
- The word “Vehicle” refers to the vehicles for transporting/carrying people or goods on the rood or for towing or is towed by the other.
- The word “Motor vehicle” refers to any vehicles with machine, which traffic on the road, such as motorbikes, tri-wheel motorbike, cars, tractors, and other tools equipped trucks.
- The word “tools equipped trucks” refers to the special trucks equipped with additional mechanical tools without loading any persons or goods out of its driver’s room such as the cement mixing trucks or any trucks serving for the construction of roads, bridge etc.
- The word “road user” refers to the vehicle drivers or any pedestrians who are travelling on the roads.
- The word “net weight” of vehicle refers to the purely weight of vehicle regardless of human or goods weights but with fuels to support engines, repairing tools and the spare tires.
- The word “Maximum loading weight” of vehicle refers to the sum of loading weights of both human and goods which was defined by factories manufacturing the vehicle.
- The word “Total maximum weight” of vehicle is the sum of the net weight of vehicle and the maximum loading weight of the vehicle. If the vehicle has the cart, the total maximum weight of the vehicle is the sum of total maximum weight of each vehicle (weight of vehicle plus weight of cart)
- The word “Total permitted maximum weight” of vehicle is the sum of the net weight of the vehicle with the weight of human or goods loads. If the vehicle has the cart, the total permitted maximum weight of the vehicle is the sum of total maximum weight of each vehicle.
- The word “Total actual weight” of vehicle is the sum of net weight of the vehicle with the actual weight of human and goods loads.
- The word “Remorque or cart” refers to the vehicle which is towed by the motor vehicle.
- The word “Semi-Remorque” refers to the vehicle which is towed with the motor vehicle engine.

- ***Article 6:*** Traffic signs comprise of the signs placed along the roads, traffic lights and traffic lanes on the roads, the traffic direction of the traffic agents and other signs. The traffic signs, traffic lights and traffic lanes on the roads are arranged in a coherent system at the important places to make it easier for the roads users. The impermanent danger signs along the roads are placed in an appropriate distance according to the type of roads, rank of road and the condition of road for which the drivers can be able to take precaution. Sticking papers or other things or drawing on the traffic signs or using the traffic sign supporting frames or other things used as the traffic signs are prohibited as these acts would cause the driver(s) from seeing the traffic signs clearly or understand the meaning of the traffic signs improperly, or for they would blind the driver’s eyes. The pictures and meaning of the land traffic signs are defined in Prakas (regulation) of the Ministry of Public Works and Transport.
- ***Article 7:*** The direction signs of the traffic police are as follows:
  - The right hand raised up in the air with the palm opened straight to the vehicles that aremoving toward the traffic police as the precaution signs to a stop except any drivers who cannot afford to stop safely can go ahead.
  - Two hands or one hand are or is stretched along the shoulders, means to stop the vehicles that are moving toward the traffic police or coming behind the traffic police.
  - In the same gesture, the vehicles that are moving from the left or right hand sides of the traffic police are allowed to pass through.
  - When the traffic police carry a red light lamp or a red light stick to point to any vehicles, it means to stop that vehicle from moving.
  - The traffic police can use a whistle instead of the above body signs.
- ***Article 8:*** The levels of priorities are defined as follows:

  1. The traffic signs have the priority over the traffic regulations.

2. The traffic lights have the priority over the traffic signs.
3. The direction signs of the traffic police have the priority over the traffic lights, the traffic lanes on the roads, the traffic signs along the roads, and the traffic regulations.

- ***Article 9:*** The drivers of all kinds of vehicles should implement and follow the following measures:

1. All drivers who drive the vehicles with the cylinder size from 49 cm3 upward must obtain the driving licenses according to the species of vehicles.
2. When driving, the drivers must always be precautious and that they should be in the easy-to-drive situation and fast particularly the possibility to move without any disturbances. Passengers, goods or other things loaded must not block the drivers' sight.
3. The drivers and passengers who sit at the front seats of the vehicles must wear the safety seat belts.
4. The drivers who drive motorcycles, tricycles and the motorcycles with trailers/Remorque must wear safety helmets.
5. No passengers or goods are allowed to load in front of the driver.
6. Children under 10 years are not allowed to sit in the front seats of vehicles without the accompanying adults or without wearing the seat belt.
7. Babies under 10 months of age must put inside the baby seat and wear with the safety belt tied firmly to this baby seat with the car's backseat.
8. Children in the age of 10 months up to 4 years must sit in the baby seat with the safety belt tied up to this seat to the backseat of the car.
9. No interruption to the road side residents and the road users.
10. The drivers are prohibited from drinking the liquor with the alcoholic rate from 0,5 mg per liter of gas or from 0,25 mg per liter of blood.
11. The vehicles with caterpillar tracks are banned from being driven on the roads. These kinds of vehicles must be transported on the vehicles with rubber tires.
12. Telephones are banned from being operated during driving. The telephones can be operated when they are connected to the communication equipment, or the drivers must stop the vehicles to operate the telephones.

- ***Article 10:*** On the roads with two traffic directions without the traffic lane, the drivers must use the middle part of the roads on the right hand side and keep driving on the right hand side. On the roads with one traffic direction without the traffic lane, the drivers must drive on the right hand side except when turning left. The drivers can only use the middle part of the roads on the left – hand side when overtaking or stopping. But in the densely-populated areas, the use of the middle of the road shall be determined by the direction of the Ministry of Public Works and Transport.
- ***Article 12****:* When the traffic light indicates in yellow, it is the sign to prepare to stop or to go forward, When the traffic light is green, it is the sign to depart. When the traffic light is red, it is the sign to stop. When the traffic light is red, it is the sign to stop, the drivers must stop in front of the white zebra lines crossing the width of the roads or in front of the lines assigned for pedestrians, If there is no obstacle a head, the vehicles on the most right hand side can turn right at the red light corners where there are signs to allow turning right.
- ***Article 14****:* The drivers must not drive side by side on the roads or the same path of the roads. The drivers must not drive passing through the military or police convoys or other kinds of convoys.
- ***Article 17:*** The driving speeds of vehicles are defined in accordance with the conditions as follows:

1. The driving speeds for vehicles in general:
   A. In towns:
   - The drivers of all motorcycles and tricycles must drive in the maximum speed of 30 km per hour
   - The drivers of all kinds of cars must drive in the maximum speed of 40 km per hour

B. Outside towns:

- The drivers of all kinds of vehicles must drive in the maximum speed of 90 km per hour, except for the trucks with the net weight of over 3.5 tons is limited with 70 km per hour and the maximum speed of the vehicles with trailers is limited with 60 km per hour

2. The driving speeds for the vehicles loading with dangerous substances:

A. In towns:

- The drivers of motorcycles or tricycles must drive in the maximum speed of 30 km per hour.
- The drivers of vehicles must drive in the maximum speed of 40km per hour.

B. Outside towns:

- The drivers of the vehicles must drive in the maximum speed of 70km per hour for the vehicle with net weight not over 3.5 tons and vehicles with net weight over 3.5 tons using the braking system to hold the tires from stiffness.
- The maximum driving speed of the vehicles with the maximum net weight of over 3.5 tons is 60 km per hour only those vehicles without the braking system to hold the tires from stiffness.

3. The driving speeds for the vehicles driving on the motorways:

A. In towns:

- The drivers of all species of vehicles must drive in the maximum speed of 60km per hour.

B. Outside towns:

- The drivers must drive in maximum of 100 km per hour for all species of vehicles, except for the trucks with maximum net weight over 3.5 tons will be limited to 80km per hour and that the vehicles with trailers will be limited to 70km per hour in the maximum.

4. Driving speed for vehicles with priorities:

- The regulations stated in Point 1 and 2 of the Article do not apply to the drivers who drive the police, military, military police vehicles, fire engines, ambulances, and some other vehicles equipped with sirens and special light signs on duty.

- The drivers must not drive in an abnormally slow speed without proper reasons because it disturbs other vehicles. The drivers who drive in a slow speed must stay on the right hand side by leaving the other drivers who drive in a high speed to be able to overtake easily on the left hand side. Any drivers who are forced to slow down in an abnormal manner must alert the other drivers by using emergency light signs and keep driving on the most right hand side of the roads.

- ***Article 19****:* A vehicle moving behind another vehicle must keep an adequate safety distance to avoid crashing with the front vehicle when it slows down or stops unintentionally. When driving in a higher speed, this kind of safety distance must be kept as far as possible. When driving in a row and in the same speed outside towns, all vehicles with the maximum net weight over 3.5 tons or with the length over 7 m must keep a distance from one vehicle to another at least 50 m.

- ***Article 21:***

Passing:

1. The drivers of all kinds of vehicles must pass each other by keeping driving on the right hand side respectively.
2. Before passing each other, both drivers must feel confident that the move does not lead to any danger.
3. To pass each other, the drivers must drive on the right hand side respectively by leaving the paths of the roads on the left hand side unoccupied as big as possible.
4. When passing each other at the narrow roads or the roads that could lead to danger, the drivers must slow down their vehicles respectively. If it is necessary, both vehicles must stop. If the two vehicles are in the same type, the vehicle that wants to go first must give a request signal by raising the hand up in the air or by honking during the daytime and using the low and high beams as a signal at nights and then wait until the vehicles coming from the opposite give a signal of approval before starting to go first. But if the vehicles are in the different type, the drivers of the bigger vehicles must leave the paths of the roads to allow the smaller vehicles to go first. 5. When passing each other at the narrow roads that are accessible only for one vehicle and there is a place that can be used to pass each other, the vehicle that arrives first at the place must stop and wait in order to allow the other vehicle to pass easily.

6. In case the paths of the roads are very narrow and the vehicles cannot pass each other and one of the vehicles is required to go backward, the drivers must act as follows:
   A. for the vehicles that are in the same type, any vehicle that wants to go first must give a requested signal and that it is agreed by the other vehicle to go backward.
   B. for the vehicles without and with trailers, the vehicles without trailers must go backward.
   C. for the light and heavy vehicles, the light vehicles must go backward.
   D. for the goods loading vehicles and passenger vehicles, the goods loading vehicles must go backward.
7. When passing each other at the slope and narrow roads, the vehicles going down the slope must stop and allow the vehicles going up the slope to go first.
8. When passing each other, if any vehicle drivers see that there is an obstacle ahead such as the road is damaged or a vehicle is stopping, that vehicle must stop and allow the other vehicles to go first.
9. On the narrow bridge that is accessible only one vehicle, the heavy vehicles must allow the light vehicles to go first.
10. Before passing each other at nights outside towns without lights along the roads, the two vehicles must turn off the high beams and turn on only the low beams.

- ***Article 24:*** *Stop and park on public road:*

1. All kinds of vehicles or animals that stop or park have not to make problem to the other vehicles, which are making the traffic.
2. in town, all kinds of vehicles have to stop or park along the traffic direction that they are trafficking by implementing the regulation as following:
   A. on the road with two traffic directions, the drivers of vehicles have to stop or park on the right hand side in accordance with their traffic direction.
   B. on the one-way road, vehicles have to be stopped or parked in the right or left hand side along with the traffic direction except having the opposite sign.
3. Outside town, the vehicles or animals have to be stopped or parked outside the middle lane if it is possible. If there is no place for parking besides the middle lane, the drivers have to carry out the regulation, which is provided in point 2 of this article.
4. At night or at the place where there is “no stopping/parking” signs, all vehicles and carts, which are malfunctioned or which are forced to stop or park on the middle lane, have leave the signs in the appropriate distance for information for other road users.
5. In town, the vehicles have to be stopped or parked for carrying or loading or unloading goods or passengers not beyond 25 centimeters from the sidewalk and at least 5 meters from the junction or interjection or the curved road and at least 10 meters in between the junctions or intersections or the curved roads of the boulevard. When outside town, all vehicles have to be stopped or parked at least10 meters away from the junctions or intersections or the curved roads.
6. For the parking, before leaving the vehicle, the drivers have to put handbrake or other measures to prevent the eventual accident from occurring while they are absent.
7. Parking or stopping the vehicles or animals is prohibited in the following cases:
   - On the middle lane and sidewalk preserved for pedestrians and leave at least 5 meters away from the crossroad sign for pedestrians or on this line.
   - On the place preserved for some kinds of vehicles parking or stopping.
   - Between the edge of the middle land of the road and dotted line land, if in between the lines and the parked vehicle is less than 3 meters which does not enable another vehicle to pass through without crossing the long line.
   - Near the pole of traffic light or traffic signs, that prevents the road users from seeing these traffic signs.
   - In all the places where the vehicles block the entrance or the parking of others vehicles.

- On the bridge, underpass, underground road, steep road, junction road, on the road crossing the railway, roundabout, curved road in which others vehicles cannot be seen from the distance.
- Less than 20 meters in front of the road crossing the railway.
- Less than 10 meters between the front and the rear pump station of the fire engine and in front of fire engine station
- On the entrance and exit of public building.
- In front of the entrance and exit of private house except the vehicle of house's owner.
- In two parallel lines.
- On the edge of the middle of the road if another opposite edge is left for parking of vehicle except in the case that the vehicles can park on both sides.
- At the place where there are no parking/stopping signs.
- On the public road beyond 72 hours.
- Less than 10 meters between the front and the rear of the bus stop sign.
- Less than 1 meter between the front and the rear parking vehicles or the long row of the parking vehicles
- Near the junction road or turning road.

- ***Article 25:*** Opening the vehicle's door to get off or in can be conducted when it does not cause the accident to the others who are using the same road and have to pay attention constantly, especially to the opening of the left door when get off or in.

- ***Article 28:*** At night or day time, when could not see clearly such as during the heavy raining, fogging, or passing through underground road, the drivers on the road have to use vehicle light as following conditions:

1. In case in the time of driving the vehicles:

   A. Far-light (high beam) light is generally used at night time on the road without electric lamps, to look far ahead but the driver has to be careful not to interfere with other vehicles coming in opposite direction. The far-light is prohibited to turn on in city or town where there is enough light of electric lamps, except in the case of giving signal for overtaking or making way by using both high and low beams.

   B. Low beam light is used in the following cases:

      - At night time inside and outside towns where there is light of electric lamps on the road
      - At night time outside town where there is no light of electric lamps on the road, in the case of being about to pass another vehicle, and when driving close after another vehicle.
      - At day time when could not see clearly due to bad weather such as heavy rain or foggy.
      - Normal light (low beam) can be used alternatively with far-light (high beam) as the signal to replace the horn at day time

   C. Location light: At night time in town, all vehicles, which are being driven, at least have to have the location lights without using normal light (low beam light) if there is enough light of electric lamps on the road. The location light is used for indicate the presence of vehicle and the size of the vehicle to other road users in opposite direction.

   D. Other lights: At night or day time when the weather is not good and cannot see clearly ahead, the drivers have to use:

      - Red light: To tell the presence and width size of vehicle to users who look from back side
      - Number plate light: To let the other see the number plate of the vehicle clearly from the back side
      - Width light of vehicle: To indicate the width of vehicle or other loadings to other road users
      - Sidelight (or traffic indicator light): To inform other road users when changing direction to left or right

- Reversing light: To inform other road users behind the vehicle when it moves backward
- Stopping light: To inform other road users behind the vehicle when braking to slow down or stopping the vehicle
- Emergency light: To inform other road users about accident, which might occurs, for example, when the drivers are forced to drive the vehicles slowly due to the towing of the broken vehicles or when loading heavy objects at night time or parking on the road outside town because the vehicles were broken or related to accident or because of the dropping of goods that cannot be re-loaded immediately.
- Foggy light: is used when there is fog or heavy rain. Foggy light can be used instead of the normal light (low beam) light or in addition to the normal light.

2. In the case of driving vehicles, which are not the motor vehicles, drivers have to carry out the following regulation:
   - The human-driven cart must equipped with lights or white or yellow reflectors in the front end and the lights or the red reflector in the back. The two lights must put in the corner facing the road.
   - The animal-driven cart must equipped with lights or two white or yellow reflectors in the front corners in both sides and also must equipped with lights and two red reflectors in the back corners in both sides.
   - The bicycle and tricycles must equipped with lights or at least with one white reflector in the front end and at least have one red reflector or red light in the back.
   - The trailer/remorque driven by motorcycle or bicycle must equipped with the reflector or two red lights placed in the two sides of the back corners.
   - This kind of vehicle must park or stop in row close to the roadside
3. In the case of stopping or parking motor vehicles on the road, which has no public electric lamps, the drivers have to use:
   - Location light: To inform other road users from the opposite direction about the presence and the width size of the vehicle
   - Red light: To inform other road users from the back about the presence and the width size of the vehicles
   - Number plate light: To let other road users behind the vehicles to see the number plate clearer. In town, the use of light, which is provided in this article, will not be necessary if there is the light of electric lamps on the road with enough light, which enable the road users to see the vehicles clearly from a proper distance.
4. In the case of parking the trailers or semi-trailers which were disconnected from the vehicles, it has to be parked near sidewalk or roadside and must use the white or yellow lights in front of vehicle and one red light in the back of vehicle. Each light has to be placed at the corner of the cart facing to the road that the trailers are parked along in rows.

In town, the use of this light is not necessary if there is enough light of electric lamps on the road that other road users can see the parked vehicles on the road from a proper distance.

5. In case the vehicles are forced to stop or park on the road, which can provoke obstacle or traffic accident such as near junction road, turning road, curved road, steep road, and road crossing railway, as because of the vehicles did not work or related to the traffic accident and cannot be removed from the road, the drivers have to inform other drivers about the obstacle by using emergency light or placing triangular sign at least 30 meters behind the vehicles. For vehicles dropping goods on the road, which cannot be re-loaded immediately, the drivers have to make the sign or inform other drivers by using triangular sign simultaneously with emergency light or at least using any triangular sign by placing 30 meters from the dropped goods.
6. For vehicles used for police, military or military police, fire engines, and ambulances, the drivers have the right to use special light all the times.

- ***Article 35:***

- All traffic accidents are under the competency of the traffic police.
- Every time when having traffic accidents, the traffic police must try their best to:
  1. Keep the public order at the accident scene.
  2. Take immediate action to save the victim
  3. Take the skilful action to collect the evidence and information to make the statement on the traffic accident.
  4. Maintain security for all related parties
  5. Record all identities and addresses from all involved parties
  6. Settle the dispute caused from the traffic accident in accordance with the stipulated law.

- ***Article 38:*** In case people are getting injuries or killed, the drivers or other road users involved in the accident or the by-standers shall do as the following:
  1. Must report immediately to the nearby local authorities or the traffic police.
  2. Must prepare the information or refer the victims to the nearby hospital. Denials from the drivers of all species of vehicles to the referral request are not accepted if inappropriate reasons are raised.
  3. To collaborate in ensuring the security to all related parties and to the process of the traffic movements around the accident site.
  4. Avoid changing of the accident site or loss marks or tracks which is very useful leading to the finding of person responsible for the accident.
  5. Keep waiting at the accident site until the arrival of the traffic police. The accident provokers are not allowed to leave the place before obtaining the permission from the traffic police.

- ***Article 51:*** All automobiles, trailers, or semi-trailers doing transportation business shall obtain the permission letter issued by Ministry of Public Works and Transport.

The permission letter for transportation business is valid for one year. The owners of the vehicles shall extend the validation for every year; it shall be fined if found of being late. Ministry of Public Works and Transport shall issue the detailed Prakas on the issuance of permission letter to the Transportation Companies.

- ***Article 52:*** While transporting, each vehicle shall obtain the documents issued by Ministry of Public Works and Transport and the concerning institutions as follow:

  a) Vehicle identification card, and number plate;

  b) The correct driving license with the type of vehicle;

  c) Certificate of technical check up of the vehicle;

  d) Permission letter allowing the vehicle to do transportation business;

  e) Permission letter allowing to do transportation business;

  f) Insurance card issued by insurance company;

  g) Other permission letters issued by other competent institutions.

- ***Article 54:*** Carrying goods on vehicle shall not exceed maximum weight of the sustaining axles and shall not exceed the limited by the company producing the vehicles and shall not be over permitted weigh as follow:
  1. Maximum weight on the sustaining axle of automobile, trailers or semi-trailers is limited as fallow:
     - 6 tons for single axle with two wheels under the steering wheel;
     - 11 tons for twin axles with four wheels under the steering wheel;
     - 10 tons for single axle with four wheels;
     - 19 tons for twin axles with eight wheels;
     - 24 tons for triple axles adjacent to each others with twelve wheels.
  2. Permitted maximum total weigh of automobile is defined as follow:

- 16 tons for automobiles with twin axles which one axle is located in the front of the automobile with two wheels, and the other one located in the back with four wheels.
- 25 tons for automobile with triple axles as one axle is located in the front of the automobile where there are two wheels and the twin ones located in the back of the automobile where there are eight wheels.
- 30 tons for automobile with four axles as twin ones are in the front of the automobile where there are four wheels and the other two axles are in the back of the automobile where there are eight wheels.

3. Limitation of permitted maximum total weight of automobile with trailers shall be defined as follow:
    - 40 tons for automobile with trailers having five axles onward.
4. Limitation of permitted maximum weight of automobile with semi-trailers shall be defined as below:
    - 35 tons for automobile with semi-trailers having four axles as a single axle is located in the front of automobile where there are two wheels and the other single axle in the back of the vehicle where there are four wheels and the twin axles of the semi-trailers with eight wheels.
    - 40 tons for automobile with semi-trailers having five axles onward.

The total weighs of the automobile and the trailers or semi-trailers which are not included in points above shall be asked for permission letter from Ministry of Public Works and Transport.

When crossing the bridges, all drivers of automobiles, automobile with trailers, or semitrailers shall obey the permitted-maximum-weight signs put in front of the bridges.

The size of automobiles, automobiles with trailers or semi-trailers with no loading shall be defined as below:

- Maximum width of the vehicles shall not exceed 2.5 meters except vehicles equipped with tools should not be more than 3 meter width
- Maximum height should not be higher than 4.2 meters
- Maximum length of each automobile shall not exceed 12.2 meters
- Maximum length of the automobiles towing semi-trailers shall not exceed 16 meters
- Maximum length of the automobiles towing trailers shall not exceed 18 meters. Technical standard of size and weight of other species of vehicles shall be defined by Prakas of Ministry of Public Works and Transport.

3.8 LAW ON LAND, 2001

The land Law which was passed by the National Assembly of the Kingdom of Cambodia on July 20, 2001 during the sixth session of its second legislature, and its legal substances by the Senate on August 30, 2001 during the sixth session of its second legislature:

- ***Article 1:*** This law has the objective to determine the regime of ownership for immovable properties in the Kingdom of Cambodia for the purpose of guaranteeing the rights of ownership and other rights related to immovable property, according to the provisions of the 1993 Constitution of the Kingdom of Cambodia.
- ***Article 3:*** All persons shall respect the property of the State and legally acquired private property. The management of the cadastral administration of immovable property belonging to the State and the competence to issue titles related to immovable property throughout the Kingdom of Cambodia are under the authority of the Ministry of Land Management, Urban planning and construction.

The regulations and procedures for the administration of State immovable properties will be determined by sub-decree.

- ***Article 5:*** No person may be deprived of his ownership, unless it is in the public interest. An ownership deprivation shall be carried out in accordance with the forms and procedures provided by law and regulations and after the payment of fair and just compensation in advance.
- ***Article 7:*** Any regime of ownership of immovable property prior to 1979 shall not be recognized.
- ***Article 30:*** Any person who, for no less than five years prior to the promulgation of this law, enjoyed peaceful, uncontested possession of immovable property that can lawfully be privately possessed, has the right to request a definitive title of ownership.

In case the granting of a definitive title to ownership is subject to an opposition, the claimant has to prove that he himself fulfills the conditions of peaceful, uncontested possession for no less than five years over the contested immovable property or to prove that he purchased the immovable property from the original possessor or his legal beneficiary; or from the person to whom the ownership was transferred, or from their successors.

- ***Article 42:*** Notwithstanding the foregoing, any person who, due to ignorance or negligence, failed to register his possession has the right to the protections of Article 29, Article 30, and Article 31 of this law.
- ***Article 43:*** In no case can the public property of the State be the subject of acquisition of ownership. The situation of an occupant of State public property remains precarious and illegal if such occupation was not authorized in the manner determined by this law.

An illegal occupant shall be forced to vacate the premises immediately and shall be punished in accordance with Article 259 of this law.

An illegal occupant is not entitled to any indemnity for any works and improvements carried out on the immovable property.

- ***Article 58:*** A land concession can only be granted on lands that are part of the private property of the State.

The land concession may not violate roadways or transportation ways or sidewalks or their borders and the ground necessary for their maintenance, nor to waterways, pools, ponds and water reserves to be used by the people in their daily lives.

- ***Article 59:*** Land concessions areas shall not be more than 10,000 hectares. Existing concessions which exceed such limit shall be reduced. However, if such reduction would result in compromising the exploitation in progress, a concessionaire may obtain a specific exemption. The procedures for reductions and specific exemptions shall be determined by sub-decree.

3.9 LAW ON LABOR, 1997

This law was adopted on January 10, 1997 by the National Assembly of the Kingdom of Cambodia during the 7th session of its first legislature, and promulgated on March 13, 1997:

- ***Article 229:*** All establishments and work places must always be kept clean and must maintain standards of hygiene and sanitation or generally must maintain the working conditions necessary for the health of the workers.

The Ministry in charge of Labor and other relevant ministries shall prepare a Prakas (minis trial order) to monitor the measures for enforcing this article in all establishments subject to the provisions of this Chapter, particularly regarding:

- The quality of premises;
- Cleaning
- Hygienic arrangement for the needs of personnel;
- Beverages and meals;
- Lodging of personnel, if applicable;
- Work stations and the seating arrangements;
- Ventilation and sanitation;
- Individual protective instruments and work clothes;

- Lighting and noise levels in the workplace.

- ***Article 230:*** All establishments and workplaces must be set up to guarantee the safety of workers. Machinery, Mechanism, transmission apparatus, tools, equipment and machines must be -installed and maintained in the best possible safety conditions. Management of technical work utilizing tools, equipment, machines, or products used must be organized properly for guaranteeing the safety of workers. The Prakas covered in Article 229 shall also determine the measures for enforcing this article, particularly regarding:
    - Risks of falling ;
    - Moving heavy objects;
    - Protection from dangerous machines and apparatus;
    - Preventive measures to be taken for work in confined areas or for work done in an isolated environment;
    - Risks of liquids spilling;
    - Fire prevention.
- ***Article 246:*** The ministry in charge of Labor and the Ministry of Health shall issue a joint Prakas to determine:
    a- the organization and operation of the labor health services;
    b- the minimums time that the labor physician must devote to personnel at the establishments in question based on the size of their work force and the nature of their activities, as well as the physician' s mandatory tasks;
    c- The frequency and the content of the reports to be filed by the manager of the enterprise or by the representative of inter-enterprise services with regard to the organization, operation and financial management of the health service.
- ***Article 248:*** An accident is considered to be work related, regardless of the cause, if it happens to a worker working or during the working hours, whether or not the worker was at fault; it is the accident inflicted on the body of the worker, or on an apprentice with or without wage, who is working in whatever capacity, or whatever place for an employer or a manger of an enterprise.

  Equally, accidents happening to the worker during the direct commute from his residence to the work place and home are also considered to be work- related accidents as long as the was not interrupted nor a detour made for a personnel or non-work-related reason. All occupational illness, as defined by law, shall be considered a work-related accident and shall be remedied in the same manner.
- ***Article 249:*** Managers of enterprise are liable for all work-related accidents stipulated in the Article above regardless of the personal status of each worker.

The same liability applies:

- Directors of private hospitals, but solely for the personnel they employ
- Professionals, solely for their employees
- Craft shops, only for workers other than the wife and the children of the craft man
- Properly owners, only for their domestic workers
- Agricultural enterprises, for their workers

Apart from categories expressly mentioned in the preceding paragraph, any person who engages the services of a worker for a specific, occasional worker is required to make reparation for accidents that victimized the worker during the work.

- ***Article 250:*** Every manager of enterprise shall manage or have someone take all appropriate measure to prevent work-related accidents.

3.10 LAW ON THE PROTECTION OF CULTURAL HERITAGE, 1996

The Law on the Protection of Cultural Heritage adopted on 25 January 1996 by the National Assembly during the fifth session of its first legislature, which reads as follows:

- ***Article-1:*** The purpose of this law is to protect national cultural heritage and cultural property in general against illegal destruction, modification, alteration, excavation, alienation, exportation or importation.
- ***Article-2:*** The national cultural heritage comprises cultural property created or discovered on national territory.
- ***Article-3:*** This law shall apply to movable and immovable cultural property, whether publicly or privately owned, whose protection is in the public interest.

  Except as otherwise provided elsewhere in this law, it shall apply only to cultural property that forms part of the national cultural heritage.
- ***Article-4:*** For the purposes of this law, cultural property is considered to be any work produced by human agency and any natural phenomenon of a scientific, historic, artistic or religious nature which bears witness to a certain stage in the development of a civilization or of the natural world and whose protection is in the public interest.

  Specific cultural property is to be registered by *Anukret*.

3.11 LAW ON LAND MANAGEMENT, URBAN PLANNING AND CONSTRUCTIONS, 1994

This law was adopted on May 24, 1994 by the National Assembly of the Kingdom of Cambodia, and promulgated on August 10, 1994:

- ***Article 4:*** All documents related to the Land Management, Urban Planning and Construction shall be classified according to each specific case, and according to the particular conditions of the land of each province, municipality and region, in the spirit of protecting the patrimony, environment and protecting natural resources as well as development of the economy.
- ***Article 5:*** The Committee for Land Management, Urban Planning and Construction of Phnom Penh or the Sub-Committee for Land Management, Urban Planning and Construction of each province and municipality, shall respectively draw up their own development master-plans for the re-organization and development of their respective city, province and municipality. Such master-Plan shall be approved by the National committee for Land Management, Urban Planning and Construction and shall be determined by a Sub-decree.

In order to protect the patrimony and the environment, and to assure the economic development of any particular region specified by the Council of Ministers, the National Committee for Land Management, Urban Planning and Construction, shall have duty to prepare a specific master-plan for such special region and submitting it to the Council of Ministers for approval.

- ***Article 7:*** Land use master plan shall be clearly indicating the area to be allocated for national defence, agriculture, commerce, industry, handicraft, culture, tourism, religion, and administrative buildings and public facilities. These plans shall also specify of the possibility for construction.
- ***Article 8:*** Land use master plan shall comply with the development master-plans as stated in the article 5 of this law.
- ***Article 9****:* Land use master plans for each capital city, province and municipality, shall be first approved by the Committee for Land management, Urban Planning and Construction of the Capital City, or from the Sub-Committees for Land Management, Urban Planning and Construction of each province or municipality, and shall be approved subsequently by the National Committee for Land Management, Urban Planning and Construction. Private entities and public authorities shall strictly adhered to such master plan.
- ***Article 11:*** All the explorations or surveys which produce and effect on archaeology, shall be firstly authorized by the Royal Government.

In every construction process, in case encouraging any object which give value or advantages in archaeological or history, the supervisor of the construction shall be obliged to report to competent authorities. After receiving the report, the competent authority has to immediately stop such construction.

- ***Article 13:*** The work of construction and settlement shall be conducted in obedience with all documents relating to the organization of territory, urbanization and construction and to the master plans mentioned in the Article 4 and 5 of this Law.

- ***Article 14:*** All construction and modifying or renovations of the building aspect shall be subjected to construction permission issued by the competent authorities.

The necessary documents and plan shall be attached with the application for construction permit. The implementing procedure of this article shall be determined by a sub-decree.

3.12 ROYAL-DECREE ONTHE ESTABLISHMENT AND MANAGEMENT OF TONLE SAP BIOSPHERE RESERVE, 2001

Royal-decree number 0401/070 NS/RKT enacted April 10, 2001 on the Establishment and Management of Tonle Sap Biosphere Reserve. In this sub-decree have object as following:

- ***Article 1:*** Recognizing the unique ecological, environmental, economical, social, and cultural significance of Tonle Sap Lake, a Tonle Sap Biosphere Reserve is hereby established in accordance with the statutory framework of the World Network of Biosphere Reserve.

The Tonle Sap Biosphere Reserve shall fulfill three complementary functions:

a) a conservation function to contribute to the conservation of biological diversity, landscapes, and ecosystem, including genetic resources, plant, fishery and animal species, and to the restoration of the essential character of the environment and habitat of biodiversity;

b) a development function to foster sustainable development of ecology, environment, economy, society, and culture;

c) a logistic function to provide support for demonstration projects, environmental education and training, research and monitoring of environment related to the local, national and global issues of conservation and sustainable development.

- ***Article 2:*** In order to fulfill three complementary functions as articulated in article 1, the Tonle Sap Biosphere Reserve is hereby divided into core areas, a buffer zone and a flexible transition zone. Tonle Sap Biosphere Reserve, including the flexible transition zone is limited within the National Road N5 in the west, National Road N6 in the east, the confluence of National road N5 and N6 (13036'51 N, 103006'32E) in the north, and commune Saeb (12005'06N, 104043'59E), district Kampong Tralach, Kampong Chhnang province in the south. The map of Tonle Sap Biosphere Reserve and coordinates are attached in the annex 1 and annex 2 of the Royal Decree.

- ***Article 3:*** The three core areas are as the following:

1. Prek Toal Core Area is located in Koh Chiveang Commune, Ek Phnom District, Battambang province, and has the area of 21342 ha;
2. Boeng Tonle Chhmar Core Area is located in Peam Bang Commune (Stong District, Kampong Thum province) which has the area of 14,560 ha;
3. Stoeng Sen Core Area is located in Phat Sanday commune (Kampong Svay district, Kampong Thom province) and has the area of 6,355 ha.

The core areas are defined likewise national park or wildlife sanctuary, which are devoted to long term protection and conservation of natural resources and ecosystem, in order to preserve flooded forest, fish, wildlife, hydrological system, and natural beauty. Scientific researches, monitoring, and ecotourism are allowed here in the core areas. Management activities that would cause degradation and destruction of biodiversity are not permitted.

Fishing lots within the core areas of Tonle Sap Biosphere Reserve shall continue to function in accordance with the Fishery Law, while the fishing lot owners must be committed to the long-term conservation objectives as defined above. These fishing lots are then subject to a periodic review every four years and adequate reform in order to be consistent with long term protection and conservation objectives of the core areas.

The family and middle scale fishing located within the core areas shall continue in accordance with the Fishery law by organizing community fishery in order to enable local people to participate in the protection as prescribed by this Royal Decree.

- ***Article 4:*** The buffer zone covers the area of 541,482 ha. Its boundary corresponds to the outer boundary of the Tonle Sap Multiple-Use Area.

The buffer zone surrounding such core areas which are covered by flooded forest of a variety of species. Activities are managed to be consistent to the protection and conservation plan of the core areas. Fishery activities and other development plans will be managed based on existing law and regulations in a co-ordinated and cooperative manner. The buffer zone is also subject to experimental research and discovery of method for the management of flooded forest, fishery, agriculture, housing settlement, land use, water resources, navigation and tourism to ensure their sustainability, increased production, while preserving the environmental quality and fish.

- ***Article 5:*** The transition area covers an area of 899,600 ha, is limited between the outer boundary of the buffer zone and National Road N5 and National Road N6.

The flexible transition area is the integrated economic zone, which is managed for the sustainable agriculture, human settlement and land uses, without having adverse effects on the flooded forest, water quality and soils of the region around the Tonle Sap Lake.

3.13 SUB-DECREES ON ENVIRONMENTAL IMPACT ASSESSMENT PROCESS, 1999

Sub-decree on environmental impact assessment process, number 72ANK, Enacted on August 11, 1999. In this sub-decree is having objective:

- To determine the environmental impact assessment under projects and activities of private or public and it shall be monitored, and evaluated by ministry of environment. Before the royal government agree and approve.
- To determine type and size of projects, activities that it proposed and activities available and under process included private and public in the requirement need environmental impact assessment.
- To emerge public to participate in the process of environmental impact assessment and also got idea from participants for analyses in order to achievement for project progress.

In the annex of Sub-decree no. 72ANK, Enacted on August 11, 1999, described about categorizing that need to do environmental impact assessment that related with this project, it is an exploitation infrastructure no. **4.8 for ≥100Km** size of National Road construction.

3.14 SUB-DECREE ON THE MANAGEMENT THE RESERVED LAND ALONG THE NATIONAL ROAD AND RAILROAD OF THE KINGDOM OF CAMBODIA, 2009

Sub-decree number 197 ANK-BK enacted November 23, 2009 on the Management the Reserved Land along the National Road and Railroad of the Kingdom of Cambodia. In this sub-decree have object as following:

- ***Article 1:*** The goal of the Sub-decree is to determine the management and use of the pavements along national roads and railroads aligned with the development and growth of the Kingdom of Cambodia.
- ***Article 2:*** The objectives of the Sub-decree are as follows:
  - Eliminating the appropriation of pavements for the purpose of construction or planting;
  - Preventing road accidents and maintaining social order which frequently occurs on road channels;
  - Reducing any obstacles to road development;
  - Reducing all state expenditures on the settlement of the impacts on residents' housing along road channels;
  - Facilitating competent authorities involved in legalizing residents with ownership on road channels;
  - Ensuring sustainable physical infrastructure development in the Kingdom of Cambodia.
- ***Article 3:*** The scope of the Sub decree covers any national roads with 1 (one) digit and 2 (two) digits and railroads in the Kingdom of Cambodia, which is under the competency of the Ministry of Public Work and Transports.

The scope of the Sub decree does not cover development roads along the borders which are non-national road, national road in wildlife sanctuary and national parks, national roads in flora conservation

areas, rural trails, paths with a canal in between, all of which are under the management and responsibilities of the Ministry of Environment, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Rural Development, and the Ministry of Water Resources and Meteorology, and other national roads built by communes, districts, communities and residents.

- ***Article 7:*** Pavements on national roads and railroads are the state properties in compliance witharticle 15 of the law on land management.
- ***Article 8:*** Pavements shall be determined to serve physical infrastructure development as follows:
    - National road grade 1: Symbolized by a number with 1 (one) digit for the pavement located 30 (thirty) meters from both sides of the road;
    - National road grade 2: Symbolized by a number with 2 (two) digits for the pavement located 25 (twenty-five) meters from both sides of the road.

Pavements on the above 2 (two) kinds of national roads which cross the capital or city of a province or an urban area will be determined separately on the pavements on national roads of the capital and city of a province or an urban area.

- ***Article 9:*** Pavements on railroads shall be determined to serve physical infrastructure development as follows:
    - Pavements on railroads outside the capitals, towns, and urban areas shall be 30 (thirty) meters from both sides of the road axle.
    - Pavements on railroads in mountainous areas with falling rocks or in jungle shall be 100 (one hundred) meters from both sides of the road axle.
    - Besides, land surrounding rail stations shall be determined in accordance with the plan in force.

Pavements on the railroads which cross the capital or city of a province or an urban area will be determined separately from the pavements on the railroads of the capital and city of a province or an urban area

- ***Article 10:*** The determination of the above pavements shall be undertaken only once and remain the same in spite of further road development.
- ***Article 11:*** All line competent ministries-institutions shall not authorize any construction or cultivation along the pavements on national roads and railroads.

Some subsistence cultivation shall be authorized in principle by the Royal Government and shall be under contract with line ministries-institutions. In the event of road development, the state is not responsible for paying the compensation.

- ***Article 12:*** The Ministry of Public Work and Transports shall issue a Prakas or a notification to determine the use of the pavements on national roads and railroads to serve the public and private interest such as burying optical cable network, pure water pipe, setting up electrical poles, optical poles, and billboard pole, and other uses related to national roads and railroads.

  The Ministry of Public Work and Transports shall conduct a study to display the illustration board on the determination of the pavements on national roads and railroads instead of setting up pavement poles.

3.15 SUB-DECREES ON AIR POLLUTION CONTROL AND NOISE DISTURBANCE CONTROL, 2000

Sub-decree number 42 ANK.BK enacted JULY 10, 2000 on monitoring water and Air pollution. In this sub-decree have object as following:

- ***Article 1:*** This sub-decree has a purpose to protect the environment quality and public health from air pollutants and noise disturbance through monitoring, curb and mitigation activities.
- ***Article 2:*** This sub-decree applies to all movable sources and immovable sources of air pollution and noise disturbance.

- ***Article 4:*** Air quality standard shall be specified in the Annex-1 of this sub-decree. The standard of maximum quality of hazardous substance allowing in the air shall be specified in the Annex-2 of this sub-decree.
- ***Article 13:*** The emission of pollutants and noise from immovable source into the atmosphere shall be asked for permission from the Ministry of Environment and shall be sent the application form copy to concerned ministries and agencies.
- ***Article 15:*** The asking for discharge permission as stipulated in the Article 13 of the sub-decree shall be carried out for new project and ongoing activities, except projects that have the Environment Impact Assessment's report.
- ***Article 20:*** Ministry of Environment shall be taken sample at all emission points of pollution source. The master of person who responsible for pollution source shall collaborate the staffs of environment who conduct a sampling to fulfill their technical duty.
- ***Article 22:*** The owner or responsible person of pollution sources shall bear the cost of the cost of the analyses of his/her own sample following the tariff determined by the Ministry of Environment and the Ministry of Economic and finance. This income shall be included into the National budget in order to allocate to the Environmental Endowment Fund Account.
- ***Article 24:*** The owner or responsible person of pollution source shall:
    - Responsible for installing or equipping any equipment to purity toxic substances and to reduce noise and vibration in order to respond to Air pollution standard as stipulated in the Annexes.
    - Responsible for installing the equipment for measurement of amount of pollutant contained in his/her pollution sources and keeps the result for record keeping. The result must send to the Ministry of Environment every 3 months.
    - Have at least an environmental compromising and prepare environmental protection plan in their institution. Environmentalist shall list and recognized from the Ministry of Environment and have the capability as required by the Ministry of Environment.
- ***Article 26:*** The Ministry of Environment shall regularly control and monitor the situation of the air quality throughout the Kingdom of Cambodia in order to take measure to prevent and reduce the pollution.
- ***Article 30:*** Where if there is complaint or report that any source of pollution discharges contaminant into human health or public property. The Ministry of Environment in collaboration with concerned ministries may enter the site of this source of pollution and conduct inspection and take sample for testing.
- ***Article 31:*** In the case of serious accident or imminent danger resulting from air pollution at public water area, the Ministry of Environment shall make urgent inspection on the above problem and shall inform the concerned ministries and local authority.

ANNEX 1: Ambient Air Quality Standard

No	Parameter	1 Hour Average mg/m³	8 Hours Average mg/m³	24 Hours Average mg/m³	1 Year Average mg/m³
1	Carbon Monoxide (CO)	40	20		
2	Nitrogen dioxide (NO_2)	0,3		0,10	
3	Sulfur dioxide (SO_2)	0,5		0,30	0,10
4	O Zone (O_3)	0,2			
5	Lead (Pb)			0,005	
6	Total Suspended Particulate (TSP)			0,33	0,10

ANNEX 7: Noise Control Standard at Workshop, Factory and Industry

Noise Level (dB (A))	Maximum Period of Time	Level
75	32	Ear protection equipment shall be provided to worker who works at a location with noise level over 80dB(A)
80	16	
85	8	

Noise Level (dB (A))	Maximum Period of Time	Level
90	4	
95	2	
100	1	
105	0,5	
110	0,25	
115	0,125	

3.16 SUB-DECREES ON MONITORING WATER POLLUTION, 1999

Sub-decree number 27 enacted April 06, 1999 on monitoring water pollution. In this sub-decree have object as following:

- The purpose of this sub-decree is to regulate the water pollution control in order to prevent and reduce the water pollution of the public water areas so that the protection of human health and the conservation of bio-diversity should be ensured.
- This sub-decree applied to all sources of pollution and all activities that cause pollution of the public water areas.

- ***Article 10:*** The discharge or transport of wastewater from any sources of pollution to other places for any purpose is subject to prior permit from the Ministry of Environment. The application for this permit shall be copied to the concerned ministries or agencies.
- ***Article 11:*** The species of any source of pollution that shall be required to have a permit from the Ministry of Environment before discharging or transporting their effluent to other places as mentioned in the article 10 of this sub-decree shall be listed in the Annex 3 of this sub-decree and are classified into two following categories:

  a- The source of pollution of category I that are subject to the prior permit from the Ministry of Environment when the amount of their effluent exceed ten cubic meter per day (10 M^3/day) but not including the amount of water volume used for according the engine.

  b- The sources of pollution of category II that shall be necessarily required to apply for the permission from the Ministry of Environment.

- ***Article 13:*** The owner or responsible person of the pollution source as mentioned in the article 11 of this sub-decree that intend to release or transport his/her effluent to other place shall be apply for permit to the Ministry of Environment:
  - Forty days (40 days), before the beginning of the functioning, for the new source of pollution located in Phnom Penh, and sixty days (60 days) for the new source of pollution located in provinces and cities.
  - Thirty days (30 days), within the after receiving guideline from MoE of the functioning, for the new source of pollution located in Phnom Penh, and fifty days (50 days) for the new source of pollution located in provinces and cities.

Annex 1: Type of the hazardous substance

1. Organophalogen compounds and substances which may form such compounds in the aquatic environment.
2. Organ phosphorous compounds.
3. Organotin compounds.
4. Substances that possess carcinogenic (cancer causing) properties in or via the aquatic environment.
5. Mercury and its compounds.
6. Cadmium and its compounds.
7. Persistent mineral oil and hydrocarbons of petroleum origin.
8. Persistent synthetic compounds which may float remain in suspension or sink and

which may interfere with any use of waters.

9. Radio activated substances.
10. Metals and their compounds.

Zinc (Zn)	Selenium (Se)	Tin (Sn)	Vanadium (V)
Copper (Cu)	Arsenic (As)	Barium (Ba)	Cobalt (Co)
Nickel (Ni)	Antimony (Sb)	Beryllium (Be)	Tellurium (Te)
Lead (Pb)	Titanium (Ti)	Uranium (U)	Silver (Ag)

11. Toxic or persistent organic compounds of silicon.
12. Inorganic compounds of phosphorous and elemental phosphorous.
13. Non-persistent mineral oils and hydrocarbons of petroleum origin.
14. Cyanides and fluorides
15. Substances which may have an adverse effect on the oxygen balance, particularly ammonia, and nitrites...etc.

Annex 4: Water Quality Standard in public water areas for bio-diversity conservation water

1. For water River

N°.	Parameter	Unit	Standard Value
1	pH	mg/l	6.5-8.5
2	COD	mg/l	1-10
3	Suspended Solid	mg/l	25-100
4	Dissolves Oxygen	mg/l	2.0-7.5
5	Coli form	MPN/100ml	<5000

2. For Lake and Reservoir

N°.	Parameter	Unit	Standard Value
1	pH	mg/l	6.5-8.5
2	COD	mg/l	1-8
3	Suspended Solid	mg/l	1-15
4	Dissolves Oxygen	mg/l	2.0-7.5
5	Coli form	MPN/100ml	<1000
6	Total Nitrogen	mg/l	0.1-0.6
7	Total Phosphorus	mg/l	0.005-0.05

3.17 SUB-DECREES ON SOLID WASTE MANAGEMENT, 1999

Sub-decree on solid waste management, number ANK36, enacted on April 27, 1999. In this sub-decree have objectives as following:

- ***Article 1:*** The purpose of this sub-decree is to regulate the solid waste management with proper technical manner and safe way in order to ensure the protection of human health and the conservation of bio-diversity.
- ***Article 2:*** This sub-decree applies to all activities related to disposal, storage, collection, transport, recycling, dumping of garbage and hazardous waste.
- ***Article 3:*** Technical terms used in this sub-decree shall have the meaning ascribed there to:

a. Solid waste refers to hard objects, hard substances, products or refuse which are useless, disposed of, are intended to be disposed of, or required to be disposed of;

b. Household waste is the part of solid waste which does not contain toxin or hazardous substance, and is discarded from dwellings, public buildings, factory, market, hotel, business building, restaurant, transport facilities, recreation site etc.;

c. Hazardous waste refers to radioactivity substances, explosive substances, toxic substances, inflammable substances, pathogenic substances, irritating substances, corrosive substances, oxidizing substances, or other chemical substances which may cause the danger to human (health) and animal or damage plants, public property and the environment. The hazardous waste may be generated from dwelling houses, industries, agricultural activities, business and service activities, mining, etc. The type of hazardous waste is listed in the Annex of this sub-decree.

- ***Article 7:*** The disposal of waste in public sites or anywhere that is not allowed by the authorities shall be strictly prohibited.
- ***Article 13:*** The owner of the hazardous waste shall be responsible for temporary storageof his/her waste in proper technique and in safe manner.
- ***Article 14:*** The owner of the hazardous waste shall make quarterly report on his/he waste and forward it to the Ministry of Environment. The report includes:

  a. Type and amount of the waste,

  b. Temporary storage method, and

  c. Treatment or elimination method.

- ***Article 15:*** The storage, transportation and disposal of the hazardous waste shall be performed separately from the household waste which will be stipulated by the Prakas of the Ministry of Environment.

The disposal of hazardous waste into public site, public drainage systems, public water area, rural area and forest area shall be strictly prohibited.

- ***Article 18:*** The owner or responsible person of storage place or landfill of the hazardous waste shall make quarterly report on the hazardous waste which is transported for disposal of or for storage and forward this report to the Ministry of Environment. The report shall include as follows:

  a. Type and amount of the waste,

  b. Sources of the waste,

  c. Packing and transport facility, and

  d. Process and management of the waste inside his/her location and forward this report to the Ministry of Environment.

AnnexType of the hazardous waste

8. Oil waste from oil refinery, use of lubrication oils, washing oils;

9. Acid waste;

10. Alkalis waste;

13. Inorganic fluorine and parts electronic of electricity wastes;

14. Inorganic batteries wastes;

18. Ethers wastes lead to infection or diseases;

21. Waste from production of drugs and medicines, and expired drugs;

22. Wastes produced as a result of wastewater treating or soil pollution.

3.18 SUB-DECREES ON ENDANGEROUS FISHERIES RESOURCES, 2009

Sub-Decree No. 123 on species results, fisheries products which is suffering dangerous was approved by Royal Government of Cambodia, date August 12, 2009. In below are some Articles that concerning to the project:

- ***Article 1:*** This sub-decree shall determine on species results, fisheries products include freshwater and marine water which have source from fisheries resource is suffering of dangerous in Royal Government of Cambodia for management, protection and sustainable conservation accordance with the fishery Law.
- ***Article 2:*** The fisheries resource which is suffering of dangerous is classified into 3 groups according to condition and situation of suffering dangerously as below:

1. Detaching Closed Species Group: is fisheries resource in Natural suffering dangerous which is challengeable to stock yield, this group is challenging to serious danger and can be destroyed of species in the nature, it is not so longer in the future because, the fish yield totally was decreased at least 80% in last period of 10 years or further passed of 3 generations accordance observations, estimations or conclusions.
2. Suffering Dangerous Species Group: is fisheries resources in Natural suffering dangerous which had proof show clearly that this group is challengeable to very dangerous and can be destroyed of species in the nature, it is not so longer in the future because, the fish yield totally was decreased at least 50% in last period of 10 years or further passed of 3 generations accordance observations, estimations, conclusions or expectations.
3. Vulnerable Species Group: is fisheries resources in Natural suffering dangerous which is very easy vulnerable and can be destroyed of species in the natural near future because, the fish yield totally was decreased at least 20% in last period of 10 years or further passed of 3 generations accordance observations, estimations, conclusions or expectations.

3.19 PRAKAS ON GENERAL GUIDELINE FOR CONDUCTING INITIAL AND FULL ENVIRONMENTAL IMPACT ASSESSMENT REPORTS, 2009

The Ministry of Environment has issued General Guideline for Conducting Initial and Full Environmental Impact Assessment Report dated on September 02, 2009. In below are some Articles that concerning to the project:

- ***Article-2:*** The project owner either, as private individuals or private companies, joint-venture companies, public companies or ministries/government agencies must prepare an IEIA or Full EIA report for proposed projects and existing activities, as mentioned in the Appendix of Sub-decree N. 72 ANKR.BK, dated 11 August 1999 on the process of Environmental Impact Assessment and submit these for reviewed and approved by the Ministry of Environment except some particular and urgently needed projects that are decided by the Royal Government.
- ***Article-4:*** Project's owner as stated in Article 2 and 3 above can use a consultant company service that shall be responsible for preparing an IEIA or Full EIA report following these general guidelines.
- ***Article-7:*** The Department of Environmental Impact Assessment Monitoring and Review or Royal Municipal-Provincial Department of Environment shall visit and comment a project site as stated in Article 2 and 3 above to appropriated screening that whether the investment project should prepare the IEIA or Full EIA report.

3.20 NATIONAL POLICY ON GREEN GROWTH, 2013

National Policy on Green Growth has been agreed from the council Ministry during the meeting dated on 01 March 2013. In below are some points that concerning to the project:

1.. Introduction:

The policy aims at contributing to environment protection, natural resources management, biodiversity and forest conservation, and maintaining quality of soil, water, soil and air and efficient ecosystem safety, and following the directionof the United Nations on" **The Future We want**" that the RGC has been implementing it today in the areas of fishery and forestry sector, economical use of energy and water, renewable energy usage, efficiency of natural resources for the support of people's livelihood and the implementation of **New Action Old Policy on Land** in order to keep natural resources for the next generations while at the same time keeping up with national economic development.

Green Growth is to strike balance between economic development and environment, society and culture to reach sustainable development goals.

2.. Vision:

The national policy is invisaged to strike balance of economic development with environment, society, culture and sustainable use national resources through intergration, matching and adaption as well as harmonization between growth principle and national policy.

3.. Gaol and Objectives:

3.1..Goal

The policy aims at enhancing the well-being and livelihood of all people in harmonization with ecological safety through green development growth, basing on green economy, blue economiy, environment protection, social safety nets system and uphold of national culture identify.

3.2.. Objectives

- Developing an economy in balance with environment, society and culture;
- Create a favourably enabling environment for green growth in equity, balance, fraternity, and quality of socio-economic systems and ecology that uphold national culture value;
- Effective management of access to water resources management and sanitation, access to food security and food safety, access to development, forest conservation, and mixed resources water, and sustainable land use, access to rewable energy, and energy efficiency, access to information and knowledge and skill, access to finance for creation of small medium enterprise and investment associated with green growth;
- Enhancing education and training on green growth;
- Strengthening information exchance, knowledge, good experiences, technology and investment related to green growth;
- Stimulating green growth cooperation at a national and sustainational leval, region and the world.

6.. Monitoring and Evaluation:

In order to implement this national policy successfully and effectively as expected and with transparency the NCGG must have a monitoring and evaluation system and propose to improve the implementation by focusing on indicators a follows:

- Having established and reviewing a legal framework and national institution on green growth and improving the system of identifying management, monitoring and evaluation;
- Determining and analyzing the sources and reasons lead to no sustainability among economy, environment, society and culture;
- Improving and strengthening capacity building of relavant officials of green growth;
- Setting up a level of education for the public and the private sectors, society and general public about green growth and encouraging the public at the local levels tobe involved in activities and dissemination programs on green growth and encouraging them to participate;
- Improvement green growth at national and subnational levels;
- Reducing economic development activity imacts on economy, society, culture.

3.21 JICA'S GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS, APRIL 2010

JICA has prepared "Guidelines for Environmental and Social Considerations, April 2010" as the referential guidelines for environmental and social considerations. The objectives of the guidelines are to encourage Project proponents etc. to have appropriate consideration for environmental and social impacts, as well as to ensure that JICA's support for and examination of environmental and social considerations are conducted accordingly. The guidelines outline JICA's responsibilities and procedures, along with its requirements for project proponents etc., in order to facilitate the achievement of these objectives. In doing so, JICA endeavors to ensure transparency, predictability, and accountability in its support for and examination of environmental and social considerations.

According to the guidelines, JICA classifies development projects into four categories with regards to the extent of environmental and social impacts, and taking into account the outlines, scale, site and other conditions. The four categories are as follows:

Category A: Proposed projects are likely to have significant adverse impacts on the environment and society.

Category B: Proposed projects are classified as Category B if their potential adverse impacts on the environment and society are less adverse than those of Category A projects.

Category C: Proposed projects are classified as Category C if they are likely to have minimal or little adverse impact on the environment and society.

Note: all these 3 types above are negative and positive *(±A, ±B, ±C)*

Category FI: A proposed project is classified as Category FI if it satisfies all of the followings:

- JICA's funding of the project is provided to a financial intermediary or executing agency;
- The selection and appraisal of the components is substantially undertaken by such an institution only after JICA's approval of the funding, so that the components cannot be specified prior to JICA's approval of funding (or project appraisal); and
- Those components are expected to have a potential impact on the environment

In JICA's preparatory survey, JICA conducts environmental and social surveys at the EIA level for Category A projects and at the IEE (Initial Environmental Examination) level for Category B projects and Master Plan Studies. JICA prepares drafts of mitigation measures - including avoidance, minimization, and compensation - as well as drafts of monitoring plans and of institutional arrangements for environmental and social considerations.

Over a certain period of time, JICA confirms with project proponents etc. the results of monitoring the items that have significant environmental impacts. This is done in order to confirm that project proponents etc. are undertaking environmental and social considerations for projects that fall under Categories A, B, and FI.

National Road No.5 (Middle Section) Thlea Ma' am to Battambang Improvement Project" is classified as "Category A", according to JICA Guidelines (2010), which causes a significant adverse impact due the large scale of involuntary resettlement. Thus, preparation of the survey report at EIA level is required.

CHAPTER-4
PROJECT DESCRIPTIONS

CHAPTER-4

PROJECT DESCRIPTIONS

The National Road No.5 (NR5) is an economic blood vessel for international transportation, liking from Phnom Penh Capital City to border of Thailand. This national road is 407.45 Km length in total which goes across six provinces (Phnom Penh Capital City was not included) such as: Kandal, Kampong Speu, Kampong Chnang, Pursat, Battambang and Banteay Meanchey. This project description is not so detailed; however, it is the first observation for rehabilitation project from Sri Sophorn to Poipet, say that: (started point at the Kilometer Post (KP366+250), Sangkat Teuk Thla, Sri Sophorn Town to Kilometer Post (KP402), Sangkat Phsa Kandan, Poipet Town, Banteay Meancheyprovince with 35.8Km of total length. The purpose of this study is to find the data and information out which require/need for cost estimation of loan project (ODA) from Japan Government.

4.1 Type of Project

This project is the NR5 improvement of Ministry of Public Works and Transport under loan project from Japan Government. The standard of project design was mentioned as the following:

In the Town area, the total road width is 28 meters paving with asphalt concrete (AC) of 4 lanes, with each 2 lanes of opposite direction and there is vehicle parking for both sides (2.5m x 2.5m), included of central median road is 3m and plus sidewalks (3m x 2) for both sides.

In the Rural area, the total road width is 23 meters paving with asphalt concrete (AC) of 4 lanes, with each 2 lanes of opposite direction, included of central median road is 3m and, and plus sidewalks and lanes for bike at both sides (3m x 2). A part of this road improved is 35.8Km length included 68 culverts in total (one row to four rows of concrete pipes).

Basic Component of Project Design:

- Project justification (by proving the project with relevant document);
- Feasibility Study;
- First draft of project design (drawing layout);
- Cost estimation for project;
- Activity schedule for project implementation;
- Activity schedule and plan for road maintenance/fix;
- Resettlement plan (Ministry of Public Works & Transport is responsible for this work, supported the technical works by JICA Survey Team and national consultants);
- Prepared the report of full Environmental and Social Impact Assessment (Ministry of Public Works & Transport is responsible for report preparation and procedure work of EIAby submitting to Ministry of Environment in order to approve supported the technical works by JICA Survey Team and local consultants).

4.2 Need for Project

As mentioned above, NR5 is an economic blood vessel for national and international transportation. The Kingdom of Cambodia became a Member State of The Association of Southeast Asian Nations (ASEAN) on 30 April 1999. Then NR5 was called ASEAN Highway A-1. See figure below of Asian Highway andnetwork road in the sub great Mekong region.



On the other hand, this national road was damaged by flood in 2000, thus, it needs to rehabilitate and fix temporarily in some places after flooded as the following:

Table 4-1: Record of road fixing works for NR5

Resources	Itinerary	Road width in average (m)	Length (Km)	Type of pavement	Inaugurate
Engineering Forces	Phnom Penh-Kampong Chhnang	9.8	91	DBST	2003
ADB	Kampong Chhnang-ThleaMaam	7.7	80	DBST	2004
ADB	Thlea Maam-Battambang	9.8	130	DBST	2003
ADB	Battambang-Sisophon	7.8	68	DBST	2004
ADB	Sisophon-Poipet	10.2	49	Asphalt Concrete	2008

Soruce:*Inception ReportJICA Study Team March 2011*

However, the condition of NR5 still has some problems at the moment after fixed such as:

- The road width is still small that the cause of traffic acidents;
- Traffic activities on the road are increasing and so busy;
- The pavement type of this road is DBS which eases to damage due to busy traffic of this road. Then the cost of road maintanance of this type is more than type of AC (Asphalt Concrete);
- Road was frequently flooded.

The purposes of this road improvement project are:

- To rehabilitate and expand road with 4 lanes which devided by central median road and road shoulder or sidewalk for pedestrian and bike at the both road sides;
- To increase height of road only some portions to prevent often flooding due to the result of topography survey;
- To improve the drainage/hydraulic structures (such as: culverts and bridges);
- To facilitate/make ensure the traffic activities go smoothly and safety on this new road;

- To increase the social economic development in national and regional level;
- To provide enough traffic secure by enlarging road and to reduce of traffic jam that it will occur in the near future of few year later.

4.3 Project Location

4.3.1 Project Infrastructure Sites

The NR5 improvement project from Sri Sophorn to Poipet is located in Banteay Meanchey province. It started from Kilometer Post (KP366+250) to Kilometer Post (KP402)of circle of Poipet Town. It located in the latitude 13º34' and 13º40' at north and longitude 102º32' and 102º56' at east (see map No.1).

The detailed coordinates of project sites are showed in the table below:

Table 4-2: The detailed coordinates of improvement project for portion of NR5 from Sri Sophorn to Poipet Town (KP366+250 – KP402).

#	KP	starting PointX, Y	Ending PointX, Y	Lenght of Road (Km)	Comm. /Sangkat Name	District /Town Name
1	Right 366+250 to 371+ 477 Left 366+250 to 371+ 084	275194, 1501826	270031, 1502404 270400, 1502342	5.45	Teuk Thla	Sri Sophorn
2	Right 371+477 to 372+ 931	270031, 1502404	268595, 1502755	1.48	Changva	O-Chrov
3	Left371+084 to 372 + 931	270400, 1502342	268595, 1502755	1.85	Samrong	O-Chrov
4	Right-Left 372+931 to 383+ 497	268595, 1502755	258398, 1505476	10.50	Kob	O-Chrov
5	Right 383+ 497 to 394+ 930 Left 383 + 497 to 397+ 000	258398, 1505476	247156, 1507614 245103, 1507719	13.46	Nimit	Poipet
6	Right 394+ 930 to 402 Left 397 + 000 to 402	247156, 1507614 245103, 1507719	240223, 1508392	6.99	Phsa Kandal	Poipet

Table 4-3: The type of rehabilitated culvert (pipe)

#	KP	X	Y	Code	Structructure type	Province Name
01	365 + 704	273850	1501947	Pc242	e oecrete	ø1.20
02	366 + 206	273355	1501995	Pc243	e oecrete	ø1.20
03	366 + 835	272727	1502053	Pc244	e oecrete	ø1.20
04	367 + 412	272158	1502106	Pc245	e oecrete	ø1.20
05	367 + 999	271564	1502173	Pc246	e oecrete	ø1.20
06	368 + 610	270967	1502260	Pc247	e oecrete	ø1.20
07	369 + 352	270238	1502369	Pc248	e oecrete	2ø1.20
08	369 + 663	269925	1502423	Pc249	e oecrete	2ø1.20
09	370 + 263	269341	1502555	Pc250	e oecrete	2ø1.20
10	371 + 041	268583	1502761	Pc251	e oecrete	2ø1.20
11	372 + 030	267630	1503024	Pc252	e oecrete	ø1.20
12	372 + 466	267208	1503139	Pc253	e oecrete	ø1.20
13	373 + 087	266611	1503301	Pc254	e oecrete	ø1.20
14	373 + 709	266016	1503465	Pc255	e oecrete	ø1.20
15	374 + 406	265341	1503650	Pc256	e oecrete	ø1.20
16	375 + 005	264769	1503803	Pc257	e oecrete	2ø1.20
17	375 + 588	264198	1503955	Pc258	e oecrete	ø1.20
18	376 + 094	263721	1504083	Pc259	e oecrete	ø1.20
19	376 + 899	262936	1504293	Pc260	e oecrete	ø1.20
20	377 + 195	262655	1504370	Pc261	e oecrete	ø1.20
21	377 + 916	261949	1504552	Pc262	e oecrete	ø1.20
22	378 + 803	261101	1504773	Pc263	e oecrete	2ø1.20
23	379 + 418	260501	1504926	Pc264	e oecrete	ø1.20
24	380 + 109	259836	1505102	Pc265	e oecrete	ø1.20
25	380 + 555	259402	1505214	Pc266	e oecrete	ø1.20
26	380 + 692	259276	1505248	Pc267	e oecrete	ø1.20
27	381 + 905	258087	1505557	Pc268	e oecrete	ø1.20
28	382 + 686	257335	1505754	Pc269	e oecrete	ø1.20
29	383 + 014	257023	1505838	Pc270	e oecrete	ø1.20
30	383 + 885	256179	1506060	Pc271	e oecrete	2ø1.20
31	384 + 341	255727	1506175	Pc272	e oecrete	ø1.20
32	385 + 038	255061	1506352	Pc273	e oecrete	ø1.20
33	385 + 990	254124	1506517	Pc274	e oecrete	2ø1.20
34	386 + 498	253626	1506586	Pc275	e oecrete	2ø1.20

#	KP	X	Y	Code	Structructure type	Province Name
35	387 + 001	253124	1506667	Pc276	e oecrete	ø1.20
36	387 + 549	252589	1506750	Pc277	e oecrete	ø1.20
37	388 + 048	252094	1506829	Pc278	e oecrete	ø1.20
38	388 + 563	251584	1506910	Pc279	e oecrete	ø1.20
39	389 + 217	250954	1507043	Pc280	e oecrete	ø1.20
40	389 + 685	250493	1507150	Pc281	e oecrete	ø1.00
41	390 + 173	250022	1507258	Pc282	e oecrete	ø1.00
42	391 + 738	248475	1507520	Pc283	e oecrete	ø1.00
43	392 + 318	247897	1507568	Pc284	e oecrete	ø1.00
44	392 + 689	247524	1507593	Pc285	e oecrete	ø1.00
45	393 + 250	246956	1507615	Pc286	e oecrete	4ø1.00
46	393 + 689	246525	1507633	Pc287	e oecrete	2ø1.00
47	394 + 509	245710	1507677	Pc288	e oecrete	2ø1.20
48	395 + 108	245112	1507717	Pc289	e oecrete	2ø1.20
49	395 + 669	244554	1507754	Pc290	e oecrete	ø1.20
50	396 + 324	243903	1507807	Pc291	e oecrete	ø1.20
51	396 + 926	243305	1507858	Pc292	e oecrete	ø1.00
52	397 + 476	242752	1507919	Pc293	e oecrete	ø1.00
53	398 + 118	242115	1508010	Pc294	e oecrete	ø1.00
54	398 + 724	241512	1508105	Pc295	e oecrete	2ø1.20
55	399 + 272	240980	1508199	Pc296	e oecrete	ø1.00
56	399 + 867	240396	1508343	Pc297	e oecrete	ø1.00
57	401 + 087	239238	1508720	Pc298	e oecrete	ø1.00
58	401 + 410	238946	1508846	Pc299	e oecrete	ø1.00
59	401 + 821	238593	1509056	Pc300	e oecrete	ø1.00
60	402 + 214	238246	1509256	Pc301	e oecrete	ø1.00
61	402 + 524	237989	1509399	Pc302	e oecrete	ø1.00
62	402 + 798	237770	1509573	Pc303	e oecrete	2ø1.00
63	403 + 412	237301	1509955	Pc304	e oecrete	3ø1.00
64	403 + 701	237082	1510141	Pc305	e oecrete	ø1.00
65	404 + 127	236757	1510406	Pc306	e oecrete	ø1.00
66	404 + 881	236122	1510833	Pc307	e oecrete	ø1.00
67	405 + 118	235927	1510957	Pc308	e oecrete	ø1.00
68	405 + 306	235768	1511057	Pc309	e oecrete	ø1.00

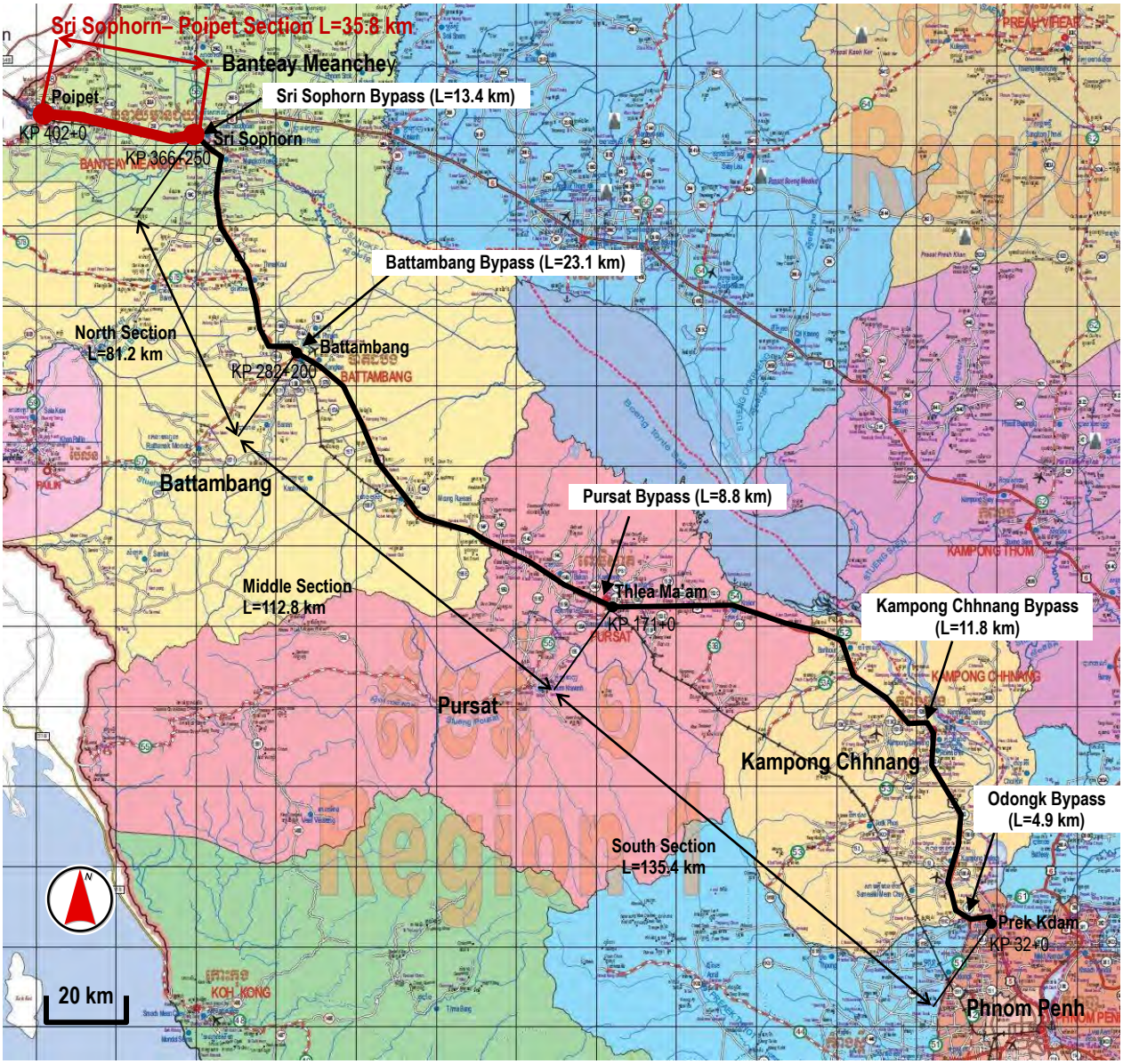
Source:*Public Works Research Center (PWRC), General Directorate of Public Works and Transport, Kingdom*

Mark: All of coordination above is in system of UTM, Datum Indian 1960, Zone 48N

Map 1

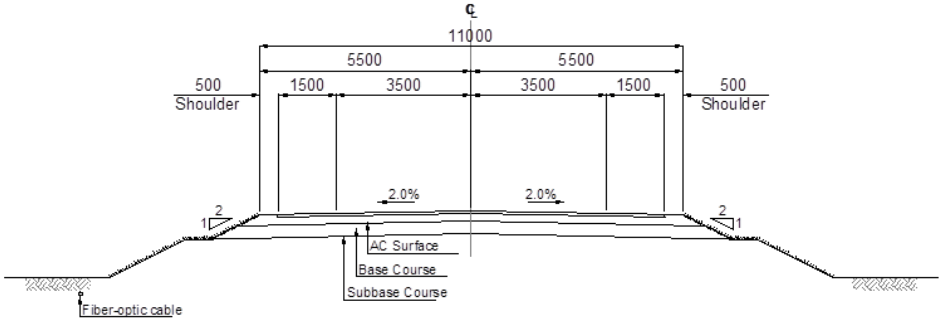
4.3.2 Survey Area and Target section

The Survey area is Banteay Meanchey province. The target section is Sri Sophorn – Poipet section in the following Figure (35.8 km long).

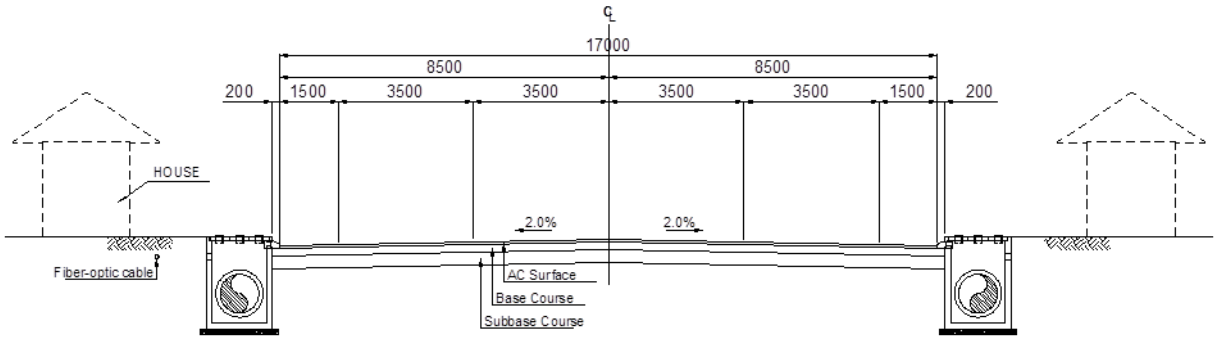


1. Cross Section:

The cross section of Sri Sophorn - Poipet Section in rural areas comprises two undivided opposing lanes with 1.5m-wide shoulders on the both sides which can be used by motorcycles and other slows vehicles. All of road surface of this section is asphalt concrete (AC) and the surface of shoulder is covered by gravel. On the other hand, the cross section in urban areas is undivided 4-lane with 1.5m-wide shoulder. The cross section for urban area starts from KP 403 and ends at KP 407. The cross sections in rural and urban areas between Sri Sophorn and Poipet are shown in in the following Figure:



Cross Section between Sri Sophorn - Poipet Section for Rural Area(KP 366 – KP 402)



Cross Section between Sri Sophorn - Poipet Section for Urban Area(KP 403 – KP 407)

2. Horizontal and vertical alignment:

In the Sri Sophorn - Poipet Section, the smallest radius of curve is 1,500m. Thus, there is no serious problem in the present horizontal alignment. There are 5 sections in the urbanized areas where the maximum speed is regulated at 40 km/h. The vertical alignment of Sri Sophorn to Poipet Section is slightly climbing in the direction. The maximum grade is 0.36 percent and gradients of most of the sections are less than 0.10 percent. Thus, the gradient itself is not imposing serious problems. Rather, the height of road surface is an important subject in view of the flood / inundation.

3. Bridges:

There is no bridge in Sri Sophorn - Poipet Section.

4. Roadside land use:

The basic form of land use outside urbanized areas in this section is cultivation, especially the cultivation of rice paddies as well as other sections of NR 5. The most of houses and small shops are about 20 meter away from road centerline. In Poipet City, there are many commercial areas and semi and full trailer trucks come from Thailand. The most of those trucks go back to Thailand after unloading containers and / or cargos in the cargo terminal for the reloading on the Cambodian trucks.

4.3.3 Problem of Present Sri Sophorn – Poipet Section

The problems of present Sri Sophorn – Poipet Section can be summarized as follows:

(1) Insufficient Road Width

- The average width of existing carriage way is 11.0 m composed of 2-lane + MC lane in the rural areas. A carriage way with this width cannot provide with sufficient space for full 4-lanes.
- Forecasted traffic demand in 2033 on the Sri Sophorn – Poipet Section is approximately 25,500 pcu/day as it is forecasted in this Survey. A full 4- lane road is necessary to accommodate this traffic volume.
- Thus, widening to full 4-lanes will become necessary before year 2033.

(2) Deteriorating Pavement Condition

- This section was rehabilitated to AC paved road in 2008 and its condition is still good. However, some damages such as cracks and ruttings were observed on the surface of the road because

five years has passed since its rehabilitation. It is assumed that new rehabilitation such as repavement or overlay will be necessary in some years.

- Traffic volume in this section is increasing more rapidly than forecasted for the planning of the rehabilitation in 2008.
- Thus, it is recommended that reconstruction of pavement structure be delivered at the same time as its widening.

4.3.4 Alternative Analysis

For the improvement of Sri Sophorn – Poipet Section of NR 5, three alternatives of cross section and 0 option was studied. The following table compares advantages and disadvantages of these alternatives. After the discussion between the JICA Survey Team and RGC counterparts: MPWT and DPWT, Alternative-2 in the following Table and Figure was selected.

Table 4-4: Comparison of Alternatives of Improvement of Existing NR 5

Alternatives	Alt-0 : Zero Option; No action	Alt-1 : Existing road width is maintained; Only pavement is improved into asphalt concrete (AC).	Alt-2 : Widen into 4-lane; pavement is improved into AC.	Alt-3 : Widen into 'Opposed 2-lane + motorcycle lane on both sides; pavement is improved into AC
Objective	Maintain the existing conditions. No impact to social & natural environment. No construction cost is required.	Resettlement is not required. Pavement is improved so that maintenance cost can be reduced.	Secure sufficient traffic capacity and smooth traffic. Improve traffic safety by slow traffic & fast traffic.	Reduce construction cost and number of households/houses to be relocated, securing required traffic capacity.
Social Impact				
Resettlement	No resettlement required.	Same as Alt-1.	Large number of households/ houses	Considerable number of (less than in Alt-2) households/houses need to be relocated.
Separation of Local Community	There is no change in conditions for crossing of road except new difficulty due to increase in traffic volume.	Same as Alt-1.	Crossing of road becomes difficult due to increase of road width and increase of vehicles speed.	Same as Alt-2 except that the degree of difficulty of crossing due to widening of road width is less than that in Alt-2.
Influence to Socio-Economic Activities and Regional Development	Sound growth of socio-economic activities is hampered, resulting in impedance in regional development, caused by traffic congestion.	Same as Alt-0.	Smooth traffic is secured resulting in growth in socio-economic activities and regional development. Increased job opportunities for local laborers and increase demand for consumer goods contributes to increase in gross income of the region.	Same as Alt-2 in principle; however, there is a possibility that traffic congestion start earlier than in Alt-2 and socio-economic activities and regional development will be hampered.
Impact to Natural Environment	Exiting conditions are maintained and no impact to natural environment is anticipated.	Only pavement structure is changed and practically no impact to natural environment is anticipated.	Since the main work is widening of an existing road, no large impacts are anticipated.	Same as Alt-2.

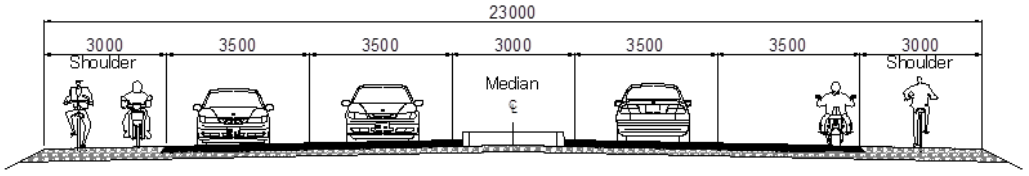
Impact to Living Environment/ Pollution	There is a high possibility of traffic jam as traffic volume increase in future. When traffic jam occurs, travel speed is decreased and frequency of stop & start increases, resulting in increase in emission of pollutant.	Same as Alt-0.	Increased traffic demand in future will be accommodated and traffic jam will be substantially reduced resulting in prevention of crease of emitted pollutant is prevented. On the other hand, increased traffic capacity will induce traffic demand and increase total emission of pollutants.	Same as Alt-2 in principle; however, smaller traffic capacity than in Alt-2 will result in traffic jam and increase of emitted pollutants starting at earlier time in future.
Impact to Traffic Condition				
Road/ Transport Function	Smooth traffic cannot be secured due to traffic jam which will occur as traffic volume increase in future.	Same as Alt-0.	Smooth traffic can be secured owing to sufficient traffic capacity.	Same as Alt-2 in principle; however, traffic jam will start to occur at earlier time in future than in Alt-2 because traffic capacity is smaller than Alt-2.
Traffic Safety	High risk of traffic accident due to narrow road width which forces travelling in the opposite lane when overtaking.	Same as Alt-0: Risk of accident increases due to higher travel speed which becomes possible owing to improved road surface.	Slow traffic, such as agricultural tractor, and fast traffic, such as passenger car, are separated resulting in less risk of accident. Also, risk of head-on collision is decreased since necessity to travel in the opposite lane for overtaking is greatly reduced. On the other hand, risk of accident may increase due to increased travel speed of vehicles.	Slow traffic and fast traffic are separated and risk of accident is decreased, although to less extent than in Alt-2.
Construction Cost/ Maintenance Cost	No construction cost is required while maintenance cost remains large due to vulnerable pavement.	Cost for improvement of pavement is required. On the other hand, maintenance cost is reduced since pavement becomes durable.	Costs for resettlement, civil works of widening, pavement etc are required. On the other hand, maintenance cost is reduced owing to improved durability of pavement.	Same as Alt-2 in principle; costs for resettlement, widening, pavement etc are smaller than in Alt-2 due to narrower road width.
Evaluation				
Main Advantage	No resettlement is required	No resettlement is required	Smooth traffic is secured. (Main objective of Project is achieved.)	Smooth traffic is secured for about 10 years after completion of the Project. Number of houses/ households to be relocated is less than those in Alternative-2.

Main Disadvantage	Traffic jam due to future increase in traffic demand and retardation in development in socio-economic activities.	Traffic jam due to future increase in traffic demand and retardation in development in socio-economic activities.	Large number of houses/ households need to be relocated.	Large number of houses/households, although less than in Alternative-2, needs to be relocated. Widening will become necessary within about 10 years after completion of the Project.
Overall Evaluation	Not recommended because the objectives of the Project are not achieved.	Not recommended because the objectives of the Project are not achieved.	Recommended with condition that due consideration is given to mitigation of negative impacts.	Recommended only when the fund needs to be minimum.

4.3.5 General Scheme of Improvement

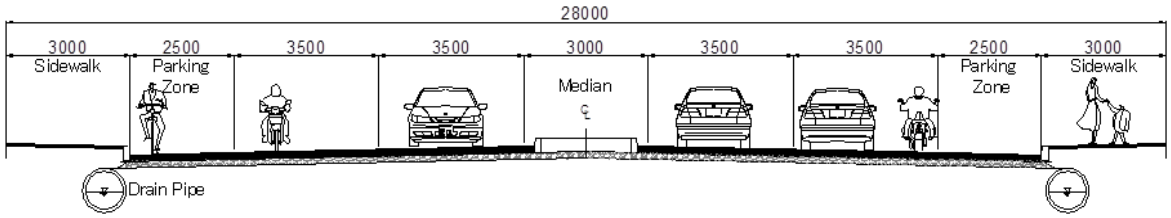
1. Cross Section:

It is proposed to widen the existing NR 5 into full 4-lanes with raised median division. The following Figure shows the proposed typical cross sections.



Rural Area

Raised Median (w=3.0 m) + full 4-lane Carriageway (w=3.5 m) + Shoulder (w=3.0 m)



Urban Area

Raised Median (w=3.0 m) + full 4-lane Carriageway (w=3.5 m) + Parking Zone (w=2.5 m) + Sidewalk (w=3.0 m)



Rural Area Road Model After constructed

2. Horizontal Alignment:

Sri Sophorn - Poipet Section of NR 5 will be improved basically keeping the present road center line. However, horizontal alignment of some sections of the road not satisfying the minimum radius of curve will be improved.

3. Elevation of Road Surface:

Elevation of the road surface and installation of new drainage facilities are planned based on the survey on the flood water level.

4. Improvement of Pavement Structure:

The pavement of Sri Sophorn - Poipet Section is AC. However, some damages such as cracks, potholes, flushes are observed in this section. It is proposed that the pavement structure of this section be reconstructed considering the strength of subgrade of the road and the future traffic volume.

5. Improvement of Intersection:

For the smooth traffic and traffic safety and access road to NR 5, improved intersection without traffic signal is applied to every intersection for the highway design in response to the forecasted traffic volume

6. Culvert:

All culverts needed to improve and enlarge these widths at the sam width size of road. There are 68 culverts needed to rehabilitate in total, included 53 box-culverts of one row concrete ring, 13 box-culverts of two rows concrete ring, 1 box-culvert of three rows concrete ring, 1 box-culverts of four rows concrete ring, located at small canals and creeks to drain water from flooding at upstream. Moreover, it will help flow current of water out and these are able to conserve the local ecosystem and aquatic plants; then there are 4 species of pipe culverts such as single, double, triple, and four cells (see picture below).



Rehabilitated and expanded single cell pipe culvert



Rehabilitated and expanded double cell pipes culvert



Rehabilitated and expanded triple cell pipes culvert



Rehabilitated and expanded four-cell pipes culvert

4.3.6 Construction Plan and Activity Schedule

The NR5 improvement project has some components and activities as the following:

- Study, observe, measure, test, examine are done on the existing road with the cooperation between JICA Survey Team and Ministry of Public Works and Transport including other concerned institutes;
- First draft of the rehabilitated and expanded drawing of NR5 was prepared and drafted by JICA Survey Team;
- Project assessment and cost estimation for ODA loan of Japan were done and prepared by JICA Survey Team;
- Measurement, observation, study of immovable properties and crops of people along the project site, 20meters from center line or CIO:20m (Total Width 40m). Then the resettlement plan will be studied by JICA Survey Team cooperating with local consultants;
- Environmental and Social Impact Assessment was be prepared by JICA with the cooperation with local consultants;
- Ministry of Public Works and Transport (MPWT) will submit the report of Environmental and Social Impact Assessment to Ministry of Environment (MoE) in order to approve;
- Ministry of Public Works & Transport (MPWT) and Ministry of Economy and Finance (MEF) will sign on agreement with JAPAN for ODA loan;

- Ministry of Public Works & Transport (MPWT) and JICA Survey Team will respond for procurements in order to select technical consultants (national and international consultants) for stage of detailed design;

- Technical consultants will respond for study detailed plan layout, and preparation of document for procurement of rehabilitation and expansion of NR5;

- Inter-ministries Resettlement Committee (IRC) leaded by MEF will work for Detail Measure Survey (DMS) for affected immovable property and crops according to detailed plan layout;

- Inter-ministries Resettlement Committee (IRC) will give the compensation and other supported money to affected people by project;

- Procurement of Contractor (international) in the construction of the project will be prepared by the Ministry of Public Works & Transport and JICA;

- The contractors company will work under management of technical consultant of the Ministry of Public Works and Transport to construct and expand this road;

- Site observation and construction quality test will be conducted by Ministry of Public Works & Transport (MPWT);

- The official inauguration of the road will be celebrated under the high sovereignty of Prime Minister of the Kingdom of Cambodia, **Samdech Akka Moha Sena Padei Techo Hun Sen**;

Rehabilitation project on NR5, from Sri Sophorn to Poipet will have planned to sign on the loan agreement by 2014 then the project will start constructing in 2017 and it will complete in 2019, duration of 2 years.

Note: *for the location of the construction, borrow pit of laterite and stone, it cannot detail identify because the project owner is not recruited the technical consultant for detail project design, because the technical consultant has to identify about soil, stone and laterite quality following to the standard of highway and it will make clear in the detail report of the project.*

4.3.7 Wastes Management

The NR5 improvement project, (from Sri Sophorn to Poipet) is two wastes: solid and liquid wastes as described below:

A. Solid Waste

The solid waste is created during the construction phase, in period of 2 years by the staff-workers of contractors and staff-workers of the project. The solid wastes such as papers, bag and bottle plastic, can or metal bottle, glass bottle, waste from kitchen, old tires, wooden boxes, concrete waste, old cloths waste, lamps, battery, flashlight battery..ect., the construction Contractor should require to the contractor to do separately into two types. Hazardous waste such as old cloth waste which contaminated of cement or oil/fuel, can or bottle of fuel/oil, paint or chemical, cement, old lamps, flashlight battery, these things should keep in rubbish basket that painted in red color notices and write down in Khmer “rubbish basket for hazardous waste”. For this waste, the construction Contractor should contact to garbage collection company in the Town (in Sri Sophorn Town, there is one company provide garbage collection service; it names GAEA; in Poipet Town there is one company also, it names Poipet Cleaner. These Companies will collect garbage to transport to dump site. For other wastes: old tires, battery should sell to the middleman waste buying. The shop buying old tires is located along the NR5 such as **Leng Thea** shop (Tel: 012 404 022 or 088 671 8188), for bag cement they will do recycle for something else to sell back to the people such as sheet for drying paddy..ect,. do not burn it. For the normal waste such as wooden metal boxes, bottle, can of plastics or metal they should re-use or sell to middleman waste. Moreover, the concrete waste, they should break it to a small parts and transport it to fill up on hole of rural road or provide it to the people to fill up on front of their houses

B. Liquid Waste

The same as solid waste, the liquid waste during the project construction phase in period of 2 years by the staff-workers of contractors and staff-workers of the project. The liquid wastes such as liquid waste outlet from latrines and both rooms, refreeze liquid waste that it expired from machines or vehicles,

waste of fuel/oil, other of chemical waste..ect,. For these liquid wastes they need to do separately into two types. Normal waste such as waste water from the bathroom, waste from kitchen and latrines ect,. They should build septic tanks which it has 2-3 blocks for treatment. For the hazardous waste such as refreeze oil/fuel solutions waste that it expired from machines or vehicles, others solution wastes should well management. Oil/fuel solutions waste should do separately due to take water out, and oil/fuel remaining should bring it to dispose into the pit that it is far from the water sources. For oil used they should do re-cycle use or the people can use for their kiln fire.

4.3.8 Water and Energy Use Planning

A. Water Use

Water use is 3 types: (1) water use drinking, (2) water use for bathing, cooking, and (3) water use for spaying on road. The water for drinking they use water bottle or tank. Water use for bathing, cooking, and others cleaning they use from water supply station or water transport by truck container and they store it in the tank or storage. Water use for spaying on road they do pumping from the Teuk Thla River direct and water sources where water is nearest from construction site.

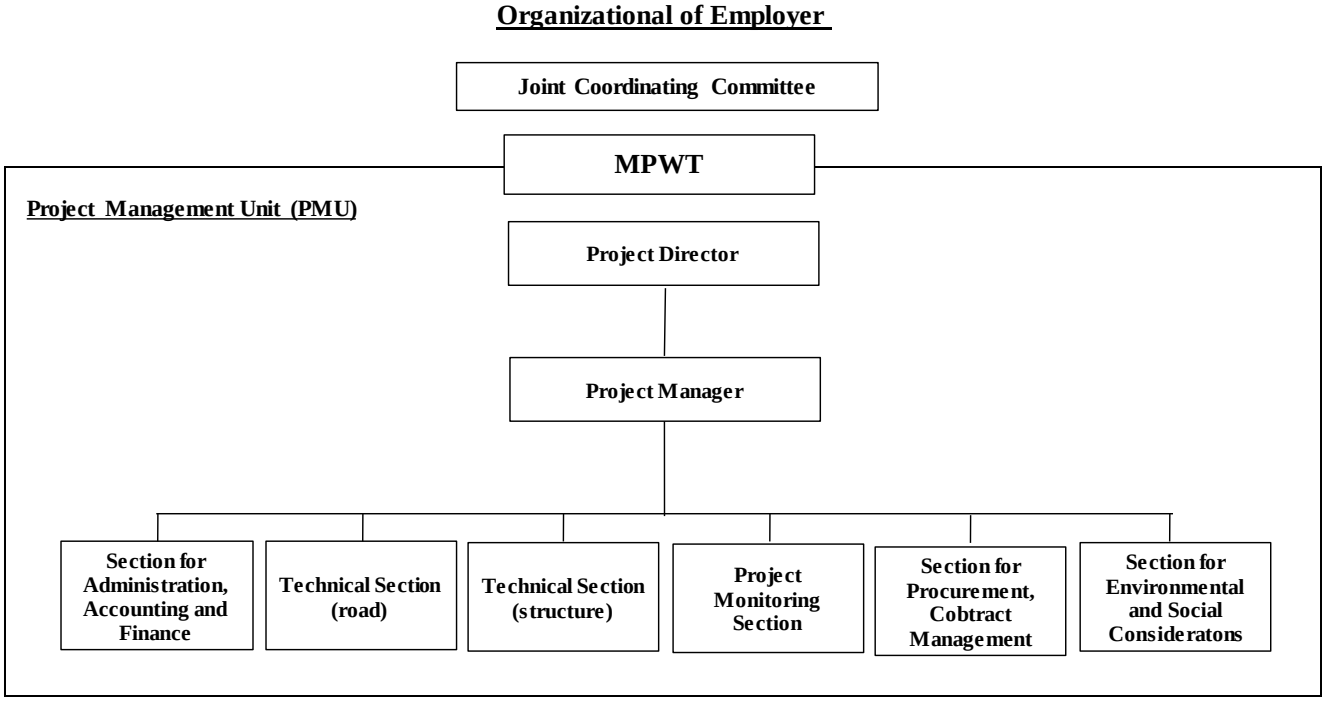
B. Energy Use

Electricity Energy use is 2 types: (1) from the generator that it has a box to protect noise (Silient Genertor), and (2) from the connection electricity network.

Note: *the volume of water use and energy use, it is not do detail design because the project is in the feasibility study for estimation loan from Japan, and in the detail design project stage it will identify next step by the technical consultant.*

4.3.9 Organizational Chart of Work Management for NR5

Chart of Structure for Management Works and Improvement of NR5



Note: ***MPWT- Ministry of Public Works and Transport, PMU- Project Management Unit***

CHAPTER-5

EXISTING ENVIRONMENT RESOURCES IN THE PROJECT AREA DESCRIPTIONS

CHAPTER-5

EXISTING ENVIRONMENT RESOURCES IN THE PROJECT AREA DESCRIPTIONS

In this chapter has given a very detailed description of the existing environmental resources (Physical, natural and Socio-economic environment) at the project area that collected from involved institution/agency and from field investigation on natural resources, as basic data for analysing and evaluating to prepare report of Environmental and Social Impact Assessment (ESIA), which will be affected by project activity. For environmental resource at the project site, the survey team studied 150 meters away from centre line of road (there is 300m width in total), its area is 1,074ha with 35.8Km length.

5.1 Natural Environment

5.1.1 Physical Resources

5.1.1.1 Geology, Topography and Soil Profile in Project Area

1- Topography

Geology of project area is located in lower part which is almost flat with elevation from 10m up to 30m (m.s.l). Landuses along this road are agricultural land, residential land, urban/counties/towns, streams/rivers, lakes/ponds and River side vegetation which growed along the river, lake (see map-1). Average slope in project area is about I=0.00075 (0.075%), equaling to 0.43 degree (it doesn't include the river bed of creek and other streams which the project goes across). For a road portion from Sri Sophorn to Poipet of NR5, the water is mostly flowed from the left side of the road (called upstream of road) to the right (called downstream of road). Sometime, water is from upstream and it continuously flows along the road, then it goes forward to streams/rivers at downstream by culverts or bridges; water from these rivers/streams will flow directly to Tonle Sap Lake.

2- Soil Type

Based on Crocker's map in 1963 with scale of 1/1.000.000 mentioned that there are two types of soil in both sides of NR5, a portion from Sri Sophorn to Poipet that were described as the following table:

Table 5-1: Soil species in sides of NR5, a portion from Sri Sophorn to Poipet KP366+250 to KP402

No.	Soil type	Direction	Located Kilometer Post (KP)	Remarks
1	Alluvial Lithosols	Right and Left	366+250 to 366+926	1 section
2	Plinthite podzol	Right and Left	366+926 to 402	1 section



Soil type:**Alluvial Lithosols** in project area.

Picture: November 27, 2013



Soil type:**Plinthite podzol** in project area.

Picture: August 22, 2013

- **Alluvial Lacustrine**: It is the same soil in Pursat province, this soil type is mostly along the Steung Teuk Thla (downstream called Steung Sisophon) and flood area of this Steung. This area is flooded in wet season due to water River. This area is adherent hard alluvial soil with reddish-brown or become grey with thickness is 0.35m and started from 0.35m to 1m; it is soil with lightly reddish-brown (during this study it was flooded). For this soil type along the road, we saw most land are rice field and small crops and possible to grow for rice, fruit and vegetable.
- **Plinthite podzol**: this soil type is clay mixed fine sand with lightly reddish-brown or become brown. Its layer is from 15cm to 30cm, and depth from 30cm to 60cm is clay-sandy soil, fine sand mixed laterite with lightly reddish-brown to dark rust color (a bit hard of laterite). Most of this soil type is available along the road, it is in lowland of rice field flooding in wet season, its nutrient is poor. We seen this soil can produce such as rice, some fruits and vegetable.

3- Geology

According to geological map of Department of Geology that sponsored by JICA in 2002, it mentioned that the project area is located in the lowland of Steung Sisophon and O-Chrov of low land of Banteay

Meanchey province. . This lowland existed in quaternary period of Holocene Epoch and Cenozoic Era that was 2.58 million years Old still now due to have two species of alluvial sediments, deltaic deposits and lake bed deposits. It is deltaic deposits started from KP-366 to KP374+750, this type was from sediments (Lake bed deposits), From KP374+750 to KP396+640, this alluvial of deltaic deposits, from KP396+640 to KP402+505, this is new alluvial of Terrace Alluvial deposits, and from KP402+505 to Poipet that it is stream of Cambodia border and Thailand, this is particle of Pediments.

4. Soil and Rock Layer

There is no bridge for construction in the section road from Sri Sophorn to Poipet; the technical study team did not do drilling for this base bridge study. Therefore, there is no data for these layers. But, based on interview with commune authority and the people; gravel-texture from 40m to 60m depth along this road.

5.Hydrogeology

The NR5 for apportion from Sri Sophorn to Poipet, is the middle part of lowland which covered by the young alluvium with layer of hard alluvial soil, clay, smooth sand, rough sand, and gravel-texture from 0m to 40m or to 60m depth. According to the experiences of engineer of drilling well for rural clean water, the project area is covered by old alluvium that the amount of ground water is more than area that covered by (young alluvium Qya). The aquifer is in the layer of smooth sand with small and average grainy size (from 0.25mm to 0.5mm) and its color is dark reddish-brown or become rust color. For layer of rough sand (its grainy size is from 2mm to 4mm), the sand color is light clear yellow or become yellow; this layer has no water. The amounts of water have small or much according to thickness of sand layer. Thicker sand layer has water much more than thinner sand layer.

There are two layers of grown water: (1) the upper layer of ground water is unconfined aquifer which its flow direction is to Tonle Sap with the depth from 7m to 16m. (2) Layer of confined aquifer with pressure is generally found out in the young and old alluvium at depth from 12m to 55m. The sand layer is separated by clay layer. However, some location of young alluvium has no water as in the Changva commune; there is no ground water from Confined Aquifer layer using. The location of tube/drilling and shallow wells in the communes/Sangkat along the NR5 for a portion from Sri Sophorn to Poipet are showed in the following table:

Table 5-2: Wells located on both sides of NR5 for a portion from Sri Sophorn to Poipet

No.	Commune/ Sangkat	Direction	Location of Kilometer Post (KP)	Shallow well (%) (Unconfined Aquifer)	Drilling well (%) (Coffined Aquifer)	Remarks
1	Teuk Thla	Right + Left	Right 366+250 to 371+ 477 Left 366 to 371+ 084	10	10	No well drillling in the project study
2	Samrong	Left	Right 371+477 to 372+ 931	1	1	No well drillling in the project study
3	Changva	Right	Left371+084 to 372 + 931			No groundwater for both species
4	Kob	Right + Left	Right-Left 372+931 to 383+ 497	0	30	Some sites were drlled but no water
5	Nimit	Right + Left	Right 383+ 497 to 394+ 930 Left 383 + 497 to 397+ 000			Some sitess were drlled but no water
6	Phsa Kandal	Right + Left	Right 394+ 930 to 402 Left 397 + 000 to 402	15	5	Some site were drlled but no water

Note:The consumption of wells was calculated by percentage of people in commune.

Source: Interviewed with Sangkat/commune cleaks or chiefe of commune council from August 12 to August 23, 2013.

6. Mines

Due to the reserved land for the NR5 (There are 60m in total, or 30m off set from center line to both sides), a portion from Sri Sophorn to Poipet, there is no any important mine exploitation which is found in the project area.

5.1.1.2 Climate

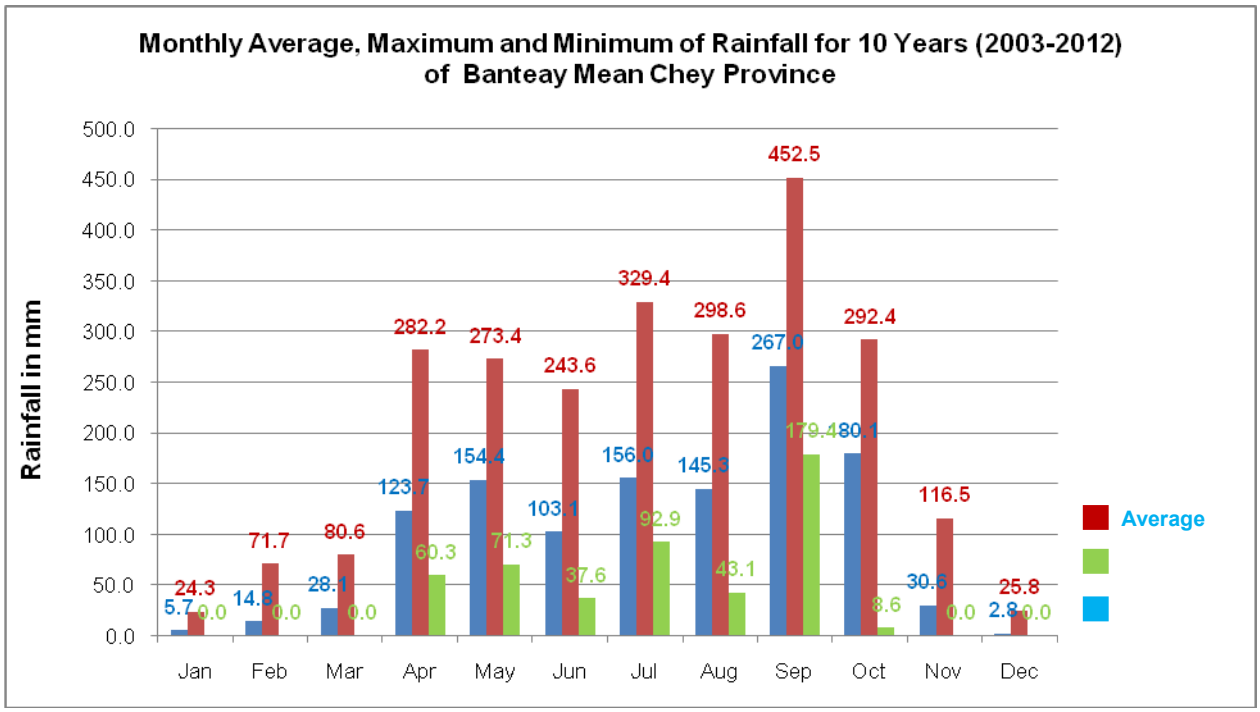
1. Rainfall

Due to data from Provincial Department of Water Resources and Meteorology in Banteay Meanchey (2003-2012) it indicated that average rainfall for 10 years of return period, from 2003 to 2012, is **1211.4mm**. However, the highest rainfall is **452.5mm** in September 2002.

Table 5-3: Rainfall in millimeters for 10 years period (2003-2012) in Banteay Meanchey

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Total
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2003	0.0	0.0	13.9	78.6	157.7	98.7	148.6	141.5	210.7	148.7	0.0	0.0	**998.4**
2004	0.0	5.2	0.5	128.7	109.0	243.6	104.3	180.6	179.4	140.5	0.0	0.0	**1091.8**
2005	12.5	0.0	5.5	91.2	209.7	82.8	209.9	94.1	210.9	260.8	5.8	25.8	**1209.0**
2006	6.3	71.7	49.7	93.8	109.2	37.6	329.4	171.6	253.8	118.0	2.5	2.0	**1245.6**
2007	4.0	29.3	15.7	139.5	206.4	87.4	164.0	104.5	267.7	137.6	116.5	0.0	**1272.6**
2008	0.0	0.0	0.0	60.3	273.4	99.7	102.4	107.1	367.6	223.1	111.3	0.0	**1344.9**
2009	0.0	0.0	69.1	182.1	144.7	125.2	97.4	43.1	294.6	86.0	8.0	0.0	**1050.2**
2010	9.7	13.5	25.7	67.9	71.3	122.6	96.8	207.0	228.5	255.6	9.0	0.0	**1107.6**
2011	0.0	13.0	20.2	282.2	89.6	57.3	213.8	298.6	204.0	292.4	4.5	0.0	**1475.6**
2012	24.3	15.5	80.6	112.3	172.7	76.3	92.9	105.1	452.5	137.8	48.5	0.0	**1318.5**
Monthly Mean	**5.7**	**14.8**	**28.1**	**123.7**	**154.4**	**103.1**	**156.0**	**145.3**	**267.0**	**180.1**	**30.6**	**2.8**	**1211.4**
Max	**24.3**	**71.7**	**80.6**	**282.2**	**273.4**	**243.6**	**329.4**	**298.6**	**452.5**	**292.4**	**116.5**	**25.8**	**2491.0**
Min	**0.0**	**0.0**	**0.0**	**60.3**	**71.3**	**37.6**	**92.9**	**43.1**	**179.4**	**86.0**	**0.0**	**0.0**	**570.6**

Source:Department of Meteorology of Ministry of Water Resources and Meteorology



2. Temperature

Based on data obtained from Ministry of Water Resources and Meteorology, this data collected from the station in Sri Sophorn Town it was showed that:

- Maximum temperature in average for return period, 10-year, is 34.6 degree Celsius.
- Minimum temperature in average for return period, 10-year, is 22.2 degree Celsius.
- Maximum temperature in average for return period, 1 year, is 28.4 degree Celsius.
- Perennial maximum temperature for return period, 10-year, is 40.3 degree Celsius in 2010 and 2011.
- Perennial minimum temperature for return period, 10-year, is 15.0 degree Celsius in 2011.

Table 5-4 (A): Monthly perennial maximum temperature in °C for return period of 10-year (2003-2012)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yeraly Mean
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2003	32.0	34.2	35.0	33.5	33.7	32.6	33.1	31.9	32.5	31.9	31.4	31.0	**32.7**
2004	32.7	33.9	36.8	37.3	35.1	33.1	33.7	32.6	32.1	32.4	33.4	32.7	**33.8**
2005	33.0	37.3	36.3	36.9	35.6	33.8	32.7	32.8	32.1	32.0	31.6	29.8	**33.7**
2006	34.5	35.0	36.5	37.5	37.0	37.0	34.8	34.0	34.0	33.4	35.0	34.0	**35.2**
2007	35.0	37.5	38.7	39.2	35.3	36.8	35.0	34.2	35.0	33.0	32.0	33.8	**35.5**
2008	33.7	36.1	37.4	37.9	36.6	34.0	34.5	33.4	33.9	32.3	32.3	31.8	**34.5**
2009	33.3	35.5	36.7	37.2	35.5	32.8	33.9	33.1	33.2	32.4	32.2	32.0	**34.0**
2010	35.2	38.1	39.9	40.1	40.3	38.2	36.3	34.5	36.3	32.0	32.5	31.0	**36.2**
2011	35.2	38.1	39.9	40.1	40.3	38.2	36.3	34.5	36.3	32.0	32.5	31.0	**36.2**
2012	33.2	35.0	35.5	37.0	36.0	34.0	34.0	35.5	33.5	32.5	33.0	33.0	**34.4**
Monthly Total	**337.8**	**360.7**	**372.7**	**376.7**	**365.4**	**350.5**	**344.3**	**336.5**	**338.9**	**323.9**	**325.9**	**320.1**	**346.1**
Monthly Mean	**33.8**	**36.1**	**37.3**	**37.7**	**36.5**	**35.1**	**34.4**	**33.7**	**33.9**	**32.4**	**32.6**	**32.0**	**34.6**
Max	**35.2**	**38.1**	**39.9**	**40.1**	**40.3**	**38.2**	**36.3**	**35.5**	**36.3**	**33.4**	**35.0**	**34.0**	**36.9**

Source: Department of Meteorology of Ministry of Water Resources and Meteorology

Table 5-4 (B): Monthly perennial minimum temperature in °C for return period of 10-year (2003-2012)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yeraly Mean
Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2003	22.0	23.1	24.2	24.6	25.7	24.9	25.2	24.6	24.5	23.2	22.7	21.9	**23.9**
2004	21.8	22.5	25.7	26.4	26.8	25.7	25.7	25.6	15.4	23.4	22.6	18.7	**23.4**
2005	19.9	24.5	23.6	25.4	25.6	25.5	24.7	24.8	24.5	23.9	22.8	19.8	**23.8**
2006	20.1	23.3	25.2	25.2	25.3	25.0	23.1	24.0	24.2	24.3	22.7	20.9	**23.6**
2007	20.4	20.2	19.5	20.3	24.5	24.3	21.0	18.5	17.8	18.0	17.5	19.3	**20.1**
2008	19.8	22.1	22.8	24.0	25.1	24.5	23.8	23.5	20.8	20.2	21.4	19.1	**22.3**
2009	20.7	22.7	23.8	24.6	25.5	24.9	24.2	23.9	20.4	20.0	21.7	20.2	**22.7**
2010	18.7	23.0	21.2	24.0	24.4	24.2	23.5	22.5	22.5	20.0	20.0	16.0	**21.7**
2011	15.0	16.3	17.0	20.0	23.0	22.0	22.0	22.0	22.0	22.0	20.1	15.0	**19.7**
2012	17.5	17.0	22.0	21.0	22.5	22.2	21.0	20.0	22.5	22.5	21.0	18.5	**20.6**
Monthly Total	**195.9**	**214.7**	**225.0**	**235.5**	**248.4**	**243.2**	**234.2**	**229.4**	**214.6**	**217.5**	**212.5**	**189.4**	**221.7**
Monthly Mean	**19.6**	**21.5**	**22.5**	**23.6**	**24.8**	**24.3**	**23.4**	**22.9**	**21.5**	**21.8**	**21.3**	**18.9**	**22.2**
Min	**15.0**	**16.3**	**17.0**	**20.0**	**22.5**	**22.0**	**21.0**	**18.5**	**15.4**	**18.0**	**17.5**	**15.0**	**18.2**

Source: Department of Meteorology of Ministry of Water Resources and Meteorology

3. Wind Speed and Wind Direction

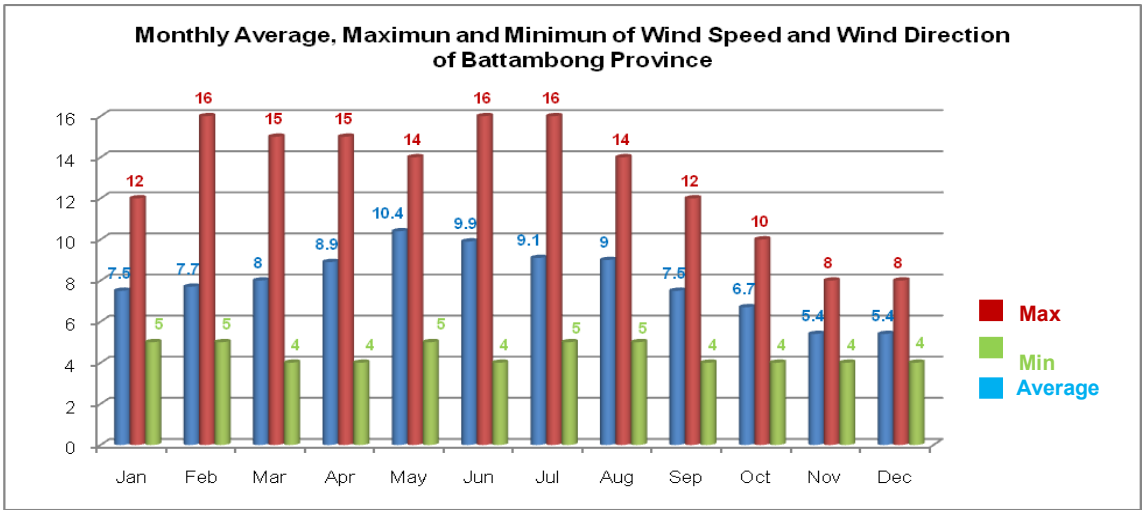
The working team has cooperation with Mr. Yim Bunrom, Director of Provincial Department of Water resources and Meteorology (PDoWRAM), Banteay Meanchey to look for data, but He said that there is no data recored for wind speed and wind direction. Moreover, the team has communicated with **Mrs. Tep Pholaroth**, secretary of Department of Meteorology in MOWRAM, She said that if, there is no station for wind speed and wind direction recorded in Banteay Meanchey; then we can usedata collected from Battambang province because this province is closed each other.

Referring to data from Department of Meteorology of MOWRAM in Battambang province shown that dry season started from November to April, wind blew from North to Northeast. Then wet season is from May to October, wind blew from Southwest to Northeast. The average of wind speed for 10 years return period is 8m/s. The highest speed of wind is in February and July, 2008; then 16m/s in June 2007.

Table 5-5:Monthly average of wind speed and direction for 10 years return period (2003-2012) in Battambang province

Month	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Yearly Mean
Year	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	dd	fx	
2003	9.0	NE	7.0	W	7.0	E/NW	9.0	NE	10.0	W	10.0	W	8.0	W	9.0	SW	9.0	W	7.0	E	5.0	E	5.0	NE	**7.9**
2004	9.0	NE	5.0	E	5.0	W/NW	6.0	SW	5.0	SW	4.0	S/SW	5.0	W/WS	5.0	S/SW	4.0	S/SW	4.0	E	4.0	N/NE	5.0	SE	**5.1**
2005	9.0	N/NE	10.0	N/NE	11.0	NE	15.0	NE	13.0	NE	10.0	W	8.0	W	7.0	SW	7.0	W	9.0	SE	4.0	N/NE	4.0	N/NE	**8.9**
2006	9.0	NW	11.0	NE	9.0	E	12.0	SE	11.0	W	12.0	S/SW	10.0	W	14.0	W	12.0	W	9.0	E	8.0	NE	8.0	E	**10.4**
2007	12.0	N	16.0	W	15.0	E	10.0	NE	14.0	W	12.0	W	16.0	W	12.0	SW	9.0	W	10.0	SW	8.0	N	8.0	E	**11.8**
2008	5.0	NE	5.0	E	7.0	NE	7.0	SE	12.0	SW	16.0	SE	9.0	SW	5.0	W	4.0	SW	6.0	NE	6.0	N	5.0	NE	**7.3**
2009	5.0	NE	5.0	N	6.0	NE	7.0	NW	7.0	SW	10.0	SW	5.0	SW	7.0	SW	10.0	SW	7.0	W	5.0	NW	5.0	NE	**6.6**
2010	5.0	NE	6.0	SW	4.0	S	4.0	SW	14.0	NW	7.0	SW	10.0	SW	8.0	E	6.0	SW	5.0	NE	5.0	N	4.0	E	**6.5**
2011	6.0	NW	5.0	NW	7.0	SE	12.0	S	8.0	W	10.0	W	10.0	W	12.0	SW	5.0	S	4.0	NE	4.0	N	5.0	N	**7.3**
2012	6.0	NW	7.0	NWN	9.0	SW/E	7.0	NE	10.0	W/SW	8.0	SW/S	10.0	SW	11.0	SW	9.0	W/SW	6.0	NE	5.0	N/NNE	5.0	NE	**7.8**
Average	**7.5**	**NE**	**7.7**	**N**	**8.0**	**NE**	**8.9**	**NE**	**10.4**	**SW**	**9.9**	**SW**	**9.1**	**W**	**9.0**	**SW**	**7.5**	**W/SW**	**6.7**	**NE**	**5.4**	**N**	**5.4**	**NE**	**8.0**
Max	**12.0**		**16.0**		**15.0**		**15.0**		**14.0**		**16.0**		**16.0**		**14.0**		**12.0**		**10.0**		**8.0**		**8.0**		**13.0**
Min	**5**		**5**		**4**		**4**		**5**		**4**		**5**		**5**		**4**		**4**		**4**		**4**		**4.4**

Source: Department of Meteorology, MOWRAM



4. Humidity and Sunlight

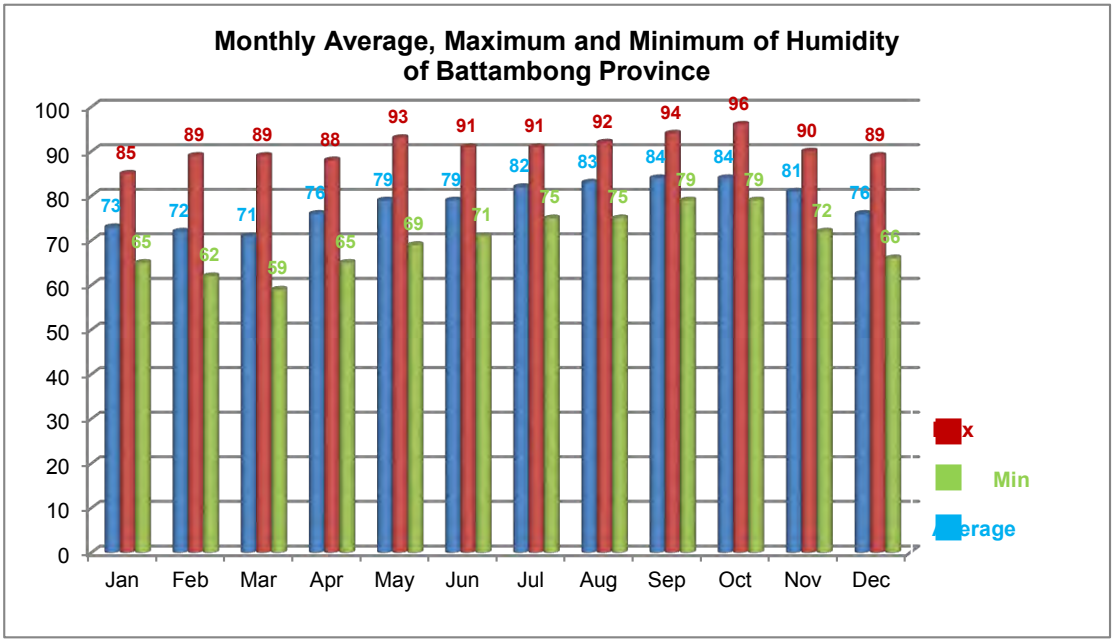
Based on discussion with Mr. Yim Bunrom, PDoWRAM, Bateay Meanchey province said that humidity and sunlight instruments were damaged since 1997 therefore sinece that year for BMC province never recorded for these data. There are these datas available only in Battambang province that there is station of Meteorology in Battambang Town.

According to data from Department of Meteorology, Ministry of Water Resources and Meteorology, it indicated that the average of humidity and sunlight in Battambang province for 10-years return period (2003-2012) is **78%**. The highest humidity and sunlight is 96%, in October 2009; while the lowest humidity and sunlight is 62% in February 2004.

Table 5-6:Humidity and Sunlight for 10-year return period (2003-2012) in Battambang

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Mean
Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2003	79	75	77	73	78	78	83	83	86	85	77	68	**79**
2004	65	62	59	65	69	74	75	75	79	79	72	66	**70**
2005	74	72	65	69	72	71	78	76	80	80	78	72	**74**
2006	75	65	68	78	80	77	80	82	83	82	75	75	**77**
2007	72	70	72	75	84	78	81	81	81	83	85	72	**78**
2008	75	81	84	88	89	91	91	91	92	89	90	89	**87**
2009	85	89	89	88	93	89	89	92	94	96	89	87	**90**
2010	69	68	59	69	71	78	81	83	84	82	76	73	**74**
2011	65	67	67	76	77	76	79	81	84	84	77	74	**76**
2012	69	74	74	76	78	82	83	85	81	85	87	86	**80**
Monthly Mean	**73**	**72**	**71**	**76**	**79**	**79**	**82**	**83**	**84**	**84**	**81**	**76**	**78**
Max	**85**	**89**	**89**	**88**	**93**	**91**	**91**	**92**	**94**	**96**	**90**	**89**	**90**
Min	**65**	**62**	**59**	**65**	**69**	**71**	**75**	**75**	**79**	**79**	**72**	**66**	**70**

Source: Department of Meteorology, MOWRAM



5. Evaporation

Related to data of evaporation is not defferent from humidity and sunlight, since 1997 due ti these instrument were damaged, there is no this data to be studied and recored in BMC province. The team has met Mr. Khai Soda, Deputy of PDoWRAM, Battambang province, said that there is no evaporation data was recorded. The team also has met Mr. Chhim Samorn, Deputy of PDoWRAM, Pursat province; he said that evaporation data can take from Pursat Station Town instead of Battambang zone to study.

The evaporation in Pursat for 5 years return period is 5720.70 mm; then the average of annual evaporation is 1430.18 mm (see table 5-7 below).

Table 5-7: The annual evaporation in millimeters (mm), Pursat province

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Total
Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2005	122.50	135.00	155.70	140.40	131.60	123.00	95.20	108.30	83.20	96.90	89.70	90.40	**1371.90**
2006	112.40	131.20	143.40	125.30	123.30	112.50	108.70	99.30	88.50	96.80	93.30	101.40	**1336.10**
2007	114.70	115.80	143.30	141.70	108.80	129.90	109.90	103.00	108.00	95.40	90.60	130.40	**1391.50**
2008	130.40	148.60	188.40	136.40	127.70	134.00	141.30	133.10	141.40	115.30	108.30	116.30	**1621.20**
Monthly Total	**480.00**	**530.60**	**630.80**	**543.80**	**491.40**	**499.40**	**455.10**	**443.70**	**421.10**	**404.40**	**381.90**	**438.50**	**5720.70**
Monthly Mean	**120.00**	**132.65**	**157.70**	**135.95**	**122.85**	**124.85**	**113.78**	**110.93**	**105.28**	**101.10**	**95.48**	**109.63**	**1430.18**

Source: Provincial Department of Water Resources and Meteorology, Pursat province

Conclusion of Meteorology in Bateay Meanchey Province

According to above statement, the average rainfall in Banteay Meanchey province is **1,211.4mm** for 10 years return period (2003-2012); then the highest rainfall is **452.6mm** in September 2012. For temperature, the average of maximum for 10 years of return period (2003-2012) is 34.6^{0}C; while the average of minimum 22.2 ^{0}C. In addition, the perennial maximum temperature is 40.3^{0}C in 2010, but the perennial minimum is 15^{0}C in 2011. However, there is no data for wind speed and direction in Banteay Meanchey province. For humidity and sun light, there is no data recorded because all instruments were damaged since 1997. Therfore, since that year there is no data was recorded and studied.

5.1.1.3 Air, Noise and Vibration Quality

1. Air Quality Measurement

For air quality measurement and analysis, the survey team did cooperation with laboratory working team of Ministry of Environment (MoE) in order to conduct the survey 24 hours of working days for each two sites. There were two times measured and analyzed for air quality, once in dry season and wet season respectively; then the location sites of air quality measurement are showed as the following:

- **Survey Location No 1**: it located at the road site in Kbal Spean village, Poipet Sangkat, Poipet City, Banteay Meanchey province. The survey was done on 19 August and on 11 December 2013 (see the detailed survey locations for section 1 below):

Survey Location Card

Location:KP 407 toKP 407+300 Poipet Town in front the Cambodian public bank

Road Site:	Lat	13.65916	E	235348
Datum: WGS 84	Lon	102.55354	N	1511367



- **Survey Location No 2**: it located about 100 m away from the first location(>100 From the Road)inKbal Spean village, Poipet Sangkat, Poipet City, Banteay Meanchey province. The survey was done on 20 August and on 12 December 2013 (see the detailed survey locations for section below).

Location: KP407 – KP407+300, Poipet Town far from the road site more than 100m

Baseline:	Lat	13.65814	E	235281
Datum: WGS 84	Lon	102.55293	N	1511254



According to table and graphic below, the result of air quality by each selected station, the existing air quality in the project area still in good condition in wet and dry seasons; all the pollution values are lower than the ambient air quality standard of the MoE (see table 5-8 (A)-(B) for details).

Table 5-8 (A): Air quality measurement at road site, Dated 19 August, and 11 December 2013

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method
1	Nitrogen Dioxide (No_2)	mg/m³	0.010	0.045	**0.1**	**0.10**	Saltzman Method
2	Sulfur Dioxide (So_2)	mg/m³	0.009	0.024	**0.3**	**0.30**	Pararosaniline Method
3	PM2.5	mg/m³	0.150	0.199	-	**0.02**	Method Weight Concentration Measuring
4	PM10	mg/m³	0.231	0.324	-	**0.05**	Method Weight Concentration Measuring

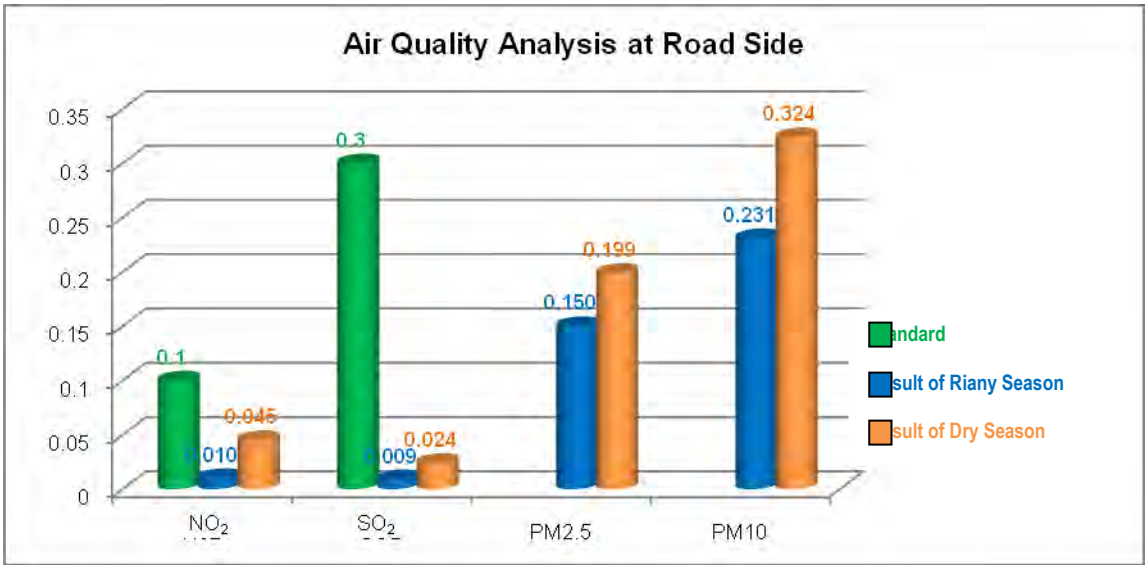
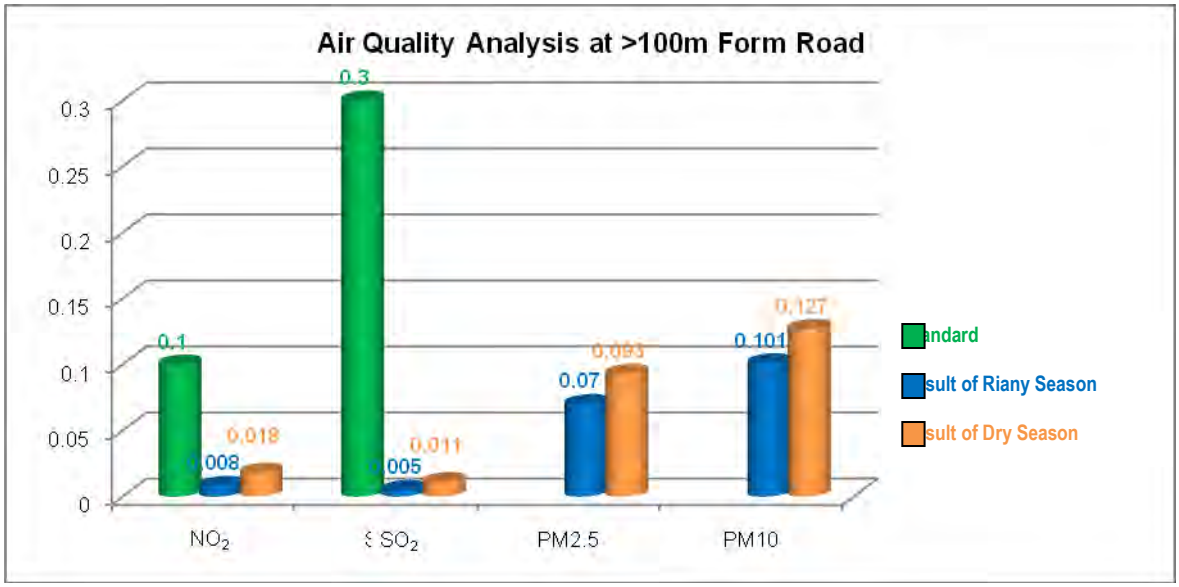


Table 5-8 (B): Air quality measurement about 100 m away, dated 20 August, and 12 December 2013

No	Parameter	Unit	Results in wet season	Results in dry season	Standard (MoE)	Standard WHO	Method
1	Nitrogen Dioxide (No_2)	mg/m³	0.008	0.018	**0.1**	**0.10**	Saltzman Method
2	Sulfur Dioxide (So_2)	mg/m³	0.005	0.011	**0.3**	**0.30**	Pararosaniline Method
3	PM2.5	mg/m³	0.070	0.093	-	**0.02**	Method Weight Concentration Measuring
4	PM10	mg/m³	0.101	0.127	-	**0.05**	Method Weight Concentration Measuring





Air Quality test activity at the shoulder road, dated: 19 August 2013, Wet season



Air Quality test activity at the shoulder road, dated: 11 Nov. 2013, Dry season



Air Quality test activity at point far of 100m, dated: 20 August 2013, Wet season



Air Quality test activity at point far of 100m, dated: 12 Nov. 2013, Dry season

2. Noise and Vibration

For noise and vibration measurement, we have done the cooperation with laboratory of Ministry of Environment in order to conduct the measurement survey at 2 locations, 24 hours of each site. Really, the measurement survey (noise and vibration) have been done in wet season only in official working days (not holiday or weekends). All of the survey sites for noise and vibration will have conducted only at road sites; then those locations are showed as the following:

- **Survey location No 1**: it located at the road site in Kbal Spean village, Poipet Sangkat, Poipett City, BMC province, with the coordinate X: 235348 and Y: 1511367. The survey was done on 19 August2013.
- **Survey location No 2**: it located far more than 100m from the location-1, in Kbal Spean village, Poipet Sangkat, Poipett City, BMC province, with the coordinate X: 582532 and Y: 1222525. The survey was done on 20 August2013.

Due to the result of noise measurement by selected location No 1 in wet season, it indicated that average of noise level from 6:00AM in the morning to 13:00PM was 62.5 dB which not identified over the standard level (standard is 70 dB). Also, it was 58.2dB from 14:00PM to 18:00PM that it was still lower than standard (65dB). However, average of noise level at night was 54.2 dB, over the standard of Ministry of Environment, from 23:00PM to 5:00AM (the standard is 50dB). (See table 5-9 (A) for details).

For result from survey location No 2 in wet season, the average of noise level from 6:00 AM to 13:00 PM was 61.4 dB which is lower than standard (the standard is 70dB). Also, the result from 14:00 PM to 18:00 PM was 55.2 dB in average that is not identified over the standard (the standard is 65dB). In contrast, the average of noise level at night was a little bit higher than standard, 52.5 dB (the standard is 50dB) from 23:00PM to 5:00AM. (See table 5-9 (B) for details).

In conclusion, the results of three survey locations for noise measurement in wet season for day-time (morning and afternoon) were not over the standard of Ministry of Environment due to at night started from 23:00 to 3:00 there was sound from the insects were cried such as crickets ect., and from 4:00 to 5:00 there were heavy trucks travelling. Excepted on the night-time was a little bit high if we compared with the standard.

Table 5-9 (A): Noise level in the project area at the point of shoulder road, studied on 19 August 2013

Time	Survey Period	Noise Level dB(A) 19.August.2013 (Riany Season)				Mean
		Laeq	Standard	Lmax	Lmin	
Day	6:00 - 7:00	60.8	70	72.4	53.2	62.5
	7:00 - 8:00	65.2		78.9	55.1	
	8:00 - 9:00	61.9		81.3	55.9	
	9:00 - 10:00	62.0		82.0	58.4	
	10:00 - 11:00	61.9		75.0	58.3	
	11:00 - 12:00	64.4		80.4	58.7	
	12:00 - 13:00	63.4		80.7	58.0	
	13:00 - 14:00	63.6		78.8	58.1	
	14:00 - 15:00	62.8		78.7	58.4	
	15:00 - 16:00	62.3		79.6	58.2	
	16:00 - 17:00	62.1		77.0	58.3	
	17:00 - 18:00	61.8		74.3	56.4	
	18:00 - 19:00	60.2		76.3	55.3	
Evening	19:00 - 20:00	60.4	65	74.5	55.5	2. 85
	20:00 - 21:00	61.1		73.4	55.2	
	21:00 - 22:00	55.8		69.0	49.9	
	22:00 - 23:00	55.5		63.9	49.3	
Night	23:00 - 00:00	55.0	50	68.0	48.2	2. 85
	00:00 - 1:00	53.5		65.4	47.9	
	1:00 - 2:00	52.1		61.6	47.7	
	2:00 - 3:00	50.9		61.1	47.4	
	3:00 - 4:00	51.8		62.3	46.9	
	4:00 - 5:00	55.3		61.9	47.0	
	5:00 - 6:00	60.9		68.8	51.4	
24 hours Average		59.36		72.72	53.70	

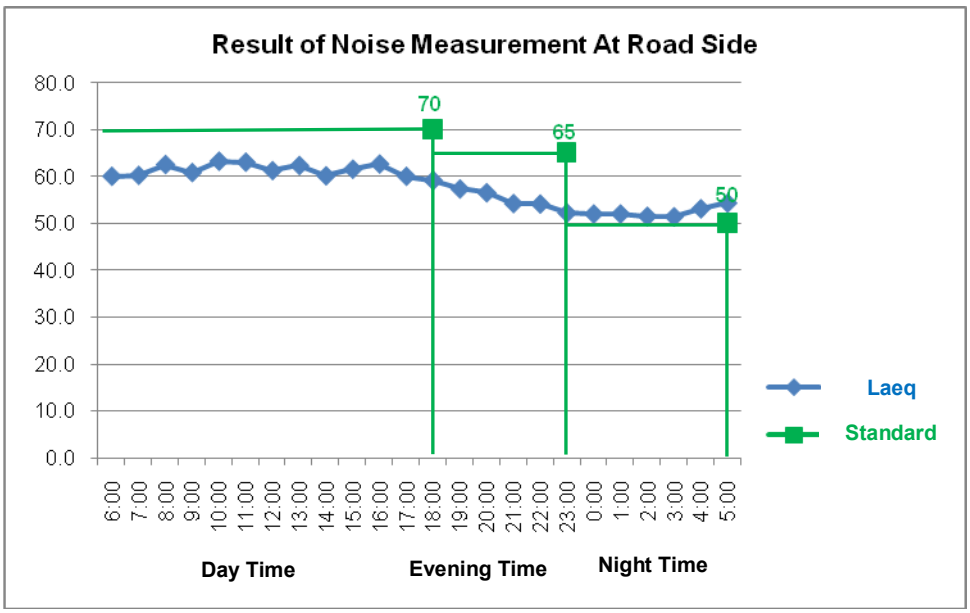
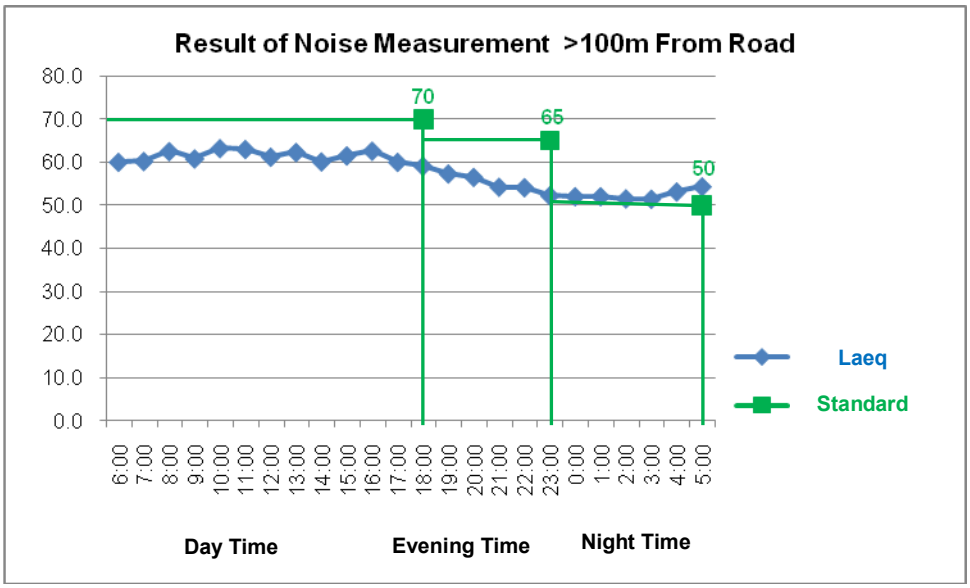


Table 5-9 (B): Noise level in the project area at point far about 100m, studied on 20 August 2013

Time	Survey Period	Noise Level dB(A) 20.August.2013 (Riany Season)				Mean
		Laeq	Standard	Lmax	Lmin	
Day	6:00 - 7:00	60.1	70	75.6	52.8	61.4
	7:00 - 8:00	60.3		75.7	52.1	
	8:00 - 9:00	62.6		79.3	55.9	
	9:00 - 10:00	60.9		77.2	55.5	
	10:00 - 11:00	63.3		76.5	56.0	
	11:00 - 12:00	63.1		78.2	57.1	
	12:00 - 13:00	61.3		81.5	54.6	
	13:00 - 14:00	62.4		77.6	54.3	
	14:00 - 15:00	60.2		77.6	53.8	
	15:00 - 16:00	61.6		78.0	54.0	
	16:00 - 17:00	62.7		78.1	54.9	
	17:00 - 18:00	60.1		75.3	53.9	
	18:00 - 19:00	59.2		76.7	54.1	
Evening	19:00 - 20:00	57.4	65	75.5	54.2	55.2
	20:00 - 21:00	56.6		70.9	53.7	
	21:00 - 22:00	54.3		70.9	50.5	
	22:00 - 23:00	54.2		73.6	50.6	
Night	23:00 - 00:00	52.3	50	77.7	50.9	52.5
	00:00 - 1:00	52.1		68.0	50.8	
	1:00 - 2:00	52.1		68.2	50.8	
	2:00 - 3:00	51.6		67.7	51.6	
	3:00 - 4:00	51.5		66.8	50.1	
	4:00 - 5:00	53.2		66.9	50.7	
	5:00 - 6:00	54.4		65.8	50.9	
24 hours Average		57.81		74.14	53.08	



For vibration in the project area, it was still lower than standard of Ministry of Environment. (See table 5-10 (A)-(B) for details).

Table 5-10 (A): Vibration level in the project area at point of shoulder road, studied on 19 August 2013

Time	Survey Period	Vibration Level dB(A) 19.August.2013 (Riany Season)				Mean
		Laeq	Standard	Lmax	Lmin	
Day	6:00 - 7:00	30.9	70	41.8	21.9	28.6
	7:00 - 8:00	30.6		47.8	22.2	
	8:00 - 9:00	29.7		40.3	23.5	
	9:00 - 10:00	28.6		46.0	23.6	

Time	Survey Period	Vibration Level dB(A) 19.August.2013 (Riany Season)				Mean
		Laeq	Standard	Lmax	Lmin	
	10:00 - 11:00	29.6		45.3	24.1	
	11:00 - 12:00	32.6		50.8	24.7	
	12:00 - 13:00	30.7		46.4	23.8	
	13:00 - 14:00	30.5		47.6	23.2	
	14:00 - 15:00	30.2		38.7	22.6	
	15:00 - 16:00	24.6		37.8	19.5	
	16:00 - 17:00	24.8		37.7	19.6	
	17:00 - 18:00	25.5		43.3	19.4	
	18:00 - 19:00	24.1		34.8	19.7	
	19:00 - 20:00	24.0		35.6	19.4	
	20:00 - 21:00	24.2	65	35.7	19.1	22.7
	21:00 - 22:00	21.2		33.4	18.2	
	22:00 - 23:00	21.3		34.5	17.9	
Night	23:00 - 00:00	20.2		31.6	17.4	
	00:00 - 1:00	20.3		27.4	17.6	
	1:00 - 2:00	19.8		31.7	17.4	
	2:00 - 3:00	19.6	50	30.8	17.6	20.6
	3:00 - 4:00	19.9		31.0	17.5	
	4:00 - 5:00	19.8		33.4	17.9	
	5:00 - 6:00	20.1		34.4	18.7	
24 hours Average		25.12		38.24	20.27	

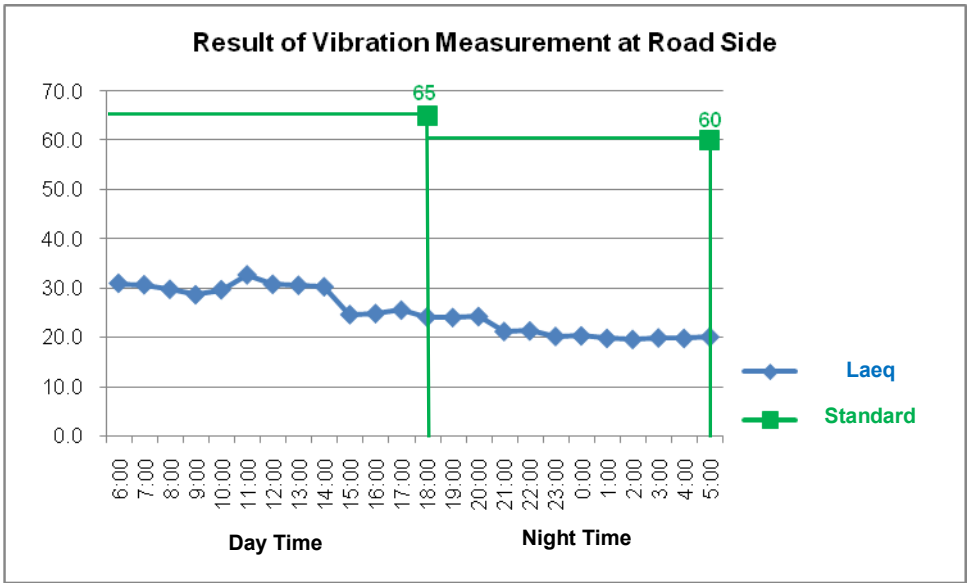
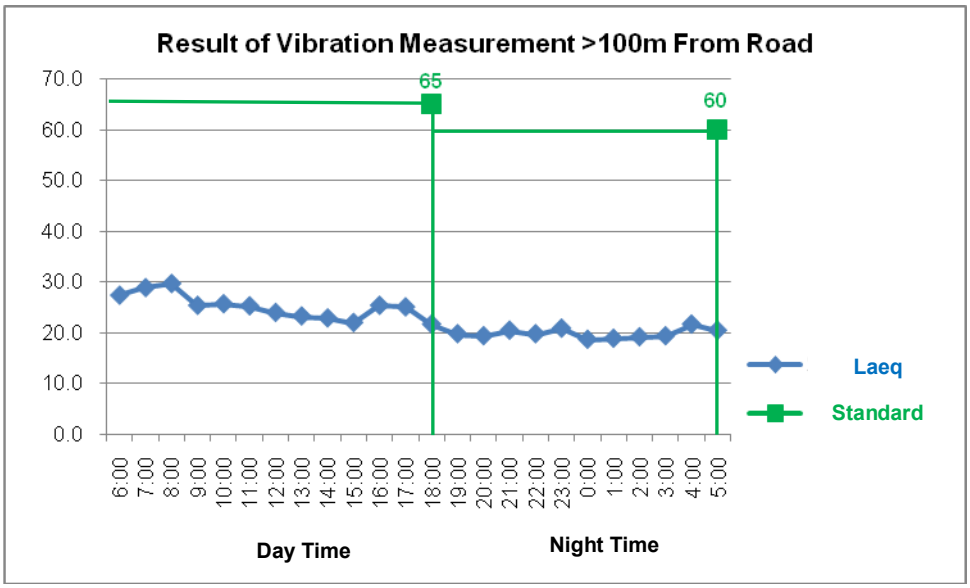


Table 5-10 (B): Vibration level in the project area at point far about 100m, studied on 20 August 2013

Time	Survey Period	Vibration Level dB(A) 20.August.2013				Mean
		Laeq	Standard	Lmax	Lmin	
	6:00 - 7:00	27.3		39.9	18.7	
	7:00 - 8:00	28.8		46.3	18.6	
	8:00 - 9:00	29.6		40.4	19.5	
	9:00 - 10:00	25.3		42.9	20.2	
	10:00 - 11:00	25.6		41.6	21.0	
	11:00 - 12:00	25.2		40.4	19.8	
Day	12:00 - 13:00	23.9	70	39.0	20.3	25.0
	13:00 - 14:00	23.2		35.1	20.3	
	14:00 - 15:00	22.8		42.0	18.9	
	15:00 - 16:00	21.9		44.0	17.4	
	16:00 - 17:00	25.3		39.9	17.1	
	17:00 - 18:00	25.0		43.0	17.3	
	18:00 - 19:00	21.6		43.7	17.6	

Time	Survey Period	Vibration Level dB(A) 20.August.2013				Mean
		Laeq	Standard	Lmax	Lmin	
Night	19:00 - 20:00	19.7	65	40.1	17.0	19.8
	20:00 - 21:00	19.3		35.9	15.8	
	21:00 - 22:00	20.4		32.7	15.1	
	22:00 - 23:00	19.7		40.2	15.6	
	23:00 - 00:00	20.8	50	36.4	14.3	19.8
	00:00 - 1:00	18.6		35.6	14.3	
	1:00 - 2:00	18.8		29.9	15.4	
	2:00 - 3:00	19.1		30.1	16.7	
	3:00 - 4:00	19.3		33.3	16.8	
	4:00 - 5:00	21.6		30.4	17.2	
	5:00 - 6:00	20.4		34.7	18.1	
24 hours Average		22.63		38.23	17.63	





Noise and Vibration Quality test at the shoulder road, dated on 19 Aug. 2013

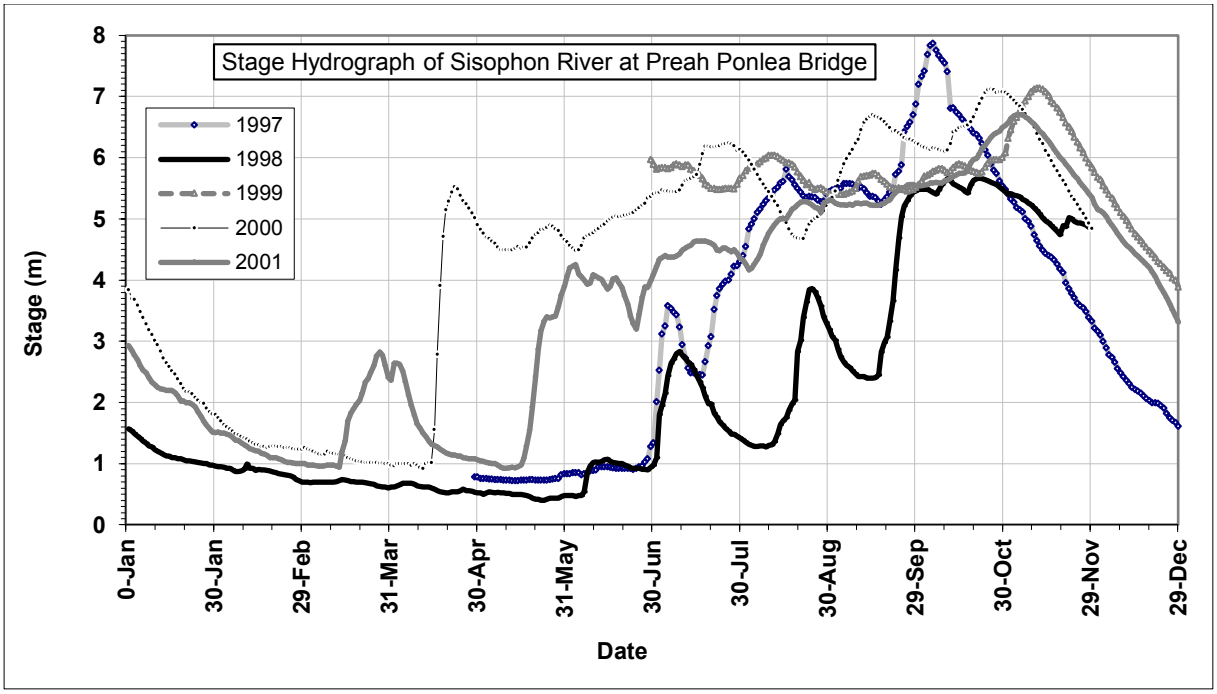


Noise and Vibration Quality test at point far about 100m, dated on 20 Aug. 2013

5.1.14 Hydrology

Referring to digital map with scale 1:1,000,000 from department of Geology, the survey team conducted at project area, from 12 August to 25 December 2013, in order to identify creek and stream which NR5 for portion from Sri Sophorn to Poipet, but there is no real mane for these water sources. Therefore, the working team called creek and stream name as name of culvert that the JICA team and Technical team of MoPWT stated in Chapter-4, table-4.3 above. Moreover the team has studied on hydrology of Steung, creek and stream at MoWRAM and relevant Departments, but there is no either data releted to stream, creek name. It is only Steung Sisophon that it has discharge water and water elevation collected data from MoWRAM/ADB-TA3758-CAM, Northweast Irrigation Sector Project, it shown below:

Data of hydrology of Steung Sisophon at point of Preah Ponlea bridge that it has coordinates X= 281678 and Y= 1502222, catchment area is 4,310Km^2 and discharge water is 515m^3/s in year 1997 (it is year of big flooded according to graph below), the water level is raised up to 7.87m.



Based on graph above and field investigation on 12 August to 25 December 2013 shown that in general, Steung Sisophon is started raise up of water level in June to middle of October, and the water is going down in middle of October to middle of June (excepted there is big flooded such as in year 1997, 2000 and 2013). Refer to Mr. Yim Bunrom, Director of PDoWRAM, Banteay Meanchey province said that the flooded level in October 2013 is 10.3m (it is over of flooded in year 1997 that it was only 7.83m) it causes most Sri Sophorn Town is under flooded.

1. Surface Water Quality Analysis

Water quality analysis in the project area was selected by JICA Survey Team. There was only 1 pointat Steung Teuk Thla, part of down stream called Steung Sisophon. Water Quality Analysis is held twice in total: once in the dry season and another was in rainy season.

Location and date of water sampling (both dry and rainy season) is shown below:

- **Location:** in Steung Sri Sophorn is located in Teuk Thla village, Teuk Thla Sangkat, Sri Sophorn Town, Banteay Meanchey province with Coordinates X = 275893; Y = 1501969 on 21 August 2013 and 5 December 2013.

Water samples were sent to analyze in the Laboratory of Ministry of Environment on August 21, 2013 and on 05 December 2013. Also, the results of water quality are in the following table. The original certificates of results for water quality were attached in annex 2.

Table 5 -11:The result of surface water quality test

No.	Parameter	Unit	Standard of Water Quality in Public Sources for Biodiversity, MoE.	Standard of Drinking Water, MIME	Sample	
					Steung Sri Sophorn	Steung Sri Sophorn
					August 21, 2013	Dec. 05, 2013
					(in wet season)	(in dry season)
1	**pH**	No Unit	**6.5 - 8.5**	**6.5 – 8.5**	7.14	6.71
2	**BOD_5**	mg/l	**-110**	**NA**	3.05	0.40
3	**COD**	mg/l	**NA**	**NA**	5.82	3.52
4	**TSS**	mg/l	**25-100**	**NA**	**117.00***	82.00
5	**Total Coliform**	MPN/100ml	**<5000**	**0**	**1500****	**110****

- **MoE:**Ministry of Environment,**Standard of Water Quality in Public Sources, lake and reservoir, for Biodiversity**
- **MIME:**Ministry of Industry, Mines and Energy**, Standard of Drinking Water**

Note: -*is over Standard of Ministry of Environment.

-**is over the Standard of Ministry of Industry, Mines and Energy.

-***is over the standard of Ministry of Environmentand Ministry of Industry, Mines and Energy.

According to above table, it showed that: there is only one parameter of surface water in wet season, TSS, exceeded the standard of Water Quality in Public Sources, lake and reservoir, for Biodiversity of Ministry of Environment (MoE). For dry season there is no one parameter exceeded.Meanwhile, it is a parameter of Total Coliform that exceeded the standard of drinking water quality of the Ministry of Industry, Mines and Energy (MIME) for dry and wet seasons.

Conclusion with Surface Water Quality before project implementation:

- **pH**: It is higher than 7, it looks like salty in the rainy/wet season (from August to October) water in Steun Sri Sophorn increased due to rain, water of rain flowed across the agriculture area. During taking the water sample, the water level is raised up. On the contrary, its value lower than 7, it looks like Acide in dry season because water in Steung Sri Sophorn is dried up, it is not flow through these area that decribed above. Therefore, according to the results of water quality test in dry and wet seasons shown that: pH is7.14 (in wet season) and pH is 6.71 (in dry season); it is not over the standard, for both of the Ministries, MoE and MIME.
- **BOD_5**and **COD** in wet and dry seasonsare required Oxygen for Bio and required Oxygen for chemical, it is not exceed of standard of MoE.
- **Total Coliform**: rain started to fall down in the wet season from July to October that all of streams and rivers along the project area are full of water. Because of much water, it flooded solid waste which people deposed on the bank of rivers or streams. So, it is the reason of coliform exceeded the standard in these six rivers for both MoE and MIME. For the present of Total Coliform in dry season (in December) it is low a little bit, but it was over the drinking water standard of MIME.
- **TSS**: It is the same as parameters above. In wet season, rain eroded soil from catchment area of rivers/streams which were cause of increasing sediments, not clear water, and especially total suspended solid in water exceeded the standard of MoE. On the contrary, the present its value in dry season is lower than standard of MIME.



Water sampling, Steung Sri Sophorn, Teuk Thla Bridge, dated on 21 August 2013, wet season.



Water sampling, Steung Sri Sophorn, Teuk Thla Bridge, dated on 5 December 2013, dry season.

2. Ground Water Investigation

As the description in Chapter-5, pages 59, there were two species of ground water, Confined Aquifer and Unconfined Aquifer, found along NR5 for portion from Sri Sophorn to Poipet.

- Unconfined Aquifer: the layer is depth shallow if we compared to the sea elevation. The depth of surface land (upper surface of the ground water) is from 7m to 16m (due to land level) and statics level is from 0.5m to 10m, then its flow direction is to go down to Tonle Sap Lake. This water layer is covered by sand and mixture of sand and mud; then water quantity is less than 500L/hr to 2,500L/hr. In dry, the amount of water decreased very much, some wells were drought. Moreover, digging shallow wells of people were not able to get ground water too, as in Changva commune, O-Chrov District.



Hand dug well in Phsa Kandal village, dated 27/11/13



Drilled well in Nimith village, dated 27/11/13

- Confined Aquifer: This layer of ground water is from 12m to 55m depth. The grain size of sand is medium for this layer with reddish-brown or become rust color. Then, it has water pressure and the statics level is from 7m to 15m. This layer of ground water (water table) has small amount of water from 1m^3/hr to 3m^3/hr. However, drilling wells of people were not able to get ground water too for some places, as in Changva commune, O-Chrov District.

5.1.2. Biological Resources

5.1.2.1. Forestry

As description in heading 2.2.3 of Chapter 2, the working team defined the target areas with 1,074ha, both of road sides (300m width), from KP366+250 to KP402. Basing on map of forest coverage area from the Forest Administration (GIS Datasets FA 2002and2006: scale 1/1000.000), it is illustrated that the project area is not covered by the forestry coverage area or protected forest. Also, along the NR5 for apportion from Sri Sophorn to Poipet has riverside vegetation according to filed observation in be tween KP366+250 to KP366+685 in Teuk Thla village, Teuk Thla Sangkat, Sri Sophorn Town.

A. Riverside Vegetation

Based on the field study by working team for COI: 20m (total: 40m), it illustrated that the affected riverside vegetation, 0.43ha with total forest of 24 species, along the NR5 for a portion from Sri Sophorn to Poipet. Most of the regenerating riverside vegetationnormally found in between KP366+250 to KP366+685 in Teuk Thla village, Teuk Thla Sangkat, Sri Sophorn Town.

The riverside vegetationspecies are in a table: 5-12

Table 5-12:Name of riverside vegetationspecies along road from Sri Sophorn to Poipet (COI: 20m), dated on 12 August – 25 December 2013

#	Kilometers(PK)	Communes	Scientific Name	Name of Ou/Canals
01	366+250 to 366+685	Teuk Thla	*Xanthophyllum glancam*	Along the road on the left hand in Teuk Thla village
02			*Mitragyna hirsuta Hav.*	
03			*Dalbergia herrida, Var.glabrescens*	
04			*Raphanus sativus*	
05				
06			*Samandura harmandii Pierre*	
07			*Phragmites karka*	
08			*Crateva andansonii Subsp odorata*	
09			*Ixora cuneifolia*	
10				
11				
12			*Croton caudatus*	
13			*Breynia rhamnoides*	
14			*Hymnocardia wallichii*	
15			*Barringtonia asiatica*	

#	Kilometers(PK)	Communes	Scientific Name	Name of Ou/Canals
16			*Zizyphus oenoplia mill*	
17			*Passiflora foetida Passifloraceae*	
18			*Dalbergia nigrescens, Varsaigonensis*	
19			*Sesbania javanica*	
20			*Gmelina asiatica*	
21			*(Stixis obusifolia)*	
22			*Cayratia trifolia*	
23			*Merremia hederacea*	
24			*Derris trifolia*	

B. PlantSpecies along the Road

JICA Survey Team decided to study plantspecies along the road sides, from both edge/side of the road to its slope. Depending on the study on sites, it illustrated that the total effected planted species along the road were 32 species and total tree number were 1,034 species, included 619 species at the right side and 415 species at the left side with the direction from Sri Sophorn to Poipet. The most of species at the right side is Acacias, 213species and 98species of Acacias at the left side, as shown in tablebelow

Table 5 -13:Name of Tree species on the right hand along road from Sri Sophorn to Poipe, dated on 12 August – 25 December 2013

Kilometers(PK)	Communes	Scientific Name	Diameter (mm)	Number
366+250 to 371+477	Teuk Thla	*Delonix regia, (Boj. Ex*	0.10 to 0.52	**1**
		Cassia fistula		**2**
		PINUS merkusii		**1**
		Acacia auriculiformis, A		**76**
		Samanea saman		**12**
371+477 to 372+931	Chang Ngha	*Acacia auriculiformis, A*	0.10 to 0.30	**3**
		Samanea saman		**4**
372+931 to 383+497	Kob		0.10 to 0.83	**13**
		Ceiba pentandra, (L.) G		**12**
		Terminalia catappa L.		**4**
		Morinda citrifolia		**1**
		Borassus flabellifer		**1**
		Peltophorum ferrugineum		**33**
		Eucalyptus camaldulensis		**4**
		Ficus religiosa, L.		**3**
		Eugenia sp.		**18**
		Bombax ceiba L.		**1**
		Cassia fistula		**19**
		Cassia siamea		**3**
		Sesbania grandiflora		**13**
		Acacia auriculiformis, A		**24**
		Samanea saman		**59**
383+497 to 394+930	Nimith	*Delonix regia, (Boj. Ex*	0.10 to 0.79	**11**
				6
		Dalbergia entadoides Pierre		**2**
		Ceiba pentandra, (L.) G		**10**
		Swietenia macrophylla King		**1**
		Butea monosperma (Lam.)		**1**
		Terminalia catappa L.		**7**
		Borassus flabellifer		**6**
		Lagerstroemia floribunda		**1**
		Peltophorum ferrugineum		**11**
		Eugenia sp.		**17**
		Bombax ceiba L.		**2**
		Cassia fistula		**24**
		Combretum quadrangulare Kurz		**1**
		PINUS merkusii		**3**
		Cassia siamea		**1**
		Sesbania grandiflora		**9**
		Acacia auriculiformis, A		**45**
		Samanea saman		**55**

Kilometers(PK)	Communes	Scientific Name	Diameter (mm)	Number
394+930 to 402+000	Phsa Kandal	*Ceiba pentandra, (L.) G*	0.10 to 1	**1**
		Swietenia macrophylla King		**1**
		Morinda citrifolia		**1**
				16
		Ficus religiosa, L.		**8**
		Eugenia sp.		**2**
		Combretum quadrangulare Kurz		**1**
		Acacia auriculiformis, A		**65**
		Samanea saman		**4**
				619

Table 5 -14:Name of Tree species on the left hand along road from Sri Sophorn to Poipe, dated on 12 August – 25 December 2013

Kilometers(PK)	Communes	Scientific Name	Diameter (mm)	Number
366+250 to 371+084	Teuk Thla	*Ceiba pentandra, (L.) G*	0.10 to 0.52	**1**
		Peltophorum ferrugineum		**4**
		Eugenia sp.		**1**
		Combretum quadrangulare Kurz		**1**
		Acacia auriculiformis, A		**30**
		Samanea saman		**8**
371+084 to 372+931	Samrong	*Mitragyna hirsuta Hav.*	0.10 to 0.30	**1**
		Acacia auriculiformis, A		**3**
		Samanea saman		**3**
372+931 to 383+497	Kob	*Delonix regia, (Boj. Ex*	0.10 to 0.83	**12**
				3
		Ceiba pentandra, (L.) G		**2**
		Terminalia catappa L.		**6**
		Borassus flabellifer		**3**
		Peltophorum ferrugineum		**15**
		Eucalyptus camaldulensis		**1**
		Schleicheria trijuga, Wi		**2**
		Eugenia sp.		**11**
		Ficus sp		**1**
		Cassia fistula		**9**
		PINUS merkusii		**4**
		Cassia siamea		**6**
		Sesbania grandiflora		**11**
		Acacia auriculiformis, A		**20**
		Samanea saman		**40**
383+497 to 397+000	Nimith	*Delonix regia, (Boj. Ex*	0.10 to 1	**4**
				9
		Butea monosperma (Lam.)		**4**
		Terminalia catappa L.		**20**
		Bauhinia acuminata		**1**
		Morinda citrifolia		**1**
		Borassus flabellifer		**4**
		Diospyros helferi		**1**
		Peltophorum ferrugineum		**4**
		Ficus religiosa, L.		**1**
		Eugenia sp.		**9**
				2
		Cassia fistula		**23**
		Combretum quadrangulare Kurz		**2**
		Azadirachta indica		**1**
		Cassia siamea		**7**
		Sesbania grandiflora		**10**
		Acacia auriculiformis, A		**13**
		Samanea saman		**21**
397+000 to 402+000	Phsa Kandal	*Dalbergia entadoides Pierre*	0.10 to 1	**1**
		Ceiba pentandra, (L.) G		**4**
		Acacia intsii		**1**
		Peltophorum ferrugineum		**12**

Kilometers(PK)	Communes	Scientific Name	Diameter (mm)	Number
		Dipterocarpus intricatus		**1**
		Pterocarpus pedatus		**2**
		Eucalyptus camaldulensis		**18**
		Ficus religiosa, L.		**2**
		Eugenia sp.		**3**
		Combretum quadrangulare Kurz		**2**
		Sesbania grandiflora		**2**
		Acacia auriculiformis, A		**32**
				415

Table 5 -15: Name and Numbers of Total Species along the NR5 from Sri Sophorn to Poipet (KP366+250 to KP402), dated on 12 August – 25 December 2013

#	Scientific Name	Number
01	*Delonix regia, (Boj. Ex*	28
02	*Mitragyna hirsuta Hav.*	1
03		31
04	*Dalbergia entadoides Pierre*	3
05	*Ceiba pentandra, (L.) G*	30
06	*Swietenia macrophylla King*	2
07	*Butea monosperma (Lam.)*	5
08	*Terminalia catappa L.*	37
09	*Bauhinia acuminata*	1
10	*Morinda citrifolia*	3
11	*Borassus flabellifer*	14
12	*Acacia intsii*	1
13	*Lagerstroemia floribunda*	1
14	*Diospyros helferi*	1
15	*Peltophorum ferrugineum*	95
16	*Dipterocarpus intricatus*	1
17	*Pterocarpus pedatus*	2
18	*Eucalyptus camaldulensis*	23
19	*Schleicheria trijuga, Wi*	2
20	*Ficus religiosa, L.*	14
21	*Eugenia sp.*	61
22		2
23	*Bombax ceiba L.*	3
24	*Ficus sp*	1
25	*Cassia fistula*	77
26	*Combretum quadrangulare Kurz*	7
27	*Azadirachta indica*	1
28	*PINUS merkusii*	8
29	*Cassia siamea*	17
30	*Sesbania grandiflora*	45
31	*Acacia auriculiformis, A*	311
32	*Samanea saman*	206
	Total	**1034**

C. The conclusion of Riverside vegetation and the affected plantspecies along the road by the project

According to the JICA survey team, the riverside vegetation and planted-tree counting along the road illustrated from table: 5-12 to table: 5-15 are able to be concluded that:

- This project will affects 0.43 hectares of riverside vegetations, 24 plant species which located from KP-366+250 to KP-366+685, at vital canl on the left hand od direction Sri Sophorn to Poipet, in Teuk Thla village, Teuk Thla commune.

- There are 32 species of plantspecies and 1,034 total affected species with diameter started from 10Cm to 100Cm, and located on the right hand of direction Sri Sophorn to poipet with totally is 619 species, and 415species at the left hand. The most of speciesat the right side is Acacia, 213species and the left side is Acacia, 98 species.

5.1.2.2. Wildlife and Fishin the Project Area

Working team defined field study for detail of wildlife in and next to project area with 150m distance along both of road sides. Within this study we used the method of Line Intersept Transect by investigating along the line of cross section area was 150m botsides, in the rice field is conducted for 5 sites, In the village is conducte for 4 sites, in the residential houses as a small Town is conducted for 4 sites and in the Town is conducted for 4 sites (detailed in heading 2.2.3.2 of Chapter-2). The results are illustrated in table below.

1.Mammals

There are sixspecies of crucial mammals found in the project area. One of them is in the appendix of CITES II, Island Flying-fox but they just only fly across the project area (Detailed in table: 5-16 below).

Table 5 -16:Name of mammals in the project area studied from 12 August –25 December 2013

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
1	*Tamiops rodolphii*	Cambodian Striped Tree Squirrel	373 to 392,	LC		
2	*(Order: CHIROPTERA)*	Bats	366 to 407+300			
3	*Otonops wroughtoni*	wroughton's Free-tailed Bat	366 to 407+300			
4	*Pteropus hypomelanus*	Island Flying-fox	366 to 404	VU	II	
5	*Cynopterus sphinx*	Lesser Short-nosed Fruit Bat	373 to 403	LC		
6	*Cynopterus brachyotis*	Lesser Short-nosed Fruit Bat	373 to 405	LC		

Note: I, II and III are the CITES convention appendix number. They are classified by forest administration, consisting of endangered species (En), rare species (r), critically endangered species (Cr), vulnerable species (Vu) and Last Cosern (LC), **LC**: Last Consern

Working team took a few pictures of mammal at the project area such as:





Working team took a picture of Bats place in the project area such as:



Bats place at Rattanak Nimit, Yeang Thmey village, Kob commune,18/08/13

2. Birds

There are crucial 38 birds species found in the project area, with 4 species in Appendix of CITES (II and III). For category-II: it is Barn Owl (*Tyto alba*) and Black-shouldered kite (*Elanus caeruleus*), and category-III are Cattle Egret (*Bubulcus ibis*)and *Egretta alble* (Great Egretta) which were shown in table: 5-17 below.

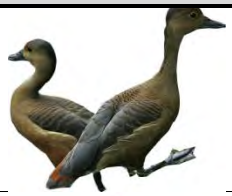
Table 5 -17:Name of birds in/near the project area studied from 12 August- 25 December 2013

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
1	*Anthus rufulus*	Paddyfield Pipit	366to 403	LC		
2	*Caprimulgus macrurus*	Large-tailed Nightjar	366to 403	LC		
3	*Ploceus philippinus*	Baya Weaver	366to 403	LC		

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
4	*Lonchura punctulata*	Scaly-breasted Munia	366to 403	LC		
5	*Acrocephalus bistrigiceps*	Black-browed Reed Wabler	366to 403	LC		
6	*Acrocephalus aedon*	Thick-billed Warbler	366to 403	LC		
7	*Prinia rufescens*	Rufescent Prinia	366 to 407	LC		
8	*Orthotomus sutorius*	Common Tailorbird	366 to 407	LC		
9	*Passer montanus*	Eurasian Tree Sparrow	366 to 407	LC		
10	*Passer flaveolus*	Plain-backed Sparrow	372 to 402	LC		
11	*Passer domesticus*	House Sparrow	366 to 407	LC		
12	*Pycnonotus goiavier*	Yellow-vented Bulbul	366 to 404	LC		

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
13	*Anastomus oscitans*	Asian Openbill	397 to 402	LC		
14	*Corvus macrohynchos*	Large-billed Crow	397 to 402	LC		
15	*Tyto alba*	Barn Owl	366 to 402	LC		
16	*Dicrurus macrocercus*	Black Drongo	366 to 402	LC		
17	*Rhipidura javanica*	Pied Fantail	374 to 403	LC		
18	*Rhipidura albicollis*	White-throated Fantail	374 to 405	LC		
19	*Alcedo atthis*	Common Kingfisher	366 to 371	LC		
20	*Lacedo pulchella*	Banded Kingfisher	366 to 371	LC		
21	*Gallicrex cinerea*	Watercock	366 to 402	LC		
22	*Bubulcus ibis*	Cattle Egret	366 to 402	LC	III	

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
23	*Ixobrychus cinnamomeus*	Cinnamon Bittern	366 to 402	LC		
24	*Ardeola bacchus*	Javan Pond Heron	366to 383, 388 to 402	LC		
25	កុកសំបកត្រពាំង	*Ixobrychus sinensis*	Yellow Bittern	LC	370to 375397 to 402	
26	កុកគ្រោងធំ	*Egretta alble*	Great Egretta	LC	370to 375397 to 402	
27	*Dupetor flavicollis*	Black Bittern	396 to 402	LC		
28	*Phalacrocorax niger*	Little Cormorant	366to 383, 388 to 402	LC		
29	*Streptopelia chinensis*	Spotted Dove	366 to 405	LC		
30	*Streptopelia tranquebarica*	Red Collared Dove	366 to 405	LC		
31	*Geopelia striata*	Zebra Dove	366 to 405	LC		
32	*Gallinula chloropus*	Common Moorhen	366 to 372,395to 402	LC		

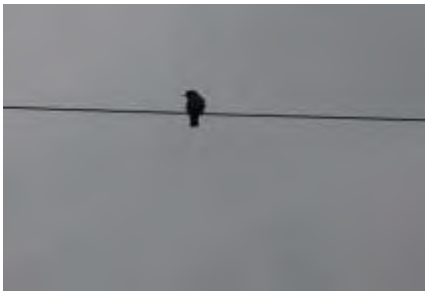
No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
33	*Dendrocygna javanica*	Lesser Whistling Duck	366 to 372,395to 402	LC		
34	*Cypsiurus balasiensis*	Asian Palm Swift	366 to 402	LC		
35	*Acridotheres tristis*	Common Myna	366 to 402	LC		
36	*Elanus coeruleus*	Black-shouldered Kite	366 to 402	LC	II	
37	*Merops viridis*	Blue-throated Bee-eater	394 to 402	LC		
38	*Hypsipetes leucocephalus*	Black Bulbul	394 to 402	LC		

Note: I, II and III are the CITES convention appendix number. They are classified by forest administration, consisting of endangered species (En), rare species (r), critically endangered species (Cr) and vulnerable species (Vu), IUCN noted on the table above for mammals.

Working team took some pictures at project area



Blue-throated Bee-eater was taken on August 20, 2013 around the project area.



Black Bulbul was taken on August 20, 2013 around the project area.



Yellow-vented Bulbul was taken on August 19, 2013 around the project area.



Black Bittern was taken on August 20, 2013 around the project area.



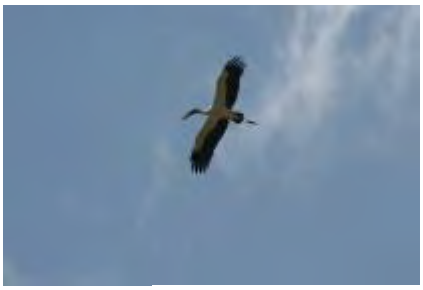
Eurasian Tree Sparrow was taken on August 20, 2013 around the project area.



Red Collared Dove was taken on August 20, 2013 around the project area.

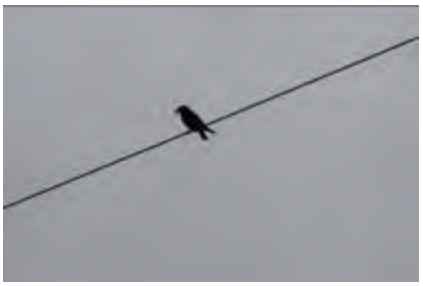


Peaceful Dove: picture was taken on August 18, 2013 around the project area.





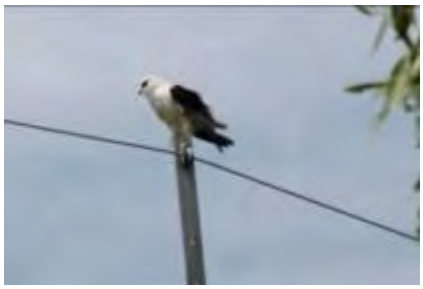
Asian Openbill was taken on August 19, 2013 around the project area.



Plain-backed Sparrow was taken on August 20, 2013 around the project area.



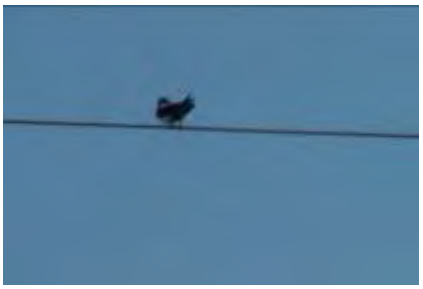
Common Myna was taken on August 20, 2013 around the project area.



Black-shouldered Kite was taken on August 18, 2013 around the project area.



Cattle Egret was taken on August 19, 2013 around the project area.



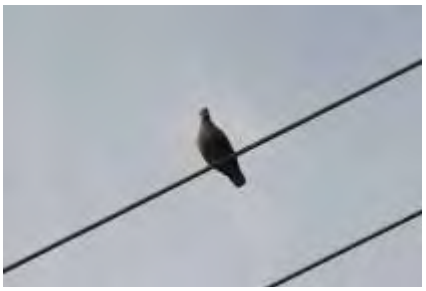
Asian Palm Swift was taken on August 19, 2013 around the project area.



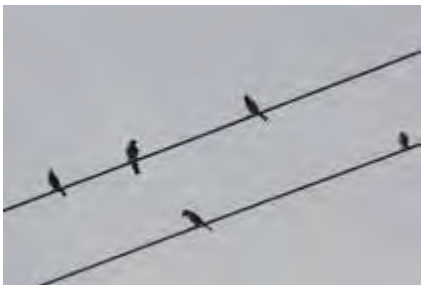
Little Cormorant was taken on August 20, 2013 around the project area.



Lesser Whistling Duckwas taken on August 20, 2013 around the project area.



Spotted Dove was taken on August 20, 2013 around the project area.



House Sparrow was taken on August 20, 2013 around the project area.



Asian Openbill and **Great Egretta** was taken on Nov. 27, 2013 around the project area



Black Drongo was taken on Nov. 27, 2013 around the project area

3. Reptiles and Amphibian

There are 30 species of reptiles and amphibians found in the project area; however, it consisted two species (**II** and **r**) in appendix of CITES. The reptile is in category-II such Monocle Cobra (*Naja kaouthia*) and Indochinese Spitting Cobra (*Naja siamensis*) according to working team found in the project area. The reptile in the category of rare species (r) it is Monocle Cobra (*Naja kaouthia*) found in the project area according to Forest Administration (FA), shown in table 5-18 below:

Table 5 -18:Name of reptiles and amphibians in the project area studied from August 12- 25 December 2013

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
1	*Calotes versicolor*	Garden Fence Lizard	366 to 405			
2	*Ahaetulla nasuta*	Long-nosed Whip Snake	366 to 405			
3	*Ahaetulla prasina*	Oriental Whip Snake	366 to 372, 389 to 402	LC		
4	*Boiga cyanea*	Green Cat Snake	366 to 372, 389 to 402			

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
5	*Cylindrophis ruffus*	Red-tailed Pipe Snake	366 to 402	LC		
6	*Daboia russelli*	Russell's Viper	366 to 370			
7	*Dendrelaphis subocularis*	Mountain Bronzeback	366 to 402	LC		
8	*Chrysopelea ornata*	Golden Tree Snake	366 to 405			
9	*Naja kaouthia*	Monocle Cobra	366 to 372, 388 to 402	LC	II, r	
10	*Naja siamensis*	Indochinese Spitting Cobra	366 to 405	VU	II,	
11	*Oligodon taeniatus*	Striped Kukri Snake	366 to 405			
12	*Ptyas korros*	Indochinese Ratsnake	366 to 372, 388 to 402			
13	*Xenochrophis piscator*	Chequered Keelback	366 to 372, 388 to 402			
14	*Xenochrophis piscator*	Chequered Keelback	366 to 372, 388 to 402			
15	*Xenopeltis unicolor*	*Sunbeam Snake*	366 to 372, 388 to 402			
16	*Enhydris enhydris*	Rainbow Water Snake	366 to 372	LC		
17	*Enhydris longicauda*	Tonle Sap Watersnake	366 to 370	VU		

No.	Scientific Name	English Name	Kilometers(PK)	IUCN	Remarks	Pictures
18	*Elaphe radiata*	Radiated Ratsnake	366 to 372, 388 to 402			
19	*Ptyas carinata*	Keeled Rat Snake	366 to 372, 388 to 402			
20	*Gekko gecko*	Tokay Gecko	366 to 405			
21	*Cosymbotus platyurus*	Flat-tailed Gecko	366 to 407			
22	*Scincella reevesii*	Speckled Leaf-litter Skink	366 to 405			
23	*Mabuya multifasciata*	Many-lined Sun Skink	366 to 405			
24	*polypedates cf. leucomystax*	Common Tree Frog	366 to 404	LC		
25	*Bufo melanosstictus*	Common Asian Toad	366 to 405			
26	*Kaloula pulchra*	Banded Bullfrog	366 to 405	LC		
27	*Glyphoglossus molossus*	Truncate snouted spadefoot frog	366 to 405	NT		
28	*Fejervarga limnocharis*	Rice Field Frog	366 to 405			
29	*Limnonectes ibanorum*	Rough Backed River Frog	366 to 372, 388 to 402	NT		
30	*Hoplobatrachus tigerinus*	Tiger Frog	366 to 372, 388 to 402	LC		

Note: I, II and III are the CITES convention appendix numbers. They are classified by forest administration, consisting of endangered species (En), rare species (r), critically endangered species (Cr) and vulnerable species (Vu), IUCN noted on the table above for mammals.

Working team took some pictures of Reptiles and Amphibian in the project area as shown below:



Tonle Sap Watersnake was taken on August 18, 2013 in the project area.



Chequered Keelback was taken on August 15, 2013 in the project area.



Rainbow Water Snake was taken on August 20, 2013 in the project area.



Golden Tree Snake was taken on August 20, 2013 in the project area.



Speckled Leaf-litter Skink was taken on August 15, 2013 in the project area.



Tiger Frog was taken on August 18, 2013 in the project area.



Garden Fence Lizard was taken on August 18, 2013 in the project area.



Keeled Rat Snake was taken on Nov. 27, 2013 at Kon Damrei Market near the project area



Frogs was taken on Nov. 27, 2013 at Kon Damrei Market near the project area

4. Fish

A. Target Area

JICA Survey Team defined field study for detail in SteungSisophon. For methodology of study, it illustrated that in heading 2.2.3.3 of Chapter-2. The target areas were divided into two areas.

1. Area-1: started from TeukThla village to Pro Hoth village along the Steung with distant is about 7Km, and
2. Area-2: started from Rong Machine village to PreakRussei village with distant is about 5Km.

B. Fisheries resource found at the project area

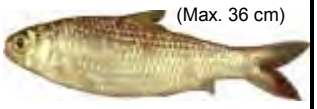
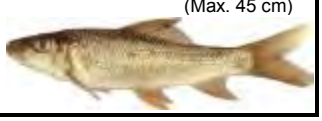
JICA Survey Team studied fish for detail at Steung Sisophon by selected 2 fishermen (their occupations are fishermen). There was a fisherman worked in a sellected area to note fish species and its yields a day per month in wet season (12 August – 12 Septembet 2013) and a day per month in wet

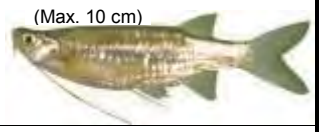
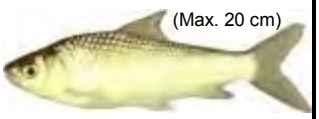
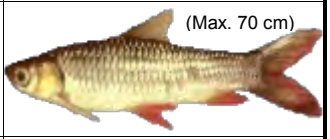
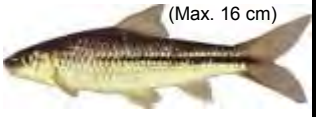
season in dry season, (30 November – 30 December 2013)**.**There were 90 fish species found out in two areas in Steung Sisophon. Moreover, the team also studied fish in the canal, creeks in the rice field. So, there were 90 species of fish in total finding in project area, which 3 types is endangered species , it is Thinlip barb *(Probarbuslabeamamjor)* are two types and PuntiusTetrazona *(Systomuspartipentazona)* 1 type.Others fish found in the canal and creek are 40species, 30species others are in rice field. These fishes are illustrated in table below:

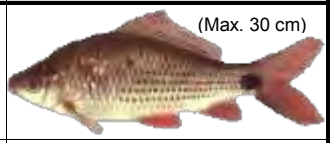
Table 5 -19: Major fish species in SteungTeukThla and SteungSisophon, in the creek, Canal and in the rice field in the project area along the road, studied from 12 August - 30 December 2013

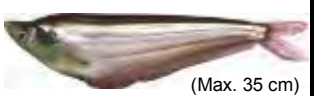
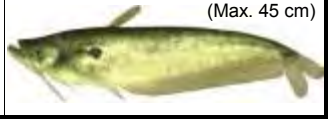
No	Fao name	*Scientific Name*	Farmily Name	River name and other Water Course	IUCN	អនុក្រម ១២៣	Picture
1	Siamese glassfish	*Pseudambassissia mensis*	AMBASSIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 6 cm)
2	Inridescent glassy perclet	*Parambassisapogo noides*	AMBASSIDAE	Sisophon	LC		 (Max. 10 cm)
3	Climbing perch	*Anabas testudineus*	ANABANTIDAE	Sisophon, Cacal, stream, rice field			 (Max. 25 cm)
4		*Mystussingaringan*	BAGRIDAE	Sisophon	LC		 (Max. 35 cm)
5		*Mystusbocouti*	BAGRIDAE	Sisophon	VU		 (Max. 24 cm)
6	Asian bumblebee catfish	*Pseudomystussiam ensis*	BAGRIDAE	Sisophon	LC		 (Max. 20 cm)
7		*Mystusatrifasciatus*	BAGRIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 15 cm)
8	Striped catfish	*Mystusmyaticetus*	BAGRIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 13 cm)
9	Striped catfish	*Mystusmyaticetus*	BAGRIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 14 cm)
10		*Hemibagrusspilopte rus*	BAGRIDAE	Sisophon	LC		 (Max. 31 cm)
11		*Hemibagrusnemuru s*	BAGRIDAE	Sisophon, Cacal, stream	LC		 (Max. 65 cm)

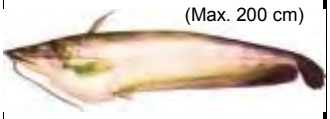
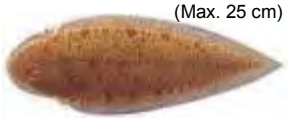
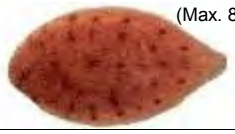
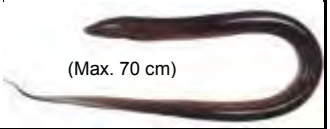
No	Fao name	*Scientific Name*	Farmily Name	River name and other Water Course	IUCN	អនុក្រ ១២៣	Picture
12		*Hemibagruswyckioides*	BAGRIDAE	Sisophon	LC		 (Max. 130 cm)
13	Talking gourami	*Trichopsispumila*	BELONTIIDAE	Sisophon, Cacal, stream, rice field	LC		(Max. 4 cm) 
14	Croaking gourami	*Trichopsisvittata*	BELONTIIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 7 cm)
15	Siamese fighting	*Battasplendens*	BELONTIIDAE	Sisophon	VU		 (Max. 6.5 cm)
16	Walking snakehead	*Channaorientalis*	CHANNIDAE	Sisophon, Cacal, stream, rice field			(Max. 20 cm) 
17	Giant snakehead	*Channamicropeltes*	CHANNIDAE	Sisophon	LC		(Max. 130 cm) 
18	Snackehead murrel	*Channastriata*	CHANNIDAE	Sisophon, Cacal, stream, rice field	LC		(Max. 100 cm) 
19		*Clariasnieuhofi*	CLARIIDAE	Sisophon			 (Max. 50 cm)
20	Walking catfish	*Clariasbatrachus*	CLARIIDAE	Sisophon, Cacal, stream, rice field	LC		(Max. 47 cm) 
21	Broad head catfish	*Clariasmacrocephalus*	CLARIIDAE	Sisophon, Cacal, stream, rice field	NT		 (Max. 35 cm)
22	Blackskin catfish	*Clariasmeladerma*	CLARIIDAE	Sisophon	LC		 (Max. 35 cm)
23		*Acanthopsoideshapalias*	COBITIDAE	Sisophon	LC		(Max. 6cm) 
24	Striped horseface loach	*Acantopsis sp. 2*	COBITIDAE	Sisophon			 (Max. 13 cm)
25	Chameleon botia	*Botianigrolineata*	COBITIDAE	Sisophon	VU		

No	Fao name	*Scientific Name*	Farmily Name	River name and other Water Course	IUCN	អនុក្រ ១២៣	Picture
26	Dwarf botia	*Yasuhikotakiasidthi munki*	COBITIDAE	Sisophon	EN		 (Max. 5.5 cm)
27	Chameleon botia	*Syncrossusbeauforti*	COBITIDAE	Sisophon	NT		(Max. 8cm) 
28	Skunk botia	*Yasuhikotakiamorlet i*	COBITIDAE	Sisophon	LC		 (Max. 9.3 cm)
29	Speckletailbo tia	*Botia sp. juvenile*	COBITIDAE	Sisophon			(Max. 20 cm) 
30	Orangefin loach	*Yasuhikotakiamode sta*	COBITIDAE	Sisophon	LC		 (Max. 25 cm)
31		*Albulichthysalbuloid es*	CYPRINIDEA	Sisophon	LC		(Max. 36 cm) 
32	Cyclocheilich thysenoplos	*Cyclocheilichthysfur catus*	CYPRINIDEA	Sisophon	LC		(Max. 75 cm) 
33		*Amblypharyngod on chulabomae*	CYPRINIDEA	Sisophon			(Max. 4 cm) 
34	Stoplight rasbora	*Rasbora sp.cf. beauforti*	CYPRINIDAE	Sisophon, Cacal, stream, rice field			(Max. 2 cm) 
35		*Crossocheilusatrilim es*	CYPRINIDEA	Sisophon	LC		(Max. 16 
36	Beardless barb	*Cyclocheilichthysap ogon*	CYPRINIDAE	Sisophon, Cacal, stream, rice field	LC		(Max. 15 cm) 
37		*Cyclocheilicthysrep asson*	CYPRINIDAE	Sisophon, Cacal, stream, rice field	LC		(Max. 28 cm) 
38	Swamp barb	*Puntiusbrevis*	CYPRINIDAE	Sisophon, Cacal, stream, rice field	LC		(Max. 12 cm) 
39		*Labeoerythropterus*	CYPRINIDAE	Sisophon, Cacal, stream, rice field			(Max. 45 cm) 

No	Fao name	*Scientific Name*	Farmily Name	River name and other Water Course	IUCN	អនុក្រ ១២៣	Picture
40		*LabiobarbusLineatus*	CYPRINIDAE	Sisophon, Cacal, stream, rice field			 (Max. 18 cm)
41		*Osteochilusschlegeli*	CYPRINIDAE	Sisophon			 (Max. 40 cm)
42	LabeoPruol	*Cirrhinusmicrolepis*	CYPRINIDAE	Sisophon	VU		 (Max. 65 cm)
43	EsomusGoddardi	*Esomuslongimanus*	CYPRINIDAE	Sisophon, Cacal, stream, rice field			 (Max. 10 cm)
44	Striped flying bard	*Esomusmetallicus*	CYPRINIDAE	Sisophon, Cacal, stream, rice field			 (Max. 7.5 cm)
45	Slender rasbora	*Rasboradaniconius*	CYPRINIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 4.5 cm)
46		*Hampalamacrolepidota*	CYPRINIDAE	Sisophon,	LC		 (Max. 70 cm)
47	Siamese mud Carp	*Henicorhynchussiamensis*	CYPRINIDAE	Sisophon, Cacal, stream			 (Max. 20 cm)
48	Tawes	*Barbodesgonionotus*	CYPRINIDAE	Sisophon, Cacal, stream	LC		 (Max. 33 cm)
49		*Hypsibarbuswetmorei*	CYPRINIDAE	Sisophon, Cacal, stream	LC		 (Max. 25 cm)
50	Mad barb	*Leptobarbushoeveni*	CYPRINIDAE	Sisophon			 (Max. 70 cm)
51	LoboheilusNigrovittantus	*Lobocheilosmelanotaenia*	CYPRINIDAE	Sisophon, Cacal, stream	LC		 (Max. 16 cm)
52	LuciosomaBleekeri	*Luciosomableekeri*	CYPRINIDAE	Sisophon			 (Max. 26 cm)
53	Black sharkminnow	*Moruliuschrysophekadion*	CYPRINIDAE	Sisophon, Cacal, stream	LC		 (Max. 60 cm)

No	Fao name	*Scientific Name*	Farmily Name	River name and other Water Course	IUCN	អនុក្រ ១២៣	Picture
54	Silver sharkminnow	*Osteochilushasselti*	CYPRINIDAE	Sisophon	LC		 (Max. 30 cm)
55	Bonylip barb	*Osteochilusmicrocephalus*	CYPRINIDAE	Sisophon	LC		 (Max. 24 cm)
56		*Paralaubucariveroi*	CYPRINIDAE	Sisophon	LC		 (Max. 18 cm)
57		*Paralaubucatypus*	CYPRINIDAE	Sisophon	LC		 (Max. 18 cm)
58	Thinlip barb	*Probarbuslabeamajor*	CYPRINIDAE	Sisophon	EN	En	 Max. 150 cm
59	Thicklip barb	*Probarbuslabeaminor*	CYPRINIDAE	Sisophon	EN	En	 (Max. 70 cm)
60		*Osteochilusmelanopleurus*	CYPRINIDAE	Sisophon	LC		 (Max. 40 cm)
61		*Puntioplitesfalcifer*	CYPRINIDAE	Sisophon	LC		 (Max. 40 cm)
62	PuntioplitesProctorysron	*Puntioplitesproctozysron*	CYPRINIDAE	Sisophon	LC		 (Max. 25 cm)
63	*Pale rasbora*	*Rasboraaurotaenia*	CYPRINIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 17 cm)
64	Marbied sleeper	*Oxyeleotrismarmorata*	ELECTRIDAE	Sisophon	LC		 (Max. 30 cm)
65		*Xenentodoncancila*	BELONIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 40 cm)
66	PuntiusSimus	*Puntiusorphoides*	CYPRINIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 25cm)
67		*Thynnichthysthynnoides*	CYPRINIDAE	Sisophon	LC		 (Max. 25 cm)

No	Fao name	*Scientific Name*	Farmily Name	River name and other Water Course	IUCN	អនុក្រ ១២៣	Picture
68	Peacock eel	*Macrognathussiamensis*	MASTACEMBELIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 30 cm)
69	Tiretrack spiny eel	*Mastacembelusarmatus*	MASTACEMBELIDAE	Sisophon	LC		 (Max. 90 cm)
70	Catopra	*Pristolepisfasciata*	NANDIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 20 cm)
71	Gangeticleaffish	*Nandusnandus*	NANDIDAE	Sisophon, Cacal, stream	LC		 (Max. 10 cm)
72	PuntiusTetrazona	*Systomuspartipentazona*	CYPRINIDAE	Sisophon, Cacal, stream	LC	En	 (Max. 5 cm)
73	Clown featherback	*Chitalaornata*	NOTOPTERIDAE	Sisophon	LC		 (Max. 100 cm)
74	Bronze featheback	*Notopterusnotopterus*	NOTOPTERRUS	Sisophon, Cacal, stream	LC		 (Max. 60 cm)
75	Moon light gourami	*Trichogastermicrolepis*	BELONTIIDAE	Sisophon, Cacal, stream, rice field			 (Max. 15 cm)
76	Threespot gourami	*Trichogastertrichopterus*	BELONTIIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 15 cm)
77		*Micronemamicronema*	SILURIDAE	Sisophon			 (Max. 33 cm)
78		*Kryptopterushexapterus*	SILURIDAE	Sisophon			 (Max. 24 cm)
79		*Kryptoperuschevery i*	SILURIDAE	Sisophon			 (Max. 35 cm)
80		*Belodontichthysdinema*	SILURIDAE	Sisophon			 (Max. 70 cm)
81	Butter catfish	*Ompokbimaculatus*	SILURIDAE	Sisophon, Cacal, stream, rice field	NT		 (Max. 45 cm)

No	Fao name	*Scientific Name*	Farmily Name	River name and other Water Course	IUCN	អនុក្រឹត្យ ១២៣	Picture
82		*Wallagoattu*	SILURIDAE	Sisophon	LC		 (Max. 200 cm)
83	River tonguesole	*Cynoglossusfeldmanni*	CYNOGLOSSIDAE	Sisophon	LC		 (Max. 25 cm)
84		*Achiroidesleucorhynchos*	SOLEIDAE	Sisophon			 (Max. 8 cm)
85	Whitelip sole	*Achiroidesmelanorthynchus*	SOLEIDAE	Sisophon			 (Max. 14cm)
86	Bengal mud eel	*Ophisternonbengalense*	SYNBRANCHIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 100 cm)
87	Swamp eel	*Monopterusalbus*	SYNBRANCHIDAE	Sisophon, Cacal, stream, rice field	LC		 (Max. 70 cm)
88	Redeye puffer	*Carinotetraodonlorteti*	TETRAODONTIDAE	Sisophon	LC		 (Max. 6 cm)
89		*Monotretacambodgiensis*	TETRAODONTIDAE	Sisophon, Cacal, stream			 (Max. 16 cm)
90		*Monotretaleiurus*	TETRAODONTIDAE	Sisophon	LC		 (Max. 13 cm)

Note: Sub decree no. 123 dated August 12, 2009, stated about endangered species of fishery resources: endangered species (En), critically endangered species (Cr) and vulnerable species (Vu), IUCN noted on the table above for mammals.

Working team took some pictures of fish species at project area as below:



Osteochilus schlegeliwas taken on October 1, 2013 in Steung Sisophon.



Black sharkminnow was taken on September 3, 2013 in Steung Sisophon.



Puntioplites Proctorysron was taken on September 3, 2013 in Steung Sisophon.



Tawes was taken on August 18, 2013 in Steung Sisophon.



Labeo Pruol was taken on September 3, 2013 in Steung Sisophon.



Puntius Simus was taken on August 20, 2013 in Steung Sisophon.



Broad head catfish was taken on August 5, 2013 in Steung Sisophon.



Striped catfish was taken on August 7, 2013 in Steung Sisophon.



Hemibagrus nemurus was taken on August 7, 2013 in Steung Sisophon.



Climbing perch was taken on August 12, 2013 in Steung Sisophon.



Catopra was taken on August 16, 2013 in Steung Sisophon.



Moon light gourami was taken on August 15, 2013 in Steung Sisophon.



Combined Fish was taken on September 29, 2013 in Steung Sisophon.



Xenentodon cancila was taken on August 12, 2013 in Creek.



Climbing perch was taken on August 13, 2013 in Canal, rice field



Striped catfish and Peacock eel was taken on August 13, 2013 in Steung Sisophon.



***Hemibagrus spilopterus* and Catopra** was taken on August 12, 2013 in Canal.



Peacock eel andCrab was taken on August 12, 2013 in Creek.



Monotreta leiurus was taken on August 12, 2013 in Steung Sisophon.



Bengal mud eel was taken on August 13, 2013 in Creek, Lake



Butter catfish was taken on August 15, 2013 in Steung Sisophon.



Swamp barb was taken on August 18, 2013 in the Lake.



Crabs were taken on August 12, 2013 in the rice field.



Snailswere taken on August 18, 2013 in the rice field.

C. Migration of vital fish species in the project area

In wet season, migration fish is congested due to flood and especially it was influential by water flooded while the water inudated on vegettations that growed along the river bank (O, creek, canal and pond) from in the middle of July to the middle of November according to the field study and interview with commune chief, village chief and fishermen. Because of bleeding time for fish and abundant food, it makes fish migrate from Tonle Sap Lake to Pursat river, then the upstream of this river in the raining season. In the period of flooding, fishermen always catch some fish such as: Puntioplites falcifer (*Cyprinidae Minnows and Carps),* Mystus nemurus (*Bagridae*), Siamese mud carp (*Henicorhnchus siamensis*), Tiny scale barb (*Thynnichthys thynnoides*) Trey Krum, (*Osteochilus microcephalus),* Black sharkminnow *(Labeo chrysophekadion) ,* Wallago *(Wallagoattu),* Goldfin tinfoil barb *(Hypsibarbus malcolmi),*Orangefin Loach (Yasuhikotakia Modesta), Giant snakehead (*Chnna mucropeltes*), Toli shad, and Spot pangaasius (*Pangasiuslarnaudii*). However, some fish species moved from the upstream to Tonle Sap Lake such as Mystus ilamentus (*Hemibagrusfilamentus*), Trey Kame, Dusky face carp (*Osteochilus lini*), red tinfoil barb (*Barbonymus schwanenfeldii*), Waandersii's Hard-lipped Barb (*Osteochilus waandersii*), Osteochilus microcehalus, Trey Khcha (*Hemibagruswyckioides*), see detail in the table for main fishes in the project area.

5.1.2.3. Habitat

According to field study along the NR5, a portion from Sri Sophorn to Poipet, there was no protected area or protected forest that was habitat of vital wildlife. The bird habitats are on planted species in villages, at the rice fields and some species in density area. Furthermore, there were little regrowth riverside vegetation (shown in heading 5.1.2.1 above) along rivers, streams and ditches that are the

habitat for aquatic species and fish, when flooding occurred most commonly from heavy rainfall and an overflow of water from the Thailand to Creek, Steung, Canal in the wet season. Then, the overflow of water flowed into creeks connecting with Rivers, streams and ditches. It helped the aquatic species such as: fish and water reptiles to migrate into the project area (name of vital rivers, streams and those locations shown in heading 5.1.1.4 of chapter-5, at the hydrology above). Some birds are *Dendrocygna javanica, Anastomus oscitans,Egretta alble*,*Tyto alba, Caprimulgus indicus, Dupetor flavicollis), Phalacrocorax niger, Corvus macrohynchos…*etc. They do not sleep and find food by the roads and just fly across the road.

5.1.2.4. Biodiversity and Ecosystem

There are 6 types of land uses along the NR5, a portion from Sri Sophorn to Poipet, and then its ecosystem was described as the following:

1. Residential area: it is normal villages where are not in a town or density area. In this area, there are Khmer style houses (thatched house, wooden house with zinc roof and with tiles roof). Most of these houses are surrounded by rice fields and far away from each other. In the land around the houses, there are fruits, species and vegetables planted by season. This area is green in the wet season, from in the middle of May to February; it is also the season of farming. But, in the past period of 4 years in the project area there was flooded from rainwater and water flow from Thailand, it causes most whole crops and farming inundated, and at the present it was not to be solved. For animals are not allowed to walk to the rice field. Most of planted crop is paddy rice, and planted fruits: mango, sugar palm, coconut, banana, jackfruit, milk fruit, lemon, grapefruit, guava, wood apple, and bamboo, Cashew.. etc. For wildlife in this area, it has a few shown in heading 5.1.2.2 above. There are some birds such as: Eurasian Tree Sparrow *(Passer montanus)*Spotted Dove *(Streptopelia chinensis)* Red Collared Dove*(Streptopelia tranquebarica)*, Geopelia striata,Yellow-vented Bulbul *(Pycnonotus goiavier)*House Sparrow *(Passer domesticus)* Common Myna*(Acridotheres tristis)*and in some part of areas, *Peaceful Dove (Geopelia striata),*Refescent Prinia *(Prinia rufescens)*Pied Fantail*(Rhipidura javanica)*Barn Owl *(Tyto alba)*(at night) and chickens and ducks were raised by villagers. Also, reptiles were found in the project area as Chequered Keelback *(Xenochrophis piscator),*Common Blind Snake*(Ramphoryphlops braminus),*Indochinese Ratsnake*(Pyftas korros),*Gloden Tree Snake *(Chrysopelea ornata),*Paddy frog *(Fejervarga limnocharis),*frog*(Limnonectes ibanorum),*Common Asian bullfrog*(Kaloula pulchra),*and common Asian toad*(Bufo melanosstictus),* including crabs and cockles as well.




2. Households in Semi-urban: This area has more people living more than the first area. Houses were built in plot of lands closely. Also, the house species are similar with in the first area; however, some houses were built by brick. This area was near the commune offices such as: Kob commune. There are some local markets and day markets (opened only in the morning from 6 am to 11 am). In the lots of land, fruits and vegetables were planted by the seasons. Here, the planted fruits were greener than planted fruits in the first area because of more water sources to supply (wells, ponds, pools, and water supply systems at some places). However, species of birds and reptiles are by no mean different from the first area.



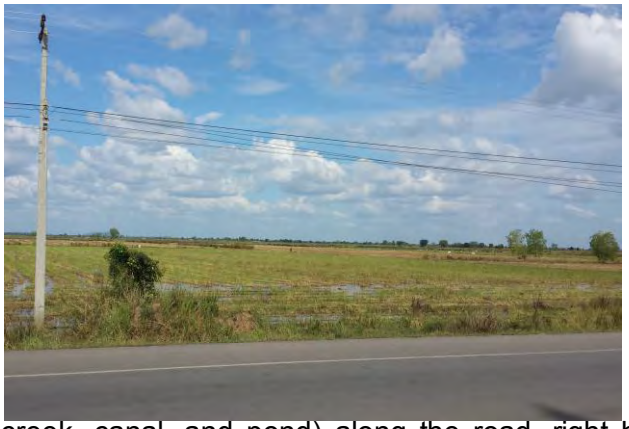


3. Urban and town area: They are consisting of many houses built closely together (wooden house with zinc roof, with a tile roof and brick house with one or more floors), and there are a lot of people living in this area and business stalls such as: At the point of Kon Damrei. Most of planted species along the road sites are khan-na *(Eucalyptus camaldulensis)*, Acacia (*Acacia auriculiformis, A)*, rain tree *(Samanea saman)*,golden shower tree (*Cassia fistula)*, Calabura *(Muntingia calabura L.)*…etc. We also found mice, cats, dogs and cows. For birds in this area, there are: Eurasian Tree Sparrow *(Passer montanus),*Spotted Dove *(Streptopelia chinensis),Geopelia striata*,Red Collared Dove*(Streptopelia tranquebarica),*Yellow-vented Bulbul *(Pycnonotus goiavier),*House Sparrow*(Passer domesticus),*Common Myna*(Acridotheres tristis)*; then in some places of this areahas *Peaceful Dove (Geopelia striata)* that were raised by villagers as chickens and ducks. But, reptiles also found here as: Chequered Keelback *(Xenochrophis piscator),*Gloden Tree Snake *(Chrysopelea ornata)*,Common Asian bullfrog*(Kaloula pulchra),*common Asian toad*(Bufo melanosstictus).*





4. The rice field area: there was no any villager's house, only field guard huts. It was green in the wet season from in the middle of May to February, it is also the season of farming (since the past of 4 years that the people in the project area was affected by flooded) and animals are not allowed to walk to the rice field. Most of planted crops are paddy rice and fruits planting along bunds are mango *(Mangifera indica, L.)*, sugar palm *(Borassus flabellifer)*, Krasaang or Feroniella Lucida*(Feroniella lucida Scheff.)*, tamarind (*Tamarindus indica, L.*), Snay *(Streblus asper Lour.)*, Sdau or Margosa *(Azadirachta indica)*, Pring or Kelat *(Eugenia sp.)*and some places had small brushes…etc. For wildlife in this area, it has a few reptiles shown in heading 5.1.2.2 above. This area has more wildlife more than three areas above. There were reptiles also finding in this area: *(Xenochrophis piscator)*, *(Xenopeltis unicolor)*, *(Ptyas korros)*, (*Ptyas carinata*(, *(Naja siamensis)*, *(Naja kaouthia)*, *(Daboia russelli)*, *(Chrysopelea ornata)*, *(Enhydris enhydris)*,*(Elaphe radiata)*, *(Fejervarga limnocharis)*,*(Limnonectes ibanorum, (Kaloula pulchra)*, *(Bufo melanosstictus)*and crabs and cockles too, shown in detail in table 5-17. ***Note:*** *Fish in rice field was rarely found, even though in the flooding time, because farmers used chemical fertilizer, pesticides and chemical substance use for killing grass that were able to kill those fish in rice field.*

5. Riverside vegetation re-growing in (O, creek, canal, and pond) along the road, right hand started from KP-366 to Kp-366+685 only. As described above at the **point-A** above. This area flooded in the wet season from the middle of July to February, Most of plants were described at **point-B** above. Most of wildlife found in the area are reptiles such as *(Xenochrophis piscator)*,*(Xenopeltis unicolor)*,*(Ptyas korros)*, (*Ptyas carinata*(,*(Naja siamensis)*,*(Naja kaouthia)*,*(Daboia russelli)*, *(Chrysopelea ornata)*, *(Elaphe radiata)*,*(Boiga cyanea)*,*(Enhydris enhydris)*,*(Enhydris bocourti)*,*(Fejervarga limnocharis)*,*(Limnonectes ibanorum)*,*(Kaloula pulchra)*, *(Bufo melanosstictus)*and crabs and cockle, etc,.*Note:* These Riverside vegetations are re-growing vegattions which are not vital habitat for fish and wildlife. Furthermore, around this area, the farmers always grow rice with chemical fertilizers and pesticides and chemical substance use for killing weed grass and insects that are extremely impact on baby fish and some insects that is food for fish.





Inudated forest in Teuk Thla village was taken on 12 August 2013

6. There were water bodies as: lake, pond, canal and ditch/stream consisting along the NR5 from Sri Sophorn to Poipet such as: Canal, creek at the location of culverts. There were fishes along the canal both sides and in the people's rice field in wet seasonconsisting a lot of fish 41 species. In detailed table 5-18 above, there were some water plant species growing in the canal, creeks, pond and stream along the road as: *Eichhornia crassipes*,*Catharanthus roseus*,*Ludwigia adscendens*,*Ipomoea aquatic*,*Neptunia oleracae*,*Marsilia quadrifolia*,*Cyperus kyllingia nemoralis,* ect…,


Ipomoea aquatica


Cyperus kyllingia nemoralis


Eichhornia crassipes

5.2 Socio-Economic Resources

5.2.1 Introduction

Socio-economic resources assessment for National Road No.5 Improvement Project was done with people living along the National Road No.5 which was from Kilometer Post (KP366+250) in Sangkat ToeukThla, Sri Sophorn Town to Kilometer Post (KP-402) in Sangkat Phsa Kandal, PoipetTown, Banteaymeanchey province. Moreover, working team also made the consultation meeting with introduction and explanation about purpose of improvement project to participants as well as local authorities in order that this road becomes the first ASEAN road No.1. For the project of road expansion, its total width was 28 meters in the Town area and it was 23 meters width in rural area. However, it also needed space for slope of the road, thus it needed average 40 meters of width (20m both sides). After public consultation meeting about project, the study working team decided to select from 10% to 20% rely on the more or few of population of people are living along both sides of the road in order to interview them about income, ideas/comments and suggestion about project (Detail see Chapter 2 sub title 2.2.4). This study was conducted to analyze their socio-economic, and to compare some existing parameters in the pre-construction, construction, and project implementation phase.

5.2.2 Demography and Resettlement

BanteayMeanchey located a province in northwest of Cambodia which is 360Km way from Phnom Penh capital city. There are 2 types of the main roads such as: National road, (NR5) and Railway. This province has total area with 66,79Km^2 and the provincial borders around are: Battambang, Siem Reap, O-Dormeanchey, and Sakeo and Borey Raim provinces of Thailand. In addition, BanteayMeanChey province has 06 districts, 02 Towns, 11 Sangkats, 53 communes, and 634 villages. The population is 67, 8033 families, equaling to 816,382 persons excluded 414,181 persons of female. For the main occupations in percentage of total population, it is agriculture with 93%, 5% of serller, 1.17% fishermen and 0.83% of Government Officer. (History of Banteay Meanchey province).

Poipet is adjacent to between Cambodia-Thailand borders. Poipet is the key of economic field betwee Cambodia and Thailand border crossing. Poipet is next to AranhPrathet (or called Aranh in Thai). It is mostly covered by extensive lowlands, with a few uplands to the north and east. The main rivers are Steung Mongkol Borey and Steung Sri Sophorn.

5.2.2.1 Ethnic Groups

According to the field study, there were few Nationalities people are living near the project area and along the NR5 from Sri Sophorn to Poipet. Thus, there is 96.24% Khmer people, 3.48% Lao people and1.48% Cham people, detail as shown in Table 5-20 below:

Working Team (ESIA Team) has also studied about the people who living along the NR5between Sri Sophorn and Poipet that it consisted of 21 villages, 6 Communes with 206 Households (15%) of whole people were living along both side of road. There were total Lao people 208HHs: 62HHs living in Khai Daong village, 75HHs living in Kob Keut village, 68HHs living in Vaing Mourng village, 1HH living in Kob Chheung and 2HHs living in Kob Lich, Kob commune, O-Chrov District. And minorities of Cham are living along bothside of road were total 63HHs: 49HHs living in Nimith 3 village, 14HHs living in Nimith 4 village, Sangkat Nimith; other 10HHs living in Phsa Kandal, 4HHs living in Steung Baot village, Poipet Town.

Table 5-20: Ethnic groups living in/surrounding project area, field study 12 - 23 August 2013

No.	Village	Total Family	Total Population	Ethnic Groups						Remarks
				Khmer	%	cham	%	Lao	%	
1	Teuk Thla(R+L)	1029	4344	1029	100					Sangkat Toeuk Thla
2	Thmei(L)	187	819	187	100					Samrong Commune
3	Ta Chreung (R)	222	854	222	100					Chang Ngan Comm.
4	Soria Thmei (R+L)	321	1490	321	100					Kob Commune
5	Kob Chheung (R+L)	85	380	84	99			1	1	Kob Commune
6	Kob Lich (R+L)	86	461	84	98			2	2	Kob Commune
7	Nakachay (R+L)	99	408	99	100					Kob Commune
8	Khai Daorng (R+L)	110	427	48	44			62	56	Kob Commune
9	Kob Keuth (R+L)	85	362	10	12			75	88	Kob Commune
10	Vaing Muorng (R+L)	76	343	8	11			68	89	Kob Commune
11	Maok Hoeun (R+L)	192	810	192	100					Kob Commune
12	Yeang Thmei (R+L)	382	1654	382	100					Kob Commune

13	Nimith-2 (R+L)	115	474	115	100					Sangkat Nimith
14	Nimith-4 (R+L)	279	1280	265	95	14	5			Sangkat Nimith
15	Nimith-3 (R+L)	325	1983	276	85	49	15			Sangkat Nimith
16	Nimith-1 (R+L)	386	1811	386	100					Sangkat Nimith
17	Nimith Thmei (R+L)	224	1000	224	100					Sangkat Nimith
18	Kon Damrei (R+L)	365	1785	365	100					Sangkat Nimith
19	Andaong Thmor (R)	191	864	191	100					Sangkat PhsaKandal
20	Steung Baot (L)	193	759	189	98	4	2			Did not meet
21	Phsa Kandal (R)	1041	4076	1031	99	10	1			Sangkat PhsaKandal
Total		**2,999**	**26,384**	**5,708**	**95.24**	**77**	**885**	**208**	**98..**	

Note: Data obtained from Commune/Sangkat Office and village along the NR5, 2013 (BMC), R: Right, L: Left

5.2.2.2 People living in and surounding the project area

According to field work and public consultation meeting with national grass root level such as provincial, district, commune and village level in the project area, they mentioned that the project area located along the both road sides from Kilometer Post (KP366+250) in Sangkat Toeuk Thla, Sri Sophorn Town, BamteayMeanchey province to Kilometer Post (KP402) locating in the Phsa Kandal village, Sangkat Phsa, Poipet Town, Banteaymeanchey province. There were 21 village, 6 communes/Sangkats and total households are 5,993 with total population is 26,384 that the project passed.

The selection sample for interviewed of people are living along the both side of road were selected 15% (n/N>10%) among the total of people living along the road is 1,336 households. For the total of interviewed people were 206 households with 902 person in which the total villages were 21, and 6 communes/Sangkats located along the road.

Table 5-21: Number of people living in and around the project area, field survey from 12 to August 23, 2013

No.	Village	Commune/ Sangkat	District	Total Family	Total People livng along road	Total Female	Total >=18 year-old	Total >=18 year-old, female	Total Teacher along the road	%	Interviewed number sample	Total member in interviewed families	%	Remarks
1	Teuk Thla(R+L)	Sangkat Toeuk Thla	Sri Sophorn Town	1029	4344	2261	2706	1369	29	3%	5	21	17%	Sangkat Toeuk Thla
2	Thmei(L)	Samrong Commune	O-Chrov	187	819	418	501	255	6	19%	3	13	2%	Samrong Commune
3	Ta Chreung (R)	Chang Ngan Comm.	O-Chrov	222	854	407	625	307	223	100%	2	8	1%	Chang Ngan Comm.
4	Soria Thmei (R+L)	Kob Commune	O-Chrov	321	1490	744	988	480	207	64%	19	83	9%	Kob Commune
5	Kob Chheung (R+L)	Kob Commune	O-Chrov	85	380	185	248	126	86	100%	10	38	12%	Kob Commune
6	Kob Lich (R+L)	Kob Commune	O-Chrov	86	461	217	288	137	44	48%	9	42	20%	Kob Commune
7	Nakachay (R+L)	Kob Commune	O-Chrov	99	408	208	263	126	44	44%	9	34	20%	Kob Commune
8	Khai Daorng (R+L)	Kob Commune	O-Chrov	110	427	199	289	132	34	31%	7	29	21%	Kob Commune
9	Kob Keuth (R+L)	Kob Commune	O-Chrov	85	362	161	155	71	36	44%	5	25	14%	Kob Commune
10	Vaing Muorng (R+L)	Kob Commune	O-Chrov	76	335	148	212	101	24	32%	6	24	25%	Kob Commune
11	Maok Hoeun (R+L)	Kob Commune	O-Chrov	192	810	410	543	264	73	38%	17	73	23%	Kob Commune
12	Yeang Thmei (R+L)	Kob Commune	O-Chrov	382	1654	831	1170	556	72	19%	18	76	25%	Kob Commune
13	Nimith-2 (R+L)	Sangkat Nimith	Poipet Town	115	474	241	324	162	42	37%	7	26	17%	Sangkat Nimith
14	Nimith-4 (R+L)	Sangkat Nimith	Poipet Town	279	1280	558	748	372	70	25%	12	53	17%	Sangkat Nimith
15	Nimith-3 (R+L)	Sangkat Nimith	Poipet Town	325	1983	1207	940	488	71	22%	21	95	30%	Sangkat Nimith

No.	Village	Commune/ Sangkat	District	Total Family	Total People livng along road	Total Female	Total >=18 year-old	Total >=18 year-old, female	Total Teacher along the road	%	Interviewed number sample	Total member in interviewed families	%	Remarks
16	Nimith-1 (R+L)	Sangkat Nimith	Poipet Town	386	1811	912	1192	602	108	28%	19	85	18%	Sangkat Nimith
17	Nimith Thmei (R+L)	Sangkat Nimith	Poipet Town	224	1000	496	619	323	72	32%	17	83	24%	Sangkat Nimith
18	Kon Damrei (R+L)	Sangkat Nimith	Poipet Town	365	1785	908	1112	557	60	16%	12	54	20%	Sangkat Nimith
19	Andaong Thmor (R)	Sangkat PhsaKandal	Poipet Town	191	864	438	316	171	19	10%	4	23	21%	Sangkat PhsaKandal
20	Steung Baot (L)	Sangkat PhsaKandal	Poipet Town	193	759	374	472	212	10	5%				Did not meet
21	Phsa Kandal (R)	Sangkat PhsaKandal	Poipet Town	1041	4076	1915	2575	1258	6	1%	4	17	66.7%	Sangkat PhsaKandal
សរុប				**5993**	**26376**	**13238**	**16286**	**8069**	**1336**	**22%**	**206**	**902**	**15%**	

Note: Data obtained from Commune/Sangkat Office and village along the NR5, 2013 (BMC), R: Right, L: Left

5.2.2.3 People impacted by the project

This section is detail studied on social impact that conducted separetly by the working group-B. They had studied detail on resolution on affected people and planning preparated for resettlement site of NR5 improvement project from Thlea ma' am to Battambang and further from Sri Sophorn to Poipet. Based on relocation site map showed that the affected people both sides from the central line of road is 20m (from 0-20m) and as well as the affected people that they are living on section from Sri Sophorn to Poipet. A total affected person is 562 families, (see detail in resettlement plan project). Among of 562 families there are vuinerable people: old people, unable for work, widow, poor people which they cannot earn income less than 20$/month and they are landless or all affected lands, they are 109 families equal 19.4%.

Table 5-22 (A): Total No. of families impacted by the project, studied from September to January 2014

Province	District	Affected Households	Vulnerable (HHs)
BMC	Ou Chrov District	239	53
	Poipet City	323	56
Total		**562**	**109**

Note: Data provided by the working group-B for impact resolution. BMC: Banteay Mean Chey

Moreover, this project is affected on people's households and immovable property which they are living on the reserver land as showed in the table below:

Table 5-22 (B): Total No. of HHs and immovable property impacted by the project, studied from September to January 2014

Province	District	AHs According to Type of Structure					
		House	House-Shop	Shop/ Restaurant	Shelter	Other Structures	Total
BMC	Ou Chrov District	108	41	0	58	15	222
	Poipet City	130	29	1	88	36	284
Total		**238**	**70**	**1**	**146**	**51**	**506**

Note: BMC: Banteay Mean Chey, all type houses, constructions are detailed in resettlement plan

5.2.2.4 Impact on public infrastructures

Based on resettlement plan shows that there are Pagoda gate, School gate and Administration Office of public institution affected by the project need to do compensation according to the value of market studied as the private fence and gate, but they do not determine exactly number, it is included in the affected registration of the project already. (Detail in annex-6 of resettlement plan of the project). Table below is shown about public structures that affected by the project:

Table 5-23 (A): Public Structures Affected

Items	Unit	NR5	Amount (USD)
2G) Construction roofing Zinc/Ferrocement, on the groud with platform or wood, wooden column, Zinc wall or Ferrocement)	m^2	23.75	23.75
2I) Construction roofing Zinc/Ferrocement, on the groud with platform or wood, wooden or concrete column, wooden wall)	m^2	10.35	10.35
2J) Construction roofing Zinc/Ferrocement, on the groud with platform or wood, wooden or concrete column, brick wall)	m^2	19.20	19.20
S4) Roof/curtain make from Zinc or Ferrocement and have platform/iron/concrete	m^2	43.40	43.40
Total		**96.7**	**96.7**

Source: Study team (B), Survey and Resettlement plan project (studied date from September 2013 to January 2014)

Table 5-23 (B): Immobility Public Structures Affected

Items	Unit	NR5	Amount (USD)
Cement Mortar	m^2	1,074.70	1,074.70
FENCE&GATEWAY			
Concrete post with wire	lm	6.00	6.00
Gate of public service office (Normal)	set	1.00	1.00
Total		**1,081.7**	**1,081.7**

Source: Study team (B), Survey and Resettlement plan project (studied date from September 2013 to January 2014)

Table 5-23 (C): Public Trees Affected

Items	Unit	NR5	Amount (USD)
Other	tree	6	6
Total		**6**	**6**

Source: Study team (B), Survey and Resettlement plan project (studied date from September 2013 to January 2014)

5.2.3 Socio-Economic condition of People living along NR5 (from Sri Sophorn to Poipet Town

5.2.3.1 Career and Main Occupations

In project area, it was classified into two main parts for occupations: (1) the people living on both sides of the road, and (2) people (fishermen) living along the Sri Sophorn River, from Toeuk Thla Bridge to downstream of it.

A. Career and Occupation of people living along road

Working team directly interviewed with local authority levels as communes, villages; public consultation meeting and interview were done with household head living along the road, in and around project area. As the result, the main occupations of interviewed people were farmers, business, government officers, staffs of private company, and other careers.

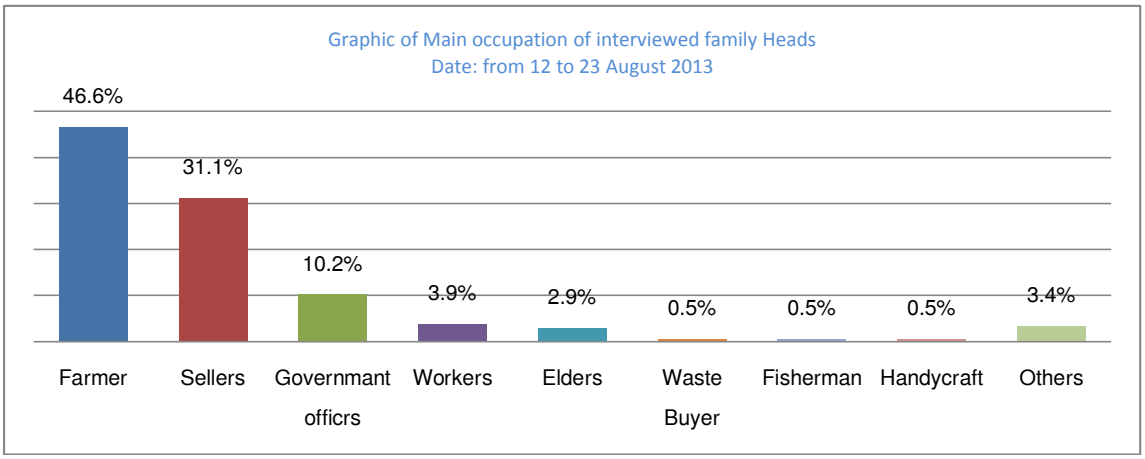
Agricultural employment was the main occupation of Khmer people in whole country with more than 80 percent. However, according to consultation meeting with local authority as communes and villages levels along the road, along the project area it indicated that most of farmers about 49% were able to cultivate rice only one time per year because of many impossible factors as the following:

- Their product impacted by flood of 3 years (based on discussed with local authority and the people living in the project area);
- Lack of water and irrigation system;
- Drought at the beginning of season and impact by flood caused to difficulty;
- Agricultural products/yields were small amount;
- Price of unhusked rice was low after harvested;
- Price of fertilizers was highly increased;
- Some farmers kept farmland abandoned or rent, and migrated to work as workers in neighbor countries because they think that working as workers will receive wage more than farming.

The main occupations of the household head interviewing were farmers was 96 H.Hs with 46.6% ,workers 8 Households with 3.9% , 62 households (31.1%) of business,21 families (10.00%) of govern ment officers, 6 households (2.9%) of elders, 1 households (0.50%) of waste buyer, 1 households (0.50%) of fishermen, 1 household (0.50%) of handycraft, and 7 families (3.4%) of others. Those main occupations shown in the following table:

Table 5-24: Main Occupations of family heads living along the both sides of roads in and around the project area, field survey on 12 - 23 August 2013

#	Total interviewed H.Hs	Total Vill.	Total Com	Main Occupation of Household Heads									
				Farmer	workers	Seller	Govt. official	elder	Waste Buyer	Fisher men	Handy craft	Other	Remarks
1	206	52	6	96	8	64	21	6	1	1	1	7	Only 20 villages has interviewed
%	100			46.6	3.96	30.69	10.5	5.9	0.50	0.50	0.50	8.5	



Moreover, people living along the Sri Sophorn River from Upper stream of Toeuk Thla Bridge to downstream of Sri Sophorn also there is another occupation as fishing which described as follows:

B. Career and Occupation of Fisherman

Working team defined 2 locations for researching on fish from upstream of Toeuk Thla Bridge to downstream of Serey Sophaon as already mentioned above.

On both sides from upstream of Toeuk Thla Bridge to down stream of Sri Sophorn, there were 11 villages of 3 Sangkats in Sri Sophorn Town, Banteay Meanchey Province. There were 412 fishing families of 8,144 of total families. Working team interviewed with 52 fishermen (12.18%), see for detail in table below.

B.1 Statistics of Fishermen and Type of Fishing Instrument

Working team did collaboration with JICA Survey team to work in the villages affected by National Road No.5 rehabilitation project. Working team directly interviewed with fishermen, the village chief, commune council chief and the Fisheries Administration in Pursat; then the results of interview were showed in Table 5-25 below.

Table 5-25: Statistics of Fishermen and Number of Fishing Instrument in from upstream of Toeuk Thla Bridge to down stream of Serey Sophaon, field study from 12 August to December 30, 2013

N0.	Village	Total Family	Fishermen Family	Fishermen Family		Fishing Gears			
				Number of Interviewed Family	%	Cast Net (set)	Gill net (set)	Hook-Fishing-with Swimbait (hook)	Fishing tackle/ Hook-Fishing-line (hook)
Fishing Location No.1									
1	Toeuk Thla	1029	42	8	19.05	59	9	150	80
2	Banay	245	36	4	11.11	41	6	200	100
3	Tumnup Chrye	206	25	3	12.50	32	5	100	100
4	Keap	963	51	5	9.80	68	8	250	150
5	O Ambil	1370	34	5	14.71	39	8	200	150
6	Prahuort	2323	38	4	10.53	47	6	100	100
Fishing Location No.2									

N0.	Village	Total Family	Fishermen Family	Fishermen Family		Fishing Gears			
				Number of Interviewed Family	%	Cast Net (set)	Gill net (set)	Hook-Fishing-with Swimbait (hook)	Fishing tackle/ Hook-Fishing-line (hook)
7	Roung Machin	427	43	5	11.63	54	8	200	80
8	Kour Than	109	28	3	10.71	31	6	150	100
9	Se Sin	497	36	6	11.54	35	7	100	50
10	Kbal Spean	320	42	5	11.90	57	16	200	100
11	Prek Russey	655	37	4	10.81	46	10	150	50
Total		**8,144**	**412**	**52**	**12.18**	**502**	**89**	**1,800**	**1,060**

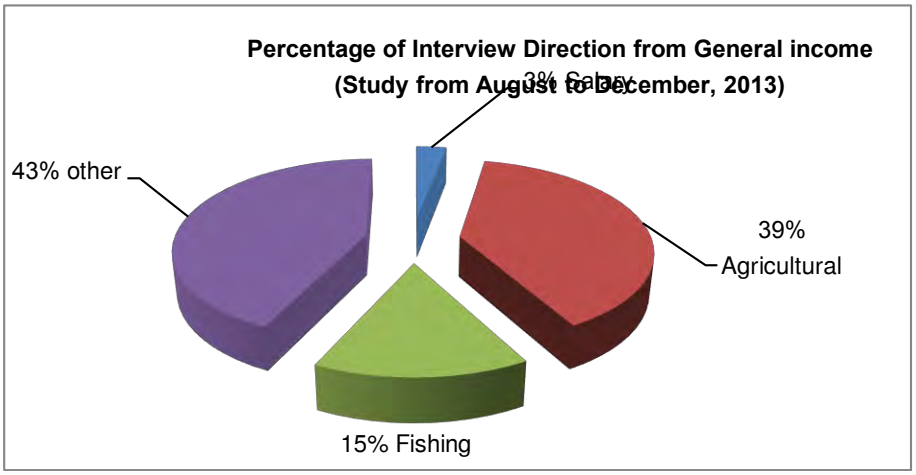
Source: Statistic of interview with the vice- chief of village and chief of commune/Sangkat, data recorder and fishermen, 2013

B.2 Incomes

There were 53 families, living along the from upstream of Toeuk Thla Bridge to Down stream of Serey Sophaon, which interviewed for their income sources; however, working team found out 21 families of them were fishermen, then the result was showed in the table below:

Table 5-26: Income sources of 53 families working as farmers and fishermen interviewed during field survey from 12 August 2013 to 30 December 2013

Number of Respondents	Income Sources									
53 families	Salary	%	Agriculture	%	fishing	%	Other	%	Total	%
	10320000 (2580)	3	132200000 (33050)	39	51210000 (12802,50)	15	145400000 (36350)	43	339130000 (84782,50)	100



Referring to table and graphic above, it indicated 21 of 53 families said that their occupations were Official government were 3 households and main occupation as farmers were 29 households. The income of 3 households `come from salary were Riel 10,320,000 or US$ 2580 per year, equaling to 3%. For other income sources as agriculture with 39%, it was Riel 132,200,000 or US$ 33050 year, while Rile 51,210,000 or US$ 12802.50 per year was from fihsing (15%). However, other 43% that their imcomes were Riel 144,400,000 or US$36,350 from different sources such as selling labor on rice field, harvesting corn, rice mill worker, driver for transporting rice, motorbike driver, construction worker/carpenter, motorbike repairer, jeweler...etc.

To the main occupation were 21 households of fishermen, in which the families earning income lowest US$ 20 was 11households only. The 3 households which their income came from salary, in which there

was only 1 households got earning lowest US$20 per month and other 36 households as farmers, among 36 households there were 8 can earning income below US$20 per month.

Totally, among 53 households, in which there were 10 households in each person got income below US$20 with 21% and the households can earning their income per month for each from US$20 upto there was 42 gouseholds with 79%.

B.3 Fishing Yields

According to field working and interviewed of working with fishermen by participating from representative of involvement villages in first fishing location (Bridge of Toeuk Thla to Pro Hoth village), there were 6 villages, in Second fishing location (from Rong Machine village toPrek Russey village), there were 5 villages, and the total were 11 villages and 3 Sangkat: Sangkat Toeuk Thla, Sangkat O Ambil, Sangkat Phrah Punlear.

Based on study of fishing yield per year in Stung Sri Sophorn, it mentioned that in total was 4,826 Kg. Among these locations were: in the second fishing zone was 4,210Kg, it was more than the first fishing zone, and it was only 3,794Kg. The reason of that was alot of inundated forest and deep many holes.

Fishing gears which fishermen used for fishing in Steung Sri Sophorn such as cast net was about 71%, fishing net was 23% and use other bangkay and Santouch and Ronorng was 6% only. To the catching fish yields in each Fishing zones see table below:

Table 5-27 (A): Yields of catching fish in Stung Sri Sophorn of two zones in raining seasons (Date: from 12 August to 30 December, 2013)

Yields in Zone :1		Yields in Zone :2		Total Yields	
K.g	%	K.g	%	K.g	%
1499	%47	1687	%53	3186	100

Table 5-27 (B): Yields of catching fish in Stung Sri Sophorn of two zones in Dry Seasons (Date: from 12 August to 30 December, 2013)

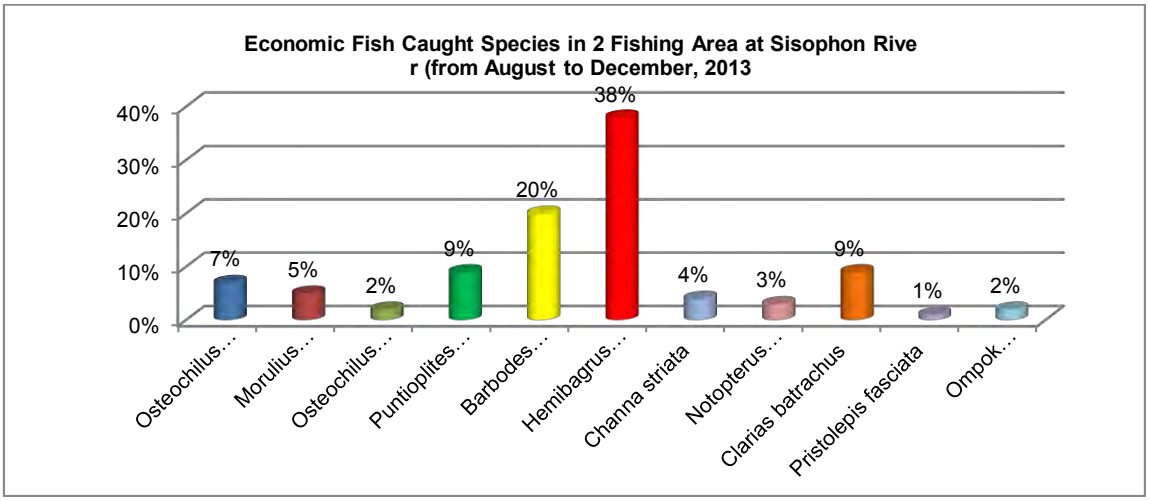
Yields in Zone :1		Yields in Zone :2		Total Yields	
K.g	%	K.g	%	K.g	%
2295	%48	2531	52%	4826	100

Table 5-27 (C): Yields of catching fish in Stung Sri Sophorn of two zones per year (Date: from 12 August to 30 December, 2013)

Yields in Zone :1		Yields in Zone :2		Total Yields	
K.g	%	K.g	%	K.g	%
3794	%47	4218	53%	8012	100

Table 5-28: Yields of catching economic fish in Stung Sri Sophorn of two zones per year (Date: from 12 August to 30 December, 2013)

Trey kros	Trey Kaek	Trey Krum	Trey Chrakeng	Trey Chhpin	Trey chhlaing	Trey traorn	Trey Pruk	Trey Slat	Trey andeng	Trey Kantrap
7%	5%	2%	9%	20%	4%	2%	38%	3%	9%	%1



Note: The reason of catch fish yield decreases because there is a lot of illegal fishing such as the use of shock devices and Uy device (use mosquito nets to make pipe); these illegal fishing were from Rich-man and powerfull people standing behind. Farmers also used some pesticides and other chemical substances to kill insects, crabs, and grass in order to increase their rice yields.

5.3.3.2 Career and Second occupation

Besides of the main occupation of the family heads, they also had another second occupation such as worker at the border of Cambodia- Thailand (harvesting corn, planting cassava, construction worker…), Sweden agriculture, raising chicken, duck, pig, cow… etc., these were the second occupations in order to get more income to support their family.

5.2.3.3 Income of People in Project Area

A. Yearly Income of People in Project Area

Gross Domestic Product (GDP) of Cambodia in 2012 was 128.61 million dollar, and the population was 14,676,591 people according to census data in 2013 of Ministry of Planning. Thus, GDP was US$ 931per capita/year (Statistic al Yearbook 2012, National Institute of Statistics, Ministry of Planning, Cambodia (http/www.nis.gov.kh) (([1]) International Monetary Fund. Retrieved April 18, 2012); ([2]) Departments of Economic and Social Affairs Population Division, *Population Estimates and Projections Section.* 2011 revision, United Nations Retrieved 6 June 2012.)).

For the people living standard in or near the project area per capita was $1,396.25; it was higher than Gross Domestic Product of Cambodia was US$ 931(1) in 2012 per capita.See in Table 5-27 as the following:

Table 5-29: Yearly income of family heads living along the both sides of road in and around the project area, Field survey from 12 to August 23, 2013

Income of interviewed villagers in and around the project area	Number of Interviewed Families	Number of the family members	Total of family members interviewed	Number of villagers over 18 years old	Income/person/ year
$1,259,419	526	4.4	209	600	$1,396.25

Note:Only 20 villages have interviewed.

B. The comparison of monthly income of people in Project area of each commune

Based on the analysis of monthly income per capita in communes which lacated along both side of the road, and has found that income from $66 to $100. There was in 3 Communes: Samroung, Changha, and Phsa Kandal. The main factors of the income were in low level come from:

- Facing with serious flooded during cultivating season;
- Lacking of irrigation system;
- High spending in farming of agriculture such as fertilizers, Diessel, Gasoline are all in

hight cost and the product of rice could not be balanced with spending;

- The cost of rice which bouthg by middle man was so cheap that wasn't expected cost of farmer;

- There were only one occupation and other income of supplementary was so less.

To the average income per capita from $112.94 up to $ 183.62 per month.There were 3 communes such as: Kob, Nimith, Sangkat Toeuk Thla. The main factors of bring to have income in level were:

- Their supplementary occupation such as besides farming they can earn money from other sources such as fishing, growing crops, and migrated to Khmer-Thai border as workers or went to work as workers in Thailand becose they were able to earn more income.

- Anyway, they were able to sell their small production owing to it was market near their house and they were able to sell vegetation or other goods, workers and went to fishing at inundated forest near Tonlesap in order to increase their daily living standard.

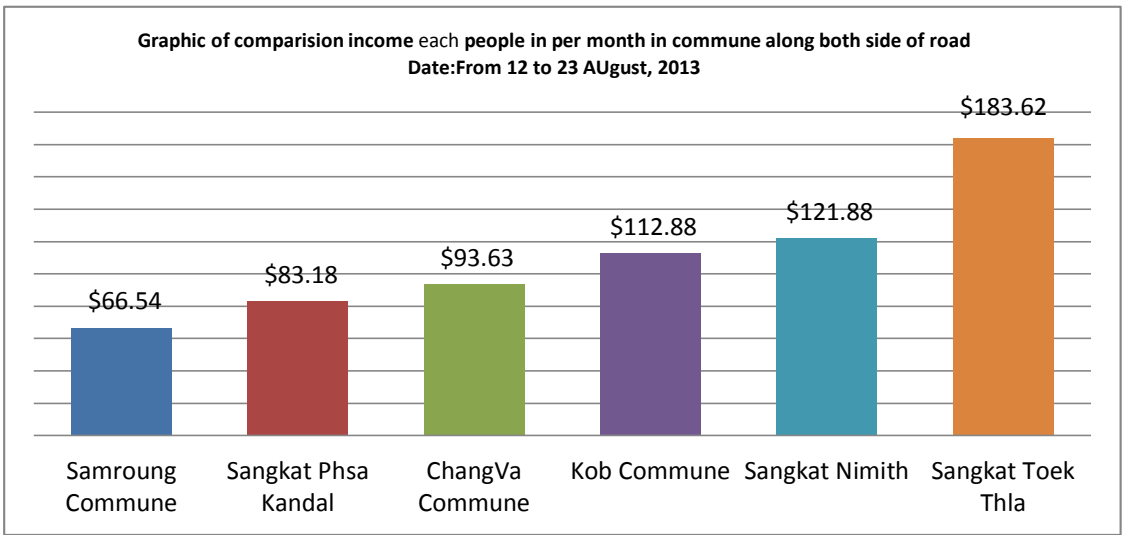
Note: *The income of each people per month as mentioned in table below were not the income of per capita represented to whole commune. It was average income of represented to people which living along national road No.5 section from Bridge of Toeuk Thla (KP366+250) to (KP402) located in Phsa Kandal village, Sangkat Phsa Kandal in which total6 communes, and in which 15% only living along road, Mostly high income were people living far from road.*

The comparison of income per capita in 6 communes along the road which interviewed households living along road of project area was illustrated in the table below:

Table 5-30:Comparison table of interviewed family heads living along the both sides of road income in the commune along the road, studied from 12 to August 23, 2013

No.	Commune/District	Total number of Villages	Number of interviewed families	Total income by communes	Total people	Income per capita) $US)	Remarks
1	Samroung	1	3	865	13	66.54	BMC
2	Phsa Kandal	2	8	3,327	40	83.18	BMC
3	Changha	1	2	749	8	93.63	BMC
4	Kob	9	100	47,888	424	112.94	BMC
5	Nimith	6	88	48,264	396	121.88	BMC
6	Toeuk Thla	1	5	3,856	21	183.62	BMC
Total		**20**	**206**	**104,949**	**902**		

Note:Only 20 villages have interviewed.



5.2.4 Land uses and Land occupation in the COI area

According to field survey and public consultation meeting with local authorities such as provincial, district, commune, and village levels, they learnt that Right of Way of NR5 from Toeuk Thla Bridge (KP 366+250) it located in Toeuk Thla Village Sangkat Toeuk Thla, Sri Sophorn Town (KP402), it was 30m from center line of bothsides with width 60m. But land acquision for rehabilitating and expanding was only 20m from the bothside of road axis and with 40m total. However, in the Corridor of Impact (COI: 20m) consisted of 238 households, 70 stalls, 1 Restaurent, 146 small stalls, and 51 other constructions will be impacted by project. (Data quoted from Resettlement Plan July 2014).

5.2.5 Water supply

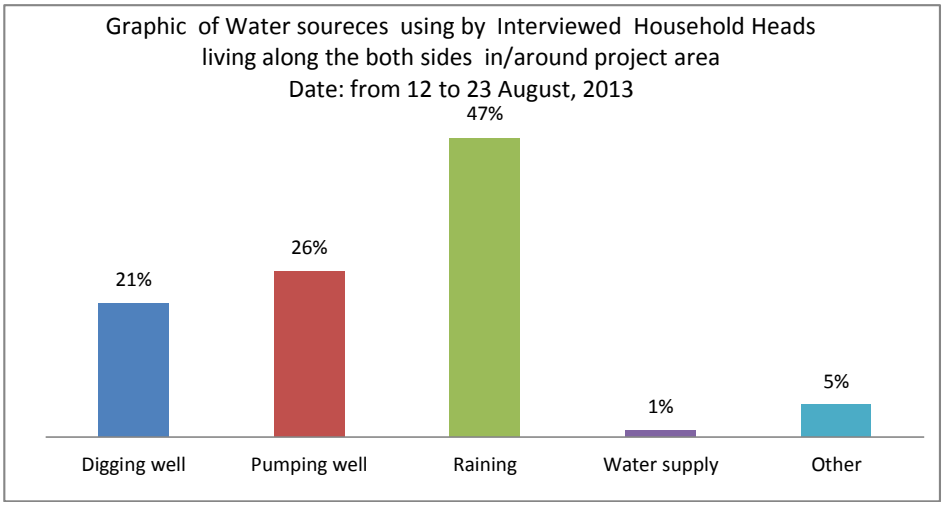
According to field survey, villagers living in and around the project area had different water resources for drinking, cooking, bathing, and washing in both dry and wet season. It was 21% from open well, 26% from pumping well, 47 % from rainwater, 1% from water supply system and 5% from other sources.

Note: For drinking water, most of villagers used water filtration tank.

Table 5-31: Clean Water supply in and around the project area, Studied from 10 July to 10 August 2013

No.	Number of interviewed family head	Total people from interviewed family	Total villages	Open well	Pumping well	Raining	Water Supply	Other
1	206	902	20	83	103	186	4	19
%	100			21%	26%	47%	1%	5%

Note:Only 20 villages has interviewed, a family had water sources from 02 or 03.



5.2.6 Sanitation

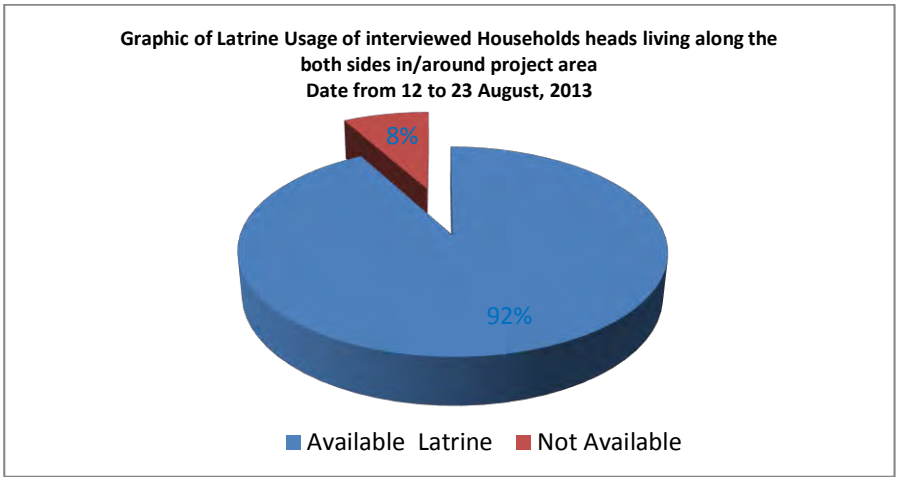
5.2.6.1 Latrine Use

According to interview with 202 family head of households living in and around the project area, it illustrated that approximately 92% of interviewed family utilized toilet and other 8% didn't have toilets, those of them defecated by digging behind their houses or at a field. The main reasons that they didn't have toilet were no money and low knowledge of hygiene, according to interview with them.

Table: 5-32: Utilization of toilet of family heads living along the both sides of road in and around the project area, Studied from 12 to August 23, 2013

No.	Number of interviewed family Heads	Total number members of interviewed family	Total villages	Toilet Utilization	No toilet
1	206	902	20	189	17
%	100			92	8

Note:Only 20 villages have interviewed



5.2.6.2 Solid waste collection service

Nowadays, in Serey Sophaon and PoyPet Towns have two different company for responsible in cleaning solid waste, because Serey Sophaon town is far from Poipet, It was 47Km. In Serey Sophaon has one private company to service for solid waste collection and Cleaning, it called **GAEA**, it collect garbages in Serey Sophaon town only, from Toeuk Thla bridge to O-Chrov district border has no provide service. Otherwise, in Poipet town started from Sangkat Phsa Kandal to Sangkat Poipet has private company it called **Poipet Cleaner**. This company has provided service for garbage collection in Casino, Hotels, Guest houses, Restaurants, and other companies and people dwellings in towns in Poipet and transport all solid waste to Dumpsite/landfill in Phsa kandal Village, Phsa kandal Sangkat, Poipet krong. According to field survey and investigate has mentioned that has a big issue that the government has hightly paid attention on, especially, on waste management and collection. Nowaday, based on field study has found that in Poipet faced seriouly problems with solid waste because of company can not provide service of waste collection to people living in town, lacking of mean of transportation, and workers are mostly resing from work and went to looking for other job in Thailand. So some people decided to throw garbage into waste water system.

Furthermore, villagers living at rural area which was far away from the collection point and collection area burned waste in front, back or free land next to their houses. For putrid waste, some households transported these wastes to make compost fertilizer at their rice field.

A…Methodology of solid waste study

JICA Working team decided to study on solid waste along the roadside, the selected sample were not over 5 locations. Moreover, working team divided dumpsite/landfill into two types: dumpsite/landfill with license (legal) and dumpsite/landfill without license (illegal). The legal dump side (with license) is a place allowed by Provincial Authority and managed by private company. Illegal dump side (without license) is a place that villagers send the waste to there without any authority permissions.

For the methodology of solid waste analysis at legal dump side, the survey team analyzed the waste at the dump site in Sri Sophornand Poipet towns. Therefore, at illegal dump site, the survey team analyzed the waste along the National Road No.5 by choosing the pile of garbages was over 1 cube meter with 4 points.

The ways of solid waste survey are:

- First, the team chose each samples of a selected point in order to analyze. The size of each sample was 20cm^3 which was chosen by random.
- Then, each sample was divided into different waste types such as hazardous waste and non-hazardous waste (plastic, piece of broken glass, metal and putrid waste).
- After separating wastes by its type, survey team weighted them.



The picture of instrument for waste study

In Sri Sophornand Poipet Towns have seperately service provider different of waste collection, because of from Sri Sophorn and Poipetis far 47Km approximately.

Waste collection service in Serey Sophaon is managed by private firm it called **GAEA**. The coverage area of waste collection is only in Town; In Sangkat Toeuk thla from Toeuk Thal bridge (KP366+250) to at the end of Sri Sophornboundary (Sangkat Teuk Thla), the company is not doing garbage collection there. There was 1 trucks transported waste, and 7 (Garbage Bins). For collection service, trucks can deliver the waste so slowly which it loaded 28tons of waste per day to dispose, in a day the company could be collected with 28 tones The location of town dumpsite/landfill is in Kang Va village, Kang Va commune, if we go there on the rNational Road No. 5 then turn on the road No. 56 , it is about 6,5kM and then turn on the laterite road on the left side, and the last we can turn on rural road, the dumpsite is about 100m from road, the area is about 2 hectares.. The dumpsite/landfill surrounded by rice fields, no residential area; but some huts of waste collectors settled around this dumpsite/landfill.

Table-5.33 (A): Garbage Tariff services in Sri Sophorn Town

No.	Type of Building	Cost in Riels
1	Flat house	5,000
2	Plot house	5,000
3	Exploitation flat house	10,000
4	Exploitation flat house (> two flats)	20,000
5	Motorbike-vehicle washing place	20,000
6	Restaurant (small size)	20,000
7	Restaurant (big size)	40,000
8	Hotel	40,000
9	Guesthouse	30,000
10	Exploitation plot house	10,000
11	Government building for staff to stay	5,000
12	Stall fish-cheese	40,000
13	Video-film theater	30,000
14	Handicraft	40,000
15	School	20,000
16	Institute-University	40,000
17	Hospital	40,000
18	Administration building and center	5,000
19	Clinic	40,000
20	Junk shop	40,000
21	Karaoke	40,000
22	Fuel station	40,000
23	Motorbike repairing stall	10,000
24	Garage vehicles	20,000
25	Metal- wooden handicrafts	40,000
26	Construction materials shop	40,000
27	Copy-printing documentation shop	10,000

28	Sand-gravel shop	20,000
29	Killing place (cow-pig)	40,000
30	Cloth tailor- hair cut stalls	10,000
31	Company office	40,000
32	Bank	40,000
33	NGO office	40,000
34	Ceremony-wedding party	40,000

Source: data obtained from Sri Sophorn Hall Town

According to the waste study at dumpsite/landfill in Serey Sophaon, it illustrated that 1 m³of waste volume contained 260 Kg with different wastes, among of this hazardous waste such as (old motorbike inner tube and shoes make from vehicle tire) it weighs is 24kg; putrid waste such as (vegetable, coconut peel, fruit peel, fruits and paper) it weighs is 132kg; plastic waste (plastic bag, plastic package of cakes and plastic drinking flexible straws...etc.) it weighs is 35kg; other wastes such as (broken glass and bottles/particle mental wastes) it weighs is 64kg; and clothes waste it weighs is 5kg.

In Poipet Town, there isPoipet cleaner Company responsible for garbage collection, called **Poipet Cleaner**. Based on discussed with **Mr. Khloeng Chamroeun**, Acting Director of Poipet Cleaner Company, said thatthere were only 2 Sangkats: Sangkat Poipet and Sangkat Phsa Kandal received the waste collection service at the moment. There were only 2000 households it was about 19% of total households in Poipet Town(Data provided by Poipet hall, 2012. the total families were 10,388). Therefore, Company was lacking of mean of transportation, lasily of workers, and some of workers ran away to looking for job as wrokers in Thailand all the reason mentioned that company could not access of collection garbages in all Sangkat. Moreover, the company collects the waste without charge for waste in public place of city. The company has 6 waste trucks, five trucks with 5-ton load. There were 60 tons of wastes collected by PPcleaner to dispose at dumpsite 3 times per day. Moreover, Company provided service for collection focus on kitchen waste subsidue of clothes only. Landfill/dumping site of Poipet Cleaner was looked for by Provincial Department of Environment. The location of landfill/dumpsite of Poipet Cleaner Company is in Phsa kandal village, Sangkat Phsa kandal, Krong Poipet, Banteay Meanchey province. We can access there on the National Road No.5 betweeb Kilometer Post 402 and 403 and on the right, it is rural road (direction from Phnom Penh to Poipet) and then we can turn on that raod. It is 2 km approximately we can reach the land fill/dump site. The area of landfill/dumpsite is about 5.5 hectares. There were a few huts of waste pickers around the landfill/dumpsite, and especially near the area has people dwelling about 500 households. So it was impacted to their health by bad smell from dumping site**,** According to making discussed with **Mr. Khloeng Chamroeun**, Acting Director of Poipet Cleaner Company, he said thatCompany to be happy making collaboration with project owner by collecting waste, even the area of collection is outside or far away from boundary of company providing services.

Table-5.33 (B): Garbage Tariff services in Poipet Town

No.	Type of Building	Cost in USD
Normal flat house		
A-Flat house of Cambodian		
1	Flat house E_0	2
2	Flat house from E_1 and upper	1.5
B-Flat house of Foreigner (rent or belong to)		
3	Flat house E_0	10
4	Flat house from E_1 and upper	8
C-Plot house of Cambodian		
5	Concrete on the ground, wooden upper, roof made from tile or Zinc	2
6	Plot house (villa)	3
D-Plot house of Foreigner (rent or belong to)		
7	Concrete on the ground, wooden upper, roof made from tile or Zinc	10
8	Plot house (villa)	10
9	Plot house (villa) of Cambodian	5
10	Plot house (villa) of Foreigner (rent or belong to)	15
Exploitation location		
A-Exploitation group-1		
11	On the ground (E_0)	3
12	First floor and upper	2
B-Exploitation group-2		

13	On the ground (E_0)	5
14	First floor and upper	3
Food stall- Restaurant		
A-Food stall- Restaurant (local food service)		
15	Food stall- Restaurant small size (flat house or similar size)	10
16	Food stall- Restaurant medium size (two flat houses or similar size)	20
17	Food stall- Restaurant big size (three flat houses or similar size)	50 upper
B-Food stall- Restaurant (abroad food service)		
18	Food stall- Restaurant small size (flat house or similar size)	20
19	Food stall- Restaurant medium size (two flat houses or similar size)	50
20	Food stall- Restaurant big size (three flat houses or similar size)	100 upper
Guesthouse/Room for rent		
A-Guesthouse		
21	Guesthouse less than 10 rooms	10
22	Guesthouse from 10 – 14 rooms	15
23	Guesthouse from 15 – 19 rooms	20
24	Guesthouse from 20 – 24 rooms	25
25	Guesthouse from 25 – 30 rooms	30
26	Guesthouse more than 30 rooms	40
27	Room for rent	1/room/month
B-Apartment, Condo		
28	The price is less than 1,000$/M (less than 250$/week)	7/room/month
29	The price is more than 1,000$/M	10/room/month
Hotel		
30	Hotel price is less than 15$/Room/Night	1/room/month
31	Hotel price is less than 15-30/Room/Night	2/room/month
32	Hotel price is more than 30$/Room/Night	3/room/month
33	Location or building for rent for ceremony, wedding, party	500
Bar, Discotheque and Slot machines		
34	Big size	200
35	Small size	50
Casino/Club		
36	Big size	1,000
37	Small size	500
Club		
38	Big Club	100
39	Medium Club	50
40	Small Club	20
Super Market		
41	Big size (there is Car parking)	300
42	Big size (there is no Car parking)	50
43	Small size (2 flats or 3 flats)	30
Office Company		
44	Big size	25
45	Small size (1 flat house)	15
Bank		
46	Big size	50
47	Small size (1 flat house)	30
NGO/Community		
48	International NGO/Community (do not count for office size)	
49	Religion Temple of Foreigner (big size)	
50	Religion Temple of Foreigner (1 flat house)	
51	Local NGO/Community (big size)	
52	Local NGO/Community (1 flat house)	
Vocational Training		
53	Big size	25
54	Small size (1 flat house)	10
55	Cinema or Theater	20
Building, warehouse for car or Motorbike selling		
56	Big size	50
57	Medium size	30
58	Small size	15
Gas – Fuel station		

59	Gas-fuel station with car washing or oil exchange or engine checking	40
60	Gas-fuel station with garage	50
61	Gas-fuel station with Starmark	50
62	Gas-fuel station with Restaurant	50
63	Gas-fuel station with injection machine more than 4 pieces	30
64	Gas-fuel station with injection machine less than 4 pieces	20
Warehouse or Cargo port		
65	Big size or dry port (>1,000m^2)	100
66	Medium size (>500m^2 up to 1,000m^2)	50
67	Small size (from 250m^2 up to 1,000m^2)	30
68	The size is same 1 flat house or similar (smaller 250m^2)	5
Hospital or Clinic		
69	Room or bed upper 10	50
70	Room or bed from 6 to 9	30
71	Room or bed from 3 to69	15
72	Room or bed from 1 to 2	10
Health Consultation Room		
73	Room consultation as 1 flat house	3
74	Room consultation as 2 flat house or similar size (plot house, small villa)	6
Private School		
75	University or College from 51 rooms and upper	150
76	University or College from 21 rooms to 50 rooms	100
77	University or College from 20 rooms and less than	50
78	Private School registered at Department or Ministry of Education and provided training and others knowledge (lower than Master degree)	20
79	Private School provided training base on hour study (in general it is not registered at Department or Ministry of Education)	10
Factory/industry/handicraft/ workshop		
A-Factory/industry		50
B-Handicraft/ workshop		
80	Flat house	6
81	2 flat houses or size similar	10
82	3 flat houses or size similar	20
Institution/government/public institution (Organization-Department-Ministry)		
83	Ministry	10
84	Department or Entity	5
Market (stall in the market)		
85	Small size of stall	200R/d
86	Medium size of stall	300R/D
87	Twice stall	500R/D
88	Stall	6,000R/D
Stall or selling place along the public road/mobile		
89	Small size	200R/d
90	Medium size	300R/D
91	Big size	500R upper/D
92	Selling stall along the public road	1,000R upper/D

Source: data obtained from the Poipet Cleaner Company

Due to the study at landfill/dumpsite in Poipet City, there were 319Kg for 1m^3 of waste volume in average, among of this consisting harzardous waste (inner tube of tire, clothes contaminated with oil/ greases) it weighs is 29Kg; putrid wastes such as (vegetable, coconut peel, fruit peel, fruits and paper) it weighs is 182kg; plastic waste (plastic bag, plastic package of cakes and plastic drinking flexible straws...etc.) it weighs is 44kg; other wastes such as (broken glass and bottles/particle mental wastes) it weighs is 35kg; and clothes waste it weighs is 29kg.

In conclusion, the wastes in average for 1m^3 of volume in both Cities are 291kg, among of this consisting harzardous waste (inner tube of tire, clothes contaminated with oil/ greases) it weighs is 27Kg; putrid wastes such as (vegetable, coconut peel, fruit peel, fruits and paper) it weighs is 157kg; plastic waste (plastic bag, plastic package of cakes and plastic drinking flexible straws...etc.) it weighs is 40kg; other

wastes such as (broken glass and bottles/particle mental wastes) it weighs is 50kg; and clothes waste it weighs is 17kg.

To sumup most of waste in two Cities is the putrid waste and then plastic waste is the second one. Plastic wastes such plastic bag; plastic packages of cake and plastic drinking flexible straw...etc. were found in two the landfills/dumpsites in two Cities. However, plastic bottles, pure water bottles were not found because it was already collected by waste collectors to recycle or to sell at junk shop.

Furthermore, other wastes as pieces of broken glass bottle, ceramic plate wastes were not presented in the landfill/dumpsite. But the glass bottles with original shape have not seen at the area because they have already been collected by waste collectors. **Note:** there were many waste buyers and collectors living in the landfill/dumpsite; they were waiting for the waste trucks in order to collect the recyclable wastes. Some hazardous wastes did not see in the landfill/dumpsite such as aluminum cans, metals, electric cable and included other hazardous waste as batteries, old tires there is no in the dumpsite because these wastes can be done recycle by the buyer. Especially, in Poipet City waste collecting firm mostly responsible to collect waste that outlet from the kitchen, therefore were found most of putrid wastes in the landfill/dumpsites only.

Table 5-34 (A): Quantity of wastes at the Legal Landfill/Dumpsite, studied on 15 – 22 August 2013

Serey Sophaon Town							
No.	**GPS**	**Waste sampling weight of 20cm^3 (Kg)**	**Hazardous waste of 20cm^3 (Kg)**	**Putrid wastes of 20cm^3 (Kg)**	**Plastic waste of 20cm3 (Kg)**	**Glass/metal/ plate/ceramic wastes of 20cm^3 (Kg)**	**Clothe waste of 20cm^3 (Kg)**
1	X: 279672	5.00	0.70	2.50	1.00	0.80	0.00
1	Y: 1509124	5.00	0.00	3.50	0.50	1.00	0.00
1		5.50	0.70	1.90	0.60	2.00	0.30
Average volume of wastes		**5.17**	**0.47**	**2.63**	**0.70**	**1.27**	**0.10**
1m^3 of volume waste		**260**	**24**	**132**	**35**	**64**	**5**
Poipet Town							
No.	**GPS**	**Waste sampling weight of 20cm^3 (Kg)**	**Hazardous waste of 20cm^3 (Kg)**	**Putrid wastes of 20cm^3 (Kg)**	**Plastic waste of 20cm3 (Kg)**	**Glass/metal/ plate/ceramic wastes of 20cm^3 (Kg)**	**Clothe waste of 20cm^3 (Kg)**
1	X: 240500	7.00	0.00	4.80	0.70	0.30	1.20
1	Y: 1510070	7.00	1.70	2.70	0.50	1.60	0.50
1		5.00	0.00	3.40	1.40	0.20	0.00
Average volume of wastes		**6.34**	**0.57**	**3.63**	**0.87**	**0.70**	**0.57**
1m^3 of volume waste		**319**	**29**	**182**	**44**	**35**	**29**
1 m ^{3} of average volume of wastes		**291**	**27**	**157**	**40**	**50**	**17**



Photo: landfill/daumpsite of GAEA in Sri Sophorn



Photo: landfill/daumpsite of Poipet Cleaner in Poipet Town



Photo: Dump truck of GAEA in Sri Sophorn



Photo: Dump truck of Poipet Cleaner in Poipet



Garbage Bin of GAEA in Sri Sophorn

C. Illegal Wastes

The working team chose 4 places of illegal wastes in order to study for analysis. The targeted locations of study were shown below:

- **Location-1:** it located in Nimith 2 village, Kob commune, O Chrov district, Banteay Meanchey province, sample volume of waste was about 2m³.
- **Location-2**: it located in Yeang Thmei village, Kob Paong commune, O Chrov district, Banteay MeancheyProvince, dumping in Kut tasort market sample volume of waste was about 3 m³.
- **Location-3:** it located in Yeang Thmei village, Kob commune, O Chrov district, Banteay Meanchey Province, sample volume of waste was about 2m³.***Note*:** During field study, it was concided with houseowner was repairing their house , so among the 4 locations , it was the first one was rich of harzardous waste such as cement bags, beside of this we could not find other harzardous.
- **Location-4:**it located in Teuk Thla village, Sangkat Teuk Thla, Sri Sophorn Town, Banteay Meanchey province, sample volume of waste was about 3m³.

  ***Note*:** in the location-4, there were selling stalls and resting places for eating on the both sidesalong the NR5. Moreover, travellers and sellers disposed garbages away or under the selling stall. So in the raining seasond all garbages such as had floated and went into Stung Sri Sophorn (local people called that Stung Toeuk thla), it was difficult for collecting to pile and burned all garbages. Otherwise, there were not wastes collecting service in there; so there is garbage under stalls verywhere that we can see all.

Illegal waste disposal is the result of villagers' activities, because they live in the area without waste collection service. So, they disposed the waste along the road. Every half or a month in the dry, villagers collected wastes to burn and burry from 0.5 to 1 month for some wastes which is not able to be burn. In wet season, the wastes were difficult to burn because the wastes were wet. Some kinds of waste such as aluminum cans, plastic bottles, hard rubbers, papers, metals, glass bottles, batteries, electrical wire, copper pots and aluminum pots were sold to waste buyers/junk shop.

According to making discussion with **Mr. Hoeurn Chanthan**, Chief of Administration of O Chrov District, he learnt that in Ochrov district there was no service of waste collection. Base on this fact, some people had disposal all waste along the both side of road and some of people had disposal at behind the house and burnt or digging.

In short, 1m³ in average volume of wastes of 4 targeted locations was 275Kg in total, among of this composing 3kg of hazardous waste (bag of cement), 199kg of putrid wastes (rice husks, vegetable, fruits, fruit peel, coconut peel) , 47kg of plastic wastes such as (plastic bag, plastic package of cakes and plastic drinking flexible straws...etc.); 5kg of other wastes such as (broken glass and bottles/particle mental wastes); and 21kg of clothes waste.

Table: 5-34 (B): Quantity of waste at the illegal landfill/dumpsite, date on 15-22 August 2013

No.	Number of Kilometer Post	Direction from Phnom Penh to Poipet	GPS	Waste sampling weight of 20cm^3 (Kg)	Hazardous waste of 20cm^3 (Kg)	Putrid wastes of 20cm^3 (Kg)	Plastic waste of 20cm3 (Kg)	Glass/metal/ plate/ceramic wastes of 20cm^3 (Kg)	Clothe waste of 20cm^3 (Kg)
1	385-386	Right Side	X: 255976	4.00	0.00	2.70	1.00	0.30	0.00
1	385-386	Right Side	Y:1506114	6.00	0.00	0.50	0.50	0.00	5.00
1	385-386	Right Side		5.00	0.00	3.50	1.50	0.00	0.00
Number of average sample				**5.00**	**0.00**	**2.23**	**1.00**	**0.10**	**1.67**
Number of sample in 1m^3				**250**	**0**	**112**	**50**	**5**	**83**
2	383-384	Left Side	X: 258702	6.00	0.00	5.00	1.00	0.00	0.00
2	383-384	Left Side	Y:1505250	5.00	0.00	4.20	0.80	0.00	0.00
2	383-384	Left Side		4.00	0.00	3.30	0.50	0.20	0.00
Number of average sample				**5.00**	**0.00**	**4.17**	**0.77**	**0.07**	**0.00**
Number of sample in 1m^3				**250**	**0**	**208**	**38**	**3**	**0**

No.	Number of Kilometer Post	Direction from Phnom Penh to Poipet	GPS	Waste sampling weight of 20cm^3 (Kg)	Hazardous waste of 20cm^3 (Kg)	Putrid wastes of 20cm^3 (Kg)	Plastic waste of 20cm3 (Kg)	Glass/metal/ plate/ceramic wastes of 20cm^3 (Kg)	Clothe waste of 20cm^3 (Kg)
3	382-383	Right Side	X: 259224	6.00	0.20	5.20	0.50	0.10	0.00
3	382-383	Right Side	Y:1505264	5.00	0.30	3.70	1.00	0.00	0.00
3	382-383	Right Side		6.00	0.30	5.00	0.70	0.00	0.00
Number of average sample				**5.67**	**0.27**	**4.63**	**0.73**	**0.03**	**0.00**
Number of sample in 1m^3				**283**	**13**	**232**	**37**	**2**	**0**
4	366-367	Right SideLeft Side	X: 275330	6.00	0.00	4.70	1.00	0.30	0.00
4	366-367	Right SideLeft Side	Y:1501827	7.00	0.00	5.30	1.50	0.20	0.00
4	366-367	Right SideLeft Side		6.00	0.00	4.70	1.20	0.10	0.00
Number of average sample				**6.33**	**0.00**	**4.90**	**1.23**	**0.20**	**0.00**
Number of sample in 1m^3				**317**	**0**	**245**	**62**	**10**	**0**
The average volume of wastes of 8 targeted locations in 1m^3				**275**	**3**	**199**	**47**	**5**	**21**



Study of wastes in targeted location No.1



Study of wastes in targeted location No.2



Study of wastes in targeted location No.3



Study of wastes in targeted location No.4

D. Waste Buyer (Junk Shop)

Moreover working team interviewed with 5 waste buyers (junk shops) learnt that they bought the types of non-hazardous wastes (aluminum cans, plastic bottle, rubbers, papers, metal, and glass bottles); and hazard wastes (batteries, electronic wire, copper pots, and aluminum pot). For the people in Poipet when

they sold these recyclable wastes to Thailand Vietnam, But Lastly, this private company continuously transfered to Thailand and Vietnam. But for waste buyer in Ochrov, transports to sell all in Poipet and continuously to Company or factory in Thailand and all these recyclable waste as material thing. InSerey sophaon as well as in Poipet, Business of buying car old tire was not available,but Company in Phnom Penh is available and continuously to sell to Vietnam.



Photo: Iron, Plastic bottle, Alluminum can, Paper, which collection all waste

5.2.7 Usage of Energy

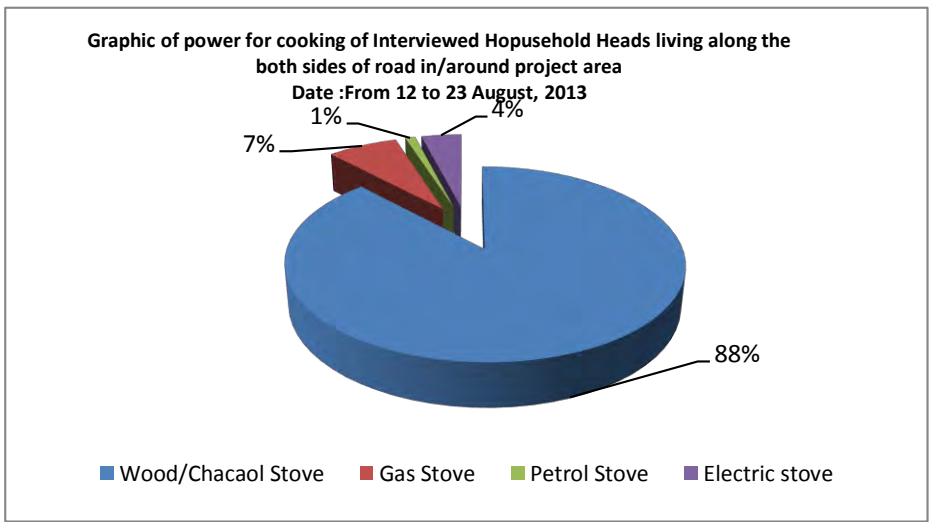
5.2.7.1 Energy for cooking

According to field survey and interview with family heads of households living in and around the project area, it illustrated that cooking stoves used wood and charcoal with 94%, Petrol stoves 0,5 % gas cooker 2% and electrical stoves 3%. The types of energy used for cooking were shown in a table below:

Table 5-35: Usage of energy for cooking of family heads in and around project area, studied from 12 to August 23, 2013

No.	Number of interviewed family	Total member of interviewed family	Total villages	Wood/charcoal Stove	Petrol cooker	Gas stoves	Electrical stoves
1	208	902	20	191	16	1	3
%	**100**			**88**	**7**	**1**	**4**

Note:Only 20 villages has interviewed



Note: A family may have one, two or three types of energy for cooking

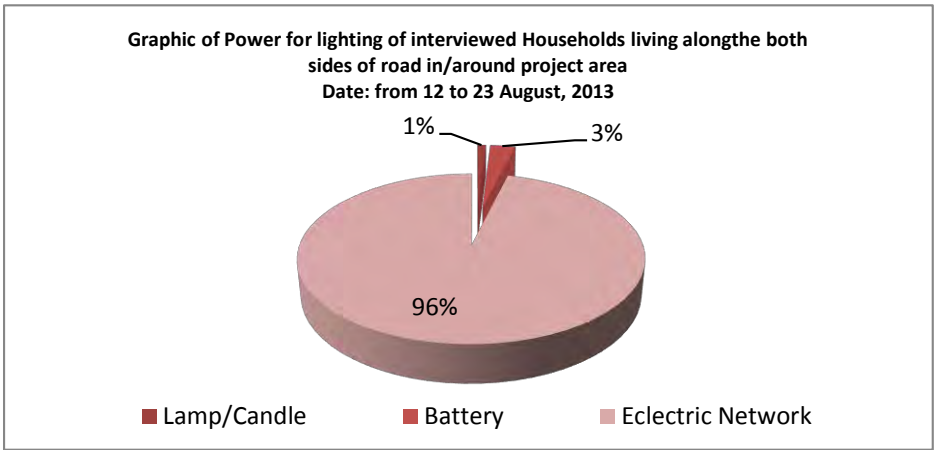
5.2.7.2 Energy for illumination

According to interviewed with family head living in and around the project area about illumination, 1 % of family used traditional lamps/candles for illuminations, batteries 3%, and electrical network 96%. The types of illuminations showed in the table below:

Table 5-36:Energy for illuminations of family in and around the project area, studied 12 to August 23, 2013

No.	Number of interviewed head family	Total member of interviewed family	Total village	traditional lamp candle	Batteries	Electrical network
1	206	902	20	2	6	197
%	100			1	3	96

Note:Only 20 villages has interviewed



Note: A family is able to use one or two power source.

5.2.8 Educational Sector and National Administration of Education

Giving all Cambodian children a chance to educate is the strategy plan of the government in order to reduce poverty and develop social economic. According to the article 65 of Cambodia Constitution, it illustrated that "the State shall protect and promote citizens' right to quality education at all levels and shall take all measures, step by step, to make quality education available to all citizens. The state shall pay attention to physical education and sports for the welfare of all Khmer citizens". It is the strategy plan of the government in order to reduce poverty and develop social economic. The government has to provide physical education for all Khmer citizens. Moreover, the state has to enhance curriculum and educational system in according the national standard and insure for freedom and educational principle. Especially, all citizens have to have equal chance to get employment and occupation.

According to interview with villagers living around and in the project area, it demonstrated that there were 260 classrooms, 7274 students and 274 teachers in Primary School; while it was 48 classrooms with 1,811 students and 98 teachers (data provided by Communes). According to table below, it demonstrates that there were 206 families interviewed. The male family heads were182 families (88%) and other 16 family head were females (6%); they were able to read and write Khmer language (got education from grade 1 to 7). At percentage, literate family head were 94% in total of 20 villages. For illiterate family head, there were 7 males (3%) and 5 females (2%).

Table 5-37: Statistic of general knowledge school, students and teachers in and around the project area, studied 12 to August 23, 2013

No	Commune/ Sangkat	Primary School			Secondary School			High School		
		No. of Class rooms	No. of Students	No. of teacher	No. of Class rooms	No. of Students	No. of teacher	No. of Class rooms	No. of Students	No. of teacher
1	Toeuk thla	56	2080	73	17	553	41			
2	SamRoung	28	1260	33	5	225	15			
3	Chang ha	20	900	17	6	300	6			
4	Kob	33	2,119	46	5	115	9	27	1,168	49
5	Nimith	41	305	35	5	259	11	16	718	36

No	Commune/ Sangkat	Primary School			Secondary School			High School		
		No. of Class rooms	No. of Students	No. of teacher	No. of Class rooms	No. of Students	No. of teacher	No. of Class rooms	No. of Students	No. of teacher
6	Phsa Kandal	41	305	35	5	100	5			
7	Poipet	41	305	35	5	259	11	60	2,154	108
Total		**260**	**7,57.**	**274**	**48**	**8,.88**	**98**	**103**	**4,040**	**193**

Note:Data obtained by Commune/Sangkat hall



Primary, Secondary, High School which project pass through

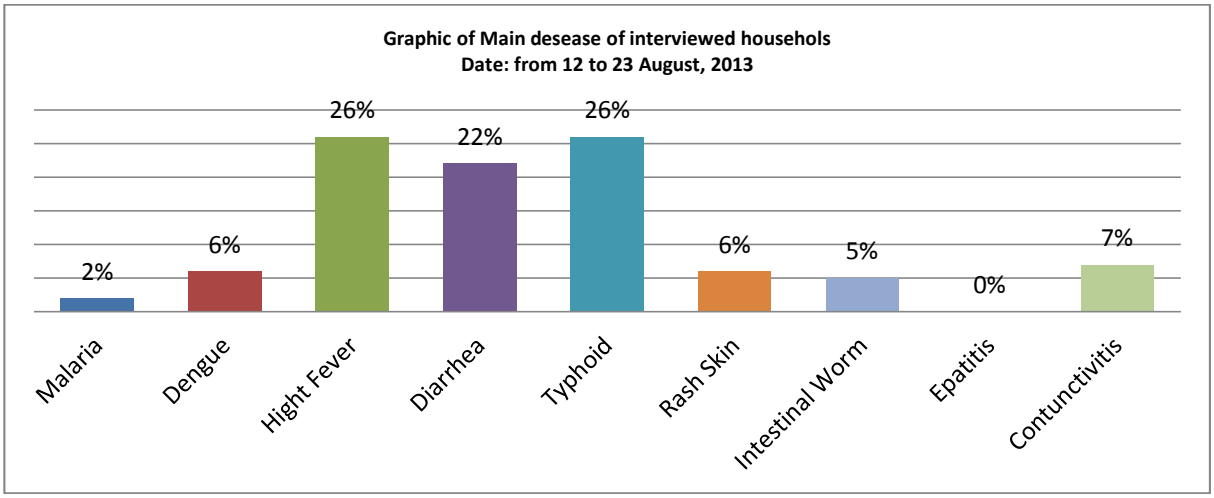
5.2.9Health and Health Conditions

According to the field survey and observation, there were provincial and district referral hospitals locating in/around the project area. There was Poipet referral hospitals had 02 buildings, 01 operational Hospital Office 03 biuldings (number of room not clearify).Anyway, the total Health care Centers was 14 biuldings with 65 rooms and doctors and nurses 93 (Data provided by Communes/Sangkat in 2013). When the villagers got serious diseases or simple diseases, they normally went to see the doctor at health center or provincial and district referral hospitals close to their houses. According to interview with family heads living both sides of the road in/around the project area with 20 villages, it showed that villagers normally got malaria 2%, dengue fever 6%, serious fever 26%, diarrhea 22%, typhoid 26%, skin disease 6%, worms 5%, liver disease 0% and conjunctivities 7%.

Table 5-38:Some diseases occurring in and by the project area, studied 12 to August 23, 2013

No.	Number of interviewed head family	Total member of interviewed family	Total village	mal aria	Dengue fever	Serio us fever	diarr hea	Typh oid	skin disea se	worms diseas e	liver disease	sore eyes disease
1	206	902	20	9	34	139	117	138	30	27	1	38
%	100			2	6	26	22	26	6	5	0	7

Note:Only 20 villages has interviewed



Note: A family is able to get over one case of diseases



Health Care Centre located along the road of project area

5.2.10 Religion and Cultural Heritages

5.2.10.1 Religion

According to the public consultation meeting with villagers and local authorities in and around the project area, 95% of villagers were Buddhist and Other 5%. Therefore, there were 31 pagodas and 503 monks in total along the project area. There were 23 of church and followers with 755. Anyway, the Islam religion with 6 places with Islam followers is about 2,191 people (data provided by communes 2013).



Mosque located in Project area

5.2.10.2 Cultural heritage

According to field survey by working team on rehabilitation and road expending of National Road No.5, it has found that in the COI of project areait will be impacted on holly spirit of Mao grandma and Red Neck(Nak Ta KrahamKar) from KP 397+090 in Poipet city. According to making of public consultation with Mr. Khiev Sonimul, sub deputy director of Department of Religion of Banteay Meanchey on 20 August, 2013 at 10:50 AM, He learnt that the project will be impacted on hermitage of Mao Grandma and Man spirit of Lok Ta Kraham Kar and Salproek which people see as the holly tree of them in Poipet city and travellers. Hoever, he reguested that Project owner should do collaboration with Mr. Seng Hok (Tel: 012 211 011), chief office of Religion in Poipet in order to pray to the holly tree before cut it and rebuild hermitage for holly spirit in the khmer traditional style.



Hermitage of spirit female (Yeay Mao) and Red Neck in Project Area

5.2.11 Tourism

As described abve, Banteay Meanchey province located at the South West of Cambodia about 259 km away from Phnom Penh capital city. There were two main transported roads crossing the province, national road (National Road N.5), railway. The area of this province is 66, 79 square kilometers. The east border of this province is Seam Reap province; on the south is Battambang and on the north and west are Sakeo and BoreyRaim provinces of Thailand. On the other hand, there are many resorts located in Banteay Meanchey province, it has cultural and historical resorts such as Ang Trapaing Thma Banteay Chhma Temple, Banteay Neang, Banteay Torp, La ang Phnom Touch, Phnom Bak, Phnom ChunhChaing. The resorts described above did not have many tourists to visit because road condition is difficult and those resorts located further from the project area. However, in the future the National Road N.5 will become an Asean Road due to this improvement project, thus we expected that there will be a lot of international and national tourists visiting and the local people living standard will be improved as well.



Resort in Banteay Meanchey

The conclusion of Socio-Economic condition:

After describing for detail above, it is able to be concluded as the following:

- There were 206 families with 902 people in total pupolation,that working team interviewed for 20 villages.
- The main occupations of the household head interviewing were farmers was 96 HHs with (46.6%); among these were: farmer that affected by flooded to their rice for 4 years continueing, they were 12 HHs with (12%), Sellers were 62HHs with (31.1%), Government officers were 21 HHs with (10%), workers were 8 HH with (3.9%), others were 7 HHs with (3.4%), Old people were 6HHs with (2.9%), waste buyer was 1HH with (0.5%), fisherman 1HH with (0.5%) and handycraft was 1HH with (0.5%).
- For farming schedule, the villagers are able to plant rice only one time per year, because of many reasons as: lack of water and irrigation systems, low harvest yield, unacceptable price of unhusked rice in harvested season, high price of fertilizes, facing with drought at early wet season and insects. Some villagers kept their rice field abandoned or for rent and then they migrated for job at neighbor countries because they think that being a migrant workers can earn more money.
- There are 562 families affected by the project (239 families in O-Chrov and 323 families in Popipet Town). Among of these there are: 238 households, 70 stalls, 1 Restaurent, 146 small stalls, 51 other constructions.
- According to field working and interviewed of working with fishermen by participating from representative of involvement villages in first fishing location (Bridge of Toeuk Thla to Prohoth village), there were 6 villages, in Second fishing location (From Roung Machin village toPrek Russey village), there were 5 villages, and the total were 11 villages and 3 Sangkats: Sangkat Teuk Thla, Sangkat O-Ambil and Sangkat Preh Ponlea.
- Based on study of fishing yield per year in Stung Sri Sophorn, it mentioned that in total was 4,826 Kg. Among these locations were: in the second fishing zone was 4,210Kg, it was more than the first fishing zone, and it was only 3,794Kg. The reason of that was alot of inundated forest and deep many holes.
- Fishing gears which fishermen used for fishing such as cast net was about 71%, fishing net was 23% and use other bangkay and Santouch and Ronorng was 6% only.
- The water resources for drinking, cooking, bathing and washing in both dry season and wet season were 21% from hand dug well, 26% from hand pump well, 47% from rainwater, 1% from water supply system and 5% from other sources. **Note:** for domestic of drinking water the people used water filtration tanks.
- There were 92% of people living along the project area utilized toilets while other 8% did not have toilets.
- Cleaning, collecting and transporting solid wastes were limited there was 1 trucks transported waste, and 7 Garbage Bins. For collection service, trucks can deliver the waste so slowly which it loaded 28tons of waste per day to dispose, in a day the company could be collected with 28 tones.In Poipet, Poipet cleaner Company was lacking of mean of transportation, lasily of workers, and some of workers ran away to looking for job as wrokers in Thailand all the reason mentioned that company could not access of collection garbages in all Sangkat. . Moreover, the company collects the waste without charge for waste in public place of city. The company has 6 waste trucks; The Company has 6 waste trucks, five trucks with 5-ton load. There were 60 tons of wastes collected by PPcleaner to dispose at dumpsite 3 times per day.
- In short, 1m³in average volume of wastes of 4 targeted locations was 275Kg in total, in which composing 3kg of hazardous wastes, 199kg of organic wastes, 47kg of non-organic wastes such as bottles, iron and piece of broken glasses, and 5kg of plate wastes, 21Kg of grease clothes waste.
- For energy of cooking stoves used wood and charcoal with 88%, Petrol stoves 1% gas cooker 7% and electrical stoves 4%.
- According to interviewed with family head living in and around the project area about illumination, 1 % of family used traditional lamps/candles for illuminations, batteries 3%, and electrical network

96%.

- There were 206 families interviewed. The male family heads were182families (88%) and other 16 family head were females (6%); they were able to read and write Khmer language (got education from grade 1 to 7). At percentage, literate family head were 94% in total of 20 villages. For illiterate family head, there were 7 males (3%) and 5 females (2%).
- According to interview with family heads living both sides of the road in/around the project area with 20 villages, it showed that villagers normally got malaria 2%, dengue fever 6%, serious fever 26%, diarrhea 22%, typhoid 26%, skin disease 6%, worms 5%, liver disease 0.05% and conjunctivities 7%.
- According to the public consultation meeting with villagers and local authorities in and around the project area, 95% of villagers were Buddhist and Other 5%.
- According to field survey by working team on rehabilitation and road expending of National Road No.5, it has found that in the COI of project areait will be impacted on holly spirit of Mao grandma and Red Neck(Nak Ta KrahomKor) from KP 397+090 in Poipet Town.
- For tourism in the future the NR5 will become an Asean Road No.1 due to this improvement project, thus we expected that there will be a lot of international and national tourists visiting and the local people living standard will be improved as well.

Executive Summary

1..INTRODUCTION

The National road No.5 (NR5) is an important National economic road among other roads of Cambodia. At the present, this road is connected from Phnom Penh City to Bangkok, Thailand which assigned Asian Highway A-1 or it is a gate of Souther Economic Corridor of GNS. Therefore, the Royal Government is decided to improve the NR5 to be wide with four traffic lines; it is two traffic lines go and two traffic lines back included right of way for pedestrian and for bycicle of bothsides.

2..**METHODOLOGY OF THE STUDY**

The main points of methodology for the ESIA study on the NR5 improvement project of MoPWT has a mechanical methodology to study 3 Environmental resources: (1) Physical Environment, (2) Biological Environment and (3) Social Environment, are described below:

- Collect data and information related to the project concerning with Institution and Stakeholder in Phnom Penh, such as Ministry of Agriculture Forestry and Fishery (MAFF), Ministry of Environment (MoE), Ministry of Water Resource and Meteorology (MoWRAM), Ministry of Public Works and Transport (MoPWT), Ministry of Planning (MoP), NGOs and other concerned Institutions;
- Collect data in the project area and organize public consultation meeting with local people and Local authorities: (Villager, village Chief, Commune Chief, District Governor/Town, Provincial Cabinet) and institutional linkaged such as: (Provincial Department of Public Works and Transport (PDoPWT), Provincial Department of Agriculture (PDoA), Provincial Department of Environment (PDoE), Provincial Department of Water Resources and Meteorology (PDoWRAM), Provincial Department of Land Urban Management Planing and Construction (PDoLUMPC), Provincial Department of Industry, Mines Energy (PDoIME), Khan of Forestry Administration, Khan of Fishery Administration and other NGOs (see Chapter-6);
- Field investigation on natural environment at project area such as: Hydrology, Soil, Geology, Forest, Wildlife, Fish ect., by mention from villagers who lived in/around project area;
- Field investigation on people's land use in the project area;
- Meet the affected and non-affected people in the project area in order to interview and understanding on their living condition before the project development; and also looking for a common idea and others suggestions which concerned to the project in order to guide the project is running smoothly;
- Taking water samplings and test of water quality sources: Surface water in order to identify of water quality before the project development;
- Taking samplings and test of Air quality, Noise and Vibration in the field (see table of Air, Noise and Vibration tested at the field in order to identify these qualities before the project development;
- Study on Ecology system (dry ans wet season) in the project area;
- Study on fishery in Steung Sri Sophorn (dry and wet season);
- Analysis all data that collected from the field and related institutions, and to describe on existing natural and social environment situation, and then predict the environmental impact may/will be happened before project Operation (in project design and project construction phases), operation and maintenance phase and disclosure phase;
- Review and modify the project master plan/relevant document;
- Determine negative and positive affected caused by project activities. Develop mitigation measure for reducing negative impact to minimum degree and increasing positive impact to maximum degree, by quoted from public consultation meeting with people and other suggestions from people, local authority, Institutional linkage in the project area;

- Prepare Environmental Management Plan (EMP) and Monitoring Program for project construction phase, project Operation and Maintenance phase. The floowing detail of methodology studies: Physical Environment resources, Biological and Socio-economic Environmental resources.

3..RELEVANT LAW AND REGULATIONS

To have well development project the 11 relevant laws, 1 Royal Decrees, 6 Sub-decrees and 3 Policy Guidelines below have to be studied and implemented.

Relevant Law:

1. Law on Constitution of Kingdom of Cambodia, 1993;
2. Law on Environmental Protection and Natural Resources Management, 1996;
3. Law on Road, 2014;
4. Law on Expropriation, 2010;
5. Law on Water Resource Management of Kingdom of Cambodia, 2007;
6. Law on Fishery, 2006;
7. Law on Cambodia Traffic, 2006
8. Law on Land, 2001;
9. Law on Labor, 1997;
10. Law on the Protection of Cultural Heritage, 1996;
11. Law on Land Management, Urban Planning and Constructions, 1994

Relevant Royal-Decree:

1. Royal-Decree on establishment and management of Tonle Sap Biosphere Reserve, 2001

Relevant Sub-Decree:

1. Sub-Decrees on the Management the Reserved Land along the National Road and Railroad of the Kingdom of Cambodia;
2. Sub-Decrees on the Air Pollution and Noise Disturbance Control, 2000;
3. Sub-Decrees on Environmental Impact Assessment Process, 1999;
4. Sub-Decrees on Water Pollution Control, 1999;
5. Sub-Decrees on Solid Waste Management, 1999;
6. Sub-Decrees on Endangerous Fisheries Resources, 2009.

Relevant Policy Guidelines:

1. General Guideline for Conducting Initial and Full Environmental Impact Assessment, 2009
2. National Policy on Green Growth, 2013
3. JICA's Guideline for Environmental and Social Considerations, April 2010

4..DESCRIPTION OF THE PROJECT

This project is the improvement project for NR5 of Ministry of Public Works and Transport under loan project from Japan Government.

In the Town area, the total road width is 28 meters paving with asphalt concrete (AC) of 4 lanes, with each 2 lanes of opposite direction and there is vehicle parking for both sides (2.5m x 2.5m), included of central median road is 3m and plus sidewalks (3m x 2) for both sides.

The NR5 improvement project from Sri Sophorn to Poipet is located in Banteay Meanchey province. It started from Kilometer Post (KP366+250) to Kilometer Post (KP402) that located in the latitude 13°34' and 13°40' at north and longitude 102°32' and 102°56' at east.

5...EXISTING ENVIRONMENT DESCRIPTION

Due to data from Provincial Department of Water Resources and Meteorology in Banteay Meanchey (2003-2012) it indicated that average rainfall for 10 years of return period, from 2003 to 2012, is **1211.4mm** and the highest rainfall is **452.5mm** in September 2002. The Perennial maximum temperature for return period, 10-year, is 40.3 degree Celsius in 2010 and 2011. The Perennial minimum temperature for return period, 10-year, is 15.0 degree Celsius in 2011.

For air quality measurement and analysis, the survey team did cooperation with laboratory working team of Ministry of Environment (MoE) in order to conduct the survey 24 hours of working days for each two sites. There were two times measured and analyzed for air quality, once in dry season and wet season respectively. The result of air quality is still in good condition in wet and dry seasons, its are lower than the ambient air quality standard of the MoE. For noise and vibration measurement had done twice: in dry and wet season in official working days (not holiday or weekends) of both sites. In conclusion, the results of three survey locations for noise measurement in wet season for day-time (morning and afternoon) were not over the standard of Ministry of Environment. Excepted on the night-time was a little bit high if we compared with the standard.

Data of hydrology of Steung Sisophon at point of Preah Ponlea bridge that it has coordinates X= 281678 and Y= 1502222, catchment area is 4,310Km2 and discharge water is 515m3/s in year 1997 (it is year of big flooded according to graph below), the water level is raised up to 7.87m.

Based on the field study by working team for COI: 20m (total: 40m), it illustrated that the affected riverside vegetation, 0.43ha with total forest of 24 species, along the NR5 for a portion from Sri Sophorn to Poipet. Most of the regenerating riverside vegetationnormally found in between KP366+250 to KP366+685 in Teuk Thla Village, Teuk Thla Sangkat, Sri Sophorn Town.

There are six species of crucial mammals found in the project area. There are crucial 38 birds species found in the project area. There are 30 species of reptiles and amphibians found in the project area. There were 91 fish species found out in two areas in Steung Sisophon. Moreover, the team also studied fish in the canal, creeks in the rice field. So, there were 91 species of fish in total finding in project area, which 3 types is endangered species , it is Thinlip barb *(Probarbus labeamamjor)* are two types and Puntius Tetrazona *(Systomus partipentazona)* 1 type. Others fish found in the canal and creek are 41 species, 31 species others are in rice field.

The bird habitats are on planted species in villages, at the rice fields and some species in density area. Furthermore, there were little regrowth riverside vegetation along rivers, streams and ditches that are the habitat for aquatic species and fish, when flooding occurred most commonly from heavy rainfall and an overflow of water from the Thailand to Creek, Steung, and Canal in the wet season. Then, the overflow of water flowed into creeks connecting with Rivers, streams and ditches. It helped the aquatic species such as: fish and water reptiles to migrate into the project area (name of vital rivers, streams. Some birds are *Dendrocygna javanica, Anastomus oscitans, Egretta alble*, *Tyto alba, Caprimulgus indicus, Dupetor flavicollis), Phalacrocorax niger, Corvus macrohynchos…*etc. They do not sleep and find food by the roads and just fly across the road.

The affected people both sides from the central line of road is 20m (from 0-20m) and as well as the affected people that they are living on section from Sri Sophorn to Poipet. A total affected person is 562 families. Among of 562 families there are vuinerable people: old people, unable for work, widow, poor people which they cannot earn income less than 20$/month and they are landless or all affected lands, they are 109 families equal 19.4%.

6...PUBLIC CONSULTATION AND DISCUSSIONS IN THE PROJECT AREA

Objective of public consultation and discussion as below:

- To announce to the public people and all related people to understand about the purpose and implementation stage of this project;
- To find criticism idea, suggestion, argument problem, and correct method to improve project successful;
- To solve complexes by doing a meeting and discussion with concerned people and will have participation from local Authorities in the project area.

RECORD OF PUBLIC CONSULTATION

Phnom Penh:

- The representative of Tonle Sap Authority, Ministry of Water Resources and Meteorology.

Pursat and Battambang Provinces:

- The representative of Provincial Cabinet, Banteay Meanchey province;
- The representative of Provincial Department of Public Works and Transport (PDoPWT), Banteay Meanchey province;
- The representative of Poi Pey City Hall;
- The representative of Sri Sophorn City Hall;
- The representative of Provincial Department of Tele-Communication and Post (PDoTP), Banteay Meanchey province;
- The representative of Provincial Department of Tourism (PDoT), Banteay Meanchey province;
- The representative of Provincial Department of Industry Mines and Energy (PDoIME), Banteay Meanchey province;
- The representative of Cambodia Electricity Authority (CEA), Banteay Meanchey province;
- The representative of An Ko Company in charge of Water Supply and Electricity, Poipet City Hall, Banteay Meanchey province;
- The representative of Khan Fishery Administration, Banteay Meanchey province;
- The representative of Provincial Department of Environment (PDoE), Banteay Meanchey province;
- The representative of Provincial Department of Culture, Fine and Arts (PDoCFA), Banteay Meanchey province;
- The representative of Provincial Department of Cult and Religion (PDoCR), Banteay Meanchey province;
- The representative of Provincial Department of Land Urban Management Planning and Construction (PDoLUMPC), Banteay Meanchey province;
- The representative of Provincial Department of Water Resource and Meteorology (PDoWRAM), Banteay Meanchey province;
- The representative of Provincial Department of Agriculture (PDoA), Banteay Meanchey province;
- The representative of Khan Forestry Administration, Banteay Meanchey province;
- The representative of O-Chrov District, Banteay Meanchey province;
- The representative of 6 Communes/Sangkats Office, 21 Villages and the people participations which they located along the National road No.5 of the project.

7...POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES OF PROJECT

PROJECT DESIGN PHASE

Negative impacts

- In between KP366+250 to KP-366+685 in Teuk Thla village; Sangkat Teuk Thla, Sri Sophorn Town is Riverside vegetation (small re-grow) about 0.7ha. This vegetation will do clearance for extending road. Moreover, at both sides along the road there are 32 types of crops (un-fruits), total is 1,034 trees (diameter from 10Cm to 100Cm) which planted by the people, both Towns Authorities and Khan Forest Administration. There are fruit trees planted by the people of 980 trees and these trees are affected by the project.
- There is some people lived on (COI: 20m, total of 40m) total is 562 families, 338 HHs, 70 business stalls, 1 Restaurant, 146 other small stalls and 51 other immovable properties that need to demolish and resettlement.
- There are some families that they get income less than 20$/month, (landless families, disable families, old head families and widow families), they are total 109 people). The NR5 improvement project will affect on these people, it causes to them become poor and poor.

- There are total of 562 families affected by the project, among of this affected people landless is 39 families and vulnerable Head household (old head household, disable people, widow) and the families that they get income is less than 20$/month), total is 109 families. The NR5 improvement project will affect on their poor living.

Mitigation measures

- Should do study, investigation on impact of crops, plant species, households that located in the COI area and including resettlement plan by insert fund to solve these impacts and fund to re-plant species along the road. The project owner should do cooperation with relevant Ministries for successful of project plan implementation.
- Should do study, investigation on impacts: crops, fruit species, households that located in COI, and including all things suitable registration that affected by the project. Deadline of registration on impacts such as houses, buildings, crops is 2 September 2013 and resettlement plan is prepared fund for compensation, support to vulnerable people (Old head household, disable people, widow, poor people that they get income less than 20$/M), support to the people landless (people live in COI), support to affected people land use of family is over 20%, there is reserve fund for new program of temporary income and fund for tree planting along the road as well. The total budget for social impact resolution is USD 8,059,913.55 (included resettlement for 2 sites in Bakan district and Moung Russei district for the road section from Thlea Ma' am to Battambang and other one O-Chrov district of this road section, see detail resettlement plan of NR5 improvement road project from Thlea Ma' am to Battambang and other section from Sri Sophorn to Poipet).
- Should prepare resettlement plan due to do compensation on houses, buildings, crops and fruit trees affected based on market price, including supplementation fund to these families such as money supports for impacts, money supports for transportations, money supports for vulnerable Head households and money supports for new program of temporary income to affected people land use of family is over 20%. For the landless of 39 families the project owner will look for buying land and creating a resettlement site them in O-Chrov district, this resettlement has to construct social infrastructures look like existing they lived or better than there.
- Conducted project resettlement plan, Should recruit staff-workers by providing a high priority to the affected people are living in the project area in order to raise additional better their living condition during the project construction. Should implement program resettlement to be successful before access to project construction phase.

PROJECT CONSTRUCTION PHASE

Negative impacts

- It will affect for water pollution by making turbid water due to construction activity works such as earth works (poor management works on borrow pit, quarry site), concrete works, foundation works ect., it may affect to surface water in the project area.
- Fishes and other aquatic life might be affected to water sources (Creek or Prek) because of turbidity of water from cleaning rock and project construction including solid and liquid wastes and other case from infrastructures of the project such as constructions: culvert crossing creek or Preak..ect.
- It will affect to a little wildlife such as snake (Chequered Keelback, Striped Kukri Snake, *Sunbeam Snake,* Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spadefoot frog, Frog) that they are living in the COI area.
- May be required some land for small resettlement such as land for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect.,
- There will be changed of land use such as lose of agriculture land by excavating soil for road construction ect.,
- It will affect some on water agriculture use of canal along the road by culvert extending of construction project.
- There are Lao people of 208 families in Kob Chheung village, Kob Lich village, Khai Daong village, Kob Keut village, Vaing Maoung village, Kob commune and Cham people is 77 families in Nimit-3 village, Nimit-4 village, Steung Baot village and Phsa Kandal. The project improvement will

be affected to some ethnic people included their culture as well by the staff-workers which they are from deferent Nationality.

Mitigation measures

- Should observe regularly the contractor for slope road based on contract document works and should order to excavate straight or rectangular at quarry site and should plant grass along slope road and shoulder also. Moreover, should control concrete mixing site, stone cleaning site to ensure that in the project area is no water quality pollution.
- Should require to the contractor to buy clean stone, gravel to avoid for stone, gravel cleaning in the concrete mixing site; concrete rings should make in dry season and should look for by-Pass and install concrete rings depend on dimension of water flow of Creek, and these canals to avoid block and low flow especially may impact on fish movement in wet season.
- Should do cooperation with MoE and local Authorities, especially closed work with PDoE and Khan Forest Administration to educate and guide to staff-workers of project, do not hunting them while they presented in the project area.
- The project owner will do cooperation with IRC to look for land rental for temporary for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect., due to there is not affect serious to resettlement site.
- The project owner should compensate to the land owner base on market price due to have agreement from each other from the seller and buyer.
- Should do cooperation with MoWRAM to extend culvert that it is irrigation system, to make sure irrigation system is normal use, never blocked and do not affect to the farmers.
- Should require to the contractor to educate staff-workers of the project to understand about habit and traditional of ethnic people, do not touch them including do not to discriminate or to be racist in stage the project is recruiting staff and workers if they willingness to work for construction worker.

PROJECT OPERATION AND MAINTENANCE PHASE

Negative impacts

- The water surface and groundwater polluted by serious accident of traffic from oil/fuel leakages on the ground and it floes to the shallow water sources and further flows to surface water in the project area.
- It might affects on Aquatic life and fishes by illegal garbage disposed along the road that it causes water pollution of creek, natural small stream, Prek and affects to fishes and Aquatic life of road.
- There is some affects to wildlife such as snake (Chequered Keelback, Striped Kukri Snake, *Sunbeam Snake,* Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spadefoot frog, Frog) that they are passing road and died by vehicle run over them.
- Due to have good road, there will be changed by using over from the local resources that can be affected to local economic such as increasing of rice products because the peole use chemical fertilizer, insecticide to kill crab, rat etc.,

Mitigation measures

- In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.
- Should do cooperation with MoE trough PDoE to install many signboards: prohibit garbage disposing and should do cooperation with local Authority: commune, village hard management to violated people.
- Should do cooperation with MoE and local Authority especially PDoE and Khan Forest Administration to introduce and regularly educate people living along the road on prohibition hunting of species where is conservation them in the project area.

- Should do cooperation with all local Authorities especially relevant Provincial Department to control and check balance of local economic in the future, to identify that either resource economic use is not exceed.

PROJECT CLOSURE PHASE

In project closure phase, it is after MoPWT planned for NR5 improvement project. Therefore, within this phase, it is not any affects to Social environment.

7.1 POSITIVE ENVIRONMENTAL IMPACTS

Physical and Ecological Resources

✓ **Air Pollution**

If they do comparison of air pollution before the project improvement, they will see that the air pollution by dust is much more than after the project improvement (the result air quality test before the project improvement see in Chapter-5, point: 5.1.13) because after the project improvement, the road is width 23m (in the rural area) and it is 28m width (in Town area), paved road is Asphalt Concrete (AC), strong and less of maintenance (before the project improvement width road is 11m, paved road is AC), and there is strengthening and fully on Traffic Law such as during the transportation require to do covering on materials ect.,

✓ **Forest Resource**

Although, the NR5 improvement project from Sri Sophorn to Poipet is affected on some river side vegetation and species along the road, the project is planned budget for species planting along the road in order to change this location to green environment and good view for additional on part of this road.

Socio-Economic Resources

✓ **Road and Transportation**

If we have the road, we will have hope for developing local community and in country because road is the blood vessel to bring economic based. People can transport their agricultural production or crops to markets easily and fast to avoid spoiling.

✓ **National Economic Development**

The NR improvement project, it will give services such as: agriculture, tourism, especially handicraft and industry which are the important base to develop national economy.

✓ **Land Use/Land Cost and Tourism**

Due to paved road and extended, it can attract to International Tourists come from Thailand to visit tourism places in Cambodia in the future, it will help people along the road to get more income from tourism services as well.

✓ **Employment and Increase Living Standard**

The project will provide jobs to Cambodia people especially the people in the project site during the project construction phase trough staff-workers recruitment.

8. ENVIRONMENTAL MANAGEMENT PLAN

The implementation EMP is a task of project owner under control of integrated team that participated from relevant offices, department, and Ministries which will be organized by the project owner with MoE. This team will monitor the environmental protection measures under monitoring and following up regularly by the Ministry of Environment (MoE) and direct cooperation from the project owner.

Note: the budget estimation for EMP is US$133,450.00 (one hundred thirty three thousand and four hundred fifty dollars).

9. ECONOMIC ANALYSIS

A sensitivity analysis is conducted to see the influence of fluctuation of benefit and construction cost. Sensitivity analysis is made on the cases with +10% in the cost and -10% in the cost and benefit,

respectively. These changes in cost and benefit are supposed to represent favorable and unfavorable scenarios.

As the results of sensitivity analysis, even if the worst case which the benefits are decreased in 10 % and the project costs are increased in 10 % is occurred, the project EIRR of the all cases exceeds the opportunity of capital in Cambodia of 12 %. The implementation of the project is economically feasible from view point of national economy.

10. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- Total land requirement is 143.2ha for project road construction (40 m x 35.8Km), the land both sides from the central road are 40m (COI: 20m for one side).
- According to inventory forest in project area by trees counting on the slope road from NR5 Sri Sophorn to Poipet is 1,034 trees; it is 619 trees on the right hand and it is 415 trees on the left hand; it is 32 types of these species which affected by the project. Moreover, there are 980 of economic trees people's that will be affected by this project as well.
- Polluting in surface water such as (Stream, Creek) in the project area (in wet and dry seasons) by human activities is not seriously. Base on water quality tested at downstream of Steung Teuk Thla, some people called Steung Sisophon; 5 parameters tested and shown that it is only Total Coliform which is a little bit high the standard of water drinking of MIME; and as well as TSS is a little bit high the water quality in public resources for maintaining of biodiversity of MoE in wet season only. Even though, are exceeded of water quality standard of MIME and MoE we concluded it is not serious water polluted that need to be declaration.
- Air quality in the project area and road site and further far more than 100m for the road site, before the project construction found that there are two parameters: NO_2 and SO_2 were low than standard of MoE (in wet and dry seasons), but it was higher in wet season.
- Noise quality in the project area and road site and further far more than 100m for the road site, before the project construction, started from 6:00am to 11:00pm was low than standard of MoE (in wet season). But started from 11:00pm to 6:00am was a little high than standard of MoE in between 2.5dB to 4.2dB.
- Vibration quality in the project area and road site and further far more than 100m for the road site, before the project construction found that there was low than standard of MoE (in wet season).
- There are 562 families, 238 HHs, 70 business stalls, 1 restaurant, 146 other small stalls and 51 others construction in the COI area that will impact by the NR5 improvement from Sri Sophorn to Poipet. The total budget planned is USD 8,059,913.55 for compensation and resettlement site implementation, it is this project and road improvement for section from Thlea Ma' am to Battabang.

RECOMMENDATIONS

- The project owner should study on project design of whole elements project's which to be sure better according to the technical highway, to avoid occuring damages by accident to the people life and animal; it is also damage on environment in/around the prject area; should do additional calculation for local earthquake. The detail project design of whole elements project's should do whatever to avoid Banyan Tree of Yeay Mao and Nak Ta Krahomkor at the KP-397+090; in generally this place the people always come from in/out of the Banteay Meanchey province to pray here. Moreover, at the point of Kon Damrei, the project owner should study on water discharge for 50 years, because there is often flooded for every year especially in year 2013.
- The project owner should solve for compensation to the affected people on the reserved land that the project required COI area for road improvement in davence before the project construction starting.

CHAPTER-6
PUBLIC CONSULTATIONS AND DISCUSSIONS

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PUBLIC CONSULTATIONS AND DISCUSSIONS

6.1. INTRODUCTION

Conducting public consultation meeting with the concerned people in the project area is very important to let concerned people aware about the project and to express their ideas, concerns and requests for supporting in project implementation more smoothly and efficiently.

Consultation meeting is extra mentioned of impact which will happen in the construction phase, The affected problems is to take fully analyse in the purpose of taking advantage from losing natural resources by project, and help to refrain from disaster will be happened eventually in the project.

Time period for public consultation and discussion with concerned from Entity, Provincial Departments, Institutions and relevant Local Authorities (Village, Commune, and District) and NGOs were taken from 15/08/2013 to 22/08/2013. ***Note:*** *We had not discussed with NGOs, because there is no NGO in the project area which has been working for this road construction.*

This public consultation and discussion meeting have been organized to introduce and explain detail to concerned people in the project area to understand about the purpose of project development which will be improved their living standard in the future (contribution and participation with Royal Government of Cambodia in poverty reduction of the people living in the project area).

6.2 OBJECTIVE OF CONSULTATION

Objective of public consultation and discussion as below:

- To announce to the public people and all related people to understand about the purpose and implementation stage of this project;
- To find criticism idea, suggestion, argument problem, and correct method to improve project successful;
- To solve complexes by doing a meeting and discussion with concerned people and will have participation from local Authorities in the project area.

6.3 RECORD OF PUBLIC CONSULTATION AND DISCUSSIONS

The working group studied on Environmental and Social Impact Assessment (ESIA), has organized public consultation meeting with related the Provincial Department, Districts, Communes, Villages in the Provinces and people as shown below:

Phnom Penh:

- The representative of Tonle Sap Authority, Ministry of Water Resources and Meteorology

Banteay Meanchey Province:

- The representative of Provincial Cabinet, Banteay Meanchey province
- The representative of Provincial Department of Public Works and Transport (PDoPWT), Banteay Meanchey province
- The representative of Poipet City Hall
- The representative of Sri Sophorn City Hall
- The representative of Provincial Department of Tele-Communication and Post (PDoTP), Banteay Meanchey province
- The representative of Provincial Department of Tourism (PDoT), Banteay Meanchey province
- The representative of Provincial Department of Industry Mines and Energy (PDoIME), Banteay Meanchey province
- The representative of Cambodia Electricity Authority (CEA), Banteay Meanchey province
- The representative of An Ko Company in charge of Water Supply and Electricity, Poipet City Hall, Banteay Meanchey province

- The representative of Khan Fishery Administration, Banteay Meanchey province
- The representative of Provincial Department of Environment (PDoE), Banteay Meanchey province
- The representative of Provincial Department of Culture, Fine and Arts (PDoCFA), Banteay Meanchey province
- The representative of Provincial Department of Cult and Religion (PDoCR), Banteay Meanchey province
- The representative of Provincial Department of Land Urban Management Planning and Construction (PDoLUMPC), Banteay Meanchey province
- The representative of Provincial Department of Water Resource and Meteorology (PDoWRAM), Banteay Meanchey province
- The representative of Provincial Department of Agriculture (PDoA), Banteay Meanchey province
- The representative of Khan Forestry Administration, Banteay Meanchey province
- The representative of O-Chrov District, Banteay Meanchey province
- The representative of 6 Communes Office, 21 Villages and the people participations which they located along the NR5of the project.

Results of consultation are detailed by ecclesiastical rank administration as follow:

6.3.1 Records of Consultations and Discussions Meeting with Working Group and Representative of Banteay Meanchey Provincial Cabinet, Representative of Ministry of Public Works and Transportation and Representative of Ministry of Economic and Finance

Public discussion meeting between working team and the representative of Banteay Meanchey province are:

1. **Mr. Chong Phen** Deputy Governor of Banteay Meanchey province
2. **Mr. Chhim Phalla** Director of Department of MoPWT
3. **Mr. Nhean Vannak** Director of Department of Resolution Affected of MoEF
4. **Mr. Kim Sovan** Director of PDoPWT, Banteay Meanchey province
5. Local Authorities of District/Town levels, Banteay Meanchey province
6. Local Authorities Sangkat/Commune levels, Banteay Meanchey province

Dated on 8 August 2013, from 2:30 to 3:20 PM, the result as mentioned below:

Idea Mr. **Kin Sovan's**, the representative of PDoPWT, Banteay Meanchey province:

- This NR5 improvement is the first study which loaned from Japan by the Royal of Government;
- It will increase Economic status;
- Since the previously study we have keep ready for the reserved land of road;

Idea Mr. **Chhim Phalla's**, the representative of MoPWT:

- The objective of the meeting today is to inform about this project;
- We have donated from the Japan Government for study on NR5; for extra section starts from Prek Kdam to Thea Ma' am located in Pursat province we also studied, it is called Southern direction;
- We have received additional donate from Japan; we have to study additional at the middle road from Battambang to Thea Ma' am. These connections road that used the budget from Japan, it is road connected from Bangkok to Hochiminh of Vietnam. This road is Asian road consisted of 4 traffic lines. It is never forgotten to extending of road from Sri Sophorn to Poipet if this road is just recently rehabilitated because it is only 2 traffic lines. In the near

future, it will be busy traffics people's. There will be not sufficient therefore, we had requested to the Japan Government to insert of study from Thea Ma' am to Battambang and from Sri Sophorn to Poipet;

- Therefore, we invited all of you (sisters and brothers, uncles and aunts) for this first meeting today to announce what is relevant of the project road improvement; it is extending of road to become for 4 traffic lines. The technical of road improvement we are studying and for another of resolution on affects we have other policy to do it;
- Welcome to Banteay Meanchey province that it will receive new road from Teuk Thla to further of Monkol Borey district, it is a very new road;
- The NR5improvement from Sri Sophorn to Battambang can be started on beginning in 2014 and it will complete in 2015;
- Thanks to Banteay Meanchey province Authority which had fully participated in this project development.

Idea Mr. **Nhean Vannak's**, the representative of Department of Resolution Affected of MoEF:

- The whole of NR5improvement project starts from Prek Kdam to Poipet is under financing of JICA. A part from North Battambang to Sri Sophorn we had completed study and the financing contract is already done on hand. The activity of resolution on affects for a part of Battambang-Sri Sophorn will implement in the beginning 2014 due to we are waiting for detail of technical design plan from the consultant that the MoPWT is recruited. To solve these affects, it needs detail of technical design plan and it will start to practice in the field. The policy to solve on affects of a part new road from Sri Sophorn to Poipet, because it is only one project, one road and one of financing, therefore a common resolution on new road affects, it is not different from the previous affected between Battambang-Sri Sophorn which we had a common agreement between Japan Government and the Cambodia Royal of Government. Therefore, it is not new for Banteay Meanchey province. To raise up only main point for the resolution process is going smoothly in the future and effectiveness; it is an advantage for the people, for the provincial and for the common National in term of Asian highway;
- In order to let resolution affects is processing and it can complete on time as planned at the end of 2019, unless the affects resolution is completed. According to affects resolution, the construction Company could not construct the road if there is no affects resolution. Therefore, if the affects resolution has delay then road construction needs to delay and the project advantage is also to delay. The policy of affects resolution which we had practiced, it is not a whole of the Kingdom of Cambodia Law implemented. It is a common practically of policy JICA partner's in 2010, it is very complicated;
- What is a main thing, it is a relevant to management on the reserved land, due to there is existing road then we have to study on it as the Director of Department said, it may be not a problem on affects excepted for small business shops that we think that it's are small thing, but according to the JICA's policy on affects resolution it is also complicated for the small business shops. Therefore, we would like to ask that starts from date on 2 September 2013 what are affected on the reserved land (buildings business services) that had been measured by study team of Mr. **Nhean Bona**, and on behalf of Inter-Ministry Committee, we ask to Brothers of local Authority participated to stop for any building on the reserved land. Because of the people may be say that it is temporally of building when the Government needs they will pay it back, but for the Japan partner is very difficult to solve this problem;
- Second point, if the people construct building or doing something, after date on 2 September 2013 then for any compensation will not be solved. This is the latest date for the old as well as new people which are living here that they will construct new building on the reserved land;
- Third point, the activity study of Mr. **Nhean Bona** in further time it is not activity of affects resolution. It is an initial study to look for affect data, whether how many affects on the road between Sri Sophorn to Poipet. In order to prepare an action plan and put on the table for discussion with Japan partner and other relevant partners inter-Ministry committee to make decision then it can be used. Therefore, the main objective today is announcement about the project to the stakeholders to know, but it is not come for affects resolution. In the past, what's concerning from the people is compensation but due to this project is the National project then they are welcome but it remaining for the people's affected. They are concerning and

worry about compensation whether it is a fair compensation or not. In the past, the policy of affects resolution that we ever implemented, especially with Japan partner, the cost that we provided to the eligible people for compensation, it is a market price, it is a price study by the free-lance consultant which they come to the field and this price is also vary depend on kind of building, other hand for the reserved land is not be compensated. For the reserved land is identify in judicial letter standard that declared in 1999 as well as in Sub-Decree on the management of the reserved land is 30m from central line of road, expected in the City-Town that will be extra determined by the relevant provincial Authority. Therefore, we would to identify that do not have any compensation after date on 2 September 2013, but before the date on 2 September it will do compensation as household's policy depend on the market price, but if we think following the Law it is wrong, but we think about the policy that need to provide to them, but it is not be promoted. Therefore, the people should not think that to build something on the reserved land when they need they will demolish and doing compensation for the people. This is wrong idea if the people think that they will lose too much, loose of time, loose of money and loose also our National fund. If there is no building on the reserved land, it is very good. The JICA's project is very difficult if there is only one family does not agree to move out then the project will be not implemented, it will delay till the resolution has to be solved, then the construction will be also delayed.

- We will use a mechanic method for the affects resolution as we did in the past for Railway resolution project; it is mechanic method of Inter-Ministry. Therefore, there is policy for affects resolution.

Idea Mr. **Nhean Bona's**, the representative of JICA Study Team of Resolution Affected:

- There are 3 main points of study: (1) Study on technical design, it is JICA team. This team is study on evaluation on road whether how much is cost?. (2) Study on Socio-Economic, it is focus on whether what is the people lose? And how much the Government should prepare fund for compensation to them? But, it is a plan in this stage, when the plan has been approved then the Inter-Ministry will come to the site. To announce that on 2 September 2013 our team will take video along the road, if either people doing any new building after 2 September, then the Ministry does not solve for them, if there is complaint then we will use this video to show them, whether what is status in the past? . (3) Study on Environment; it is team of Mr. **Um Sereyvuth**. On 26 to 30 August I will organize the meetings continuing starts from Thlea Ma' am to Poipet. It will organize for two communes in one meeting or one commune one meeting, it depends on the real situation if the people are far living then we will organize one meeting in order to announce to the people, to let them know about this project. I would like to ask the commune Chiefs to help inform to the Village Chiefs. But, I will write a letter to provincial Cabinet to clarify, whether which data and which one commune that we need to meet and following the plan as well. Therefore the village Chief has received information then she/he should invite the people are living along the NR5, both sides to the meeting, for other people are far living from the road do not invite them. On 2 September our team will do statistic recording in the meeting. The main priorities of study are 3: (1) study on life (Socio-economic), we want to know that before the project development how is the people living condition? (2) Study recording to know whether what the people are loses. How many coconut trees? How many brick houses? How many wooden houses? How many plots? It is focus along the NR5; it is not count on land because the land is the reserved land. After then we will study about the cost but it is not cost for compensation, we just want to know whether the market cost which these kinds affected how much is cost, then we will insert into the plan in order to avoid getting wrong information in the future and it could not be high range for both comparison.

Idea Mr. **Um Sereyvuth's**, the representative of JICA Study Team of EIA:

- The objective for our study team is study on natural environment which divided: Physical environment consisted: water, soil air; and Bio-logical environment consisted: fish, animal which are living along the road and surrounding of the project area. We have study also on fish in Teuk Thla Steung till Sisophon Steung. Our team will finish activity in Battambang province soon and the team will study as Mr. **Nhean Bona**study team, it is field study that we have to go to the village, commune for information and data collection from the people who are living along the road with affected and not affected people. It means that we study on social sector, but we take only 20% of the total people are living along the road. The purpose

of the study is trying to understand people's idea whether what they think about the National project development? The team will ask the people also for natural environment and recommendation from them about the NR5improvement in the near future.

Question and Answer

- The Vice-Governor of O-Chrov district has raised 3 questions:

  First, the road improvement project from Sri Sophorn to Poipet, whether where is the starting point of Sri Sophorn Town? It is from Teuk Thla Bridge or starts point from provincial Town?

  Second, how much is cost estimation for road?

  Third, there are some Towns such as Kitesat Market area that it is brick house and it is official land title available, whether it is in project affected? I think that if we extend this road I believed there are affects for all buildings because their house wall of brick closed to the road side. On behalf of the local Authority, I am worry about that. Another hand part of road from Teuk Thla to Sala Krohaom there will be affected only few trees, it seem that it is not the problem.

Mr. Chhim Phalla's, the representative of MoPWT:

- I would like to say that when the NR5 improvement from Battambang to Sri Sophornis better, then by-pass of Sri Sophorn Town will become to new of NR5therefore, the starting point that connected to new NR5 it means that started from on front of Teuk Thla bridge. We had studied and doing design plan but it is not vary so much; when we are doing detain on that it was different only for 4m-5m only. We have designed, when this road is constructed and used then this road will become a part of new NR5. For existing road at the present it becomes to provincial Town road. I believed that this road improvement project, I had study and came to field by myself for many times, found that was not serious affects on that. It started from Teuk Thla Bridge to Poipet Town, and in the Poipet Town we had seen the road is already wide. Our study is not difficult but we need the local Authority to assist for facilitation especially the Provincial Governor, because starting from now the team will study if we use JICA name's, but it is under umbrella of MoPWT. They will come to meet and cooperation with the local Authority in order to do data collection on Socio-economic and Natural environment. I believed that all people (village, commune Authorities) are very busy for government works and development project as well; but I believed that we have good cooperation with Banteay Meanchey province in National infrastructure development project and will fully participate because we have truth on the Royal Government action plan; and it also continue for country development in the future, because we could not live like this because here is main border gate, we do not keep it like this because this gate is logistic transportation from Thailand to Vietnam, due to Japan Government is seeing of this important gate for Japan's economic in the future.

Idea of reply Mr. Nhean Vannak's, the representative of Department of Resolution Affected of MoEF:

- For both questions I would like to do common reply; in the project implement on affect resolution it is first important policy for that, we have to mitigate on these affects into minimize, if we can avoid for that we will do the best. Therefore, some sites we have to look for by-pass of the City-Town in order to avoid on affected and it also to keep for Town improvement and to avoid for affects resolution which it is serious affects that cause to bar to progress for project implementing. But if there is important thing, we have no chance then by-pass is necessary because it is not depend on few households affected. By-pass, is considering on project cost, other advantages for this by-pass. If we could not avoid these affects, however project procurement service is important to solve for how much? We could not decide it now; it is cost that it depends on study result from the study team when we come to field to solve to the people. The cost of compensation is not cost for affected that decided by the Royal Government therefore, I would like to inform that do not confuse on that and listening to inciter of third party. Therefore, this implementing is transparency and focus on justifiable for affected people and none affected people. This compensation is done a common rate by the free-lance consultant depend on the market price. The result is divided to compensation cost and they settle with the market price. In case, there is important to pay how much for that? We have to pay for this road improvement. As I clarified that if there is less affect then it is very easy to solve but if there is more affects then it is difficult to solve which following the new policy JICA's.

Mr. **Nhean Bona** add identified that the compensation for brick house is depend on technical calculation from the freelance consultant that he is not under Government or owner's project. The calculation for that, the consultant comes to the affected field and getting to know about cost of construction materials: for cement and steel bar, labours in the project area. After then we will pay as that cost, it means that the people received of compensation they have ability to build for new house as the previously. Therefore, to inform that the brick house was affected then after doing affect resolution this house is not zinc house.

Mr. Kim Sovan, PDoPWT, Banteay Meanchey province, added clarification that at the present the PDoPWT has looked for Town but it cannot determine. Nowadays, in Cambodia are plenty of illegal buildings located in the Town; it looks like neck of a bottle and it is easy to notice and that place is many people. Regarding to Kateseth area, the people are encroached the Law for buildings, I don't know whether the District Authority approved for them or not; I believed that the PDoLUMPC is determined for the reserved land of road is 30m from the central line.

The Vice-Governor of O-Chrov district added his idea: The cost that I would like to know is not relevant to the cost of compensation, it is a common cost related to the new road construction of 13Km and cost of road extending. Secondly, I would like to know that reflection to your replied and mentioned on middle of September will be recruited the freelance consultant, then my question is: when the project bidding will be started for road of 13Km? whenthis road will be extended?

Mr. Chhim Phalla's, the representative of MoPWT: (Reflect to his reply)

The cost of building that we are studying from Sri Sophorn to Poipet, it is fully data collected, but the project that will be implemented in the near future is project road improvement from Sri Sophorn to Battambang province included by-pass. It calculated cost for this road in YEN (Japan's currency) is more than 5000 million of loan, if transferred in to USD is more than 90 million. This is budget that keep for the project bidding. Therefore, if either the bidding company is low cost then this company will be won. To reply when the project starts, it is follow to the project plan. Now, we are trying, because the Japan's project is the project has to be every transparency and strict. It also reflects to affected of the people property, it is not doing like tentative work, it is first time that the Royal Government loaned from the Japan Government, because the Japan Government never truth us for loan after election in 1993. It was once loan such as for Kisona Bridge, Chrouy Changva bridge, Nek Loeun bridge and NR1, it is donated and bigger than other. Why does Japan did not loan for us because Japan thinks we could not repay to them. Why now Japan has loaned to us because Japan thinks about economic policy as tourism. It was loaned from Japan in the past but it was loaned to Sihanouk Port because this Port is an Autonomy Port; they have fund to repay to them. It is the first time; we have to show to Japan Government to truth us. To inform that the loan from Japan is low of interest, it is 0.02% and included of condition. If the whole project has high negative impacts then the project can be cancelled. If we do not fair to solve on these affects and it is not enough to fix of budget plan for these affects then payment is not approval. Therefore, the procedure to recruit the consultant is completed, then duration of 12 months they have to do detail for construction company recruitment. The construction company is not only from Japan, it is for other companies that they eligible for international bidding. At the present, there are Consultant Company of USA, Korea and local Company, it will be transparency. It means that this project will start to construct in 2015, to identify that in next year (2014) we will speed up to sign for loan of North and South that it starts from Prek Kdam to Thea Ma' am, and may be in the middle of 2014 we will start for both projects. I would like to inform that Japan party has studying on daily movement people's in this year till year 2020. How much movement people's? Therefore to extend this road is follow to data collected for that. For the future the road is 4 lines, I would like to say is far of 20m from the central line of existing road for both sides, it is not far from the reserved land.

At the circle road of Poipet Town, what we want to do? Should do by-pass? First we have to study, when the result is coming up, what is method we are going to work with? What is type of by-pass? We do integration both results from Social environment and Natural environment, whether which one site is high affects? First we have to study into itself base; to inform that there is no affected; do not worry for the people living along the road when the road is improving; but if found that there is affected the Royal Government will do transparency because this is the Japan's project and it is loan from Japan or donated for Japan, the people will not lose their

property; we also believed to Inter-Ministry committee and local Authority will make people truth and happy us and it will make infrastructure development to improve economic people's.

Mr. Inn Rith, Kob commune Chief: (Raised the question), if the road improvement is far of 20m from the central line whether it is difficult or not? It is the point of Ketaseth Market.

Mr. Kim Sovan, PDoPWT in Banteay Meanchey, added that there are two stories on the reserved land. It is a policy resolution if there is outside of the reserved land, it will get compensation. Therefore, regarding to the brick house affects that constructed illegal or legal it depends on the affect resolution team. It means that to help people lives in bad situation to resettle in better situation place which it had enough of infrastructures. But starts from now, the local Authority all level: Village, Commune should prevent for new construction building anymore.

Mr. Chong Phen, Vice-Governor of Banteay Meanchey province Conclusion:

On behalf of H.E Provincial Governor, I would like to say thanks and happy because the Banteay Meanchey province will get a Asian road passing, and it is the Royal Government policy which decided to participate into Asian Community in 2015 for next future. The Royal Government has making decision for Asian road construction, it will be improved of provincial economic itself in participatory of people poverty reduction, it is in stage of cargos transportation such as Asian country and as well as socio-economic. Therefore, on behalf of local Authority we are welcome and to get for this making decision for on behalf of vice provincial committee.

Therefore, I would like to suggest **first**, to the local Authority of District, Town, commune to participate in practice for this work in order to prevent of new building on the reserved land for this new road that it is 13Km length; because a part of this road has been took video, it found that there is no affected. There are some affects but it is rice fields affected. After this date, the Inter-Ministry and affect resolution team will not be paid.

In year 2013 we had informed to Monkol Serey district and Sri Sophorn Town about this issue. We have data of existing buildings. After this meeting the provincial Cabinet will issue letter announcement again and the local Authority of District/Town level do not wait till date on 2 September; we have to prevent and inform them about the reserved land is 30m far from the central line; do not allow to construct for any hard building starting point from Teuk Thla bridge to circle road of Poipet Town.

Second, to suggest to Ministry and relevant Institutions what they can do to inform to the provincial Cabinet at least 3 days in advance in order to the provincial level can make plan and inform to local Authorities. Especially, you can call by phone to us in advance then Administrator will work on that and then will invite for all membership which related and the people to participate with. All of you already know that JICA's program is a purpose to assist to the Royal Government for poverty reduction and to solve for people affected. It is true that something which affected on the reserved land, it will be not got any compensation; but due to it is a policy and Cambodia has Law Land stated that do not have any compensation. But we could not follow for whole this Law, it should have a policy. For compensation, the relevant Institution has identified therefore, should delivery this information to the people, don't let them worry. I believed that you will continue cooperation with Inter-Ministry working team as planned. Once again, I would like to say thanks to Inter-Ministry working team which has been done well cooperation with the provincial local Authority for participation all project related in this province.

6.3.2 Records of Consultations and Discussions Meeting with Working Group and the Representative of Poipet City Hall, Banteay Meanchey Province

Public discussion meeting between working team and the representative of Poipet City Hall are:

1. **Mr. Ngor Meng Chroun** Governor of Poipet City Hall;
2. **Mr. Prak Poly** Chief Office of LMUPC, Poipet City Hall;
3. **Mr. Sok Penh An** Chief Office of Development, Poipet City Hall;
4. **Mr. Khat Thea** Vice-Chief of Administration Office, Poipet City Hall;

Dated on 1 August 2013, from 2:30 to 3:15 PM, the result as mentioned below:

- 100% supported for this project because the NR5improvement will link for the National Economic of Cambodia, Thailand and Vietnam and also it will increase more Tourists that they pass at point Poipet border;
- The people are living in Poipet they are mostly migration people, some were resettled since 1980 up to the present time;
- The City-Hall Poipet did not provide any land title to these people, excepted who were requested for households construction, these people are got land title for their own houses;
- The City-Hall Poipet is length about 5Km along the National road No.5, and it is far outside the City Hall about 3Km (Sangkat Nimit is 1Km and Sangkat Kon Damrey is 2Km);
- The size of road in the City Hall is 17m of width, therefore the road needs to extend is 1.75m for a side, it will not affect to the people's households if we do not think about the people are living on the reserved land which was calculated of 20m – 30m from the central line;
- The people are living on the reserved land which had distance from 20m - 30m from the central line is 70%;
- For others big impacts such as: Electricity Towers, Water pipe systems, Optic cables underground and Trading signboards;
- The Royal Government has requested to open two border gates for export and import of goods and for Poipet we want to welcome for Tourists only. The two gates are O-Neang and Steung Boat that requested to Thailand did not official reply yet from Thai Party;
- It is a propose to look for by-pass of Poipet City Hall because of many people are living in this Town and it has complex of traffic, it is requesting to project road improvement as a standard of MoPWT, it is sure that both views of beauty and mitigation of less accident;
- It is difficult for the garbage collection in Town due to the **Poipet Cleaner** of Korea Company which contracted with the provincial Cabinet of Banteay Meanchey for 20 years. They are not good implemented such as the Dump site is not like a Technical standard that make sure there is not negative impact on surrounding of Environment, the road to the dump site is very poor and there is not broad announcement to the people to participate as well. The medium of garbage collection is between 60T/d to 70T/d, and the Dump site is sized 5.7ha which it calculated to fill up in period of 70 years;
- The City Hall has plan to change this Dump site and will expand to 10ha (at the present it is 5.7ha), and also will look for other investor for garbage recycle as well;
- For hermitage of Lok Yeay Mao (Banyan tree) and Lok Ta Krohaom Karhermitage in Poipet City Hall are not responsible and manage by the Poipet City Hall.

Suggestions:

- If the by-pass from Banteay Meanchey and at end of point which managed by Poipet City Hall, we propose to the project owner to install light posts from intersection road to the end of Poipet border of Cambodia and Thailand;
- The project owner should construct garden on the central road where is Poipet Town for beauty view;
- The project owner should do good cooperation with Poipet City Hall in order to solve for all negative impacts by this project and effectiveness.

6.3.3 Records of Consultations and Discussions Meeting with Working Group and the Representative of Sri Sophorn City Hall, Banteay Meanchey Province

Public discussion meeting between working team and the representative of Sri Sophorn City Hall **Mr. Lous Sophea**, Deputy Deputy Governor; **Mr. Mao Vanna**, Deputy Deputy Governor and **Mr. Yean Phuthea**, Chief Office of Administration of Sri Sophorn City Hall. Dated on 19 August 2013, from 8:15 to 9:30 AM, the result as mentioned below:

- Fully supported for this project because the National Country will receive an International road and also it will improve for transportation sector between Cambodia and Thailand;
- The border of Sri Sophorn City Hall on NR5is started from the point of Teuk Thla bridge to border of Monkol Borey district;

- The provincial Cabinet of Banteay Meanchey has got information on project NR5improvement, then we done public announcement to the people, it is not responsible for any damage and any compensation on buildings effected on reserved land after 2 September 2013;
- If the project owner can look for by-pass of Sri Sophorn Town, then the serious impacts of 104 people's Households, Electricity Towers, Optic cables, water pipe systems and other public buildings in the Town will be passed;
- For outside the provincial Town is not serious impacts, we can solve these problems because since the past the people's households and rice fields were affected and they over got once compensation in period road improvement from Poipet to Siem Reap province and from Banteay Meanchey to Pursat province in 2004 – 2006;
- By-pass is the way easy for good traffic safety in the Town and easy to solve for all impacts on Environment;
- It may be affected on by-pass of Sri Sophorn Town for their rice fields. But we have provincial Committee and relevant Ministries had studied and they are not allowed for land title and for land selling to them;
- The City Hall has concerned for this project road improvement because, in the past the road construction seem it was not good quality; for this stage the project owner should focus on quality and high safety;
- Should install slow-down signboard where is the main intersection road, should construct a small road which it connects to the National road for both sides easy for the drivers to reach there and safe;
- Should install enough traffic signboards, traffic lights, traffic line and should have protected fence on reserved land in the Town, should do less hump road, additional one should install light inflection along the road;
- Should consider on drainage along the National road especially the road from Poipet to Teuk Thla bridge and to keep water flow bigger because discharge water there is high, it flows from some areas of Thailand;
- The garbage collection: there is only one company has contracted with Sri Sophorn City Hall. It is GAEA Company; this company is an Agency for garbage collection from the people's households and public garden. It is difficult for them due to they have not enough of truck and their Dump site is small of 2ha. The GAEA garbage collection does not have a Technical standard of Dump site in order to be sure that do not have impact to surrounding of Environment.

Suggestions:

- The project owner, should do have good cooperation with Sri Sophorn City Hall in order to solve for all negative impacts by this project and effectiveness.

6.3.4 Records of Consultations and Discussions Meeting with Working Group and the Representative of Tele-Communication and Post,Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Kong Dara**, Chief Office of Tele-communication of Department of Tele-communication and Post, Banteay Meanchey province, dated on 19 August 2013 from 9:30 to 10:15 AM, the result as mentioned below:

- Fully support for this Road improvement, because the NR5will make Cambodia improvement;
- The Telecom is Government enterprise and it is branch of Ministry of Tele-communication and Post of Cambodia. There have optic cable in Bateay Meanchey province. The optic cable is buried underground with length connect from Phnom Penh – Pursat – Battambang province and other one line is connected from Phnom Penh – Kampong Thom – Siem Reap province;
- The optic cable buried along the NR5from Phnom Penh to Provincial Town of Sri Sophorn is located on the right hand, it is far about 6m – 7m with depth of 0.8m – 1m from the central line of road;

- To solve affected on optic cable underground, the office of Telecom will report to Ministry Tele-communication and Post through monitoring and agreement from PDoTP, Banteay Meanchey province and Provincial Cabinet of Banteay Meanchey in advance;
- For the optic cable underground along the NR5from Banteay Meanchey to Poipet Town is located under National road. It may be not affected if the road improvement keep on the existing road;
- It may be affected on Optic cable along the NR5because these Optic cables belong to Camintel Company which it is a Company combination with Government. They have task to distribution by purchase from the Government enterprise of Tele-Com. The cable Towers are far about 6m – 7m from central line of road.

Suggestions:

- The project owner should do have discussion with MoTP on this Optic Cable affected;
- The project owner should do cooperation with PDoTP of Banteay Meanchey in order to assign staff to participate for demolish optic cable and to avoid serious damage of optic cable if needed;
- The project owner should inform about demolishing of Optic cable in advance for at least one month if needed.

6.3.5 Record of Consultation and Discussion Meeting with Working Group and the Representative of Provincial Department of Tourism, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Choung Lim**, Director of Provincial Department of Tourism, dated on 19 August 2013 from 9:30 to 10:15 AM, the result as mentioned below:

- Fully support this Road improvement, because we have good and widely road, it will make easy for Tourists to pass Poipet gate to visit Siem Reap more and more and Tourism income will be increased;
- At the moment, the Tourist is not less than 50000 person per month that they passed Poipet gate;
- For the future, the tourist will come from Thailand passing others gate such as: Prum in Pailin province, Doung and Laem in Battambang province to visit Angkor Watt Temple. They also need to pass NR5 from Poipet Town to Banteay Meanchey province. Therefore, the NR5improvement needs to be sure good quality for utilizing follow the Royal Government of Cambodia has contracted with;
- Should install enough of traffic lights, traffic signboards, traffic lines and should has protected fence on the reserved land at the Town and where is curve road;
- Should do cooperation with relevant institutions to delivery on law traffic to the people, especially the people are living along the NR5.

Suggestions:

The project owner should respect to the Law and the contract which has been signed with the Royal Government of Cambodia for this NR5improvement, it will be best.

6.3.6 Record of Consultation and Discussion Meeting with Working Group and the Representative Provincial Department of Industries Mine and Energy, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Heng Sopheang**, Deputy Director of Provincial Department of Industries Mine and Energy, dated on 19 August 2013 from 2:30 to 3:00 PM, the result as mentioned below:

- 100% support for this project because it will make progressive of National Economic and transportation between Cambodia and Thailand;
- In Banteay Meanchey province is not Water Supply Entity, there are two water supply companies: (1) Phnom Touch Phnom Thom water supply Company or **Chhun Development** Company and **Monkulborey** Company. The Provincial Department of Industries Mine and Energy can do facilitating for both Companies if necessary needed;

- The project NR5improvement will affect on water pipe systems for above both Companies which located along the road and for both sides;
- The project is also will affect on Electricity Towers of branch of Cambodia Electricity Authority in Banteay Meanchey and CPTL Company. Therefore, the study team should do discussion with them on this environment impact.

Suggestions:

- The project Owner should make good quality of road and safety for travellers.

6.3.7 Records of Consultations and Discussions Meeting with Working Group and the Representative of Cambodia Electricity Authority in Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Cheav Narin**, Deputy Director and **Mr. Teuk Siseth**, Chief of Electricity Network Distribution Section of Electricity Authority of Cambodia (CEA) in Banteay Meanchey province, dated on 19 August 2013, from 3:30 to 4:15 PM, the result as mentioned below:

- 100% supported for this project, because NR5improvement will improve the National Country;
- This project will affect on Electricity Tower of CEA in BMC started from the border of BCM to border of Battambang province with distance of 8,346m;
- For this affected the CEA in BCM has proposed plan budget for demolishing of these Electricity Towers. But in the Sri Sophorn Town (from Se Sen to Teuk Thla bridge) is not budget planned yet;
- The Electricity Towers of the CEA in BCM that started from Teuk Thla bridge to O-Chrov district, it will not be affected because these Electricity Towers are far not less than 28m from the central line of road;
- The Electricity Towers of the CEA in BCM has two types: (1) Medium voltage of Electricity Towers (MV) is height of 12m, and (2) Low voltage of Electricity Towers (LV) is height of 9m;
- The project will also affect on the Electricity Towers of Private Electricity Servers in Communes and Districts which located along the National road No.5;
- These Servers has connected Electricity power from the CEA in BCM to distribute to the local people such as **Banteay Neang Server** (provide service in O-Sngout Town, Phnom Touch, Phnom Thom and O-Nhor), **Pak Sunheng Server** (provide service in Nimit Town and Kob Town) and **Sok Vitith Server** (provide service in Monkol Borey district Town)
- The Electricity Towers of these Servers are far not over 8m from the central line of road and there are many electricity cables crossed the main road, it is not follow the standard of MIME;
- The Servers had received license from CEA trough the local Authority of Village, Commune and PDoIME in Banteay Meanchey province;
- Besides that, the project will affect on Electricity Towers of **CPTL** Company which Company is doing on high voltage transmission of 115kV from Thailand to here, because these Electricity Towers are far not over 18m from the central line of road.

Suggestions:

- The project owner should open meeting with MIME and CEA to solve of these affects.

6.3.8 Records of Consultations and Discussions Meeting with Working Group and the Representative of Water Supply and Electricity Sectors in Poipet City Hall, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Kim Le Daro**, General Manager of An Ko Company in Poipet Town, **Mr.Yean Puthea**, Chief of Executive sector of An Ko Company, and **Mr**. **Ngor Meng Chroun**, Poipet City Hall Governor, Banteay Meanchey Province, dated on 17 August 2013, from 10:30 to 11:00 AM, the result as mentioned below:

- Fully supported for NR5improvement, because it will be high Tourists to Cambodia;
- The Electricity Towers, Optic cable and water pipe lines of **An Ko** had prepared on the NR5in the Poipet City Hall that it far about 5Km – 6Km;

- The Electricity Towers are far 8m – 9m from the central line and its height are 9m – 12m, the optic cable is buried on reserved land along the road;
- This project will serious affect on Optic cable than the Electricity Towers because to demolish of Electricity Towers can be loosed only 30% but for Optic cable demolishing with distance of 6Km at depth of 0.7m – 1m, it will be loosed for whole this system;
- For water pipe systems, it is difficult because we have to excavate of distance 5Km – 6Km at depth of 1.5m – 2m and then cut-off water for long time to the Users.

Suggestions:

- The project owner should do cooperation with An Ko Company for any demolishing of Electricity Towers, Optic cable and water pipe lines, if needed;
- The project owner should inform to Company in advance at least 3 months when the project needs to demolish for these facilities: Electricity Towers, Optic cable and water pipe lines.

6.3.9 Record of Consultation and Discussion Meeting with Working Group and the Representative Khan of Forestry Administration, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Chea Phally**, Chief of Khan Forestry Administration (KFA), dated on 20 August 2013 from 8:15 to 8:45 AM, the result as mentioned below:

- 100% supported for this Road Improvement project, because it will improve of Economic Country and transportation sector between Cambodia and Thailand near the future;
- This project is not any affected on farm, plantation of trees of Khan Administration Forestry in BCM province;
- There is a proposed to the provincial Cabinet to plant some trees along the NR5in BCM province with PDoLUMPC after this road is constructed;
- The advantage of tree plantation is to assist for beauty view, to reduce of erosion, it is a shelter for the travellers and to use as well;
- The trees which can plant for beauty view are: Thnoung, Kranoung because these leaf are green and it is not easy to fall down by the sunshine.

Suggestions:

The project owner should do good quality for the NR5improvement and make sure to avoid for accident of travellers.

6.3.10 Records of Consultations and Discussions Meeting with Working Group and the Representative Provincial Department of Environment, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Yaom Yoeun**, Chief Office of EIA of Provincial Department of Environment, dated on 20 August 2013, from 9:15 to 9:45 AM, the result as mentioned below:

- 100% supported for this project because the NR5improvement will improve of National Country;
- For all impacts should have fair compensation, to avoid for any complaint that it will create and cause to the project un-success;
- The project will be serious affected on people's households and people rice fields that they have a small and small size and it makes them poor and poor if we do not well resettlement to them;
- The study team needs to make interview with actual people affected in order to solve in direction way for them;
- In the part of road from Teuk Thla bridge to Poipet Town, it is not serious affected because the people has ever received once for compensation during the National road improvement in 2007 2009;
- The main serious affected are Sri Sophorn Town and Poipet Town. There are people's households, public building, Electricity Towers, Optic cables, water pipe systems and big trading signboards;

- The project should do by-pass for both Town above to mitigate negative impacts;
- By-pass project needs to study on clearly price of rice fields, and then after study need to have a principle to keep a stable of the price rice field in a suitable period of time with the people;
- The project should design for environment and beauty view to attract to Tourists to come to Cambodia more and more by passing this National road No.5;
- For hermitage of Lok Yeay Mao (Banyan tree) and Lok Ta Krohaom Karhermitage's in Poipet City Hall, the study Team has to contact direct to the local community to solve this problem.

Suggestions:

- The project owner, should inform and date of demolishing to the people affected in advance at least 3 months in order to that people has time enough to preparation;
- The project owner should hire Environment road Agency to monitoring in regular after detail study, to make sure that there is no resettlement on existing area studied. This Agency has recognized by the MoE or PDoE in Banteay Meanchey province.

6.3.11 Record of Consultation and Discussion Meeting with Working Group and the Representative of Department of Culture, Fine and Arts, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Young Taing Kouy**, Deputy Directorand **Mr. Saing Don**, Chief Office of Culture Development of Department of Culture, Fine and Arts, Banteay Meanchey province, dated on 20 August 2013 from 10:30 to 10:50 AM, the result as mentioned below:

- Fully supported on this project because the NR5improvement will make National Economic improvement;
- For hermitage of Lok Yeay Mao (Banyan tree) and Lok Ta Krohaom Karhermitage's in Poipet City Hall are not responsible and manage by the Department of Culture, Fine and Arts, Banteay Meanchey province. This problem is may be under management of Department of Cult and Religion or it is under management of Poipet City Hall.

Suggestions:

- The project owner should do cooperation with the Department of Department of Cult and Religion or Poipet City Hall.

6.3.12 Record of Consultation and Discussion Meeting with Working Group and the Representative of Department of Cult and Religion, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Kiev Sonimol**, Deputy Director of Department of Cult and Religion, Banteay Meanchey province, dated on 20 August 2013 from 10:50 to 11:30 AM, the result as mentioned below:

- 100% supported on this project because the NR5improvement will make National Economic improvement;
- It is affected on hermitage of Lok Yeay Mao (Banyan tree) and Lok Ta Krohaom Karhermitage's which the people in Poipet Town always respected and donated in there;
- This affected, needs to solve and look for agreement on Banyan tree digging because the people in there believed as wonderful thing;
- The affected on hermitage of Lok Yeay Mao (Banyan tree) is managed by community of Andoung Thmor Pagoda in Poipet Town. The study team can contact to Mr. **Seng Hok** (Tel: 012 211 011) in order to solve this issue above. He is Chief Office of Cult and Religion in Poipet Town;
- This resolution needs to participate from Mr. **Kong Chhoeun** (Tel: 092 591 829), he is a Chief of layman Pagoda in Poipet City Hall;
- It is key, it needs to pray ceremony to cut the Banyan tree and re-construct a best hermitage for Lok Yeay Mao and Lok Ta Krohaom Kar as Khmer traditional.

Suggestions:

- The project owner should do cooperation with Mr. **Seng Hok** (Tel: 012 211 011) in order to solve this issue.

6.3.13 Record of Consultation and Discussion Meeting with Working Group and the Representative of Provincial Department of Land Management, Urban Planning and Construction, Banteay Meanchey Province

Public discussion meeting between working team and the representative of Provincial Department of Land Management, Urban Planning and Construction (PDoLUMPC) in Banteay Meanchey province are:

1. **Mr. Long Vuth** Deputy Director of PDoLUMPC, Banteay Meanchey province
2. **Mr. Ros Chamreun** Vice-Chief Office of PDoLUMPC, Banteay Meanchey province
3. **Mr. Pang Rob** Officer of PDoLUMPC, Banteay Meanchey province

Dated on 20 August 2013, from 2:30 to 3:15 PM, the result as mentioned below:

- 100% support for this Road improvement, because it will make progress Economic of Cambodia;
- The people in Sri Sophorn Town are not registered of land title because the PDoLUMPC has no plan to register yet. Some household's owner but they are little registered for their land title because they proposed for house, guest house or building construction.
- The land tile above registered are issued before 2009; it was determined of 20m from the central line of road and for outside the Town was 25m from the central line (such as outside the Sri Sophorn Town to end of border Poipet City Hall);
- After Sub-Decree No.197 ANK-BK dated on 23 November 2009 issued, the area from Sri Sophorn Town to end of border Poipet City Hall it determined of 30m from the central line of National road No.5;
- The realistic area in Phnom Thom commune, Monkol Borey district has been registered of land tile system; it was determined of 30m from the central line of National road No.5;
- The land tile system registration just implemented from Monkol Borey district to Phnom Thom commune only; the plan will continue to registration to Phnom Touch commune and further to border of Battambang province;
- There are land title that provided by the local Authority of commune and district; its determined of 15m – 20m from the central line but these land title is not official we can make it change;
- If the project can look for by-pass of Sri Sophorn Town, then it is less affected on the people land title; there are land title that it's are recently registered on by-pass project most are rice field belong to the people in Monkol Borey district;
- The resolution on people's rice field need to solve as the same between the people has land title and the people's land title registered by Commune and District level; it depend on the real situation measuring of the Provincial Complex Land Solution Committee of Banteay Meanchey province;
- This committee is consisted from PDoLUMPC of Banteay Meanchey to measure of lands;
- Since the past, the project construction of Electricity Towers, Optic cable and water pipe system never cooperated with PDoLUMPC;
- The project NR5improvement should implement as a National standard; it is make sure that it safe for traffic driving;
- In general, the people are living near the road they always created a complex market on the reserved land. This factor the project owner should prepare a budget to look for market moving from the reserved land of road.

Suggestions:

- The project owner should have good cooperation with PDoLUMPCin Banteay Meanchey province in order to solve well on negative impact of lands.

6.3.14 Record of Consultation and Discussion Meeting with Working Group and the Representative Provincial Department of Water Resources and Meteorology, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Yim Bun Rom**, Director of Provincial Department of Water Resources and Meteorology and **Mr. Teum Narong**, Vice-Chief Office of water supply, Banteay Meanchey province,dated on 20 August 2013 from 4:30 to 5:15 PM, the result as mentioned below:

- 100% support for this project, because NR5is a great Economic Road of Cambodia;
- The PDoWoRAM did not know about by-pass of Sri Sophorn Town. If there is project by-pass then the study on water way from Poipet Town to Sri Sophorn Town is necessary;
- Since the past, the water way system has been filled up by the extend of the people plots for households construction and others for business;
- There are 5 of floods pressure from Poipet Town to Sri Sophorn Town: (1) it is at point of Nimit,(2) it is at point of Ketiseth, (3) it is at point of Khai Don, (4) it is at point of Dong Aranh and (5) it is at point of Sala Krohaom. Its collected water of some parts from Thailand which its border closed Cambodia through O-Lhong gate and O-Bei Chaorn of Banteay Meanchey province;
- These 5 points above are big canals or drainages were filled up. Since the last project of road No.5 and No.6 improvement from Poipet to Siem Reap in 2009 did not re-install the concrete rings on existing places;
- The water discharge these 5 points are flowed to the Sri Sophorn Steung and Monkol Borey Steung for both sides;
- There are some places was dried up and some places are very shallow of both canals of the National road No.5. It's not let big capacity discharge of water to flow as the original in the past. Therefore, the flood always blocked, it is always created flooded in the West of Banteay Meanchey province;
- Should do study on water way above and should rehabilitate both canal of Road, and do excavating dimension of water flow, install big box culverts in term of existing culverts rings;
- On the by-pass of Sri Sophorn Town, the project needs to extend bigger of water flow dimension bridge, Steung, Canal or Creeks in order to release water on time;

Suggestions:

- The project owner should have good cooperation with PDoWRAM in Banteay Meanchey province in order to solve well for flood releasing.

6.3.15 Record of Consultation and Discussion Meeting with Working Group and the Representative Provincial Department of Agriculture, Banteay Meanchey Province.

Public discussion meeting between working team and **Mr. Hout Sothy**, Deputy Director of Provincial Department of Agriculture (PDoA), Banteay Meanchey province,dated on 21 August 2013 from 8:00 to 9:00 AM, the result as mentioned below:

- 100%supportfor this project, because this NR5rehabilitation will make transportation improvement and helpful of poverty reduction;
- It may be affected on the people's rice field along the NR5from Poipet Town to Sri Sophorn Town if the project needs 30m from the central line, because the people in there are received land title in the past from local Authority that they determinate only 15m – 20m from the central lin of road;
- For a part of by-pass of Sri Sophorn Town will affect on whole of people rice fields. These affects need to do a fair of compensation in order to let the project going smoothly;
- Need to have study on price of rice field with the people and it also to have a principle to keep this price a s stable in the period of time before the project implementation phase;
- The product of paddy is 3T/ha in average per year and once time cultivation a year;

- It is necessary to consider to release flooded because at the West of Banteay Meanchey province always under flooded every year; another hand this area is low land and sloped that it will collect flood from many water sources to the Tonle Sap Lake;
- There is one point of Ta Phan bridge on South of Sri Sophorn Town of NR5always got flooded every year;
- The PDoA has plan to delivery message to the people to grow the grass, cow-pen husbandry in order to avoid animal to pass the road;
- The NR5improvement should install safety camera to check and control of traffic at many places in order to reduce accident and violate the traffic law.

Suggestions:

- The project owner should do cooperation with PDoA in Banteay Meanchey province to solve good on agriculture land.

6.3.16 Record of Consultation and Discussion Meeting with Working Group and the Representative of Khan Fishery Administration, Banteay Meanchey Province.

Public discussion meeting between working team and **Mr. Nov Leang**, Chief of Sangkat Fishery Administration of Malai,Khan Fishery Administration, Banteay Meanchey province, dated on 21 August 2013 from 8:00 to 9:00 AM, the result as mentioned below:

- 100% supported for NR5improvement, because the project will lead of National Economic Country improvement;
- Should not close any water way by bridge construction, the project has to look for by-pass and install the concrete rings depend on the dimension of water flow to avoid impact on fish movement;
- Should re-dig canals along the National road for both sides in order to release flood on time; especially a part from Poipet to Sri Sophorn, because this road is affected by flood every year and some water channels are filled up by extending land for the people houses construction;
- Should grow of grass on channel bank in order to protect erosion and also should assign Agent to maintain this grass field to keep for good view as well;
- Should construct warehouse to keep materials and equipment; should be have own fuel station where is safe location;
- Should manage well of chemical elements and bituminous and fuel in order to keep good environmental surrounding of the project area;
- Should build enough latrine and its septic tanks for staff-workers project', and should do well management of solid wastes in their Camps;
- Should do cooperation with Agency and Company of garbage collection in Banteay Meanchey province in order to collect garbage from the Staff-workers camps in regularly;
- To forbid for staff-workers to do fishing in the fishery conservation area that there are 5 locations along the Sri Sophorn Steung;
- To forbid for staff-workers to use equipment of illegal fishing such as fish shocked, net mosquito ect., where are at the public fishery sites;

Suggestions:

The project owner should do well cooperation with each Sangkat fishery Administration in order to avoid affect on fishery resources by the project activities;

6.3.17 Record of Consultation and Discussion Meeting with Working Group and the Representative of Poipet Cleaner Company, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Kleung Chamreun**, Acting General Managerof Poipet Cleaner and **Mr. Khat Thea**, Chief of Office Administration in Poipet City Hall, Banteay Meanchey province, dated on 16 August 2013 from 3:15 to 3:45 PM, the result as mentioned below:

- Fully supported on this project because it will improve of National Economic Cambodia;

- The solid wastes in here mostly are: waste from the kitchen, plastics and small parti-cloths;
- It is a limit participation from the people because they are most not permanent lived in the Poipet City Hall.They are participated for garbage collection about 40% only;
- The tariff of household garbage collection is 8000 Riels per month; for the business shop is range from 12000Riels to 15000Riels per month.
- The Dump site is located on North of Sangkat Kandal market of Poipet City Hall, it is size of 5.7ha, at the moment there is stocked wastes about 30% already;
- The dump site is affected on the people are living there more than 500HHs. These people are migrated to there by the resettlement of railway project. Due to this affect, the Poipet City Hall has new plan to study for new Dump site of 10ha and also looking for investor for garbage re-cycle.

6.3.18 Record of Consultation and Discussion Meeting with Working Group and the Representative of O-Chrov District, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Heun Chanthaon**, Chief of Administration of O-Chrov District, Banteay Meanchey province, dated on 16 August 2013 from 10:00 to 11:00 AM, the result as mentioned below:

- 100% supported on this project because the National road improvement will improve of transportation between Cambodia and Thailand and it will make better condition for the living people's;
- This project will affect for two communes along the NR5in O-Chrov district;
- The land title people's in this district are approved by Local Authorities: Village, Commune level and some are approved by O-Chrov District level;
- The impact on people land use should do discussion with them and should do have fair resolution for them as well;
- This affect can be solved; it is not a bar to progress for the project implementation, because the people known well about the reserved land of road. Moreover, they had compensated once on land affected in 2007 2009, in period of National road implementation phase from Poipet to Siem Reap province;
- Should be sure that the NR5improvement project follows to the technical standard of MoPWT for quality and safety. Should have enough of traffic lights, traffic signboards and traffic lines. At the intersection road that connected from village road the National road, should make sure that doing better joint to facilitate for the village people can access it and safe;
- Should provide jobs to Cambodians in order to achieve of poverty reduction principle.

Suggestions:

- The project owner should do well cooperation with O-Chrov district in order to solve these affects above.

6.3.19 Record of Consultation and Discussion Meeting with Working Group and the Representative of Tonle Sap Authority

Public discussion meeting between working team and **H.ELim Pouy**, Vice-Chaiman of Tonle Sap Authority, Ministry of Water Resources and Meteorology, dated on 29 August, 2013; from 10:30 to 11:00 AM, the result as mentioned below:

- 100% supported this project because theNR5improvement will improve of National Economic of Cambodia and it also will get better of people living condition;
- Tonle Sap Authority has a role-play and it is study Entity follow up and evaluate on Social-Economic and natural resources in Tonle Sap area and relevant areas;
- The main activity of Tonle Sap Authority is facilitating for management conservation and development around Tonle Sap Lake and relevant areas of 8 provinces around Tenle Sap Lake;
- The conservation area is divided into 3 zones: Transition zone, Buffer zone and core zone;

- By-pass of road of City-Towns along the NR5 improvement project can be affected on first zone; it is Transition zone. This zone is not forbid for any project development; but wishes to do only careful.

Suggestions:

- The project owner should write an official letter to Tonle Sap Authority if needs for facilitation on affected area which management by Tonle Sap Authority or any data and documentation needed.

6.3.20 Record of Consultation and Discussion Meeting with Working Group and the Representative of Sangkat Teuk Thla, Sri Sophorn Town, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Duch Ra**, Chief of Sangkat Teuk Thla, Sri Sophorn Town, Banteay Meanchey province, dated on 12 August, 2013; from 9:18 to 9:40 AM, the result as mentioned below:

- We are 100% supported for the NR5 improvement project from Sri Sophorn to Poipet because it is an economic gateway provincial/Town and neighbour country of Asian;
- The provincial Banteay Meanchey Cabinet has done public inform already after we got news about the NR5 improvement project, due to we are not responsible for any damage and compensation of building affected by the project which are new construction on the reserved land after date on 2 September 2013;
- At the same time for this happy on behalf of local Authority we have concerned on safety due to there is widely road then it cause for some drivers is use very high speed.

Suggestions:

- When the road is re-construction, the project owner should do properly drainage system for both sides road as standard.

6.3.21 Record of Consultation and Discussion Meeting with Working Group and the Representative of Samrong commune, O-Chrov District, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Uch Kan**, Chief of Samrong commune, O-Chrov district, Banteay Meanchey province, dated on 12 August, 2013; from 10:51 to 11:30 AM, the result as mentioned below:

- It is fully supported for this project because the NR5 improvement project will make national economic progress, quickly in short time near the future;
- To enlarge of bridge or road, do not close waterway, there will open waterway by installing of concrete rings refer to dimension of waterway;
- The project should construct drainage system, bridge and culvert including installation enough of traffic signboards, traffic lights.

Suggestions:

- In case, there is affect on land and household people's the project owner should have clear and fair of compensation.

6.3.22 Record of Consultation and Discussion Meeting with Working Group and the Representative of Chang Ha commune, O-Chrov District, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Hean Yuk**, Chief of Chang Ha commune, O-Chrov district, Banteay Meanchey province, dated on 13 August, 2013; from 10:47 to 11:30 AM, the result as mentioned below:

- It fully100% supported for this project because the NR5 improvement project will increase on transportation between Thailand and Cambodia;
- The District hall has done public information on the NR5 improvement project to the people who live along the NR5 in Chang Han commune, O-Chrov district after the meeting and discussion with PoDPWT of Banteay Meanchey on impact by the project.

Suggestions:

- The project owner should do good quality, safe and aestheticism of project implementation;
- Should start this project for next year, do not delay it.

6.3.23 Record of Consultation and Discussion Meeting with Working Group and the Representative of Kob commune, O-Chrov District, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. En Rith**, Chief of Kob commune, O-Chrov district, Banteay Meanchey province, dated on 13 August, 2013; from 2:51 to 3:20 PM, the result as mentioned below:

- It fully 100% supported for this project because the NR5 improvement project will increase on transportation between Thailand and Cambodia;
- This project is not affect to culture and pleasant sites which located along the NR5 in this commune;
- The project should install enough of traffic signboards, traffic lights and traffic line.

Suggestions:

- The project owner should do good quality, safe and aestheticism of the project implementation.

6.3.24 Record of Consultation and Discussion Meeting with Working Group and the Representative of Sangkat Nimit, Poipet City Hall, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Pal Setha**, Chief of Sangkat Nimit, Poipet City Hall, Banteay Meanchey province, dated on 16 August, 2013; from 8:35 to 9:00 AM, the result as mentioned below:

- It fully 100% supported for this project because the NR5 improvement project will increase on transportation between Thailand and Cambodia;
- Along this NR5 should do have light poles;
- The project should construct bridge, install concrete rings and digging canal according to location which these canals, creeks passed on this road;
- Should have protected concrete of the middle road in the Town and install reflection light along the central road, make easy to the driver during the driving on the road.

Suggestions:

- The project owner should do cooperation with the provincial committee complex resolution, local Authority and relevant institutions to solve and effectiveness for all affects.

6.3.25 Record of Consultation and Discussion Meeting with Working Group and the Representative of Sangkat Phsa Kandal, Poipet City Hall, Banteay Meanchey Province

Public discussion meeting between working team and **Mr. Keat Haol**, Chief of Sangkat Phas Kandal, Poipet City Hall, Banteay Meanchey province, dated on 16 August, 2013; from 9:30 to 10:00 AM, the result as mentioned below:

- It is100% supported for this project because the NR5 improvement project will make increase for transportation with Thailand and also it will make national economic improvement;
- On behalf of local commune Authority we will participate with the project to solve for all problems which the study team could not solved, but we believed that the people are living along the National road known about the project development;
- Should raise high road and install additional concrete rings where is low road level;
- The project should do by-Pass because it is less spend of budget for construction and less spend of time for travelling.

Suggestions:

- Should do have protected concrete in the middle road where are main places.

6.4 SUMMARY ON SUGGESTIONS FROM ENTITIES AND RELEVANTL AUTHORITIES AND RESOLUTIONS FROM THE PROJECT ONWER

Table 6-1: Summary on suggestions from Entities and relevant Authorities and Resolutions from the project owner

Idea raised up	Suggestion raised up	Project's Solutions
100% supported for this project because: - It will make economic improvement; - It will link with Thailand economic improvement; - It will increase of transportation with Thailand; - It will improve for communication of Thailand commercial and some Asian Countries ; - It will be safe of traffic and increase of Tourists; - It will provide fast transportation and good road utilizing.	Should implement this project soon in near future.	- The project owner will try to complete of study at the end of March 2014; - The project design will be improved base on Ideas and suggestions from the people on time.
The NR5improvement project from Prek Kdam to Poipet is financing under JICA.		
The Compensation depends on technical studying of the Independent Consultant that they are not under the Government or other any project owner.		
By-pass construction needs to consider on project cost and others benefits.		
It is not compensation for the Government's reserved land, therefore all affects for illegal or legal buildings. It depends on the affect resolutions working team that they can assist people for resettlement which it has enough infrastructures.		
The commune/village Authorities has to protect for any new buildings.	The consultant should do also check after all compensations were done, to make sure that there is no new building in this area.	
The City-Hall Poipet did not provide any land title to these people, excepted who were requested for households construction, these people are got land title for their own houses.	- The project owner should do fair compensation on legal building and land of affected people; - The project owner should inform in advance to the trading signboard owner; - The project owner should inform in advance at least 3 months before date demolishing of Electricity Tower, Optic cable and water pipes system Owners; - The project owner should do cooperation with An Ko company to demolish all relevant of Electricity Tower, Optic cable and water pipes system.	- The project owner will discuss with MoPWT on this impacts and will do cooperation with the Provincial Complex Resolution Committee and relevant people; - The project will study on impacts on Provincial Town; district Town and all Commune Towns that located along the NR5.
The City-Hall Poipet is length about 5Km along the National road No.5, and it is far outside the City Hall about 3Km (Sangkat Nimit is 1Km and Sangkat Kon Damrey is 2Km).		
The size of road in the City Hall is 17m of width, therefore the road needs to extend is 1.75m for a side, it will not affect to the people's households if we do not think about the people are living on the reserved land which was calculated of 20m – 30m from the central line. It is about 70%.		
Big impacts such as: Electricity Towers, Water pipe systems, Optic cables underground and Trading signboards.		
The Electricity Towers are far 8m – 9m from the central line and its height are 9m – 12m, the optic cable is buried on reserved land along		

the road; The Electricity Towers demolishing can be loosed only 30%, but for Optic cable demolishing will be loosed all.		
Should look for by-pass of Poipet City Hall through gate: Steung Baot or O-Neang, because of many people are living in this Town and it has complex of traffic. But the project should do road improvement as a standard of MoPWT, it is sure that both views of beauty and mitigation of less accident in Poipet Town. Should improve Town road as a standard of MoPWT to ensure that for good view and reduce accident to minimize at the Poipet City-Hall.	- If the by-pass from Banteay Meanchey and at end of point which managed by Poipet City Hall, we propose to the project owner to install light posts from intersection road to the end of Poipet border of Cambodia and Thailand; - The project owner should construct garden on the central road where is Poipet Town for beauty view; - The project owner should do good cooperation with Poipet City Hall in order to solve for all negative impacts by this project and effectiveness.	- The project owner will discuss with MoPWT on this problem for by-pass of Poipet City Hall; - The project owner will construct garden on the central road where is Poipet Town and will install enough of traffic signboards, traffic lights, traffic lines, and will do enough of protected fences as requirement.
For hermitage of Lok Yeay Mao (Banyan tree) and Lok Ta Krohaom Karhermitage's in Poipet City Hall are not responsible and manage by the Poipet City Hall.	Should do cooperation with Office of Cult and Religion in Poipet Town and the layman Pagoda in Poipet City Hall to solve this issue.	The project owner will do cooperation withOffice of Cult and Religion in Poipet Town and the layman Pagoda in Poipet City Hall to solve this issue.
For the optic cable underground along the NR5from Banteay Meanchey to Poipet Town is located under National road. It may be not affected if the road improvement keeps on the existing road. The TeleCom is Government enterprise and it is branch of Ministry of Tele-communication and Post of Cambodia. There have optic cable in Bateay Meanchey province. The optic cable is buried underground with length connect from Phnom Penh – Pursat – Battambang province. It may be affected on Optic cable along the NR5because these Optic cables belong to Camintel Company which it is a Company combination with Government. They have task to distribution by purchase from the Government enterprise of Tele-Com. The cable Towers are far about 6m – 7m from central line of road.	- The project owner should do have discussion with MoTP on this Optic Cable affected; - The project owner should do cooperation with PDoTP of Banteay Meanchey in order to assign staff to participate for demolish optic cable and to avoid serious damage of optic cable if needed; - The project owner should inform about demolishing of Optic cable in advance for at least one month if needed.	The project owner will discuss with MoPWT on these impacts and will do cooperation with MoTP and relevant people to solve for these problems.
In Banteay Meanchey province is not Water Supply Entity, there are two water supply companies: (1) Phnom Touch Phnom Thom water supply Company or **Chhun Development** Company and **Monkul Borey** Company. Bothe companies will affect on water pipe systems because the water pipe systems are buried on the reserved land, along the road and for both sides. This project will affect on Electricity Tower of CEA in BMC started from the border of BCM to border of Battambang province with distance of 8,346m.	The project owner should open meeting with MIME and CEA and relevant people to solve of these affects.	The project owner will discuss with MoPWT on these impacts and will do cooperation with MoIME and CEA and relevant people to solve for these problems.
The Electricity Towers of the CEA in BCM that started from Teuk Thla bridge to O-Chrov district, it will not be affected because these Electricity Towers are far not less than 28m from the central line of road.		
The border of Sri Sophorn City Hall on NR5is started from the point of Teuk Thla bridge to border of Monkol Borey district.		
If the project owner can look for by-pass of Sri Sophorn Town, then the serious impacts of 104 people's Households, Electricity Towers, Optic cables, water pipe systems and other public buildings in the Town will be passed.	The project owner should look for by-pass of Sri Sophorn Town to avoid these negative impacts at the present and for the future.	
The Electricity Towers of the CEA in BCM that started from Teuk Thla bridge to O-Chrov district, it will not be affected because these Electricity		

Towers are far not less than 28m from the central line of road.		
Most of the people in the Monkul Borey district were registered of Land Title.		
The provincial Cabinet of Banteay Meanchey has got information on project NR5improvement, then we done public announcement to the people, it is not responsible for any damage and any compensation on buildings effected on reserved land after 2 September 2013.		
The Electricity Towers of these Servers are far not over 8m from the central line of road and there are many electricity cables crossed the main road, it is not follow the standard of MIME.	The project owner should open meeting with MIME and CEA and relevant people to solve of these affects.	The project owner will discuss with MoPWT and will do cooperation with Provincial Complex Resolution Committee, relevant Ministries, CEA and relevant Electricity Servers to solve for these impacts.
The Servers had received license from CEA trough the local Authority of Village, Commune and PDoIME in Banteay Meanchey province;		
Besides that, the project will affect on Electricity Towers of **CPTL** Company which Company is doing on high voltage transmission of 115kV from Thailand to here, because these Electricity Towers are far not over 18m from the central line of road.		The project owner will discuss with MoPWT and will do cooperation with Provincial Complex Resolution Committee, relevant Ministries, CEA and CPTL company to solve for these impacts.
For outside the provincial Town is not serious impacts, we can solve these problems because since the past the people's households and rice fields were affected and they over got once compensation in period road improvement from Poipet to Siem Reap province and from Banteay Meanchey to Pursat province in 2004 – 2006.	The project owner should do well cooperation with Provincial Complex Resolution Committee, relevant Ministry, and affected people in order to solve on impacts and effectiveness on public land, residential land, household and others development lands.	- The project owner will discuss with MoPWT and will do well cooperation with Provincial Complex Resolution Committee, relevant Ministry, and affected people in order to solve on impacts and effectiveness on public land, residential land, household and others development lands. - Will discuss with the people, in case they have land title certificate that provided by the local Authority before 2009 for affected on household and public buildings.
It may be affected on by-pass of Sri Sophorn Town for their rice fields. But we have provincial Committee and relevant Ministries had studied and they are not allowed for land title and for land selling to them.		
There are lands titles that provided by the local Authority of commune and district; it determined of 15m – 20m from the central line which decided it is impact by the project.		
The land tile above registered are issued before 2009; it was determined of 20m from the central line of road and for outside the Town was 25m from the central line. After 2009 for outside the Town is determined of 30m from the central line of National road No.5.		
Some people living in the Sri Sophorn Town along the NR5 have registered of land title but there was determined only 20m from the central line of road.		The project owner will do detail study on provincial Town and will do well cooperation with Provincial Complex Resolution Committee, relevant Ministry, and affected people in order to solve on impacts and effectiveness on public land, residential land, household and others development lands.
It may be affected on by-pass of Sri Sophorn Town for their rice fields. This affect should have fair for their compensation in order to lead project smoothly implanting.		
On the NR5 from Poipet to Sri Sophorn, there is determined 30m from the central line. It will affect on the people's land of agriculture, because they have land title issued in the past by local Authority which determined of 15m – 20m from the central line of road.		
The people living in the Sri Sophorn Town, O-Chrov district Town along the NR5 have no registered of land title provide by the relevant Department. Therefore, the project should do fair compensation to them.		
The resolution on people's rice field need to solve as the same between		

the people has land title and the people's land title registered by Commune and District level; it depend on the real situation measuring of the Provincial Complex Land Solution Committee of Banteay Meanchey province.		
In general, the people are living near the road they always created a complex market on the reserved land. This factor the project owner should prepare a budget to look for market moving from the reserved land of road.		
The PDoA has plan to delivery message to the people to grow the grass, cow-pen husbandry in order to avoid animal to pass the road.	The project owner should do cooperation with PDoA in Banteay Meanchey province to solve good on agriculture land.	The project owner will do cooperation with PDoA to delivery message to the people to grow the grass, cow-pen husbandry in order to avoid animal to pass the road.
The project should construct strong box drainage along the reserved land, for every Town.	- The project owner should do good quality for the NR5improvement and make sure to avoid for accident of travellers; - The project owner should respect to the Law and the contract which has been signed with the Royal Government of Cambodia.	- The project owner will check for weakness point and do additional study on design plan, to make sure for road quality and safety of traffic; - The project implementation will do high activity in dry season such as by-Pass construction of provincial Town and bridge construction; - To encourage to study team to do detail on Environment Impacts.
The project implementation should do high activity in dry season to avoid soil erosion, it will make dry or shallow of Steung and natural Creek ect,.		
The study team needs to make interview with actual people affected in order to solve in direction wayfor them.		
The project should install enough of traffic lights, traffic signboards and traffic lines.		
The project should build protected fence on the reserved land at the Town and where is curve road.		
The project owner should construct concrete border on the central road with a suitable base on standard of MoPWT.		
For the future, the tourist will come from Thailand passing others gate such as: Prum in Pailine province, Doung and Laem in Battambang province to visit Angkor Watt Temple. They also need to pass NR5from Poipet Town to Banteay Meanchey province. Therefore, the NR5improvement needs to be sure good quality for utilizing follow the Royal Government of Cambodia has contracted with.		
If there is project by-Pass then the study on water way from Poipet Town to Sri SophornTown is necessary.	The project owner should have good cooperation with PDoWRAM in Banteay Meanchey province in order to solve well for flood releasing.	- The project owner will do additional detail study on flood level for base of height road construction in order to ensure for road quality; - The project owner will discuss with MoPWT and will do well cooperation with MoWRAM/PDoWRAM in order to study flood impact on road from Poipet to Banteay Meanchey province; - The project owner will study clear on technical road to avoid flood that it causes to damage of road.
There are 5 of floods pressure from Poipet Town to Sri Sophorn Town: (1) it is at point of Nimit,(2) it is at point of Ketiseth, (3) it is at point of Khai Don, (4) it is at point of Dong Aranh and (5) it is at point of Sala Krohaom. Its conllected water of some parts from Thailand which its border closed Cambodia through O-Lhong gate and O-Bei Chaorn of Banteay Meanchey province.		
These 5 points above are big canals or drainages were filled up. Since the last project of road No.5 and No.6 improvement from Poipet to Siem Reap in 2009 did not re-install the concrete rings on existing places.		
The water discharge these 5 points are flowed to the Sri Sophorn Steung and Monkol Borey Steung for both sides.		
There are some places was dried up and some places are very shallowof both canals of the National road No.5. It's not let big capacity discharge of water to flow as the original in the past. Therefore, the flood always blocked, it is always created flooded in the West of Banteay		

Meanchey province every year.		
Should do study on water way above and should rehabilitate both canal of Road, and do excavating dimension of water flow, install big box culverts in term of existing culverts rings.		
On the by-pass of Sri Sophorn Town, the project needs to extend bigger of water flow dimension bridge, Steung, Canal or Creeks in order to release water on time.		
Should construct warehouse to keep well materials, equipment; Bituminous and chemical elements. Should do also to manage well of fuel and oil leakages.	The project owner should well manage on solid and liquid wastes to avoid water pollution spread out in to around the project area and lead in to Steung, Creek and other inundation area.	The project owner will construct warehouse to keep well and safe of materials, equipment; Bituminous and chemical elements and will do also to manage well of fuel and oil leakages.
Should build enough latrine and its septic tanks for staff-workers project', and should do well management of solid wastes in their Camps.		The project owner will build enough latrine and its septic tanks for staff-workers project's in their Camps.
Should not close any water way by bridge construction, the project has to look for by-pass and install the concrete rings depend on the dimension of water flow to avoid affect on fish movement.		The project owner will do not close any water way by bridge construction; they will dig canal or install concrete rings let water flow as normal in wet season.
To forbid for staff-workers to do fishing in the fishery conservation area that there are 5 locations along the Sri Sophorn Steung.	The project owner should do well cooperation with each Sangkat fishery Administration in order to avoid affect on fishery resources by the project activities.	The project owner will order to staff-workers project's do not use any illegal tools and fishing in the fishery conservation area of Khan fishery Administration, Banteay Meanchey province.
To forbid for staff-workers to use equipment of illegal fishing such as fish shocked, net mosquito ect., where are at the public fishery sites.		
Should re-dig canals along the National road, outside the Town and should grow of grass on channel bank in order to protect erosion to keep for good view as well.		The project owner will grow of grass on channel bank in order to protect soil erosion and will organize staff to maintain regularly this grass to keep for good view as well during road operation and maintenance phase.
Khan Forestry Administration has planned to plant the trees along the NR5 for beauty view are: Thnoung, Kranoung because these leaf are green and it is not easy to fall down by the sunshine.	The project owner should grow of grass on road bank additional and should have regular maintained.	The project owner will grow grass on road bank and trees to protect soil erosion by cooperation with Khan Forestry Administration, Banteay Meanchey province. There will have staff to maintain regularly this grass during road operation and maintenance phase.
The advantage of tree plantation is to assist for beauty view, to reduce of erosion; it is a shelter for the travellers and to use as well.	The project owner should plant trees along the road additional and should have regular maintained.	
The project should design for environment and beauty view to attract to Tourists to come to Cambodia more and more by passing this NR5.	The project owner should hire Environment road Agency to monitoring in regular recognized by the MoE or PDoE in Banteay Meanchey province.	The project owner will discuss with MoPWT in order to organize to have Agency of road maintenance because PDoPWT Agency is expert for this work.
The NR5improvement should install safety camera to check and control of traffic at many places in order to reduce accident and violate the traffic law.	The project owner should do well cooperation with the MoPWT/PDoPWT in order to get successful on NR5 improvement project.	The project owner will discuss with MoPWT/PDoPWT in order to install security Camera to monitor of traffic; because MoPWT/PDoPWT will responsible for these Cameras.
Should do not do protection concrete border in the middle of road outside the Town; it causes accident.		The project owner will discuss with MoPWT/PDoPWT in order to install enough traffic signboards, traffic lights, traffic lines. They will construct a small road which it connects to the National road for both sides easy for the drivers to reach there and safe. They will do less hump road, additional one should install light inflection along the middle road.
Should install enough traffic signboards, traffic lights, traffic line and should construct a small road which it connects to the NR for both sides easy for the drivers to reach there and safe.		
Should do less hump road, additional one should install light inflection along the middle road.		
The City Hall has concerned for this project road improvement because, in the past the road construction seem it was not good quality; for this		

stage the project owner should focus on quality and high safety.		
Should do cooperation with relevant institutions to delivery on law traffic to the people, especially the people are living along the National road No.5.	The project owner should do cooperation with relevant institutions to delivery on law traffic to the people.	The project owner will discuss with MoPWT/PDoPWT in order to delivery on this law traffic.
Should provide jobs to Cambodians in order to achieve of poverty reduction principle.	The project owner should recruit staff-workers from the Cambodian in order to raise their life.	The project owner will provide jobs to staff-workers of Cambodian more than the foreigner.

6.5 CONCLUSION OF PUBLIC CONSULTATION

Based on consultations and discussions conducted, it found that some negative impacts by the project. These impacts are described below:

- It can be occurred flood a part upstream of the project area and it causes to erosion for road mamages due to did not well done of design plan focussed on drainages especially be careful on by-pass construction;

- It may be occurred of flood if the project has fill up on natural creeks and Steung in period of road construction phase;

- It can be low quality due to it is not based on technical road standard which it makes sure for operation on time based on contracted, if it is not well management;

- It can be occurred accident if the project has not enough installed of traffic signboards, traffic lights and it is not done on hump roads; it is not make protection fence on reserved land where are Towns and at the point of hump roads as standard of MoPWT;

- It may be affected to people's life if there is no suitable resolution to compensate for their households or rice field;

- Cambodia will not get experience, it will not increase human resources for work on International road construction; if the project can not provide for jobs to Cambodian for staff-workers in this project;

- Staff-workers will be not got well health or they will get accident for works if the company is not consider on safety first works for them;

- It will destroy to people's and public properties, especially networks of Optic cable underground, Optic Towers, water pipes, public buildings, hermitage of Lok Yeay Mao (Banyan tree) and Lok Ta Krohaom Karhermitage's ect., if the project owner is not well cooperation with the local Authorities and relevant Institutions to resettle all facilities;

- It will be got complaints from the people due to their householdes, business stalls and rice fields ect., affected and the project owner is not well cooperation with the local Authorities and relevant Institutions to solve all affected that it will occur if there is solved as well;

- It will be polluted on water sources (Creek, Steung ect.,) and rice fields if the project onwer is not have warehouse to keep properly of tools and equipment, own fuel station and good management;

- It may affect to people's health near the project area and travellers that they pass this road if the project is not often spraying water during the construction phase.

Photos of Public Consultation with Involved Institutions (Banteay Meanchey Province)





Meeting and consultation on NR5 Improvement under the presidency of **H.E. Chong Plen**, Vice-Governor of, Banteay Meanchey Province. Mr. **Chhim Phalla**, Director of Department of MoPWT, Mr. **Nhean Vannak**, Chief Office of Complex Resolution of MoFC and Mr. **Kim Sovan**, PDoPWT and Local Authorities Sangkat/Commune, District,Town. Dated: 12 August 2013



Meeting with **Mr. Ngaor Meng Chrun**, Governor of Poipet City Hall and his Colleagues, Banteay Meanchey Province. Dated: 16 August 2013



Meeting with **Mr. Lous Sophea**, Deputy Governor and **Mr. Mao Vanna** Deputy Governor of Serey Sophorn City Hall, Banteay Meanchey Province, Dated: 19 August 2013



Meeting with **Mr. Kong Dara**, Chief of Branch of Telecommunication and Post, Banteay Meanchey Province. Dated: 19 August 2013



Meeting with **Mr. Chung Lim**, Director of Department of Tourism, Banteay Meanchey Province. Dated: 19 August 2013

Photos of Public Consultation with Involved Institutions (Banteay Meanchey Province)



Meeting with **Mr. Heng Sokeang**, Deputy Director of PDoIME, Banteay Meanchey Province. Dated: 19 August 2013



Meeting with **Mr. Cheav Narin**, Deputy Director and **Mr. Teuk Viseth,**Chief office of transmission line distribution of Cambodia Electricity Authority, Banteay Meanchey Province. Dated: 19 August 2013



Meeting with **Mr. Kim Ledaro**, General Director of Electric and Water Supply, Poipet Town, Banteay Meanchey Province. Dated: 17 August 2013



Meeting with **Mr. Chea Phally,**Chief of Khan Forestry Administration, Banteay Meanchey Province. Dated: 20 August 2013



Meeting with **Mr. Yaom Yoeun**, Chief office of EIA, PDoE, Banteay Meanchey Province. Dated: 20 August 2013



Meeting with **Mr. Young Taing Kouy**, Vice-Director of Department of Culture, Fine and Arts, BMC Province. Dated: 20 August 2013

Photos of Public Consultation with Involved Institutions (Banteay Meanchey Province)



Meeting with **Mr. Keav Sonimol**, Vice-Director of Department of Cult and Religion, Banteay Meanchey Province, Dated: 20 August 2013



Meeting with **Mr. Long Vuth**, Deputy Director of PDoLMPC, Banteay Meanchey Province and his Colleagues. Dated: 20 July 2013



Meeting with **Mr. Yeum Bun Rom**, Director of DoWRAM, Banteay Meanchey Province. Dated: 20 August 2013



Meeting with **Mr. Hout Sothy**, Deputy Director of Department of Agriculture, Banteay Meanchey Province. Dated: 21 August 2013



Meeting with **Mr. Nov Leang**, Chief of Sangkat Fishery Administration, Malai District, Banteay Meanchey Province. Dated: 21 August 2013



Meeting with **Mr. Kleung Chamreun**, General Manager of Poipet Cleaner Company, Banteay Meanchey Province. Dated: 16 August 2013

Photos of Public Consultation with Involved Institutions (Banteay Meanchey Province)



Meeting with **Mr. Ouch Ang**, Chief of Administration of o-Chrov District, Banteay Meanchey Province, Dated: 16 August 2013



Meeting with **H.E. Lim Pouy**, Deputy Director of Tonle Sap Authority. Dated: 29 July 2013



Meeting with **Mr. Douch Ra**, Chief of Sangkat Teuk Thla, Banteay Meanchey Province. Dated: 12 August 2013



Meeting with **Mr. Uch Rann**, Chief of Samrong Commune, Banteay Meanchey Province. Dated: 12 August 2013



Meeting with **Mr. In Rith**, Chief of Kob Commune, Banteay Meanchey Province. Dated: 13 August 2013



Meeting with **Mr. Hoeun Yun**, Chief of Chang Ha, Banteay Meanchey Province. Dated: 13 August 2013

Photos of Public Consultation with Involved Institutions (Banteay Meanchey Province)



Meeting with **Mr. Pal Setha**, Chief of Sangkat Nimit, Banteay Meanchey Province. Dated: 16 August 2013



Meeting with **Mr. Kean Haol**, Chief of Sangkat Phsa Kandal, Banteay Meanchey Province. Dated: 16 August 2013

CHAPTER-7

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

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POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Introduction

The environmental study of the project is based on the requirement of sub-decree on environmental impact assessment process which signed date 11 August 1999 by prime minister Samdech **HUN SEN**. The NR5 (NR5) Improvement project of MoPWT was studying and preparing the report of Environmental and Social Impact Assessment (ESIA) from 12 August 2013 to 30 July 2014.

The ESIA is the environmental study to find out and determine environmental impact on the natural and social in project design phase (before construction), construction phase (before operation), operation phase and project closure phase. All the environmental impacts were mitigated to the minimum for the negative impacts and environmental management planning (EMP) for whole project stage were prepared which will carry out by project owner in cooperation with professional institution concerns such as Provincial Department of Environment (PDoE), Provincial Department of Water Resource & Meteorology (PDoWRAM), Provincial Department of Agriculture (PDoA), Provincial Department of Land Management Urban Planning & Construction (PDLMUC) and all level of local authorities due to manage under line of MoE, MoWRAM, MoAFF.

The working team used checklist to study on Environmental and Social Impact Assessment of road project which based on "JICA Guidelines for Environmental and Social Considerations, 2010 and Prakas of guideline No. 376 ប្រកាស.date on 2 September 2009 on report preparation for IESIA and ESIA of MoE in order to determine degree of impacts, small medium and high, on each natural and social environmental items and then selected mitigation measures of negative impacts for reduction of those potential environmental impacts will be fell in minimum degree (see checklist below).

Note: *A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent. C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses) D: No impact is expected.*

Checklist JICA for determination degree of impact for NR5Improvement project

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction, Construction Phase	Operation Phase	
Pollution				
1	Air pollution	B-	B±	**Construction Phase:** - Dust occur and exhaust gas from vehicles; - Traffic congestion in construction site will cause increase in exhaust gas from vehicles; - Dust will occur in borrow pit and quarry site. **Operation Phase:** - Operation of construction equipment will generate dust and emission gas; - However, because of improved traffic efficiency, the amount air pollution may be reduced compared to without project (positive impact)
2	Water pollution	B-	B-	**Construction Phase:** - Turbid water caused by construction works is likely to affect existing surface water resources in the project area; - Accidental massive leaking of fuel or oil, water pollution including ground water may occur; - In case of inadequate management in borrow pit and quarry site, turbid water from borrow pit and quarry site by rainfall may cause surface water contamination; - Some cases there are lack of management or there is not well management on solid and liquid wastes. **Operation Phase:**

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction, Construction Phase	Operation Phase	
				- Accidental massive leaking of fuel or oil, water pollution including ground water may occur; - In case of inadequate management or recovery in borrow pit and quarry site, turbid water from borrow pit and quarry site by rainfall may cause surface water contamination in the project area.
3	Waste	B-	B-	**Construction Phase:** - Solid and liquid wastes caused by construction works and general waste from construction office, staff-workers project's will be generated. **Operation Phase:** - Illegal dumping of solid waste may increase along the newly road construction improved.
4	Soil pollution	B-	B-	**Construction Phase:** - Soil pollution caused by construction works, earth works, concrete works ect.; - Soil pollution caused by massive leaking of fuel at parking car or in the vehicles workshop of this project; - Accidental massive leaking of fuel or oil, soil pollution may occur from heavy trucks. **Operation Phase:** - Illegal dumping of solid waste may increase along the newly road construction improved; - Because the target road mostly passes through agricultural land, leaking of fuel, oil and harmful cargo by traffic accident is likely to cause agricultural soil pollution.
5	Noise and vibration	B-	B-	**Construction Phase:** - Construction works is likely to increase in the noise and vibration level; - Noise and vibration will occur in borrow pit and quarry site. **Operation Phase:** - To enlarge of road, noise level caused by vehicle driving will increase. However, because right of way will be widened, the level on road side may be reduced and noise, vibration increase surrounding of people house compared to without project.
6	Ground subsidence	B-	B-	**Construction Phase:** - Subsidence near the road due to added soil weight may occur. - There are soft ground areas along the proposed bypass. Subsidence near the road due to the soil weight filled on the rice field may occur. **Operation Phase:** - To enlarge of road, pressure of loading on road will be low including vibration level caused by subsidence near this area due to the soil weight may occur.
7	Offensive odors	B-	B-	**Construction Phase:** - Offensive odors caused by construction works, especially operation of ill-serviced construction equipment and asphalt mixing plant will be generated. **Operation Phase:** - Exhaust gas from vehicles with incomplete combustion may cause offensive odors.
8	Bottom sediment	C-	B-	**Construction Phase:** - Filled soil may be eroded by rain water and flow into rivers or streams, and be accumulated at the bottom of rivers or streams. Such soil can finally flow into Tonle Sap Lake.

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction, Construction Phase	Operation Phase	
				Operation Phase: - In case of inadequate management or recovery in borrow pit and quarry site, erosion from borrow pit and quarry site by rainfall may cause sedimentation on riverbed.
Natural Environment				
9	Protected areas	D	D	**Construction Phase:** - There is no impact for this area because there is no protected area or protected forest in the project area. **Operation Phase:** - There is no impact for this section.
10	Ecosystem	B-	B-	**Construction Phase:** - It may impact by clearing on trees and Riverside vegetation that re-glowed along the road about 0.7ha in COI: 20m (total of 40m); - It may some impacts on wildlife such as snake, frog that it lives in the COI: 20m (total of 40m); - It may some impacts on fish by culverts construction along the Steung, Canals as described above; **Operation Phase:** - It may impact on snake such as Chequered Keelback, Radiated Ratsnake, *Sunbeam Snake*, Golden Tree Snake, frog, crab ect., while they creep, jump to pass the road then they dead by vehicle rolling.
11	Hydrology	B-	B-	**Construction Phase:** - It may impact (temporary) due to water flow in the river or stream may be altered during construction of culverts at the site. However, there is not enough concrete rings installation or too small that it causes flooded on part upstream of road such as Kon Damrei location from PK-392 to PK-394, there is small concrete rings along the road and it blocked by wastes, low water drained out on time, it causes to inundated road; - Road extended can fill up on drainages along the road it causes to block water flow and flooded in that area. **Operation Phase:** - It might blocks of culvert that located crossing the road by rubbish and algae.
12	Geographical features	B-	D	**Construction Phase:** - Topography will be changed and impact on soil formation by soil and stone digging for road construction; - Topography will be changed also due to Town by-Pass construction such as road raising. **Operation Phase:** - There is not Impact anymore because the road has been constructed.
Social Environment				
13	Resettlement/ Land Acquisition	A-	D	**Pre-Construction Phase:** - There is some people living on the reserved land in the project area of COI: 20m (total 40m) total is 562 families, among of this 238 HHs are house owners and 268 HHs are owners of immovable properties. Need to solve for compensation in order to get land for road construction through resettlement plan. **Construction Phase:** - Temporal lease of land and additional small scale resettlement will be required, such as need some land for stone, materials of construction and concrete site. **Operation Phase:** - There is not Impact anymore because the road has

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction, Construction Phase	Operation Phase	
				been constructed.
14	Poor people	B-	B-	**Construction Phase:** - Some of the poor people who do not have their own land living within Right of Way and selling something for their life in COI:20m (total of 40m), if the project is not consider for them they will fall into poor and poor. **Operation Phase:** - In case there is no resolution for the poor people who has no own their own land living within Right of Way and selling something for their life in COI: 20m (total of 40m) then, they will fall into poor and poor.
15	Ethnic minorities and indigenous peoples	D	D	**Construction Phase:** - There are Lao people of 223 families in Khai Daong village, Kob Keut village, Vaing Maoung village, Kob commune and Cham people is 63 families in Nimit-3 village, Nimit-4 village, Sangkat Nimit, that they affected by this project. **Operation Phase:** - There is no affected at this point because the road is completed.
16	Local economies, such as employment, livelihood, etc.	B-	B±	**Pre-Construction Phase:** - Land acquisition and resettlement may cause livelihood degradation of Project Affected Persons (PAPs). - In any Towns, there is electricity Tower, Optic cable Tower, Optic cable underground, water pipe system need to demolish out from COI:20m (total of 40m) which caused livelihood degradation of Project Affected Persons (PAPs). **Construction Phase:** - It is positive impact due to the project created job opportunities for the local people living in the project area. **Operation Phase:** - It is positive impact by the project due to reduction of travel time, less expense for transportation, contribute to local economies and promote National and International tourists. - Change of access to local resources may widen gap in local economy.
17	Land use and utilization of local resources	B-	B+	**Construction Phase:** - It will require change of land use along the road such as agriculture land can transfer to borrow pit for road construction ect., **Operation Phase:** - Especially in bypass sections, land use along NR5 will be changed and be developed economically and socially; - Road improvement is to transport and it will continue effectiveness for economic development.
18	Water usage	B-	B-	**Construction Phase:** - Existing agricultural cannels along the road will be affected by culverts construction works; - It may affect on water pipe lines along the road in the Towns. **Operation Phase:** - Newly larger culverts constructed not properly or blocked by rubbish or algae along the road may be lose water discharge of these canals, creeks.
19	Existing social infrastructures and services	B-	B-	**Pre-Construction Phase:** - In any Towns, there is electricity Tower, Optic cable Tower, Optic cable underground, water pipe system need to demolish out from COI:20m (total of 40m) which caused livelihood degradation of Project Affected

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction, Construction Phase	Operation Phase	
				Persons (PAPs). **Construction Phase:** - Temporary traffic congestion in construction site including NR 5 and other rural roads by cut-off for will occur. **Operation Phase:** - Access to social services will be improved after road rehabilitated. - Spilt of local communities or widening disparity may occur in bypass section.
20	Social institutions such as social infrastructure and local decision-making institutions	D	D	**Construction Phase:** - It will be not affected for this section. **Operation Phase:** - It will be not affected for this section.
21	Misdistribution of benefits and damages	D	D	**Construction Phase:** - It will be not affected for this section. **Operation Phase:** - It will be not affected for this section.
22	Local conflicts of interest	D	D	**Construction Phase:** - It will be not affected for this section. **Operation Phase:** - It will be not affected for this section.
23	Cultural heritage	B-	D	**Pre-Construction Phase:** - At the PK-397+090, there is hermitage of Lok Yeay Mao (Banyan tree) located in COI: 20m on the right hand which is affected by the project. **Construction Phase:** - In case, it is not consider for by-Pass of this place, that it causes to make people unhappy because they ever come to respect here. **Operation Phase:** - It will be not affected for this section.
24	Landscape	B-	D	**Construction Phase:** - Vegetation at existing roadside including high trees will be lost by widening works, and cause change of landscape in COI area. **Operation Phase:** - It will be not affected for this section.
25	Gender	B-	D	**Construction Phase:** - It will be un-equality both sex for workers recruitment and works during project construction. **Operation Phase:** - It will be not affected for this section.
26	Children's rights	D	B±	**Construction Phase:** - It might get accident to the children, because they come into the construction site to visit something. **Operation Phase:** - Traffic venerable people including children can be separated safely from main vehicle lane. - Road improvement may cause traffic accident of children due to more traffic volume and faster vehicle speed.
27	Infectious diseases such as HIV/AIDS	B-	D	**Construction Phase:** Infection risks of HIV/AIDS may be increased among construction workers and local business offering food and entertainment ect., **Operation Phase:** - It will be not affected for this section.
28	Working conditions (including occupational safety)	B-	B-	**Construction Phase:** - Dust and emission gas caused by construction works, materials construction transportation may affect staff-workers, people health in the project area;

No.	Impact Item	Assessment		Reason / Remarks
		Pre-Construction, Construction Phase	Operation Phase	
				- Accident may occur to staff-workers by careless of them and Employer is not provided for safety materials enough to them based on these jobs. **Operation Phase:** - It will be accident occurred along the road due to road is wide and busy of traffics.
29	Accidents	B-	B±	**Construction Phase:** - Traffic accident may occur surrounding of construction site. **Operation Phase:** - Traffic safety including pedestrians will be improved by road widening and vehicle separation - Traffic accident due to more traffic volume and faster vehicle speed may increase ratio of traffic accident
Other				
30	Trans-boundary impacts or climate change	B-	B±	**Construction Phase:** - Trans-boundary impacts including climate change will not occur. - Operation of construction equipment will generate CO2. **Operation Phase:** - The positive impact will be safe because of improved traffic efficiency; the amount may be reduced compared to without project. - In the future, total amount of CO2 emission from vehicles will increase.

7.2 Negative Environmental Impacts and Mitigation Measures

The NR5 improvement project (Sri Sophorn – Poipet) of MoPWT is length of 35.8Km. It starts from KP366+250 to KP402. A part of this road is passed Banteay Meancheyprovince which there are two Towns and one district (Sri Sophorn Town, Poipet Town and O-Chrov district), the road is passed throgh 6 Communes and 21 Villages.

The NR5 improvement project in rural area is total width surface of 23m; in the Town area is total width surface of 28mand it required Corridor of Impact (COI:20m, total width is 40m), see detail in Chapter-4, on project description.

Detail impacts by the project and its mitigation measurement as described below:

7.2.1 Project Design Phase (Before Construction Phase)

In the project design stage, there are not main harmful activities. In this stage, there are the professional study teams doing the research or investigation for preparing project design properly in the project area. However, this stage is so important if project design preparing is not in planning to solve the problem on environment impact; it is caused harmful to environmental and social impacts. The negative environmental impacts to physical and social resources are described as following:

A. Physical Resource:

A-1 Hydrology

- Negative impacts

Based on consultation and discussion with the local village Authority and villagers in Kon Damrei village shown that at this point in between PK392 to PK394 of this road there is very small culvert and the drainage along the road is which was constructed by ADB is blocked by wastes, it causes the water drain out not on time and there was inundated road at this area for most every years (it is not included for 2013, there are many places area inundated).

- Mitigation Measures

The detail project design of this road improvement has to consider for additional concrete pipes installation or enlarge of existing culverts at between PK392 – KP394 of this road. It plans to dig canal on both sides to regulate water flow of flood out from the residential land and inundated road.

A-2 Erosion and Soil Quality

- Negative impacts

Soil erosion might have at the borrow pit, quarry site, and road slope which raised at high level in case the project has not considered about this problem.

- Mitigation measure

The detail project design of this road improvement has to insert procurement document project construction on soil erosion measure at the borrow pit (should have slope based on type of soil and to excavate straight), quarry site and to plant grass on road slope.

A-3 Air Pollution

- Negative impacts

There is air pollution by road damage some places, DBST floor is easy damage, road is not large, dust blows from this road because the project is not started and enlarged.

- Mitigation measure

In order to reduce air pollution, it needs to have this project by enlarging road for rural area is 23m of width and at the Town it will be increased up to 28m of width and paved asphalt concrete to reduce dust.

B. Biological Resources:

B-1 Forest Resource and Wildlife Habitat

- Negative impacts

The NR5 improvement project from Sri Sophorn to Poipet in Corridor of Impact (COI: 20m, total 40m) is not forestry but there are trees and fruit trees that planted by Khan Forestry Administration and people. These crops are not habit of wildlife for endangered species, critically endangered species and vulnerable species. Moreover, this area is high activities such as traffic busy on this road that it causes of big wildlife cannot come close.

Another hand, along this road of COI in between KP366+250 to KP366+685 in Teuk Thla village; Sangkat Teuk Thla, Sri Sophorn Town is River side vegetation (small re-grow) about 0.7ha. This vegetation will do clearance for extending road. Moreover, at both sides along the road there are 32 types of crops (fruits), total is 1,034 trees (diameter from 10Cm to 100Cm) which planted by the people, both Towns Authorities and Khan Forest Administration. There are fruit trees planted by the people of 980 trees and these trees are affected by the project. The data these trees see in Chapter-5, point: 5.1.2.***Note****: fruit study in located in between the point of reserved land to the road slope bank that these trees are not belong to the people.*

- Mitigation Measures

Before project construction phase needs to study, investigation on impact of crops, trees, households that located in the COI area and including resettlement plan by insert fund to solve these impacts and fund to re-plant trees along the road. The project owner should do cooperation with relevant Ministries for successful of project plan implementation.

C. Socio-Economic Resources

C-1 Land use/Relocation

- Negative impacts

There is some people lived on (COI: 20m, total of 40m) total is 562 families, 338 HHs, 70 business stalls, 1 Restaurant, 146 other small stalls and 51 other immovable properties that need to demolish and resettlement.

Table 7-1 (A): Total Number Families Affected, Study from September 2013 to January 2014

Province	District	Affected Households	Vulnerable (HHs)
BMC	Ou Chrov District	239	53
	Poipet City	323	56

Total	**562**	**109**

Note: Data provided by working Grou (B), "Impact Resolution Group"; BMC: Banteay MeanChey Province

Table 7-2 (B): Total Number Households and Immovable Properties Affected, Study from September 2013 to January 2014

Province	District	AHs According to Type of Structure					
		House	House-Shop	Shop/ Restaurant	Shelter	Other Structures	Total
BMC	Ou Chrov District	108	41	0	58	15	222
	Poipet City	130	29	1	88	36	284
Total		**238**	**70**	**1**	**146**	**51**	**506**

Note: PST: BMC: Banteay MeanChey Province, Type of Houses, Constructions were detail stated in the project Resettlement Plan

➢ Mitigation Measures

Before the project construction phase, need to study, investigation on impacts: crops, fruit trees, households that located in COI, and including all things suitable registration that affected by the project. Deadline of registration on impacts such as houses, buildings, crops is 2 September 2013 and resettlement plan is prepared fund for compensation, support to vulnerable people (Old head household, disable people, widow, poor people that they get income less than 20$/M), support to the people landless (people live in COI), support to affected people land use of family is over 20%, there is reserve fund for new program of temporary income and fund for tree planting along the road as well. The total budget for social impact resolution is USD 8,059,913.55 (included resettlement for 2 sites in Bakan district and Moung Russei district for the road section from Thlea Ma' am to Battambang and other one O-Chrov district of this road section, see detail resettlement plan of NR5 improvement road project from Thlea Ma' am to Battambang and other section from Sri Sophorn to Poipet).***Note****: the resettlement plan of this project is integrated together (Thlea Ma' am to Battambang section and Sri Sophorn to Poipet section*).

C-2 Poverty

➢ Negative impacts

In the COI area, there are some families that they get income less than 20$/month, (landless families, disable families, old head families and widow families), they are total 109 people). The NR5 improvement project will affect on these people, it causes to them become poor and poor.

➢ Mitigation Measures

In order to mitigation for these problems, the project owner should prepare resettlement plan due to do compensation on houses, buildings, crops and fruit trees affected based on market price, including supplementation fund to these families such as money supports for impacts, money supports for transportations, money supports for vulnerable Head households and money supports for new program of temporary income to affected people land use of family is over 20%. For the landless of 39 families the project owner will look for buying land and creating a resettlement site them in O-Chrov district, this resettlement has to construct social infrastructures look like existing they lived or better than there. Detail description in resettlement plan of the project.

C-3 Economic and Living of Community in/around Project Site

➢ Negative impacts

In the COI area, there are total of 562 families affected by the project, among of this affected people landless is 39 families and vulnerable Head household (old head household, disable people, widow) and the families that they get income is less than 20$/month), total is 109 families. The NR5 improvement project will affect on their poor living.

Moreover, in the COI area on the left hand of project there are electricity Towers of 115kV and 22kV, Telephone cable line, water pipes, waste water systems, Optic cable underground which located in the Towns such as Kon Damrei zone, Sangkat Nimith and Poipet Town; it will affect by the project, it will be un-normal of economic and community life process.

➢ Mitigation Measures

The method to mitigate on affected among this, it is mitigation measurement the same at point C-2. It is project plan for resettlement. However, the project needs to recruit workers by providing priority to affected people and the people who living in the project site in order to improve their living condition in the project construction phase. Should be achieved resettlement plan before the project construction phase started.

Before project construction, the project owner should do announcement and cooperation with the local authority, relevant institutions and to ask the project affected owners to demolish all electric networks, electric cable, water pipe systems, waste water systems ect,.. which impacted by the project to secure on the reserved land in order to avoid to remove for many time when this road to be improved once again.

C-4 Land used and Resource used in the Project Site

- Negative impacts

In this project construction, there is no impact because the project owner is not started any activity yet. Moreover, the land is belong to the people, it is the reserved land with width of 30m from the middle of road both side (total is 60m). Therefore, there is no impact on that but there is impact on the production and there is compensation on crops, tree fruit, and immovable property only. (see detail in the project resettlement Plan).

C-5 Existing Social Infrastructures and Services in the Project Site

- Negative impacts

In the COI area, there are social infrastructures such as: electricity Towers of 115kV and 22kV, Telephone cable poles, Optic cable Towers, Optic cable underground, electric cable underground, waste water drainages, water pipes underground such as located in Kon Damrei zone, Sangkat Nimith and Poipett Town will affect by this project road extended.

- Mitigation Measures

Before the project construction, the project owner should inform to these infrastructures owners in advance and should do cooperation relevant institutions to demolish and move its to new locations where are safe places, to avoid re-demolish again in the future that it is costly.

The project owner should consider on electricity Towers of 115kV that will be affected because there will be cut off of electricity power for 3 provinces such as Battambang, Banteay Meanchey and Siem Reap. Therefore, the project owner should do discussion with the EDC and CPTL Company or aim straight direction road to the right hand due to avoid from the electricity Towers..

C-6 Culture and Traditional

- Negative impacts

In the COI area, there is hermitage of Lok Yeay Mao (Banyan tree) and Lok Ta Krahomkor located in COI: 20m at the PK397+090 which it is place people always come to pray for safe and rainwater from Poipet Town Authority, it will affect by the project road extended.Moreover, there are some fences and Mosque gateways along the road will be affected also.





- Mitigation Measures

Before the project construction, the project owner should discuss with Provincial Authority, Provincial Department of Religions and Cults in advance, whether it needs to do bypass or another resolution that can be solved before construction project. Moreover, the detail design technical Consultant should

consider alignment and to do whatever detour or escape this place, if there is no choice to do detour then we need to do follow the local people traditional before project construction. For other fence and gateway of Mosque, the project owner should discuss with Provincial Authority, Provincial Department of Religions and Cults and relevant Mosque Committees to do compensation; all these fences and gateways need to be solved whatever is far from the reserved land to avoid impact again for the future. Detail in resettlement plan of this project.

When they do detail project design, the project owner should ask the Technical consultant to discuss with the local Authority and Provincial Department of Religions and Cults.

7.2.2 Project Construction Phase

The project construction has 2 years period. Many infrastructures construction activities such as: earth work for constructing access road into the buildings, offices, staff-workers houses ect., These construction activities may cause negative impacts as following:

A. Physical Resources

A-1 Morphology and Topography

- Negative impacts

It may change the morphology and topography in the COI area, borrow pit and quarry sites of the project due to land clearing and earth work activities for base road arranging/constructing ect.,

Note: the construction site, borrow pit of soil, stone and laterite soil cannot identify detail because the project owner has not recruited the technical consultant for project detail design due to the technical consultant has to identify about quality of soil, stone and laterite soil for a standard highway and during the project detail design it will indicate clear in the project report.

- Mitigation Measures

The project owner has technical Expert for monitoring of this construction such as earth compacting, concrete bed culvert making, slope of borrow pit and quarry site making, grass planting along road slope ect.,

In addition to, construction work will start in dry season to protect soil erosion that might affect topography in rainy season.

A-2 Hydrological System

- Negative impacts

In the project construction phase, water discharge of Creek and canal might be affected due they close waterway for road extending or new construction of culvert that it will block waterway in wet season;

Moreover, soil erosion at the borrow pit and quarry site by excavating of soil and stone that it is not properly slope as standard of earth and quarry works, there will lead to break the wall of borrow pit or mountain wall. There is also occurring to create soil sediment at the bottom and make shallow of canal, creek, and canal in/around the project area.

On the other hand, this road construction will affect on water quality by construction activity such as stone cleaning, vehicles washing, soil erosion from the wall of borrow pit or quarry site that it is high turbid water.

However, there will affect to the water quality by disposing of solid and liquid wastes from the living places such as: it is from toilets of staff- workers house, fuel/oil from vehicles used in the field and washing bodies of staff-workers; all these will pollute water and it causes to decrease water quality level.

- Mitigation Measures

The project construction activity such as big earth works, it will work in dry season in order to avoid soil erosion and water polluted reduction. Moreover, at the site of road extending, new culvert, bridge constructions and install concrete rings to lead water flow out from the construction site with suitable dimension to drain water to downstream as normal flow in wet season; do this in order to avoid inundated water at upstream or it occurs to break the road by water pressure into the construction site.

For road extended construction at Kon Damrei site, should enlarge construction or install enough of concrete rings with suitable dimension to drain water out to reach the natural water including to rehabilitation of existing culvert or drainage of both new road sides.

To grow grass along the road banks both sides in order to protect soil erosion, slope and wall road damageable.

At the project site, should do have for vehicles washing place, workshop to repair of vehicles, warehouse to keep good store of construction materials and fuel to have suitable platform to avoid of fuel spilling on the ground that it finally is flowing or pollute into the water sources in the project area.

At the field, Staff-workers Camps, workshop, warehouse to store construction materials, should have garbage site, the project owner should contact to Servers of garbage collection such as in Banteay Meanchey province there is GAEA Company and in Poipet Town, there is Poipet Cleaner Company. For oil waste, can sell to who asks for buying it to assist their fire kiln; for old tires, can sell to the middleman that they collect its transport to Vietnam (information about garbage data and shop buying of waste is described in Chapter-5, point 5.2.6.3. Moreover, the project owner should consider enough on latrine and its septic tank construction base on number of staff-workers.

A-3 Soil Erosion and Water Quality

- Negative impacts

Soil erosion in the borrow pit, quarry site and along slope road which it will raise high, in case the project owner is not consider about the problem.

Moreover, soil filling on road in the field in wet season, it leads to soil erosion to cover of rice field and it will lose soil quality (low quality) in there.

- Mitigation Measures

In construct phase, the project owner should observe regularly the contractor for slope road based on contract document works and should order to excavate straight at quarry site and should plant grass along slope road and shoulder also.

Most activities of the project road extending are implementing in dry season that there will less impact.

A-4 Water Pollution (Surface/Groundwater)

- Negative impacts

In the project construction phase, it will affect for water pollution by making turbid water due to construction activity works such as earth works (poor management works on borrow pit, quarry site), concrete works, foundation works ect., it may affect to surface water in the project area.

Moreover, in this phase surface water and groundwater is serious polluted, it occurred from accident of trucks which it leakages oil/fuel to the ground and go into the shallow water source and continue flows to surface water in the project area.

In case, there is not well solid waste management (waste soil, waste of rubber floor road etc.,) and liquid waste (waste water outlet from the toilet and kitchen ect.,) in the field works, Staff-workers houses, workshop, warehouse then there will be polluted water in the project area. See detail in Chapter-4, point 4.3.7 waste management plan

- Mitigation Measures

In construct phase, the project owner should observe regularly the contractor for slope road based on contract document works and should order to excavate straight or rectangular at quarry site and should plant grass along slope road and shoulder also. Moreover, should control concrete mixing site, stone cleaning site to ensure that in the project area is no water quality pollution.

Waste soil, waste of rubber floor road, the project owner will contact to the local Authority to transport it to fill on the rural road and do well compacting it, do not dispose it into water sources. Moreover, the project owner should respect to Policy Guideline of MoE and local Authority for solid and liquid wastes management, especially waste soil and existing rubber road have to keep in properly place.

In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.

The project owner should require to the contractor to educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. The project owner should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. Other hand, for oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle (see detail in Chapter-5 , point 5.2.6.3. Should well manage on solid and liquid wastes, do not let its polluted into the water sources.

In the field works, Staff-workers houses, workshop, warehouse, it is important to have enough and properly for latrines equipped with septic tank of 2-3 blocks and bath rooms. It is proportional to the number people uses.

A-5 Air Pollution

- Negative impacts

Air pollution is creating due to dusty and exhausting gas from vehicles which its are constructing; its will impact to the travelers and the people living in/around the project area.

Other hand, air pollution may be occurred due to traffic jam in the project area, there will increase emission gas from vehicles.

As well as air pollution causes from dusty in borrow pit and quarry site, there are many trucks are transporting its to the site, along the road that it will affect to the travelers and the people living in/around the project area.

Moreover, air pollution is creating by bad odor from spilling oil/fuel of old engines where is workshop, dump site, waste water site of staff-workers house ect.,

- Mitigation Measures

In the project construction phase, the project owner should use good quality of vehicles and machines with lowest air pollution will be used to assure air quality in the project area. Especially, new vehicles and Engines are useful because its exhaust low gas and strong for works.

At the project site, should have technical staff to operate traffic in order to avoid of traffic jam. Moreover, should do extending reserved land first and let the people use temporary on existing road.

From the borrow pit and quarry site to project site, need to spraying water regularly in each construction site especially at the Town area, school, district Hospital or health center or clinic, pagoda ect., in order to reduce dust swirling up to the travelers, students, ill people and the people living around the project area.

The project owner should require to the contractor to do properly manage in the workshop, dump site and staff-workers house; to advise them to dispose in cask wastes, and oil/fuel wastes will keep in safe place to avoid its spilling on the ground. Moreover, these wastes will sell the middleman and selling waste shop for their wastes recycle as described in Chapter of Mitigation Environment Measures.

A-6 Soil Pollution

- Negative impacts

As well as air pollution, in the project construction phase, there is some soil pollution by construction work activities such as earth works (it is not well management for borrow pit and quarry site), concrete works, base works; such as cement spilling, liquid cement ect., that spilled on the ground and it causes soil pollution in the project area.

In case lack of well wastes management in the staff-workers houses, workshop, warehouse that it causes soil pollution in the project area.

Moreover, soil pollution causes from serious accident of vehicles by spilling oil/fuel on the project area.

- Mitigation Measures

In the project construction phase, the project owner has to control regularly to the contractor construction for slope road as standard of contract works document works and should order to excavate straight at quarry site and should plant grass along slope and shoulder road. Moreover, should control in concrete mixing site, stone cleaning to ensure that in the project area is no soil pollution.

In case, there is serious fuel spilling (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.

The project owner should educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. The project owner should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. Other hand, for oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle (see detail in Chapter-5 , point 5.2.6.3. Should well manage on solid and liquid wastes, do not let its polluted into the water sources.

A-7 Noise and Vibration

- Negative impacts

In the project construction phase, infrastructure construction activities of the project, it might disturb to the people living in/around project area because of sound, noise and vibration from construction machineries are operating on earth works, concrete works, base works, transport works and repairing works ect.,

It might disturb to the people living around borrow pit and quarry site because of sound, noise and vibration from construction activity works such as soil excavating, transportation of (soil and stone), and breaking stone ect.,

- Mitigation Measures

In this phase, the project owner should require to the constructor to use machineries and transport vehicles which are low noise shall be used in the project area;

The project owner should assign working day for daytime only, stating in the morning from 7:30am to 12:00am and afternoon from 1:30pm to 5:00pm in order to reduce disturbance to the people in the project area

B. <u>Ecological Resource</u>

B-1 Aquatic life/Fishery

- Negative impacts

In the project construct phase, fishes and other aquatic life might be affected to water sources (Creek or Prek) because of turbidity of water from cleaning rock and project construction including solid and liquid wastes and other case from infrastructures of the project such as constructions: culvert crossing creek or Prek ect.,.

- Mitigation Measures

The project owner should require to the contractor to buy clean stone, gravel to avoid for stone, gravel cleaning in the concrete mixing site; concrete rings should make in dry season and should look for by-Pass and install concrete rings depend on dimension of water flow of Creek, and these canals to avoid block and low flow especially may impact on fish movement in wet season.

Moreover, the project owner will avoid to outlet waste water out from vehicle washing place, concrete washing place, material and waste of concrete and waste oil direct into the water sources that existed in the project area, due to use a private site of vehicle washing service instead.

In the field works, Staff-workers houses, workshop, warehouse, it is important that the project owner should require to the contractor to build enough and properly for latrines equipped with septic tank of 2-3 blocks and bath rooms. It is proportional to the number people uses; and make sure there is not affect to Aquatic life/fishery systems in the project area.

The project owner should require to the contractor to educate to staff-workers in project area to avoid spilling fuel/oil on the ground in the project site. Moreover, should do well management on all wastes, such as solid wastes: can, plastic bottle, glass bottle, battery, oil used, old tires; boxes should separately keep for middleman buying for waste recycles. For other remaining wastes: old lumps, plastic bags, vegetable waste ect., should contact to garbage collection Company to transport its to Dump site.

B-2 Forest Resources and Wildlife Habitat

- Negative impacts

The NR5 improvement project from Sri Sophorn to Poipet is needed Corridor of Impact of 20m (COI: 20m, total is 40m). In the COI: 20m area, there is crops, fruits 980 trees (see detail in Chapter of Resettlement Plan) which grown by the people. The fruit trees that grown on the reserved land are 32 types and total is 1,034 trees (diameter from 10Cm to 100Cm. The Riverside vegetation that re-grows is 0.7ha; there is 24 species (detail in Chapter-5, point 5.1.2.1 Forestry; data of forest see in Chapter-5, point 5.1.2). Its will affect by this project, these some trees are wildlife habitats that described in point 5.1.2.2.

Note: *for Mammal: Small Asiun Mongoose, Lyle's Flying-fox; Birds: Asian Openbill, Barn Owl, Lyle's Flying-fox, Grey Nightjar, Yellow-breasted Bunting, Large-billed Crow, Common Snipe, Common Kingfisher; and for Reptiles and Amphibian there have some that they lived in the COI area, to say that they just only pass this area only.*

- Mitigation Measures

In the project construct phase, the project owner should do cooperation with relevant Ministries and local Authorities especially, Khan Forest Administration to plant small trees which is planning to re-grow along the road such as Krongaok tree, Koki tree, and Chan Kiri tree in order to change to green environment, protection erosion and prevented vehicle to fall out of road and crash to people household ect.,

B-3 Biological Wildlife

- Negative impacts

In the project construction phase, it will affect to a little wildlife such as snake (Chequered Keelback, Striped Kukri Snake, *Sunbeam Snake,* Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spade-foot frog, Frog) that they are living in the COI area.

Moreover, staff-workers of the project can eat wildlife meat that it causes to increase for wildlife hunting near this project area such as protection area or protection forest ect.,.

- Mitigation Measures

In the project construction phase, the project owner should do cooperation with MoE and local Authorities, especially closed work with PDoE and Khan Forest Administration to educate and guide to staff-workers of project, do not hunting them while they presented in the project area. ***Note:*** they are species not Rare species and Vulnerable species.

The project owner should assign working day for daytime to reduce disturbance to the people and wildlife by noise or vibration in the project area.

The project owner should do cooperation with MoE and Forest Administration to train about wildlife conservation and wildlife punishment case to the staff-workers project's.

C. Socio-Economic

C-1 Land use/Relocation

- Negative impacts

In the project construction, may be required some land for small resettlement such as land for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect.,

- Mitigation Measures

The project owner will do cooperation with IRC to look for land rental for temporary for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect. due to there is not affect serious to resettlement site.

Moreover, to settle between construction building for the staff-workers and store for materials of construction should be far at least 500m from the residential household of the people.

C-2 Poverty

- Negative impacts

There are vulnerable families (old people, unable people, widow, family that they have member earns income less than 20$/month), total is 109 families, and landless families or affected families for whole land that they have it, they are 39 families and they are living and they have business on this reserved land in COI:20m (both sites is 40m). In case the project is not considered about them they will get poor and poor.

➢ Mitigation Measures

In the project construction phase, the people are landless or affected all their land, in case the project owner looks for land resettlement for them including access for infrastructures as the same they ever got or better than before, the project owner should do monitoring on their life condition due to identify that they are 148 families (109 + 39) have a better life without this project.

C-3 Land used and Resource used in Project Site

➢ Negative impacts

In the project construction phase, there will be changed of land use such as lose of agriculture land by excavating soil for road construction ect.,

➢ Mitigation Measures

The project owner should compensate to the land owner base on market price due to have agreement from each other from the seller and buyer.

C-4 Water Use

➢ Negative impacts

In the project construction phase, it will affect some on water agriculture use of canal along the road by culvert extending of construction project.

Moreover, in the COI area at Poipet Town, there is water pipe system will affect by this road extending project.

➢ Mitigation Measures

The project owner should do cooperation with MoWRAM to extend culvert that it is irrigation system, to make sure irrigation system is normal use, never blocked and do not affect to the farmers.

Moreover, The project owner should inform to PDoIME, Sangkat/Town Authority and water supply Companies that they have own pipes buried on the COI area to demolish its and move to the new safe places (on reserved land) to avoid re-demolish for many times, it causes to lose money in the future while there will be road improvement again.

C-5 Traffic and Services in the project site

➢ Negative impacts

In the project construction phase, it will get traffic jam for temporary along the NR5 and on the intersection road that connect to the rural road by cutting-off of these roads during construction.

➢ Mitigation Measures

In case during extending road construction on paved road or rural road, the project owner should do on this site faster, if there is not finished on time the project owner should do traffic facilitate to avoid traffic jam. Moreover, should install traffic signboards and working group for monitoring and provide traffic service during the construction phase.

C-6 Culture and Traditional

➢ Negative impacts

In this phase, in case do not solve for hermitage of Lok Yeay Mao (Banyan tree), it will reflect unhappy from the people that they always come to pray at this place.

Moreover, There are Lao people of 208 families in Kob Chheung village, Kob Lich village, Khai Daong village, Kob Keut village, Vaing Maoung village, Kob commune and Cham people is 77families in Nimit-3 village, Nimit-4 village, Steung Baot village and Phsa Kandal. The project improvement will be affected to some ethnic people included their culture as well by the staff-workers which they are from deferent Nationality.

➢ Mitigation Measures

The project owner should discuss with Provincial Authority, Provincial Departmentof Cult and Religion (PDoCR), Banteay Meanchey province in advance, whether it needs to do detour or another resolution that can be solved before project construction that located at PK397+900.

In addition, the project owner should require to the contractor to educate staff-workers of the project to understand about habit and traditional of ethnic people, do not touch them including do not to discriminate or to be racist in stage the project is recruiting staff and workers if they willingness to work for construction worker.

C-7 Aestheticism

- Negative impacts

In the project construction phase, the Aestheticism will be changed in COI area for temporary by clearance of vegetation, crops and trees in order to do extending road especially a lot of dust and mud while there is raining.

- Mitigation Measures

The project owner should ask the contractor to do regularly spaying water to reduce dusty and should do compacting soil immediately in that site after soil landed from the truck.

Moreover, at the road site that is enough of level needed for new road, there should plant grass and small trees along the slope road in order to correct Aestheticism to be green site.

C-8 Gender

- Negative impacts

In the project construction phase, there can be recruited workers not equality and also is not promotional to sex for works.

- Mitigation Measures

The project owner should ask to the contractor to recruit workers is not to side with one's sex, and should divide for labor depend on sex (male or female) and the wage should be equality.

C-9 Children's Rights

- Negative impacts

In the project construction phase, there will have some children come and see the site, it causes to get accident to them such as traffic accident, soil erosion falls to them, something hard fall down on them. Moreover, in the borrow pit or quarry site is deep excavated then during the raining there is inundated water and the children can be died by drowning.

- Mitigation Measures

In the project construction site should build barrier, it shows as project site and do not allow in and out excepted staff-workers of the project, surrounding should organize the guard to regular control, even though during time break, to make sure that there is no children come in to the project site.

When the borrow pit is completely finished, this borrow pit should do well sloping and smoothly and install signboard shows picture of borrow pit, be careful for children, do not allow for swimming including delivery information to local Authorities: Commune and village to assist announcement to every people to prohibit their children to come for swimming in this place. In case, the borrow pit is nearby the villager household should do as above described including the fence protection as well.

C-10 Infectious Diseases such as HIV/AIDS, Liver Diseases

- Negative impacts

In the project construction phase, it can occur infection HIV disease for staff-workers of project and other disease such as liver, lust disease, tuberculosis and other infection diseases ect., from staff-workers, food sellers and the server of sexual services.

- Mitigation Measures

In the project site should organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred.

The project owner should require to the contractor to do cooperation with PDoH and Hospital to educate on sanitation and hygiene to treat for staff-workers in order to prevent these infection diseases to the people in the project area. Should contact any Hospital if while there is accident that can be occurred.

C-11 Safety and Public Health

- Negative impacts

It might affect on health people's in the project site to staff-workers by pollution of dust or materials transportation. Moreover, there will have Opium use and trading it.

It might get accident works to staff-workers due to they are careless and the Employer is not provide enough safety tools or materials of construction works to them based on these type of works.

- Mitigation Measures

In this project construction, should keep safety first for daily working. The project owner should ask the contractor to provide mask to protect dust and helmets, boots, gloves to workers; should do spaying water regularly on this road construction.

It the project site should build fair Camp to the staff-workers including enough water supply and latrines, and education program on safety first for the staff-workers.

The project owner should ask to the contractor to organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred.

The project owner should require to the contractor to do cooperation with the local Authority and relevant institutions to protect Opium and people trading. Moreover, the contractor should do cooperation with Health institution in this project area to prevent other infection diseases that its can be occurred.

C-12 Accidents

- Negative impacts

In the project construction phase, it might occur some accidents in/around the project site such as accident works (rope cut-off or breaking of crane machine, crushing, something hard to scatter down, fire caused by careless such as short circuit, welding, do not careful use power caused to fire of fuel station and materials ect.,

- Mitigation Measures

The project owner should ask to the contractor to train staff-workers about safety first, provide mask to protect dust and helmets, boots, gloves to workers of the project. Moreover, the project owner will provide building to stay with facility of water supply, to train on technical training and provide tools for safety work to the staff-workers.

The project owner should ask to the contractor to organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred.

In the project site, at the staying place, warehouse, and fuel station should have extinguisher, sand pile, axe to repress or to extinguish fire when there will be occurred.

C-13 Trans-boundary Impacts or Climate Change

- Negative impacts

Trans-boundary impacts or climate change will not occur because the existing NR5 is the project improvement only.

In the project construction phase, the amount of CO_2 emission from vehicles and machines will increase in the project site.

- Mitigation Measures

In this construction phase, should use vehicles and machines that its are low of CO_2 emission in order to reduce air pollution in this area; especially should use new vehicles that its are low of CO_2 emission.

7.2.3 Project Operation and Maintenance Phase

In the operation and maintenance phase, it is very long term after completely finished of construction works. Within this phase, some activities may give negative impacts to environment as follow:

A. <u>Physical Resources</u>

A-1 Hydrological System

- Negative impacts

In the Operation and Maintenance phase, it might have blocked by garbage and algae at/in the canal on front of culvert which it makes low water discharge from upstream. Other hand, it blocks by illegal garbage disposing along the road. ***Note:****The study team has surveyed, investigated on garbage that the people disposed along the road for 4 sites, the result of this study see in Chapter-5, at point-3: illegal wastes.*

- Mitigation Measures

The MoPWT through the PDoPWT should responsible for maintain and rehabilitation of culverts along the road, do not to have garbage or soil filling up on front of culverts, to do announcement to local Authorities: Commune and village about soil filling up that caused to block water discharge of culvert and drainage system along the road. Moreover, the project owner should do cooperation with MoE through the PDoE to install environment signboards: to prohibit for garbage disposed along the road.





A-2 Soil Erosion and Water Quality

- Negative impacts

In the Operation and Maintenance phase, in case the project owner is not consider to follow up on borrow pit or quarry site, to make sure there is good slope that it cause soil erosion by rainfall. As well as it might have erosion at the slope of road that there is no grass because of it is not well grow causes by mud covered.

In this phase, there is widely road and traffic is increasing, it causes of weight loaded and vibrated on the road and nearby will be compacted; it causes to be low quality of soil as well.

- Mitigation Measures

The project owner should do follow up on borrow pit and quarry site, make sure that it is good slope, grass planting according to the technical standard that can be accepted for this result from the contractor or not?.

The project owner should install of traffic loading signboard and maximum speed of vehicles that allowed driving on this road, should having weight station for heavy vehicles and making sure that weight is properly control based on standard.

A-3 Water Pollution (Surface/Groundwater)

- Negative impacts

In this phase, it might affects of water pollution by turbidity that it causes erosion from borrow pit and quarry site; it is affected to water quality in the project area.

The water surface and groundwater polluted by serious accident of traffic from oil/fuel leakages on the ground and it flows to the shallow water sources and further flows to surface water in the project area.

There can be illegal disposed garbage along the road and during wet season it pollutes into the water in the project area.

- Mitigation Measures

The project owner should do follow up on borrow pit and quarry site, make sure that it is good slope according to the standard that can be accepted for this result from the contractor.

In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.

The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to inform to local Authority: commune, village about garbage disposal along the road and installing many signboards: prohibit garbage disposing, and should do urgently for violator.

A-4 Air Pollution

- Negative impacts

Air pollution is created from dust and other soil, sand fallen down during transportation and also it is emission gas from vehicles along the road; it affects to the travelers and people living around the project area.

Moreover, air polluted due to bad smell from oil/fuel leakages of vehicles or oil/fuel smell from the vehicles that remained fire, including bad smell of cargos transportation ect., ***Note:*** *but air pollution was lower when this project is not existed.*

- Mitigation Measures

Soil/sand and cargos transportation that its have bad smell, is needed well to cover or put in the packet, do not allow smell to spread out.

A-5 Soil Pollution

- Negative impacts

In the Operation and Maintenance phase, soil is polluted by serious accident of traffic from oil/fuel spilling on the ground, in the project area.

Other hand, there is soil pollution by illegal disposed garbage along the road.

- Mitigation Measures

In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources.

The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to inform to local Authority: commune, village about garbage disposal along the road and installing many signboards: prohibit garbage disposing.

A-6 Noise and Vibration

- Negative impacts

In this phase, there is widely road and traffic is increasing, it is creating some noises and vibrations. Other hand, road widely extending, it causes the right of way is remaining small, noise and vibration are creating higher at surrounding of residential houses if comparison to without construction this road.

- Mitigation Measures

The MoPWT through the PDoPWT, especially to do cooperation with local Authority: commune, village to inform to people along this road about people's living condition on the righ of way and they should do for house construction far away from the right of way to avoid disturbance by this noise and vibration.

B. Ecological Resources

B-1 Aquatic Life/Fishery

- Negative impacts

In the Operation and Maintenance phase, it might affects on Aquatic life and fishes by illegal garbage disposed along the road that it causes water pollution of creek, natural small stream, Prek and affects to fishes and Aquatic life of road.

- Mitigation Measures

The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to install many signboards: prohibit garbage disposing and should do cooperation with local Authority: commune, village hard management to violated people.

B-2 Forest Resources and Wildlife Habitat

In the Operation and Maintenance phase, it is not affected but the project owner should do cooperation with relevant Ministries and local Authorities, especially with Khan Forest Administration to re-plant the trees such as Kngaok tree, Chankiri tree and Koik tree ect., along the road in order to transfer this area to be green environment, erosion and vehicle protected to fall down or crash to household people's.

B-3 Biological Wildlife

- Negative impacts

In this phase, there is some affects to wildlife such as snake (Chequered Keelback, Striped Kukri Snake, *Sunbeam Snake,* Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spade-foot frog, Frog) that they are passing road and died by vehicle run over them.

- Mitigation Measures

In this phase, the project owner should do cooperation with MoE and local Authority especially PDoE and Khan Forest Administration to introduce and regularly educate people living along the road on prohibition hunting of species where is conservation them in the project area. ***Note:*** they are species not Rare species and Vulnerable species.

C. Social Environment

C-1 Poverty

- Negative impacts

There are vulnerable families (old people, unable people, widow, family that they have member earns income less than 20$/month), total is 109 families, and landless families or affected families for whole land that they have it, they are 39 families and they are living and they have business on this reserved land in COI:20m (both sites is 40m). In case the project is not considered about them they will get poor and poor.

- Mitigation Measures

In the project construction phase, the people are landless or affected all their land, in case the project owner looks for land resettlement for them including access for infrastructures as the same they ever got or better than before, the project owner should do monitoring on their life condition due to identify that they are 148 families (109 + 39) have a better life without this project. In case for either family got un-normal living (lower down than before the construction), the project owner should help them to re-improve their life on time.

C-2 Water use

- Negative impacts

In this phase, can be affected to water agriculture use along the canal and road because concrete ring installed may be small or blocked by the rubbish and algae (dry up).

- Mitigation Measures

The project owner, should do follow up regularly along the existing canal in wet season and to make sure to maintain and repair well for long life, do not in there block of water by water agriculture used.

The MoPWT through PDoPWT will responsible for repair and maintain for all culverts along the road, do not allow rubbish or algae or soil filling on front of culverts, to do announcement to the local Authorities: commune, village about prohibit soil filling to block water on front of culvert and drainages along the road. Moreover, the project owner should do cooperation with MoE through PDoE to install environment signboards, prohibit to dispose garbage along the road.

C-3 Aestheticism

- Negative impacts

In this phase, there will be changed of Aestheticism in the project area by tree plantation, due to some trees were died that it causes to bad view.

- Mitigation Measures

The project owner should do cooperation with relevant Ministries and local Authority especially Khan Forest Administration to re-plant trees along the road, in order to become this area to be green forever.

C-4 Children's Rights

- Negative impacts

In this phase, can be affected for children accident when they pass the road, due to of wide road and good it causes for vehicles use high speed and there is busy road as well.

- Mitigation Measures

The project owner should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect., including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down.

The project owner should do cooperation with Ministry of Education Youth and Sport to insert traffic program for the students, in order to reduce for traffic accident along the road, because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle as well.

C-5 Working Conditions (Including Occupational Safety and Public Health

- Negative impacts

In this phase, can be occurred accident along the road because there is wide road and good it causes for vehicles use high speed and there is busy road as well.

- Mitigation Measures

The project owner should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect., including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down.

Moreover, the project owner should do cooperation with local Authority of commune to delivery and educate people about traffic law and traffic light of vehicle because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle and especially animal husbandry (cow, buffalo, dog, goat ect..) do not allow to walk everywhere along the National road.

C-6 Accidents

- Negative impacts

In this phase, it will be traffic accident because of traffic increasing, high speed use, good and wide road. Moreover, because of center divider newly installed, cars running counter to traffic way may increase and cause accident.

- Mitigation Measures

The project owner should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect., including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down.

The project owner should do cooperation with local Authority of commune to delivery and educate people about traffic law and traffic light of vehicle because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle and especially animal husbandry (cow, buffalo, dog, goat ..ect) do not allow to walk everywhere along the National road.

C-7 Trans-Boundary Impacts or Climate Change

- Negative impacts

In the future at this phase, due to vehicle are increased, its caused for high emission gas as well.

- Mitigation Measures

The Royal of Government should consider for second hand vehicle import which these vehicles are used and very old in their country and then these engines are not well fired including high emission gas also.

7.2.4 Project Closure Phase

In project closure phase, it is after MoPWT planned for NR5 improvement project. Therefore, within this phase, it is not any affects to Social environment.

7.3 Summary of Environmental Impact Assessment and Mitigation Measure

Table-7.1: Environmental Impact Checklist and Mitigation Measure

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
1. Impact Environment before project operation phase						
1.1 Before project construction phase						
A. Physical Resources						
A-1 Hydrology	- Based on consultation and discussion with the local village Authority and villagers in Kon Damrei village shown that at this point in between PK392 to PK394 of this road there is very small culvert and the drainage along the road is which was constructed by ADB is blocked by wastes, it causes the water drain out not on time and there was inundated road at this area for most every years (it is not included for 2013, there are many places area inundated).		✓		- The detail project design of this road improvement has to consider for additional concrete pipes installation or enlarge of existing culvert at between PK392 – KP394 of this road. It plans to dig canal on both sides to regulate water flow of flood out from the residential land and inundated road.	
A-2 Erosion and Soil Quality	- Might have at the borrow pit, quarry site, and road slope which raised at high level in case the project has not considered about this problem.		✓		- The detail project design of this road improvement has to insert procurement document project construction on soil erosion measure at the borrow pit (should have slope based on type of soil and to excavate straight), quarry site and to plant grass on road slope.	
A-3 Air Pollution	- Air pollution by road damage some places, DBST floor is easy damage, road is not large, dust blows from this road because the project is not started and enlarged.		✓		- It needs to have this project by enlarging road for rural area is 23m of width and at the Town it will be increased up to 28m of width and paved asphalt concrete to reduce dust.	
B. Biological Resources						
B-1 Forest and Wildlife Habitat	- The NR5 improvement project from Sri Sophorn to Poipet in Corridor of Impact (COI: 20m, total 40m) is not forestry but there are trees and fruit trees that planted by Khan Forestry Administration and people. These crops are not habit of wildlife for endangered species, critically endangered species and vulnerable species. Moreover, this area is high activities such as traffic busy on this road that it causes of big wildlife cannot come close. - Along this road of COI in between KP-366 to KP-366+685 in Teuk Thla village, Sangkat Teuk Thla, Sri Sophorn Town is inundated forest (small re-grow) about 0.7ha. This vegetation will do clearance for extending road. Moreover, at both sides along the road there are 32 types of crops (fruits), total is 1,034 trees (diameter from 10Cm to 100Cm) which planted by the people, both Towns Authorities and Khan Forest Administration. There are fruit trees planted by the people of 980 trees and these trees are affected by the project. The data these trees see in Chapter-5, point: 5.1.2. ***Note**: fruit study in*		✓		- Needs to study, investigation on impact of crops, trees, households that located in COI, and including resettlement plan by insert fund to solve these impacts and fund to re-plant trees along the road. The project owner should do cooperation with relevant Ministries for successful of project plan implementation.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
	located in between the point of reserved land to the road slope bank that these trees are not belong to the people.					
C. Social-Economy Resources						
C-1 Land use/Relocation	There is some people lived on (COI: 20m, total of 40m) total is 562 families, 338 HHs, 70 business stalls, 1 Restaurant, 146 other small stalls and 51 other immovable properties that need to demolish and resettlement.			✓	Need to study, investigation on impacts: crops, fruit trees, households that located in COI, and including all things suitable registration that affected by the project. Deadline of registration on impacts such as houses, buildings, crops is 2 September 2013 and resettlement plan is prepared fund for compensation, support to vulnerable people (Old head household, disable people, widow, poor people that they get income less than 20$/M), support to the people landless (people live in COI), support to affected people land use of family is over 20%, there is reserve fund for new program of temporary income and fund for tree planting along the road as well. The total budget for social impact resolution is USD 8,059,913.55 (included resettlement for 2 sites in Bakan district and Moung Russei district for the road section from Thlea Ma' am to Battambang and other one O-Chrov district of this road section, see detail resettlement plan of NR5 improvement road project from Thlea Ma' am to Battambang and other section from Sri Sophorn to Poipet).***Note****: the resettlement plan of this project is integrated together (Thlea Ma' am to Battambang section and Sri Sophorn to Poipet section*).	
C-2 Poverty	There are some families that they get income less than 20$/month, (landless families, disable families, old head families and widow families), they are total 109 people). The NR5 improvement project will affect on these people, it causes to them become poor and poor.			✓	- Should prepare resettlement plan due to do compensation on houses, buildings, crops and fruit trees affected based on market price, including supplementation fund to these families such as money supports for impacts, money supports for transportations, money supports for family who loaned land, money supports for vulnerable Head households and money supports for new program of temporary income to affected people land use of family is over 20%. For the landless of 39 families the project owner will look for buying land and creating a resettlement site them in O-Chrov district, this resettlement has to construct social infrastructures look like existing they lived or better than there. Detail description in resettlement plan of the project.	
C-3 Economic and living of Community in/around Project Site	- There are total of 562 families affected by the project, among of this affected people landless is 39 families and vulnerable Head household (old head household, disable people, widow) and the families that they get income is less than 20$/month), total is 109 families. The NR5 improvement project will affect on their poor living. - In the COI area on the left hand of project there are electricity Towers of 115kV and 22kV, Telephone cable line, water pipes, waste water systems, Optic cable underground which located in the Towns such as Kon Damrei zone, Sangkat Nimith and Poipet; it will affect by the project, it will be un-normal of economic and community life process.			✓	- The method to mitigate on affected among this, it is mitigation measurement the same at point C-2. It is project plan for resettlement. However, the project needs to recruit workers by providing priority to affected people and the people who living in the project site in order to improve their living condition in the project construction phase. Should be achieved resettlement plan before the project construction phase started. - The project owner should do announcement and cooperation with the local authority, relevant institutions and to ask the project affected owners to demolish all electric networks, electric cable, water pipe systems, waste water systems ect,.. which impacted by the project to secure on the reserved land in order to avoid to remove for many time when this road to be improved once again.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-4 Land used and Resource used in Project Site: there is no impact because the project owner is not started any activity yet. Moreover, the land is belong to the people, it is the reserved land with width of 30m from the middle of road both side (total is 60m). Therefore, there is no impact on that but there is impact on the production and there is compensation on crops, tree fruit, and immovable property only.						
C-5 Existing Social Infrastructures and Services in the project site	- There are social infrastructures such as: electricity Towers of 115kV and 22kV, Telephone cable poles, Optic cable Towers, Optic cable underground, electric cable underground, waste water drainages, water pipes underground such as in Kon Damrei zone, Sangkat Nimith and Poipet Town will affect by this project road extended.			✓	- The project owner should inform to these infrastructures owners in advance and should do cooperation relevant institutions to demolish and move its to new locations where are safe places, to avoid re-demolish again in the future that it is costly; - The project owner should consider on electricity Towers of 115kV that will be affected because there will be cut off of electricity power for 3 provinces such as Battambang, Banteay Meanchey and Siem Reap. Therefore, the project owner should do discussion with the EDC and CPTL Company or aim straight direction road to the right hand due to avoid from the electricity Towers.	
C-6 Culture and Traditional	- In the COI area, there is hermitage of Lok Yeay Mao (Banyan tree) and Lok Ta Krahomkor located in COI: 20m at the PK-397+090 which it is place people always come to pray for safe and rainwater from Poipet Town Authority, it will affect by the project road extended.Moreover, there are some fences and Mosque gateways along the road will be affected also.			✓	- The project owner should discuss with Provincial Authority, Provincial Department of Religions and Cults in advance, whether it needs to do bypass or another resolution that can be solved before construction project. Moreover, the detail design technical Consultant should consider alignment and to do whatever detour or escape this place, if there is no choice to do detour then we need to do follow the local people traditional before project construction. For other fence and gateway of Mosque, the project owner should discuss with Provincial Authority, Provincial Department of Religions and Cults and relevant Mosque Committees to do compensation; all these fences and gateways need to be solved whatever is far from the reserved land to avoid impact again for the future; - When they do detail project design, the project owner should ask the Technical consultant to discuss with the local Authority and Provincial Department of Religions and Cults.	
1.2 Project Construction						
A. Physical Resources						
A-1 Morphology and Topography	- It may change the morphology and topography in the COI area, borrow pit and quarry sites of the project due to land clearing and earth work activities for base road arranging/constructing ect., *Note: the construction site, borrow pit of soil, stone and laterite soil cannot identify detail because the project owner has not recruited the technical consultant for project detail design due to the technical consultant has to identify about quality of soil, stone and laterite soil for a standard highway and during the project detail design it will indicate clear in the project report.*		✓		- Has technical Expert for monitoring of this construction such as earth compacting, concrete bed culvert making, slope of borrow pit and quarry site making, grass planting along road slope ect., - Construction work will start in dry season to protect soil erosion that might affect topography in rainy season.	
A-2 Hydrological	- In the project construction phase, water discharge of Creek				- The project construction activity such as big earth works, it will work in	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
System	and canal might be affected due they close waterway for road extending or new construction of culvert that it will block waterway in wet season; - Soil erosion at the borrow pit and quarry site by excavating of soil and stone that it is not properly slope as standard of earth and quarry works, there will lead to break the wall of borrow pit or mountain wall. There is also occurring to create soil sediment at the bottom and make shallow of canal, creek in/around the project area. - This road construction will affect on water quality by construction activity such as stone cleaning, vehicles washing, soil erosion from the wall of borrow pit or quarry site that it is high turbid water. - There will affect to the water quality by disposing of solid and liquid wastes from the living places such as: it is from toilets of staff- workers house, fuel/oil from vehicles used in the field and washing bodies of staff-workers; all these will pollute water and it causes to decrease water quality level.		✓		dry season in order to avoid soil erosion and water polluted reduction. Moreover, at the site of road extending, new culvert, bridge constructions and install concrete rings to lead water flow out from the construction site with suitable dimension to drain water to downstream as normal flow in wet season; do this in order to avoid inundated water at upstream or it occurs to break the dam by water pressure into the construction site. - For road extended construction at Kon Damrei site, should enlarge construction or install enough of concrete rings with suitable dimension to drain water out to reach the natural water including to rehabilitation of existing culvert or drainage of both new road sides. - To grow grass along the road banks both sides in order to protect soil erosion, slope and wall road damageable. - At the project site, should do have for vehicles washing place, workshop to repair of vehicles, warehouse to keep good store of construction materials and fuel to have suitable platform to avoid of fuel spilling on the ground that it finally is flowing or pollute into the water sources in the project area. - At the field, Staff-workers Camps, workshop, warehouse to store construction materials, should have garbage site, the project owner should contact to Servers of garbage collection such as in Banteay Meanchey province there is GAEA Company and in Poipet Town, there is Poipet Cleaner Company. For oil waste, can sell to who asks for buying it to assist their fire kiln; for old tires, can sell to the middleman that they collect its transport to Vietnam. Moreover, the project owner should consider enough on latrine and its septic tank construction base on number of staff-workers.	
A-3 Soil Erosion and water quality	- Soil erosion in the borrow pit, quarry site and along slope road which it will raise high, in case the project owner is not consider about the problem. - Soil filling on road in the field in wet season, it leads to soil erosion to cover of rice field and it will lose soil quality (low quality) in there.		✓		- Should observe regularly the contractor for slope road based on contract document works and should order to excavate straight at quarry site and should plant grass along slope road and shoulder also. - Most activities of the project road extending are implementing in dry season that there will less impact.	
A-4 Water Pollution	- It will affect for water pollution by making turbid water due to construction activity works such as earth works (poor management works on borrow pit, quarry site), concrete works, foundation works ect., it may affect to surface water in the project area. - Surface water and groundwater is serious polluted, it occurred from accident of trucks which it leakages oil/fuel to the ground and go into the shallow water source and continue flows to surface water in the project area.		✓		- Should observe regularly the contractor for slope road based on contract document works and should order to excavate straight or rectangular at quarry site and should plant grass along slope road and shoulder also. Moreover, should control concrete mixing site, stone cleaning site to ensure that in the project area is no water quality pollution. - Waste soil, waste of rubber floor road, the project owner will contact to the local Authority to transport it to fill on the rural road and do well compacting it, do not dispose it into water sources. Moreover, the project owner should respect to Policy Guideline of MoE and local	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
	- There is not well solid waste management (waste soil, waste of rubber floor road etc.,) and liquid waste (waste water outlet from the toilet and kitchen ect.,) in the field works, Staff-workers houses, workshop, warehouse then there will be polluted water in the project area.				Authority for solid and liquid wastes management, especially waste soil and existing rubber road have to keep in properly place. - In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources. - Should require to the contractor to educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. The project owner should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. Other hand, for oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle (see detail in Chapter-5 , point 5.2.6.3. Should well manage on solid and liquid wastes, do not let its polluted into the water sources. - In the field works, Staff-workers houses, workshop, warehouse, it is important to have enough and properly for latrines equipped with septic tank of 2-3 blocks and bath rooms. It is proportional to the number people uses.	
A-5 Air Pollution	- Air pollution is creating due to dusty and exhausting gas from vehicles which its are constructing; its will impact to the travelers and the people living in/around the project area. - Air pollution may be occurred due to traffic jam in the project area, there will increase emission gas from vehicles. - As well as air pollution causes from dusty in borrow pit and quarry site, there are many trucks are transporting its to the site, along the road that it will affect to the travelers and the people living in/around the project area. - Air pollution is creating by bad odor from spilling oil/fuel of old engines where is workshop, dump site, waste water site of staff-workers house ect.,		✓		- Should use good quality of vehicles and machines with lowest air pollution will be used to assure air quality in the project area. Especially, new vehicles and Engines are useful because its exhaust low gas and strong for works. - Should have technical staff to operate traffic in order to avoid of traffic jam. Moreover, should do extending reserved land first and let the people use temporary on existing road. - From the borrow pit and quarry site to project site, need to spraying water regularly in each construction site especially at the Town area, school, district Hospital or health center or clinic, pagoda ect., in order to reduce dust swirling up to the travelers, students, ill people and the people living around the project area. - Should require to the contractor to do properly manage in the workshop, dump site and staff-workers house; to advise them to dispose in cask wastes, and oil/fuel wastes will keep in safe place to avoid its spilling on the ground. Moreover, these wastes will sell the middleman and selling waste shop for their wastes recycle as described in Chapter of Mitigation Environment Measures.	
A-6 Soil Pollution	- As well as air pollution, in the project construction phase, there is some soil pollution by construction work activities such as earth works (it is not well management for borrow pit and quarry site), concrete works, base works; such as cement spilling, liquid cement ect., that spilled on the ground and it				- Project owner has to control regularly to the contractor construction for slope road as standard of contract works document works and should order to excavate straight at quarry site and should plant grass along slope and shoulder road. Moreover, should control in concrete mixing site, stone cleaning to ensure that in the project area is no soil	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
	causes soil pollution in the project area. - In case lack of well wastes management in the staff-workers houses, workshop, warehouse that it causes soil pollution in the project area. - Soil pollution causes from serious accident of vehicles by spilling oil/fuel on the project area.		✓		pollution. - In case, there is serious fuel spilling (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources. - Should educate staff-workers how to dispose solid and liquid wastes, especially spilling fuel/oil on the ground that it causes to damage soil quality in the project area. The project owner should educate staff-workers about sanitation, lead them to know waste disposal in place where has been prepared in project area. Other hand, for oil waste, can sell to who asks for buying it to assist their fire kiln; and waste of can, bottle and old tires, can sell to the middleman that they can do recycle. Should well manage on solid and liquid wastes, do not let its polluted into the water sources.	
A-7 Noise and Vibration	- In the project construction phase, infrastructure construction activities of the project, it might disturb to the people living in/around project area because of sound, noise and vibration from construction machineries are operating on earth works, concrete works, base works, transport works and repairing works ect., - It might disturb to the people living around borrow pit and quarry site because of sound, noise and vibration from construction activity works such as soil excavating, transportation of (soil and stone), and breaking stone ect.,		✓		- Should require to the constructor to use machineries and transport vehicles which are low noise shall be used in the project area; - Should require to the constructor to assign working day for daytime only, stating in the morning from 7:30am to 12:00am and afternoon from 1:30pm to 5:00pm in order to reduce disturbance to the people in the project area	
B. Ecological Resources						
B-1 Aquatic life/Fishery	- Fishes and other aquatic life might be affected to water sources (Creek or Prek) because of turbidity of water from cleaning rock and project construction including solid and liquid wastes and other case from infrastructures of the project such as constructions: culvert crossing creek or Prek ect.,.		✓		- Should require to the contractor to buy clean stone, gravel to avoid for stone, gravel cleaning in the concrete mixing site; concrete rings should make in dry season and should look for by-Pass and install concrete rings depend on dimension of water flow of Creek, and these canals to avoid block and low flow especially may impact on fish movement in wet season. - The project owner will avoid to outlet waste water out from vehicle washing place, concrete washing place, material and waste of concrete and waste oil direct into the water sources that existed in the project area, due to use a private site of vehicle washing service instead. - In the field works, Staff-workers houses, workshop, warehouse, it is important that the project owner should require to the contractor to build enough and properly for latrines equipped with septic tank of 2-3 blocks and bath rooms. It is proportional to the number people uses; and make sure there is not affect to Aquatic life/fishery systems in the project area.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
					- Should require to the contractor to educate to staff-workers in project area to avoid spilling fuel/oil on the ground in the project site. - Should do well management on all wastes, such as solid wastes: can, plastic bottle, glass bottle, battery, oil used, old tires; boxes should separately keep for middleman buying for waste recycles. For other remaining wastes: old lumps, plastic bags, vegetable waste ect., should contact to garbage collection Company to transport its to Dump site.	
B-2 Forest Resources and Wildlife Habitat	- Needed Corridor of Impact of 20m (COI: 20m, total is 40m). In the COI: 20m area, there is crops, fruits 980 trees (see detail in Chapter of Resettlement Plan) which grown by the people. The fruit trees that grown on the reserved land are 32types and total is 1,034 trees (diameter from 10Cm to100Cm. The Riverside vegetation that re-grows is 0.7ha; there is 24species Forestry; data of forest. Its will affect by this project, these some trees are wildlife habitats. ***Note:*** *for Mammal: Small Asiun Mongoose, Lyle's Flying-fox; Birds: Asian Openbill, Barn Owl, Lyle's Flying-fox, Grey Nightjar, Yellow-breasted Bunting, Large-billed Crow, Common Snipe, Common Kingfisher; and for Reptiles and Amphibian there have some that they lived in the COI area, to say that they just only pass this area only.*		✓		- Should do cooperation with relevant Ministries and local Authorities especially, Khan Forest Administration to plant small trees which is planning to re-grow along the road such as Krongaok tree, Koki tree, and Chan Kiri tree in order to change to green environment, protection erosion and prevented vehicle to fall out of road and crash to people household ect.,	
B-3 Biological Wildlife	- It will affect to a little wildlife such as snake (Chequered Keelback, Striped Kukri Snake, Sunbeam Snake, Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spadefoot frog, Frog) that they are living in the COI area. - Staff-workers of the project can eat wildlife meat that it causes to increase for wildlife hunting near this project area such as protection area or protection forest ect.,.		✓		- Should do cooperation with MoE and local Authorities, especially closed work with PDoE and Khan Forest Administration to educate and guide to staff-workers of project, do not hunting them while they presented in the project area. ***Note:*** *they are species not Rare species and Vulnerable species.* - Should assign working day for daytime to reduce disturbance to the people and wildlife by noise or vibration in the project area. - The project owner should do cooperation with MoE and Forest Administration to train about wildlife conservation and wildlife punishment case to the staff-workers project's.	
C. Social-Economic						
C-1Land use/Relocation	- May be required some land for small resettlement such as land for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect.,			✓	- Will do cooperation with IRC to look for land rental for temporary for construction site, land for stone, soil, materials of construction, warehouse and concrete mixing site ect. due to there is not affect serious to resettlement site. - To settle between construction building for the staff-workers and store for materials of construction should be far at least 500m from the residential household of the people.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-2 Poverty	There are vulnerable families (old people, unable people, widow, family that they have member earns income less than 20$/month), total is 109 families, and landless families or affected families for whole land that they have it, they are 39 families and they are living and they have business on this reserved land in COI:20m (both sites is 40m). In case the project is not considered about them they will get poor and poor.			✓	- The people are landless or affected all their land, in case the project owner looks for land resettlement for them including access for infrastructures as the same they ever got or better than before, the project owner should do monitoring on their life condition due to identify that they are 148 families (109 + 39) have a better life without this project.	
C-3 Land used and Resource used in/ around Project Site	- There will be changed of land use such as lose of agriculture land by excavating soil for road construction ect.,		✓		- Should compensate to the land owner base on market price due to have agreement from each other from the seller and buyer.	
C-4 Water use	- It will affect some on water agriculture use of canal along the road by culvert extending of construction project. - In the COI area at Poipet Town, there is water pipe system will affect by this road extending project.		✓		- Should do cooperation with MoWRAM to extend culvert that it is irrigation system, to make sure irrigation system is normal use, never blocked and do not affect to the farmers. - Should inform to PDoIME, Sangkat/Town Authority and water supply Companies that they have own pipes buried on the COI area to demolish its and move to the new safe places (on reserved land) to avoid re-demolish for many times, it causes to lose money in the future while there will be road improvement again.	
C-5 Traffic and Services in the project site	- It will get traffic jam for temporary along the NR5 and on the intersection road that connect to the rural road by cutting-off of these roads during construction.		✓		- In case during extending road construction on paved road or rural road, the project owner should do on this site faster, if there is not finished on time the project owner should do traffic facilitate to avoid traffic jam. - Should install traffic signboards and working group for monitoring and provide traffic service during the construction phase.	
C-6 Culture and Traditional	- In case do not solve for hermitage of Lok Yeay Mao (Banyan tree), it will reflect unhappy from the people that they always come to pray at this place. - There are Lao people of 208families inKOb Chheung village, Kob Lich village, Khai Daong village, Kob Keut village, Vaing Maoung village, Kob commune and Cham people is 77families in Nimit-3 village, Nimit-4 village, Steung Baot village and Phsa Kandal villaget. The project improvement will be affected to some ethnic people included their culture as well by the staff-workers which they are from deferent Nationality.			✓	- Should discuss with Provincial Authority, Provincial Department of Cult and Religion (PDoCR), Banteay Meanchey province in advance, whether it needs to do detour or another option that can be solved before construction project that located at PK397+900. - Should require to the contractor to educate staff-workers of the project to understand about habit and traditional of ethnic people, do not touch them including do not to discriminate or to be racist in stage the project is recruiting staff and workers if they willingness to work for construction worker.	
C-7 Aestheticism	- The Aestheticism will be changed in COI area for temporary by clearance of vegetation, crops and trees in order to do extending road especially a lot of dust and mud while there is raining.		✓		- Should ask the contractor to do regularly spaying water to reduce dusty and should do compacting soil immediately in that site after soil landed from the truck. - At the road site that is enough of level needed for new road, there should plant grass and small trees along the slope road in order to correct Aestheticism to be green site.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-8 Gender	- There can be recruited workers not equality and also is not promotional to sex for works.		✓		- Should ask to the contractor to recruit workers is not to side with one's sex, and should divide for labor depend on sex (male or female) and the wage should be equality.	
C-9 Children's Rights	- There will have some children come and see the site, it causes to get accident to them such as traffic accident, soil erosion falls to them, something hard fall down on them. Moreover, in the borrow pit or quarry site is deep excavated then during the raining there is inundated water and the children can be died by drowning.		✓		- Should build barrier, it shows as project site and do not allow in and out excepted staff-workers of the project, surrounding should organize the guard to regular control, even though during time break, to make sure that there is no children come in to the project site. - When the borrow pit is completely finished, this borrow pit should do well sloping and smoothly and install signboard shows picture of borrow pit, be careful for children, do not allow for swimming including delivery information to local Authorities: Commune and village to assist announcement to every people to prohibit their children to come for swimming in this place. In case, the borrow pit is nearby the villager household should do as above described including the fence protection as well.	
C-10 Infectious Diseases such as HIV/AIDS, Liver Diseases	- It can occur infection HIV disease for staff-workers of project and other disease such as liver, lust disease, tuberculosis and other infection diseases ect., from staff-workers, food sellers and the server of sexual services.		✓		- Should organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred. - Should require to the contractor to do cooperation with PDoH and Hospital to educate on sanitation and hygiene to treat for staff-workers in order to prevent these infection diseases to the people in the project area. Should contact any Hospital if while there is accident that can be occurred.	
C-11 Safety and Public Health	- It might affect on health people's in the project site to staff-workers by pollution of dust or materials transportation. Moreover, there will have Opium use and trading it. - It might get accident works to staff-workers due to they are careless and the Employer is not provide enough safety tools or materials of construction works to them based on these type of works.			✓	- Should keep safety first for daily working. The project owner should ask the contractor to provide mask to protect dust and helmets, boots, gloves to workers; should do spaying water regularly on this road construction. - It the project site should build fair Camp to the staff-workers including enough water supply and latrines, and education program on safety first for the staff-workers. - Should ask to the contractor to organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred. - Should require to the contractor to do cooperation with the local Authority and relevant institutions to protect Opium and people trading. Moreover, the contractor should do cooperation with Health institution in this project area to prevent other infection diseases that its can be occurred.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-12 Accidents	- It might occur some accidents in/around the project site such as accident works (rope cut-off or breaking of crane machine, crushing, something hard to scatter down, fire caused by careless such as short circuit, welding, do not careful use power caused to fire of fuel station and materials ect.,		✓		- Should ask to the contractor to train staff-workers about safety first, provide mask to protect dust and helmets, boots, gloves to workers of the project. Moreover, the project owner will provide building to stay with facility of water supply, to train on technical training and provide tools for safety work to the staff-workers - Should ask to the contractor to organize emergency treatment place and prepare enough medicines and equipment to checkup and treat regularly for the project staff-workers and should do have ambulance when there is accident that can be occurred. - In the project site, at the staying place, warehouse, and fuel station should have extinguisher, sand pile, axe to repress or to extinguish fire when there will be occurred.	
C-13 Trans-boundary Impacts or Climate Change	- Trans-boundary impacts or climate change will not occur because the existing NR5 is the project improvement only. - The amount of CO2 emission from vehicles and machines will increase in the project site.		✓		- Should use vehicles and machines that its are low of CO2 emission in order to reduce air pollution in this area; especially should use new vehicles that its are low of CO2 emission.	
2. Project Operation & Maintenance Phase						
A. Physical Resources						
A-1 Hydrological System	- It might have blocked by garbage and algae at/in the canal on front of culvert which it makes low water discharge from upstream. Other hand, it blocks by illegal garbage disposing along the road.		✓		- The MoPWT through the PDoPWT should responsible for maintain and rehabilitation of culverts along the road, do not to have garbage or soil filling up on front of culverts, to do announcement to local Authorities: Commune and village about soil filling up that caused to block water discharge of culvert and drainage system along the road. Moreover, the project owner should do cooperation with MoE through the PDoE to install environment signboards: to prohibit for garbage disposed along the road.	
A-2 Soil Erosion and Water Quality	- In case the project owner is not consider to follow up on borrow pit or quarry site, to make sure there is good slope that it cause soil erosion by rainfall. As well as it might have erosion at the slope of road that there is no grass because of it is not well grow causes by mud covered. - In this phase, there is widely road and traffic is increasing, it causes of weight loaded and vibrated on the road and nearby will be compacted; it causes to be low quality of soil as well.		✓		- Should do follow up on borrow pit and quarry site, make sure that it is good slope, grass planting according to the technical standard that can be accepted for this result from the contractor or not?. - Should install of traffic loading signboard and maximum speed of vehicles that allowed driving on this road, should having weight station for heavy vehicles and making sure that weight is properly control based on standard.	
A-3 Water Pollution (Surface/Groundwater)	- It might affects of water pollution by turbidity that it causes erosion from borrow pit and quarry site; it is affected to water quality in the project area. - The water surface and groundwater polluted by serious		✓		- Should do follow up on borrow pit and quarry site, make sure that it is good slope according to the standard that can be accepted for this result from the contractor. - In case, there is serious fuel leakages (over 1,000L), the project owner	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
	accident of traffic from oil/fuel leakages on the ground and it flows to the shallow water sources and further flows to surface water in the project area. - There can be illegal disposed garbage along the road and during wet season it pollutes into the water in the project area.				should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources. - The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to inform to local Authority: commune, village about garbage disposal along the road and installing many signboards: prohibit garbage disposing, and should do urgently for violator.	
A-4 Air Pollution	- Air pollution is created from dust and other soil, sand fallen down during transportation and also it is emission gas from vehicles along the road; it affects to the travelers and people living around the project area. - Air polluted due to bad smell from oil/fuel leakages of vehicles or oil/fuel smell from the vehicles that remained fire, including bad smell of cargos transportation ect., ***Note:*** *but air pollution was lower when this project is not existed.*		✓		- Soil/sand and cargos transportation that its have bad smell, is needed well to cover or put in the packet, do not allow smell to spread out.	
A-5 Soil Pollution	- Soil is polluted by serious accident of traffic from oil/fuel spilling on the ground, in the project area. - Other hand, there is soil pollution by illegal disposed garbage along the road.		✓		- In case, there is serious fuel leakages (over 1,000L), the project owner should do urgent measurement by doing cooperation with local Authority and relevant institutions to take this fuel and bring soil-fuel out to keep at safe place that it far from the water sources. - The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to inform to local Authority: commune, village about garbage disposal along the road and installing many signboards: prohibit garbage disposing.	
A-6 Noise and Vibration	- There is widely road and traffic is increasing, it is creating some noises and vibrations. Other hand, road widely extending, it causes the right of way is remaining small, noise and vibration are creating higher at surrounding of residential houses if comparison to without construction this road.		✓		- The MoPWT through the PDoPWT, especially to do cooperation with local Authority: commune, village to inform to people along this road about people's living condition on the righ of way and they should do for house construction far away from the right of way to avoid disturbance by this noise and vibration.	
B. Ecological Resources						
B-1 Aquatic Life/Fisher	- It might affects on Aquatic life and fishes by illegal garbage disposed along the road that it causes water pollution of creek, natural small stream, Prek and affects to fishes and Aquatic life of road.		✓		- The MoPWT through the PDoPWT, especially to do cooperation with MoE trough PDoE to install many signboards: prohibit garbage disposing and should do cooperation with local Authority: commune, village hard management to violated people.	
B-2 Forest Resources and Wildlife Habitat: It is not affected but the project owner should do cooperation with relevant Ministries and local Authorities, especially with Khan Forest Administration to re-plant the trees such as Kngaok tree, Chankiri tree and Koik tree ect., along the road in order to transfer this area to be green environment, erosion and vehicle protected to fall down or crash to household people's.						

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
B-3 Biological Wildlife	- There is some affects to wildlife such as snake (Chequered Keelback, Striped Kukri Snake, Sunbeam Snake, Rainbow Water Snake, Red-tailed Pipe Snake); some frogs (Banded Bullfrog, Truncate snouted spadefoot frog, Frog) that they are passing road and died by vehicle run over them.	✓			- The project owner should do cooperation with MoE and local Authority especially PDoE and Khan Forest Administration to introduce and regularly educate people living along the road on prohibition hunting of species where is conservation them in the project area. ***Note:*** they are species not Rare species and vulnerable species.	
C. Social Environment						
C-1 Poverty	There are vulnerable families (old people, unable people, widow, family that they have member earns income less than 20$/month), total is 109 families, and landless families or affected families for whole land that they have it, they are 39 families and they are living and they have business on this reserved land in COI:20m (both sites is 40m). In case the project is not considered about them they will get poor and poor.		✓		In the project construction phase, the people are landless or affected all their land, in case the project owner looks for land resettlement for them including access for infrastructures as the same they ever got or better than before, the project owner should do monitoring on their life condition due to identify that they are 148 families (109 + 39) have a better life without this project. In case for either family got un-normal living (lower down than before the construction), the project owner should help them to re-improve their life on time.	
C-2 Water use	- Can be affected to water agriculture use along the canal and road because concrete ring installed may be small or blocked by the rubbish and algae (dry up).	✓			- Should do follow up regularly along the existing canal in wet season and to make sure to maintain and repair well for long life, do not in there block of water by water agriculture used. - The MoPWT through PDoPWT will responsible for repair and maintain for all culverts along the road, do not allow rubbish or algae or soil filling on front of culverts, to do announcement to the local Authorities: commune, village about prohibit soil filling to block water on front of culvert and drainages along the road. Moreover, the project owner should do cooperation with MoE through PDoE to install environment signboards, prohibit to dispose garbage along the road.	
C-3 Aestheticism	- There will be changed of Aestheticism in the project area by tree plantation, due to some trees were died that it causes to bad view.	✓			- Should do cooperation with relevant Ministries and local Authority especially Khan Forest Administration to re-plant trees along the road, in order to become this area to be green forever.	
C-4 Children's Rights	- Can be affected for children accident when they pass the road, due to of wide road and good it causes for vehicles use high speed and there is busy road as well.		✓		- Should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect., including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down. - Should do cooperation with Ministry of Education Youth and Sport to insert traffic program for the students, in order to reduce for traffic accident along the road, because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle as well.	

Environmental Resources	Negative Environmental Impact	Effect Value			Mitigation Measure	Others
		Small	Medium	High		
C-5 Working Conditions (including Occupational Safety and Public Health	- Can be occurred accident along the road because there is wide road and good it causes for vehicles use high speed and there is busy road as well.		✓		- Should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect..including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down. - Should do cooperation with local Authority of commune to delivery and educate people about traffic law and traffic light of vehicle because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle and especially animal husbandry (cow, buffalo, dog, goat ect..) do not allow to walk everywhere along the National road.	
C-6 Accidents	- It will be traffic accident because of traffic increasing, high speed use and good and wide road. Moreover, because of center divider newly installed, cars running counter to traffic way may increase and cause accident.		✓		- Should install enough traffic signboards along the road, especially at location near the school, Health Center, Market, Pagoda ect..including small mound line (good quality it is not easy worn-out) for consciousness attraction of driver to know that this is location be careful and slow down. - Should do cooperation with local Authority of commune to delivery and educate people about traffic law and traffic light of vehicle because at the present most of people did not know well about traffic signboard including the knowledge about traffic light of vehicle and especially animal husbandry (cow, buffalo, dog, goat ect..) do not allow to walk everywhere along the National road.	
C-7 Trans-Boundary Impacts or Climate Change	In the future at this phase, due to vehicle are increased, its caused for high emission gas as well.		✓		- The Royal of Government should consider for second hand vehicle import which these vehicles are used and very old in their country and then these engines are not well fired including high emission gas also.	
3. Project Closure Phase						
In project closure phase, it is after MoPWT planned for NR5 improvement project. Therefore, within this phase, it is not any affects to Social environment.						

7.4 POSITIVE ENVIRONMENTAL IMPACT

7.4.1 Physical and Ecological Resources

- ✓ **Air Pollution**

If they do comparison of air pollution before the project improvement, they will see that the air pollution by dust is much more than after the project improvement (the result air quality test before the project improvement see in Chapter-5, point: 5.1.13) because after the project improvement, the road is width 23m (in the rural area) and it is 28m width (in Town area), paved road is Asphalt Concrete (AC), strong and less of maintenance (before the project improvement width road is11m, paved road is AC), and there is strengthening and fully on Traffic Law such as during the transportation require to do covering on materials ect.,.

- ✓ **Forest Resource**

Although, the NR5 improvement project from Sri Sophorn to Poipet is affected on some river side vegetation along the road, the project is planned budget for trees planting along the road in order to change this location to green environment and good view for additional on part of this road, expected to plant these trees will be better than before the project improvement.

7.4.2 Socio-Economic Resources

- ✓ **Road and Transportation**

If we have the road, we will have hope for developing local community and in country because road is the blood vessel to bring economic based. People can transport their agricultural production or crops to markets easily and fast to avoid spoiling. On the other hand, villagers or local people can go to hospital on time whenever they get urgent at night or day time such as: delivering baby and other accidences in family etc. the common say is: to have a good road, it will help to reduce for expenses of travelling and transportation of the people, it is an effectiveness for poverty reduction.

- ✓ **National Economic Development**

The NR improvement project, it will give services such as: agriculture, tourism, especially handicraft and industry which are the important base to develop national economy. Moreover, this project might help villagers, people in the project area to save their money from less spending of travelling, access to target on time and there will be increased of National and International Tourists that it will help for getting high income to National and social aspect also.

On the other hand, the NR5 is an Asian Highway A-1 of this road project; it is a honor of the Royal Government as well as whole Cambodia in Asian Community because, in year 2015 Cambodia will integrate into Asian Economic.

Moreover, this project will do communication commercial Cambodia with Thailand and other countries such as Vietnam, Malaysia, Singapore and Lao in the near future.

Through this project, it will be high trust and solidarity from Japan that can be shown and confidential to Japan's investors to invest in Cambodia.

- ✓ **Land Use/Land Cost and Tourism**

Because of Influence of project development, there can be changed along this road, Town will change to commercial zone, Industrial zone, Town zone which at the present (2013) at some places is not well developed. Due to paved road and extended, it can attract to International Tourists come from Thailand to visit tourism places in Cambodia in the future, it will help people along the road to get more income from tourism services as well.

- ✓ **Employment and Increase Living Standard**

The project will provide jobs to Cambodia people especially the people in the project site during the project construction phase trough staff-workers recruitment.

Cambodia will have more human resource on road improvement trough this project. Moreover, road maintenance is Cambodia experts from MoPWT.

CHAPTER-8
ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER-8

ENVIRONMENTAL MANAGEMENT PLAN

8.1 INTRODUCTION

The chapter is described the environmental management plan (EMP) which implement throughout each of the project phases especially, construction phase, operation and maintenance phase, and closure phase.

The implementation EMP is a task of project owner under control of integrated team that participated from relevant offices, department, and Ministries which will be organized by the project owner with the Ministry of Environment (MoE). This team will monitor the environmental protection measures under monitoring and following up regularly by MoE and direct cooperation from the project owner.

8.2 OBIJECTIE AND PURPOSED OF ENVIRONMENT MANAGEMENT PLAN

The environmental management plan is established and implemented for the NR5 improvement project from Sri Sophorn to Poipet including monitoring and follow-up of implementation plan from relevant Ministries and other institutions for important purposed of this EMP. It is purposed of monitoring and follow-up of implementation to mitigate environment impact which is described in Chapter-7.

The EMP is an important document among the all those documents included bidding document for this road improvement project. It is required to update, correction and regularly additional fill-up according to each phase of the project activity.

8.3 MONITORING TEAM ON ENVIRONMENTAL PROTECTION MEASURES

The monitoring team consists of members from various relevant institutions as follows:

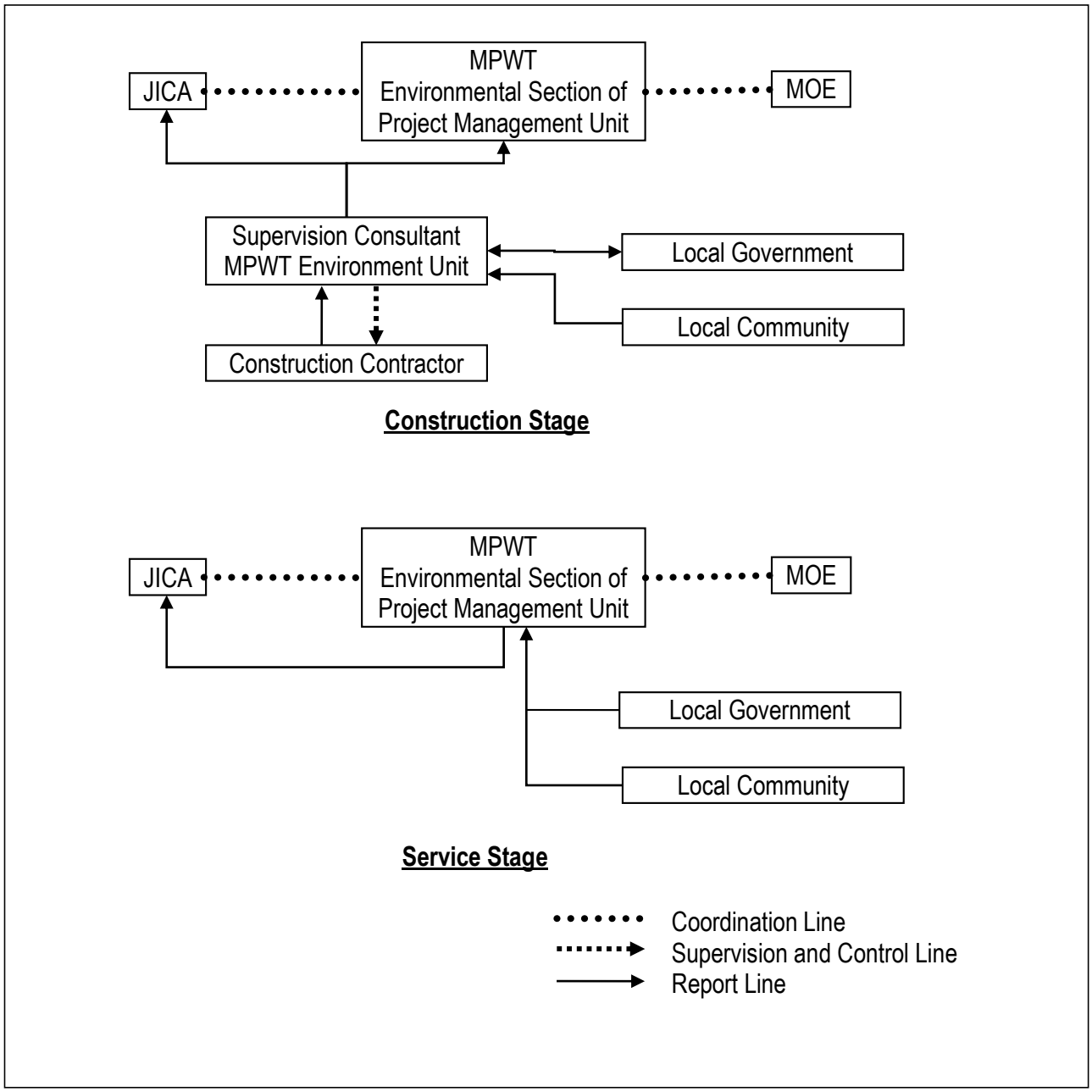
1. Ministry of Environment including Representative of EIA Department, Representative of Department of Control pollution and related Departments;
2. Representative of Ministry Public Work & Transport;
3. Representative of Ministry of Economy and Finance;
4. Representative of Forestry Administration, Banteay Meanchey Province;
5. Representative of Department of Environment, Banteay Meanchey Province;
6. Representative of Department Public Work & Transport, Banteay Meanchey Province;
7. Representative of PDoWRAM, Banteay Meanchey Province;
8. Representative of Provincial Department of Agriculture, Banteay Meanchey Province;
9. Representative Department of Land Management, Urban Planning and Construction, Banteay Meanchey Province;
10. Representative of Department of Health, Banteay Meanchey Province;
11. Representative of Provincial of Tourism, Banteay Meanchey Province;
12. Local Authorities, Banteay Meanchey Province;

All members as mentioned above are directly and indirectly take responsibility in order to orientate and improve of any insufficient of the project owner for implementing procedure protection of environment project.

Note: All representatives will have roles and responsibilities are under designation of MoE and the project owner (MoPWT).

Moreover, the project manager has to manage for every relevant people according to each phase of the project, due to have person to responsible clearly of section and all these people should do cooperation closely with the working team to monitor and follow-up of this project.

ORGANIZATION CHART OF PROJECT MANAGEMENT AND E.M.P IMPLEMENTATION



Note: *MPWT – Ministry of Public Works and Transport, JICA – Japan International Cooperation Agency, MOE– Ministry of Environment*

8.4 SIGNIFICANT MEASURES FOR ENVIRONMENTAL PROTECTION

In accordance with, sub-decree on environmental impact assessment (EIA), and the result of Environmental and social impact assessment which all activities has occurred in project, it described in chapter-7, the project owner will prepare some important mitigation measure to protect and reduce all negative environmental impact and to ensure good management on environment resources, according to technical and environmental standards for sustainable development. The company has to:

- Organize unit or team is directly responsible for the project implementation plan such as assigning for the project manager;
- Recruit technical Experts and contractors, assigning Engineer to follow-up the contractors;
- Discuss with Engineering project Unit for detail plan management based on mitigation of negative impact measures;
- Prepare for emergency response plan;
- Clarify schedule for environment protection tasks;

- Provide equipment/tools and other facilities for health protecting and work safety and use new modern machines according to technical plan;
- Protect and prevent disease infection or transmitting due to have emergency save and ambulance;
- Manage solid and liquid wastes, and keeping hazardous waste in safety place;
- Promote for trees plantation in public land and at shoulder road;
- Cooperate with related institutes for technical site inspection, and review or correction as required from expert;
- To install enough traffic signboards and traffic lights at the village people area, in Town and in the City;
- To delivery and introduce about traffic law, traffic signboard, traffic light and vehicle light to the people living along this National road;
- Health and Sanitation protection awareness and work safety to be done;
- Prepare budget for implementing the environmental management plan (EMP) including resettlement plan.

Note: The project owner should prepare a packet of budget US$133,450 (One hundred thirty three thousand and four hundred and fifty US Dollars)

Table below is summary of Mitigation Measurement on Negative Impact

Table-8.1: Significant Measurement for Mitigation on Negative Impact Environment for NR5 Improvement Project from Sri Sophorn to Poipet

No.	Project Activities	Environmental Impact	Proposed Mitigation Measures	Institutional Responsibilities		Remarks
				Implementer	Supervisor	
A.. Project Design Phase (Before Construction Phase)						
1	The procurement project study and prepare other documents such as Resettlement plan and ESIA report ect.,	- There is not negative impact		JICA working Team and Local Consultants	JICA, MPWT, PMU, MoE, MEF and relevant Institutions	
2	Looking for land to extend for this road (COI: 20m bothsites)	- There are 109 families living in COI area, among of these there are 237 of HHs, 268 HHs are other constructions and 980 species are corps and fruits. There are 1,303 pieces that grown on shoulder road affected by the project; - In the COI area are infrastructures suchas: Electricity Towers, Telphone cable, water pipes, Optic cable underground ect.,.	- The resolution is needed to follow as resettlement plan project - To inform to people affacted by the project about date of COI area clearance;	MEF, MPWT, MoE, relevant Ministries and local Authorities	JICA, and NGOs	
B.. Project Construction Phase						
1	Camp building for staff-workers to stay.	- Garbage and other wastes - Defecation, Sanitation and Hygiene - Fire un-intention	- There is rubbish busket and dump site (as decribed in wastes management below); - To build bathroom and latrines according to propotion of number users included septic tank 2-3 blocks; - To floow accident management plan below.	Contractor	Supervisor Consultant, PMU and Technical Experts	
2	To build fuel staion, warehouse and worshop.	- Garbage and other wastes - Oil/fuel spilling causes to environment pollution;	- To floow wastes management plan below; - Should construct platform for all places and required for fuel tank;	Contractor	Supervisor Consultant, PMU and Technical Experts	

No.	Project Activities	Environmental Impact	Proposed Mitigation Measures	Institutional Responsibilities		Remarks
				Implementer	Supervisor	
		- Fire un-intention; - Traffic jam causes to accident at in/out entry gate.	- To floow accident management plan below; - Install signboard say: Attention at in/out entry gate.			
3	Looking for land to keep soil, stone mixer and other machineries of concrete, concrete column for conrete ring ect.,	- Traffic jam can occur accident by something lived on the existing road; - It impacts on people land use.	- Do not keep these things on existing road that it is small road; - To rent for free land people's with suitable price; - Install signboard say: Attention at in/out entry gate.	Contractor	Supervisor Consultant, PMU and Technical Experts	
4	Staff-workers training	- There in no affected.		Contractor	Supervisor Consultant, PMU and Technical Experts	
5	Earth works such as bad soil clearance, soil excavation, soil dgging, soil tranportation, land clearance.	- There is soil pile along the road collasped to the people land use; - Soil collasped at the borrow pit and quarry site; - Dusty; - Air pollution by emission gas from engines; - Muddy; - Traffic jam and can be accident; - Affected on trees grown in between slope shoulder road; - Affectd on Riverside vegetation.	- Bad soil has to take out and put it at illegal site; - To excavate slope of borrow pit and quarry site; - To spray water regularly on paved road and road cleaning. To cover on materials construction during transportation; - Well and regular of road maintained, to avoid muddy; - To use new vehicles and regularly maintained; - Install signboard say: Attention at the project site and person opertion of traffic.	Contractor	Supervisor Consultant, PMU and Technical Experts	
6	Earth fill up, base road and sloping road for bothsides	- There is soil pile along the road collasped to the people land use; - Soil erosion along slope road and soil filled up; - Dusty and spread out of small part of stone; - Soil filled up on drainage system along the road; - Water way cut-off by road extended construction; - Mudldy; - Traffic jam and can be accident.	- To plane and bring out of pile soil that fallen to the shoulder road; - To plant grass on slope road bothsides; - To spray water regularly on paved road and road cleaning. To cover on materials construction during transportation; - To rehabilitate canal for both sides along the road; - During the construction should have by-Pass and install concrete rings according to dimension of water floe; - To use new vehicles and regularly maintained; - To plane and compact for soil that spilledon the ground; - Install signboard say: Attention at the project site and person opertion of traffic.	Contractor	Supervisor Consultant, PMU and Technical Experts	
7	Base pit digging work or bridge column construction or new culvert construction and foundation works.	- There is soil pile along the road collasped to the people land use; - Soil collasped of borrow pit that can be accident to people;	- To take that soil from the borrow pit or transport it to keep where is safe place; - To istall temporary something to protect wall soil falling down;	Contractor	Supervisor Consultant, PMU and Technical Experts	

No.	Project Activities	Environmental Impact	Proposed Mitigation Measures	Institutional Responsibilities		Remarks
				Implementer	Supervisor	
		- Air pollution by emission gas from engines; - Blocked of water way and fish; - Desturbance by noise and vibration; - Waste concrete and other wastes.	- To floow accident management plan below; - To use new vehicles and regularly maintained; - To transmit of water direction by by-Pass and install concrete rings as suitable of water dimension at that site. Do not close the Steung to construct column of bridge, there should use G.I pipe surrounding of column for construction; - To work in dry season and determined for daytime works; - To floow wastes management plan below.			
8	Concrete mould installation at the project site	- Desturbance by noise and vibration; - Accident; - Garbage and other wastes.	- To work in dry season and determined for daytime works; - To floow accident management plan below; - To floow wastes management plan below.	Contractor	Supervisor Consultant, PMU and Technical Experts	
9	Concrete work	- Environment poluution by spilling cement, stone washing, liquid cement spilling on the ground or in to the water; - Accident; - Garbage and other wastes.	- To work in dry season and determined for daytime works and make carefull for something spilling; - To floow accident management plan below; - To floow wastes management plan below.	Contractor	Supervisor Consultant, PMU and Technical Experts	
10	Bituminous paved work	- Traffic jam and can be accident; - Air pollution by bad smell from bituminous; - Accident.	- Install signboard say: Attention at the project site and person opertion of traffic; - To work in dry season and during concrete transportation should be covered; - To floow accident management plan below.	Contractor	Supervisor Consultant, PMU and Technical Experts	
11	Sowing small trees and plant the trees for good aestheticism along the road	- Traffic jam and can be accident.	- Install signboard say: Attention at the project site and person opertion of traffic.	Provincial Authority and Khan Forest Administration	MPWT, PMO/PMU and MAFF	
C.. Project Operation and Maintenance Phase						
1	Garbage disposed along the road and illegal dump site	- Environment pollution along the road at station bus, taxi and illegal dump site; - Affectd to aestheticism along this Asian way; - These garbages will block to waterway which crosses of road.	- To do cooperation with village and commune Authorities to manage for garbage collection to dump site and should install signboard say: prohibit garbage disposed along the road; - To detain and penalize to violator; - Follow up and regular garbage cleaning on front of culvert and drainage along the road.	PDPWT, PdoE and village and commune Authorities	MPWT and MoE	
2	To plant the trees for good aestheticism along the road and good maintained.	- Traffic jam and can be accident.	- Install signboard say: Attention at the project site and person opertion of traffic.	PDPWT, Khan Forest Administration and provincial Authority	MPWT, MoE and MAFF	
3	Traffic signboard and traffic light installation	- Can be occured traffic accident.	- Install signboard say: Attention at the project site.	PDPWT	MPWT and MoE	
4	Operation and Maintenance	- Traffic jam and can be	- Install signboard say: Attention	PDPWT	MPWT and	

No.	Project Activities	Environmental Impact	Proposed Mitigation Measures	Institutional Responsibilities		Remarks
				Implementer	Supervisor	
		accident.	at the project site and person opertion of traffic.		MoE	

8.5 URGENT RESPONSE TO THE PROBLEM WHICH OCCURRED

8.5.1 Waste Management

The NR5 improvement project, (from Sri Sophorn to Poipet) is two wastes: solid and liquid wastes as described below:

A. Accident

The accident can be occurred by the project, it will affect to health of staff-workers as well as the people living near/close the project site (can be died), it caused from:

- Fire can be occurred by careless or electricity short circuit, welding metal from power using, fire fuel station, warehouse ect.,;
- Accident occurs from careless or cut-off of cable of crane or molds of concrete ring;
- Accident occurs from careless of works such as sliding, fall down from high construct places, soil collapsed, crushing or hard thing fallen down, hitting of pieces from high pressure ect.,.
- Accident occurs from oil/fuel spilling over 1,000L;

To mitigate or manage for this accident in case there will be happened, the construction Contractor should prepare plan as below:

- Measurement of fire accident in the Camps or in each building, warehouse, workshop, fuel storage should prepare extinguisher fire, fire water head, sand piles including axe in the in/out gate of office and warehouse. Moreover, the construction Contractor should do cooperation with the provincial fire entity in order to get guideline about safety of fire;
- Measurement of work accident for every staff-workers, should do training about safety first and to provide clothes, helmet, protected glasses, gloves, boots, metal mask, dusty musk ect.,. Moreover, there should organize emergency room treatment including ambulance to transport sick-people to the province or Phnom Penh City, for budget to expend for accident works is responsible by the contractors or the Project Management Unit (PMU);;
- Measurement for oils/fuel spilling over 1,000L, all relevant the provincial Departments should do cooperation with the traffic Police unit, extinguishing fire Police unit and provincial Health Center to transport victim to the Hospital. In case, there is fuel fired should use extinguishing fire vehicle and cleaning where oil/fuel spilling and bring all oil/fuel polluted on soil to dispose into the safe pit far from the water sources.

B. Risks

Risk can be occurred to the project, it is rain, storm, flood, earthquake, war, terror, rebellion, insurrection which there cannot manage and it causes to damage this road as well.

To manage and preventing this risk, the design and Supervisor Consultant should prepare a plan as below:

- Project design plan should include calculation of earthquake pressure for concrete ring thickness ect.,;
- While there is flooded and inundated on road or water is raised up exceeded of maximum level that it causes to damage road, the PMU should inform immediately to relevant local Authorities trough announcement about this event and then do not allow heavy vehicle (weight over 10 tones) to drive on this road, because it might be serious damage and it will spend more of National budget for rehabilitation;
- For the earthquake in Cambodia is never happened since the past of century;

- For terror, rebellion and insurrection, the PMU should do cooperation with all level local Authorities and relevant Ministries included all army to solve and look for mean to urgent preventing.

8.6 MONITORING PROGRAM FOR IMPLEMENTATION OF ENVIRONMENTAL PROTECTION MEASURES

Monitoring program for implementation of environmental protection measures (mitigation measures for environmental impacts has been clarified in chapter-7 or determination of the scopes of negative impacts and its mitigation measures) is also to define tasks and activities to be monitored in the project. In addition, this program is to follow up and monitor the activities implemented by the project owner throughout each of project phase. This program is described in the table below:

Table 8-2: Environmental Monitoring Program

No.	Environment resources	Inspection and Monitoring Activities	Evaluator	Periodic
A..Physical Resources				
1	Geomorphology and topography	- Check at borrow pit and quarry site whether, is there properly doing slope to protect soil erosion or not? - Check for outside the COI area whethter any agriculture land people's afected or not?	Supervisor Consultant, PMU and MoE	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure.
2	Hydrology system	- Check on vary water flow of Steung, prek, creek that passed on thid road; - Check for duration project construction whethter there is some blocks of waterway or not? - Check for duration project operation whethter there is some blocks of water flow by rubbish or trees on front of culvert or not?	Supervisor Consultant, PMU, MoE and MoWRAM	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure; - Once for 6 monyhs in project Operation stage.
3	Erosion and Soil Quality	- Check at borrow pit and quarry site whether, is there properly doing slope to protect soil erosion or not? - Check for outside the COI area whethter any agriculture land people's afected or not? - Check for soil quality at materials stock, fuel station and workshop whethter is there clean and properly management or not? - Check for grass planting along the shoulder road, is there can be well soil protected? - Check for vehicles parking palce, workshop, fuel station and chemical element, is there any element spilled on the ground? - Check for garbage and other wastes at the staying place, warehouse, vehicle parking place, construction site, is there properly management or not?	Supervisor Consultant, PMU, MoE and MAFF	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure.
4	Surface water and groundwater quality	- Check on borrow pit and quarry site, is there soil erosion and can be affected on water quality or not? - Check on water quality nearbt water source of satying place, vehicle parking, workshop, fuel storage, warehouse, bridge and culvert construction site; - Check for garbage and other wastes at the staying place, warehouse, vehicle parking place, construction site, is there properly management or not? - Check in duration operation stage whether waste water outlet system at by-Pass road is there water pollution or not?	Supervisor Consultant, PMU, MoE and MoWRAM	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure; - Once for 6 monyhs in project Operation stage. ***Note:*** *Water quality test should be done twice per year during the construction stage which year is busy and hard works, once in dry*

		- Water quality test done for 6 locations and tested for 5 parameters as dicribed in Chapter-5, point 2 is about surface water quality test.		*season and once again in wet season.*
5	Air Pollution	- Check for air quality in the construction site during construction work such as dust at borrow pit, quarry site and sand site. On the road, whether water sraying in regularly to protect dust or not? - Check for garbage and other wastes at the staying place, warehouse, vehicle parking place, construction site, is there properly management or not? Is there bad smell spreading out? - Air quality test done for 6 locations and tested for 4 parameters as dicribed in Chapter-5, point 1 is about air quality test in the projetc area and then to do comparision of result whether how much exceeed rate or not? ***Note:*** *Water quality test should be done twice per year during the construction stage which year is busy and hard works, once in dry season and once again in wet season.*	Supervisor Consultant, PMU and MoE	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure; - Once for 6 monyhs in project Operation stage.
6	Noise and Vibration	- Check for working day time of the project, depend on situation people's living there, do not working at night; - Check for noise, vibration and air quality that emission gas spreaded out from the vehicle and machines; - Noise and vibration test done for 3 locations as dicribed in Chapter-5, point 2 is about noise and vibration quality test in the projetc area and then to do comparision of result whether how much exceeed rate or not? - Note: noise and vibration test in the project construction stage is done twice in the year that it most busy and hard activity, it will do test in dry and wet seasons.	Supervisor Consultant, PMU and MoE	- Once of Starting project implementation; - Every 3 months in project construction stage; - Once in project closure; - Once for 6 monyhs in project Operation stage.
B..Biological Resources				
1	Aqualtic and fish	- Survet and follow up at Steung, Prek that road passed whethter there is fish died or not? - Check during project construction whethter there is water blocked that it causes for fish cannot pass to upstream; - Check for duration project operation whethter there is some blocks of water flow by rubbish or trees on front of culvert or not? That it causes for fish cannot pass to upstream.	Supervisor Consultant, PMU, MoE and MAFF	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
2	Forestry and wildlife shelter	- Check for trees plantation along the road whether there is planted or not? While this road is completed construction; - Check for trees planted whether these trees are well grown.	Supervisor Consultant, PMU, MoE and MAFF	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
3	Biological wildlife	- Check for that, is there education and delivery message to village, commune and people about wildlife protection including threatened species (fish) to the village-commune and the people or not?	MoE and MAFF	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
C..Economic and Social Resources				
1	Lang Use/Resettlement	- Check for compensation on impact by the project, is there fair solution for them based on resettlement plan or not? - Check for grievance complaint from the people, is there remaining or not?	Supervisor Consultant, PMU, MoE, MLUMPC, Provincial Authority and NGOs	- Once of Starting project implementation; - Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
2	Living and job of community	- Check for staff recruitment of Contractor (provide priority for the villager living around the project area and the affected people who are male and fimale); - Check for wage rate of Contractor, is there suitable wage based on market price and is there provide regularly salary for the staff or not?	Supervisor Consultant, PMU, MoE, MEF and village and commune Authorities	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.

3	Culture and religion	- Check for PK-397+090, there is hermitage of Lok Yeay Mao (Banyan tree) which people always come to pray, it needs to be fair solved - Chech for fence and gateway of Pagoda, is there re-constructed that it far from the reserved land? - Check and follow up for violation of the Contractor, staff on Culture and Traditional of the vllagers and other ethnic as Lao and Cham.	Supervisor Consultant, PMU, MEF, MLUMPC, Provincial Authority and NGOs	- Once of Starting project implementation; - Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
4	Water Supply	- Check for water canal use for agriculture that the road is passed, is there block caused to lose some discharge for irrigation or not? - Check for resolution for water supply pipe affected by the project on the COI area and these pipes removed from the reserved land or not?	Supervisor Consultant, PMU, MEF, MLUMPC, MoWRAM and village and commune Authorities and NGOs	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
5	Road and Traffic	- Check for operation and maintenance of this road construction; - Check for traffic in the construction site and repairing site of this road; - Check for traffic signboard, traffic light, is there properly installation or not? - Check for weight vehicle, is there proeperly weight? Should clarify that do not any vehicle is over laoded that passed this weight station.	Supervisor Consultant, PMU, MoE and Provincial Authority	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
6	Public Health	- Check for safety takecare during the project construction stage; - Check for health takecare of staff-workers projec's; - Check for other diseases infection protected in the project area; - Check for prevented of Opium and people trading along this road.	Supervisor Consultant, PMU, MoE, MoH, MoI and Provincial Authority	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
7	Aestheticism	- Check for quality of construction whether doing as planned or not?; - Check for illegal disposed of garbage along the road and at the bus station, taxi station ect.,	Supervisor Consultant, PMU, MoE and village and commune Authorities	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.
8	Risks	- Check and follow up for flooded that it causes to inudate and damage on road; - Check and takecare for security and safety on fire and explosives.	Supervisor Consultant, PMU, MoE and village, commune, provincial Authorities	- Every 6 months in project construction stage; - Once for 6 monyhs in project Operation stage.

Table 8-3: Environmental Quality Monitoring form

Project Construction Phase:

Item	Location	Parameter/ Means of Monitoring	Result (Average / Max / Total, etc.)	Standard (Legal / International Standard)	Frequency	Remarks
Air quality	Construction site	Visual inspection of mechanical condition and exhaust gas			Every day before working	
	Construction site	Visual observation of dust			Every day	
	Storage facilities for dust generating materials					
	Boundary of ROW nearest to	SPM10		0.05 mg/m^3 (WHO, average	2 times in dry season and 2	

Item	Location	Parameter/ Means of Monitoring	Result (Average / Max / Total, etc.)	Standard (Legal / International Standard)	Frequency	Remarks
	construction site			24h)	times in rainy season during construction period	
		SPM2.5		0.02 mg/m^3 (WHO, average 24h)		
		SO_2		0.30 mg/m^3 (MOE, average 24h)		
		NO_2		0.10 mg/m^3 (MOE, average 24h)		
Water Quality	Rivers including Pursat, Steung, agriculture canals, streams and other public water bodies where construction works are executed.	Visual observation			Every day	
		Analysis using potable pH and turbidity meter			Every week	
		pH		6.5-8.5 (MOE)	When any pollution is suspected	
		TSS		25-100 (mg/l) (MOE)		
		BOD		1-10 (mg/l) (MOE)		
		COD		1-8 (mg/l) (MOE)		
		Other items (as required)				
Noise	Boundary of land plot nearest to the construction site	Noise Level		60dB (06:00-18:00) 50dB (18:00-22:00) 45dB(22:00-06:00) (MOE, residential area)	- When noise/vibration level exceeding the Cambodian standards is suspected - When local residents complain	
Vibration		Vibration Level		65Hz (05:00-17:00) 60Hz (17:00-05:00) (Lab. MOE)		

Project Operation and Maintenance Phase:

Item	Location		Parameter/ Means of Monitoring	Result (Average / Max / Total, etc.)	Standard	Frequency	Remarks
Air quality	Kbal Spean village, Poipet Town	Road side	SPM10		0.05 mg/m^3 (WHO, average 24h)	1 time in dry season and 1 time in rainy season per year for 2 years	
		200m away from road side					
		Road side	SPM2.5		0.02 mg/m^3 (WHO, average 24h)		
		200m away from road side					
		Road side	SO_2		0.30 mg/m^3 (MOE, average 24h)		
		200m away from road side					
		Road side	NO_2		0.10 mg/m^3 (MOE, average 24h)		
		200m away from road side					
Noise	Kbal Spean village, Poipet		Noise		60dB (06:00-		

Item	Location	Parameter/ Means of Monitoring	Result (Average / Max / Total, etc.)	Standard	Frequency	Remarks
	Town	Level		18:00) 50dB (18:00-22:00) 45dB(22:00-06:00) (MOE, residential area)		
Vibration	Kbal Spean village, Poipet Town	Vibration Level		65Hz (05:00-17:00) 60Hz (17:00-05:00) (Lab. MOE)		

WHO: World Health Organization, MOE: Ministry of Environment (Cambodia)

***Remarks; Past trend and current status including remedial measures if necessary*

8.7 TRAINING PROGRAMS

Training program is an important factor in the EMP that needs to take into account and put in the master plan of the project for ensures successfully implementation. Moreover, in order to promote sustainable development and successful of the project is needed human resource with adequate capacity for improvement work and perfective both technical and environmental working skilled. Therefore, the project owner will organize or provide training courses to staffs-workers project's such as:

- Technical skills for operating the machines in the project construction and operation
- Providing knowledge to staffs/workers on safety work in construction project;
- Training on technical skill, law and procedures that related to the project activities to prevent for accidentally, in case of it will occur by the project activities on the Natural and social resources;
- Educate and campaign on methodology of preventing social disease, especially HIV/AID, BT ect.;
- Provide training course to staff-workers on solid and liquid wastes management and educate them on how to operation and maintenance of latrine and bathroom including Septic tank;
- Educate on important Environmental resources in the project area for social requirement such as: water, land, air, forestry, wildlife especially Natural resource in the project area
- Educate on method for environment protection in/around project area and knowledge on project study related with quantity and quality existing environment that it will affect by project activities;
- Educate to workers on raw materials management that it is chemical elements use for product chain of the project;
- The project owner will recruit the Consultant with high capacity from Japan to work for design plan and technical monitoring of this road improvement including to help for staff-Khmer workers training in relevant institutions and in this project;
- Hope that through this project, the Japan Government will share experience each other between Japan technician and Cambodia due to invitation delegator to visit/study in this country as well.

8.8 COST ESTIMATION OF EMP

The cost estimation for EMP such as environmental monitoring cost and training coast is shown in Table below:

Table 8-4: Environmental Quality Monitoring Form

No	Description	Unit	Quantity	Unit Rate	Total Cost Estimate in US$
I. Environmental Quality Monitoring					

No	Description	Unit	Quantity	Unit Rate	Total Cost Estimate in US$
1	Air quality (Construction Phase)	Sample	4	1,400	5,600
2	Air quality (Operation and Maintenance Phase)	Sample	4	1,400	5,600
3	Water Quality (Construction Phase)	Sample	4	700	2,800
4	Potable pH Meter	LS	1	100	100
5	Potable Turbidity Meter	LS	1	1,900	1,900
6	Noise and Vibration (Construction Phase)	Sample	4	800	3,200
7	Noise and Vibration (Operation and Maintenance Phase)	Sample	4	800	3,200
				Sub-Total	**22,400**
II. Mitigation Activity					
1	Sowing small trees and plant trees for good aestheticism along the road (Construction Phase)	LS	1	29,000	29,000
2	Garbage disposed along the road and illegal dump site	LS	1	35,800	35,800
3	To plant the trees for good aestheticism along the road and good maintained (Operation and Maintenance Phase)	LS	1	37,700	37,700
				Sub-Total	**102,500**
III. Training Fee					
1	Training course on environmental management and field practice	Course	1	1,500	1,500
2	Training course on site monitoring and field practice	Course	1	1,500	1,500
3	Training course on general site management	Course	1	1,500	1,500
4	Transportation for the field practices	Time	3	400	1,200
5	Training materials and snacks for all the courses	Lump Sum	1	450	450
				Sub-Total	**6,150**
III. Training Allowance					
-	-	-	-	Daily Stipend Allowance (US$)	-
1	Engineers from the MPWT	Man-Day	4	100 x 4 Days	1,600
2	Engineers from the MOE	Man-Day	2	100 x 4 Days	800
				Sub-Total	2,400
				Grand Total	**133,450**

Note: *Daily stipend allowance included food, accommodation and transportation.*

Venue fee is included for the training courses.

Source: *JICA working group*

CHAPTER-9
ECONOMIC ANALYSIS

CHAPTER-9

ECONOMIC ANALYSIS

9.1 PROJECT EVALUATION OF ROAD AND VEHICLE UNTILIZATION

Economic cost is a monetary expression of goods and services to be actually consumed for implementation of the Project. Also, economic cost is converted from financial cost by deducting tax portions and applying the standard conversion factor to the non-trade. Road user cost needs to estimate the travel costs in order to the Project. This project evaluation is taking to account for only two section of NR5 improvement from Thea Ma Am to Battambang and another from Sri Sophorn to Poipet. Travel costs consist of two components;

- Vehicle operating costs (VOC), is the physical costs of operating a vehicle such as consumption of fuel, lubricants, spare parts, deprecation, crew costs, and so on
- Travel time costs (TTC), is the value of time spent in travelling that could be used in the other activities.

(1) Vehicle Operating Cost (VOC)

The VOC, estimated in "the Preparatory Survey for National Road No. 5 (South Section) Improvement Project in the Kingdom of Cambodia" implemented by JICA in 2012-2013, was used as the basic reference for this survey. The VOC in this Survey was estimated considering consumer price index in 2013. Inputs for vehicle operating costs required for calculating the VOC are as follows.

(a) Shadow wage rate (SWR)

The shadow wage rate (SWR) is an estimate of the economic price of labor. The labor divided into two categories: skilled and unskilled corresponding on degrees of scarcity. The SWRs as shown below are applied.

Table 9-1: Shadow Wage Rate

	Skilled	Unskilled
Shadow Wage Rate	1.00	0.50

Source: Cost-Benefit Analysis for development a practical Guide 2013

(b) Vehicle Price

The vehicle price is estimated on the basis of average prices for new vehicles purchased from car dealer ships. Most of vehicles are imported to Cambodia as second hand reconditioned vehicles. However, as second hand price is uncertain and depends on the frequency of use, a new vehicle prices are used in this Survey. For the purpose of calculating the economic price of each vehicle taxes and import duties have been subtracted from the retail price. The resulting economic price includes elements of Cost Insurance and Freight (CIF) price, retailer's margin.

Table 9-2: Vehicle Prices and Characteristics

Type		Fuel Type*	Km per driven (Annual Km)	Service Life	Financial Price (US$)	Economic Price (US$)
Motor Cycle	Honda Dream 110	P	10,000	10	1,500	936
Sedan Car	Camry 2000	P	30,000	10	40,000	23,250
Pick-Up	Toyota Hilux	P	30,000	10	30,000	21,360
Mini Bus	Toyota Hiace Commuter	P	30,000	10	47,500	33,428
Big Bus	Hyundai Bus for 45Pax	D	70,000	10	83,000	58,420
Light Truck	Isuzu NPR 55 E	D	60,000	10	32,000	22,535
Medium Truck	Isuzu FSR 33	D	100,000	12	85,000	59,808
Heavy Truck	Isuzu CYR 80	D	100,000	12	108,000	75,988

Fuel Type: P: Petrol D: Diesel

Source: Car dealerships

(c) Tire Cost

The economic costs of tires are assessed in the same way as vehicle prices. Suppliers in Phnom Penh were surveyed to assess general prices of different types (motor cycle, passenger car, bus and truck) of tire. New tires are subject to import duty and VAT, whose rates vary depending on the type of tire. Custom import duty is principally charged at 15% of the CIF value of the tire. The rate of VAT and special tax are 25% and 15% for all types of tire. Special tax (zero) is applied for motor cycle tire. For the purpose of calculating the economic price of each vehicle tire, taxes and import are subtracted from the retail price. The resulting economic price includes elements of CIF price and retailer's margin.

Table 9-3 Tire Cost

Type	Tire Size	No. of Tire	Financial Price (US$)	Economic Price (US$)
Motor Cycle	100/17	2	44.0	35.9
Sedan Car	185/70-14	4	224.0	149.3
Small Bus	195/70-14	4	292.0	194.7
Large Bus	11.00-20	6	2,280.0	1,520.0
Light Truck	7.50-16	4	700.0	466.7
Medium Truck	8.25-16	6	1,770.0	1,180.0
Heavy Truck	11.00-20	10	3,800.0	2,533.3

Source: Retail shop

(d) Fuel and Lubrications

Fuel and lubricants prices are estimated based on a survey of market prices. There are a number of suppliers in Cambodia operating competitively. Fuels are subject to import duty, special tax and VAT. For the purpose of calculating the economic price of fuel and lubricants, these taxes and import duty are subtracted from the retail price. The resulting economic price includes elements of CIF price, customs import duty, value added tax and retailer's margin.

Table 9-4: Fuel and Tire Cost

Type	Financial Price (US$) / liter	Economic Price (US$) / liter
Gasoline Regular	1.28	1.04
Diesel	1.23	1.00
Lubricant (motorcycle)	3.60	2.93 (0.8ℓ)
Lubricant (4 wheels or more)	7.50	6.11

Source: Retail shop

(e) Spare Parts Cost

Spare parts costs are assumed to be 1% of the vehicle price.

(f) Maintenance Labor Cost

The maintenance costs estimated based on a survey of the average monthly cost of skilled supervisors and mechanics. Average working hours applied 200 hours per month.

Table 9-5: Maintenance Labor Cost

	Motor Cycle	Sedan Car	Pick-up	Mini Bus	Large Bus	Light Truck	Medium Truck	Heavy Truck
Wages per month (US$)								
Supervisor	600	600	600	600	600	600	600	600
Mechanic	300	300	300	300	300	300	300	300
Owner	0	0	0	0	0	0	0	0
Maintained by (%)								
Supervisor	10	25	25	25	50	25	50	50
Mechanic	40	50	50	50	50	50	50	50
Owner	50	25	25	25	0	25	0	0

Maintenance hours per year	40	70	70	250	300	250	300	350
Average hourly rate for services (US$)	36.0	105.0	105.0	375.0	675.0	375.0	675.0	787.5
Shadow wage rate factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Economic Price (US$)	36.0	105.0	105.0	375.0	675.0	375.0	675.0	787.5

(g) Crew Cost

Crew cost of a vehicle per km is calculated over certain time period (hours) and divided by the distance (km) traveled during this time period. The crew costs per unit of vehicle are estimated based on a survey of drivers and conductors or assistants. In Cambodia, unit costs for drivers are estimated at around US$150 to $300 per driver per month, depending on the type of vehicle, while unit cost for conductors or assistants are estimated to be one half of the average monthly cost of skilled supervisor and semi-skilled worker, respectively.

Table 9-6 Crew Cost

	Motor Cycle	Sedan Car	Pick-up	Mini Bus	Large Bus	Light Truck	Medium Truck	Heavy Truck
Number of drivers	0.01	0.1	0.1	1	1	1	1	1
Average monthly wage rate	150	200	200	250	300	250	300	300
Working Hour	200	200	200	200	200	200	200	200
Average hourly rate for driver	0.008	0.100	0.100	1.250	1.500	1.250	1.500	1.500
Skilled wage factor – Semi - skilled	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Driver cost (Economic)	0.008	0.100	0.100	1.250	1.500	1.250	1.500	1.500
Number of conductors	0	0	0	0.5	1	1	1	1
Average monthly wage rate	0	0	0	125	150	125	150	150
Working Hour	200	200	200	200	200	200	200	200
Average hourly rate for conductor	0.000	0.000	0.000	0.313	0.750	0.625	0.750	0.750
Skilled wage factor – Unskilled	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Conductor cost (Economic)	0.000	0.000	0.000	0.156	0.375	0.313	0.375	0.375
Total Crew Cost	0.008	0.100	0.100	1.406	1.875	1.563	1.875	1.875

(h) Depreciation

Depreciation cost can be expressed as a percent of new vehicle cost and is given by the following formula:

Vehicle per 1,000 veh-km = DEP/ New vehicle prices

A vehicle is a medium-term asset. The purchase cost represents an investment which yields services over several years. The market value of the asset declines with both the passage of time and with amount and type of usage. It is this loss of market value that represents vehicle depreciation. The vehicle depreciation per km is a function of the average annual depreciation and annual utilization.

DEP = ADEP/AKM

Where:ADEP: Average annual depreciation, expressed as % of average new vehicle cost
ADEP: (1 / LIFE)*100
LIF is average vehicle service life
AKM: Average number of kilometers driven per vehicle per year

(i) Insurance Cost

Insurance cost was assumed to be 1% or 3% of vehicle price.

(j) Overhead Cost

Overhead cost was calculated at 10% of the sub-total of the VOC. Based on the above mentioned discussion and estimations the basic vehicle operating costs are calculated and are shown in Table 9-7.

Table 9-7 Vehicle Operating Cost by Vehicle Type

Unit US$

Type	Item	Motor Cycle	Sedan Car	Pick-up	Mini Bus	Large Bus	Light Truck	Medium Truck	Heavy Truck
Distance related VOC	Fuel cost	311.7	3,116.7	3,116.7	4,051.7	13,974.1	10,181.1	19,963.0	32,938.9
	Lubricant cost	5.9	73.3	91.7	122.2	1604.2	366.7	1833.3	1833.3
	Tire cost	17.9	112.0	112.0	146.0	2128.0	560.0	2360.0	5066.7
	Maintenance cost	9.4	232.5	213.6	334.3	584.2	225.3	598.1	759.9
	Depreciation cost	0.6	14.4	13.2	20.6	36.1	13.9	30.8	39.1
	Sub total	345.4	3,548.9	3,547.1	4,674.8	18,326.5	11,347.0	24,785.2	40,637.9
	Overhead cost	0.0	0.0	354.7	467.5	1,832.7	1,134.7	2,478.5	4,063.8
	Total	345.4	3,548.9	3,901.8	5,142.3	20,159.2	12,481.7	27,263.7	44,701.7
Time related VOC	Crew cost	4.5	75.0	75.0	2,250.0	3,375.0	2,500.0	3,750.0	4,500.0
	Maintenance cost	36.0	105.0	105.0	375.0	675.0	375.0	675.0	787.5
	Insurance cost	28.1	697.5	640.8	334.3	584.2	225.3	598.1	759.9
	Depreciation cost	0.3	7.7	7.1	11.1	19.4	7.5	16.6	21.1
	Sub total	68.9	885.2	827.9	2,970.4	4,653.6	3,107.8	5,039.7	6,068.4
	Overhead cost	0.0	0.0	82.8	297.0	465.4	310.8	504.0	606.8
	Total	68.9	885.2	910.7	3,267.4	5,119.0	3,418.6	5,543.6	6,675.3
Total		414.3	4,434.1	4,812.5	8,409.7	25,278.1	15,900.4	32,807.3	51,376.9
VOC /1000 km		41.4	147.8	160.4	280.3	361.1	265.0	328.1	513.8

(2) Travel Time Cost (TTC)

Travel time cost (TTC) is the cost of time spent on transport/travel. It includes various factors such as the following:

(i) Value of time spent on going to or coming back from to office (passenger car).

(ii) Cost of the crews of trucks/buses.

(iii) Income of trucks/buses obtained by transporting cargo/passenger car.

However, the results of the roadside interview survey, asked to truck drivers, showed that the truck drivers are not aware of the three item above. Thus, item (iii) is not considered for the trucks here. If the alternative activity can have monetary value assigned to it, this can be used as a part of road user cost in the economic appraisal of the projects, particularly road improvement projects.

In order to estimate the travel time costs, the average wage approach method is adopted. The time travel cost of a vehicle is calculated based wage level of a passenger/driver and occupancy ratio of each vehicle type. Time value of a passenger/driver is assessed for working time and non-working time as shown in Table 9-8.

Table 9-8: Estimation of Travel Time Cost

Vehicle Type	Travel Time Value (US$/hour)		Trip Purpose Composition		Weighted Average Value (US$/hr/person)	Average No. of Passengers	Time Value by Vehicle Type (US$/hr)
	Work	Non-Work	Work	Non-Work			
Motorcycle	1.27	0.42	31.0%	69.0%	0.38	1.80	0.68

Light Vehicle	9.93	3.28	57.0%	43.0%	2.02	3.50	7.07
Bus	7.09	2.34	69.0%	31.0%	0.31	18.00	5.61
Truck	1.31	0.43	95.0%	5.0%	0.63	2.00	1.27

TTC in 2018, 2023 and 2033 were calculated with 2014value value derived from estimation growth rate of per capita GDP. Future results are shown in table below:

Table 9-9: Forecast of Time Value per Vehicle

Unit: US$/ hour

Year	Motorcycle	Light Vehicle	Bus	Truck
2014	0.68	7.07	5.61	1.27
2018	0.99	10.23	8.12	1.84
2023	1.28	13.25	10.52	2.38
2033	1.63	16.84	13.37	3.02

The benefit is regarded as various desirable effects given to the national economy when the project is implemented, and the cost is regarded as all national economical expenditure required for the project implementation concerned.

(3) Construction Cost, Maintenance Cost and Land Acquisition Cost

The cost of construction, maintenance and land acquisition presented in Chapter 12 and Chapter 13 are used in the economic evaluation. Maintenance costs are classified into annual routine maintenance cost and periodic maintenance cost. Periodic maintenance costs are assumed to be expended each 10 years. Some basic presumptions adopted in the economic analysis are as follows:

- Escalation factor: Price escalation is not taken into account for construction cost, maintenance cost and land acquisition cost.
- Tax and import duty: Value added tax and import duty are excluded from cost.
- Land acquisition cost: Land acquisition cost is included.

9.2 Economic Evaluation

9.2.1 Methodology

Economic evaluation is conducted in terms of comparative analysis between benefits and costs. Benefits contain i) time saving benefit and ii) vehicle operating cost saving benefit, while costs consist of construction cost, land acquisition cost and operation / maintenance cost. Indicators adopted for economic evaluation are the conventional “economic internal rate of return (EIRR)”, “benefit-cost ratio (B/C ratio)” and “net present value (NPV)”. Evaluation was conducted on the basis of transport demand forecast.

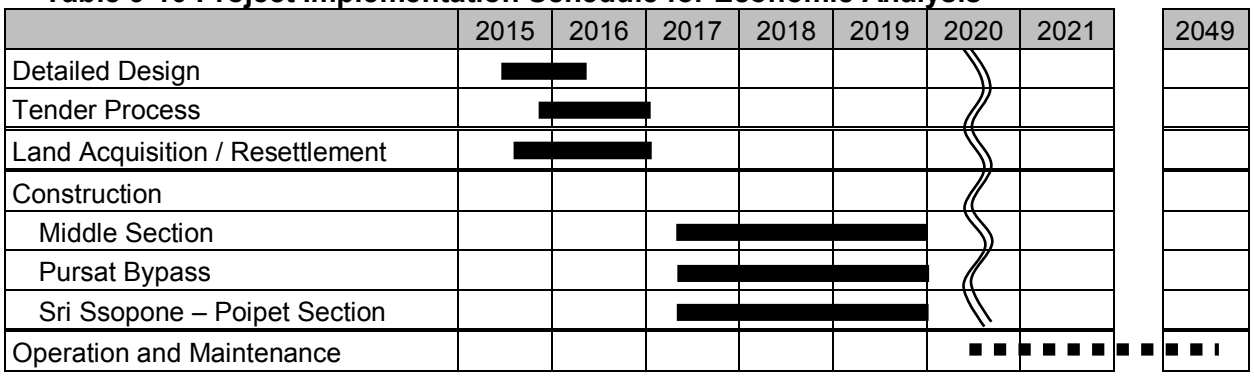
In order to evaluate the road projects from an economic view point, the following economic indicator were considered:

- The net present value (NPV) of a given cost-flow is obtained by subtracting the present value of the costs from the present value of the future benefits. The benefits as well as the costs are discounted at the opportunity cost of capital. The investment is viable if the NPV is positive.
- The economic internal rate of return (EIRR) of a given project is defined as the discount rate at which the present value of benefits and the present value of costs are equal. It is a measure of the marginal efficiency of capital. For a project to be viable, the EIRR has to be greater than the opportunity cost of capital rate. Normally the NPV and EIRR will give the same indications of viability and priority ranking between projects.
- The benefit cost ratio (B/C ratio) refers to the ratio of the present value of the economic benefits stream to the present value of the economic cost stream. The investment is viable for the project if the B/C ratio is greater than 1.0.

(1) Implementation Plan of the Project and Evaluation Period

The evaluation period is assumed to be 30 years from 2020 to 2049 taking the service life of the Project into account.

Table 9-10 Project Implementation Schedule for Economic Analysis



(2) Evaluation Period and Daily Factor

Evaluation period is set as 30 years after opening to traffic. The annualized factor of the daily benefits is assumed to be 340 days per year taking into consideration the weekly variation in the volume of traffic on the roads.

(3) Social Discount Rate

The social discount rate of 12% is assumed.

(4) Residual Value and Inflation

Residential value and inflation are not considered in this economic evaluation

(5) Standard Conversion Factor (SCF)

The standard conversion factor (SCF) is a standard method for adjusting domestic prices which are considered to be distorted in the domestic market price. SCF used 0.90 in this Survey.

$$\text{Standard Conversion Factor (SCF)} = \frac{\text{(Import +Export)}}{\text{(Import + Import Custom) +(Export – Export Custom)}}$$

Table 9-11 Calculation of SCF

Unit: US$ million

	2008	2009	2010	2011	2012
CIF	5,076.6	4,489.9	5,466.0	5,219.5	6015.7
FOB	3,492.3	2,995.7	3,884.3	6,709.5	7964.9
Import Custom	1,123.8	1,080.8	1,444.0	1,378.9*	1,589*
Export Custom	76.6	78.1	130.9	226*	268*
SCF	0.891	0.882	0.877	0.912	0.914
Average					0.90

Source: Key Indicators for Asia and the Pacific 2013, ADB

** Estimation of Study Team*

(6) Cost Benefit Analysis

The result of the economic analysis is shown in table 9-12. The economic analysis is based on the annual user's benefit and VOC shown in the above table. The result analysis shows EIRR of 17% which is usually considered to be sufficient.

Table 9-12 Cost Benefit Stream of the Project

Unit: US$

SQ	Year	Project Cost	Maintenance Cost	Total Cost	Benefit	Net Benefit	Discount Cash Flow (at 12%)		
							Cost	Benefit	Net Benefit
	2015	135,933		135,933		-135,933.1	135,933.1	0.0	-135,933.1
	2016	12,054,233		12,054,233		-12,054,232.8	10,762,707.8	0.0	-10,762,707.8
	2017	52,943,918		52,943,918		-52,943,917.6	42,206,567.0	0.0	-42,206,567.0
	2018	121,338,718		121,338,718		-121,338,718.4	86,366,503.1	0.0	-86,366,503.1
	2019	110,767,373		110,767,373		-110,767,373.3	70,394,668.3	0.0	-70,394,668.3
1	2020	60,572,619	435,825	61,008,444	7,748,444.8	-53,259,999.6	34,617,829.8	4,396,675.7	-30,221,154.1
2	2021	126,021	435,825	561,846	13,148,329.6	12,586,483.5	284,648.7	6,661,353.0	6,376,704.2
3	2022		435,825	435,825	15,021,131.0	14,585,306.0	197,145.1	6,794,796.8	6,597,651.7
4	2023		435,825	435,825	19,965,205.6	19,529,380.6	176,022.4	8,063,611.7	7,887,589.3
5	2024		435,825	435,825	23,570,385.6	23,134,560.6	157,162.9	8,499,717.3	8,342,554.5
6	2025		435,825	435,825	27,603,937.5	27,168,112.5	140,324.0	8,887,729.1	8,747,405.1
7	2026		435,825	435,825	32,109,789.9	31,673,964.9	125,289.3	9,230,797.3	9,105,508.0
8	2027		435,825	435,825	37,136,381.9	36,700,556.9	111,865.4	9,531,984.3	9,420,118.9
9	2028		435,825	435,825	54,296,530.9	53,860,705.9	99,879.8	12,443,363.5	12,343,483.6
10	2029		31,121,025	31,121,025	71,284,778.2	40,163,753.2	6,367,978.3	14,586,277.9	8,218,299.6
11	2030		435,825	435,825	90,348,278.6	89,912,453.6	79,623.6	16,506,292.7	16,426,669.1
12	2031		435,825	435,825	111,691,848.3	111,256,023.3	71,092.5	18,219,359.9	18,148,267.4
13	2032		435,825	435,825	135,538,689.6	135,102,864.6	63,475.4	19,740,443.1	19,676,967.7
14	2033		435,825	435,825	200,917,932.9	200,482,107.9	56,674.5	26,127,285.6	26,070,611.1
15	2034		435,825	435,825	213,192,076.4	212,756,251.4	50,602.2	24,753,044.9	24,702,442.6
16	2035		435,825	435,825	226,221,731.1	225,785,906.1	45,180.6	23,451,675.1	23,406,494.5
17	2036		435,825	435,825	240,037,097.3	239,601,272.3	40,339.8	22,217,740.5	22,177,400.7
18	2037		435,825	435,825	254,715,865.4	254,280,040.4	36,017.7	21,050,358.6	21,014,340.9
19	2038		435,825	435,825	341,621,422.8	341,185,597.8	32,158.6	25,207,546.4	25,175,387.8
20	2039		31,121,025	31,121,025	362,481,625.0	331,360,600.0	2,050,318.6	23,881,051.9	21,830,733.3
21	2040		435,825	435,825	384,614,771.2	384,178,946.2	25,636.7	22,624,312.6	22,598,675.9
22	2041		435,825	435,825	408,098,512.7	407,662,687.7	22,889.9	21,433,664.2	21,410,774.3
23	2042		435,825	435,825	433,015,236.8	432,579,411.8	20,437.4	20,305,634.6	20,285,197.2
24	2043		435,825	435,825	553,582,333.5	553,146,508.5	18,247.7	23,178,086.9	23,159,839.3
25	2044		435,825	435,825	587,374,518.9	586,938,693.9	16,292.6	21,957,983.0	21,941,690.5
26	2045		435,825	435,825	617,387,593.6	616,951,768.6	14,546.9	20,607,116.1	20,592,569.2
27	2046		435,825	435,825	648,827,481.5	648,391,656.5	12,988.3	19,336,173.5	19,323,185.1
28	2047		435,825	435,825	681,940,029.4	681,504,204.4	11,596.7	18,145,521.7	18,133,925.0
29	2048		435,825	435,825	716,741,504.4	716,305,679.4	10,354.2	17,028,163.3	17,017,809.1
30	2049		31,121,025	31,121,025	587,601,001.8	556,479,976.8	660,147.7	12,464,353.5	11,804,205.8
	Total	357,938,816	105,130,350	463,069,166	8,097,834,466.2	7,634,765,300.5	255,483,146.6	507,332,114.6	251,848,968.0

EIRR	16.6%
B/C	1.99
NPV	251.85

(7) Sensitive Analysis

A sensitivity analysis is conducted to see the influence of fluctuation of benefit and construction cost. Sensitivity analysis is made on the cases with +10% in the cost and -10% in the cost and benefit, respectively. These changes in cost and benefit are supposed to represent favorable and unfavorable scenarios. The results of the sensitivity analysis are shown in Table 9-13.

As the results of sensitivity analysis, even if the worst case which the benefits are decreased in 10 % and the project costs are increased in 10 % is occurred, the project EIRR of the all cases exceeds the opportunity of capital in Cambodia of 12 %. The implementation of the project is economically feasible from view point of national economy.

Table 9-13 Results of the Sensitivity Analysis

Case		Economic Indicator	Benefits		
			-10%	Base Case	10%
Costs	-10%	NPV (US$ million)	202.43	247.73	293.02
		B/C	1.99	2.21	2.43
		EIRR (%)	16.6%	17.4%	18.1%
	Base Case	NPV (US$ million)	179.62	251.85	270.22

		B/C	1.79	1.99	2.18
		EIRR (%)	15.9%	16.6%	17.3%
		NPV (US$ million)	156.82	202.12	220.89
	10%	B/C	1.63	1.81	1.99
		EIRR (%)	15.2%	15.9%	16.6%

8) Conclusion

The benefit of the project is summarized as the reduction of transport cost, reduction of travel time. Environmental conservation and increase job opportunities for the local people have also considered as indirect benefit which are not taken into consideration the above economic analysis.

Project roads serve as the most important freight transport road for Cambodia and Thailand. It is also, the majority of domestic product from western provinces which need to be transported through NR5. The project influential area has a high development potential for Cambodia.

One last thing, the number of fatalities by traffic accidents also recorded the highest at NR 5 compared to other 1-digit trunk roads. Therefore, development of NR 5 will not only promote ASEAN connectivity, international and domestic economic development but also traffic safety in Cambodia.

CHAPTER-10
CONCLUSIONS AND RECOMMENDATIONS

CHAPTER-10

CONCLUSIONS AND RECOMMENDATIONS

10.1 CONCLUSIONS ON NR5 IMPROVEMENT SECTION PROJECT FROM SRI SOPHORN TO POIPET

The environmental and Social Impact Assessment (ESIA) on NR5 improvement project from Sri Sophorn to Poipet, Ministry of Public Works and Transport (MPWT), could be drawn conclusion as follow:

- This project will be improved road and new road with length is 35.8Km of length, starts from PK-366+250to KP402 (Poipet Town); it is 23m width of road (in rural area) and it is 28m width of road (in Town area), paved of AC that it is four lines (3.5m x 4), divided by central median of road is 3m at the shoulder road is 3m width for both sides (3m x 2) for bike and motorbike; additional road in Town there is road for parking vehicle for both sides is 2.5m width (2.5mx 2), included both sides shoulder road for Pedestrian is (3m x2). The NR5 improvement project from Sri Sophorn to Poipet required extending construction 68 culverts (one row to 4 rows of concrete pipes).
- Total land requirement is 143.2ha for project road construction (40 m x 35.8Km), the land both sides from the central road are 40m (COI: 20m for one side).
- According to inventory forest in project area by trees counting on the slope road from NR5 Sri Sophorn to Poipet is 1,034 trees; it is 619 trees on the right hand and it is 415 trees on the left hand; it is 32 types of these species which affected by the project.
- The NR5 improvement project from Sri Sophorn to Poipet will be less effect on Riverside vegetation that it re-grows a little bit along the road located on the left hand in between PK366 +250 to KP366+685, and in totally is 0.7ha with 24 types.
- The ESIA study team determined for the study area on environmental resource 150m of width from the central line road totally is 300m with 1,074ha area. Within this area the working teams found that total wildlife are: **6** species of mammals, 38 species of birds, 30 species of reptiles and 91 species of freshwater fishes.
- Polluting in surface water such as (Stream, Creek) in the project area (in wet and dry seasons) by human activities is not seriously. Base on water quality tested at downstream of Steung Teuk Thla, some people called Steung Sisophon; 5 parameters tested and shown that it is only Total Coliform which is a little bit high the standard of water drinking of MIME; and as well as TSS is a little bit high the water quality in public resources for maintaining of biodiversity of MoEin wet season only. Even though, are exceeded of water quality standard of MIME and MoE we concluded it is not serious water polluted that need to be declaration.
- Air quality in the project area and road site and further far more than 100m for the road site, before the project construction found that there are two parameters: NO_2 and SO_2 were low than standard of MoE (in wet and dry seasons), but it was higher in wet season.
- Noise quality in the project area and road site and further far more than 100m for the road site, before the project construction, started from 6:00am to 11:00pm was low than standard of MoE (in wet season). But started from 11:00pm to 6:00am was a little high than standard of MoE in between 2.5dB to 4.2dB because there was transporting at night from the truck.
- Vibration quality in the project area and road site and further far more than 100m for the road site, before the project construction found that there was low than standard of MoE (in wet season).
- The social economic people's along the road before project construction was studied and the study team has determined n/N≥ 10% (equal 15%) the people are living along the road. Along the NR5, there is 21 villages, 3 communes, 3 Sangkats, 1 District and 2 Towns of Banteay Meanchey province. The total pupolation within 21 villages is 5,993 families, among of 1,336 families equal 22.29% are living along the project road.

  Note: *All these families that living along the road, they are not all affected by the project.*

- There are 562 families, 238 HHs, 70 business stalls, 1 restaurant, 146 other small stalls and 51 others construction in the COI area that will impact by the NR5 improvement from Sri Sophorn

to Poipet. The total budget planned is USD 8,059,913.55 for compensation and resettlement site implementation, it is this project and road improvement for section from Thlea Ma' am to Battabang.

Jump to conclusion, this project is not serious impact on Social and Environment, if the project owner strongly follows the environmental mitigation measures in Chapter-7 and also following to the environmental management plan in Chapter-8. In addition, the project owner recruited Technical Experts and the Contractors of construction from Japan which they have high experiences in project design, construction monitoring for this project. For example: protection and mitigation measures summary for wastes that it is fuel and chemical elements or wastes. For other wastes the project owner will require to the contractor to manage properly based on technical waste condition. Moreover, the project owner will require to the contractor to build septic tank of 2-3 blocks to treat wastewater with adequate capacity to treat base on outlet of this project. The project owner will do cooperation with MoE and relevant institutions to do monitoring and recommendation regularly on solid and liquid wastes management activity, especially illegal garbage disposal along the road during the operation and maintenance phase.

Moreover, there is get income to the National budget through this project, because the contractor used fuel and materials of construction which the company imported or bought. The company will pay on Tax, VAT and other Tax for fuel or other materials of construction used for construction.

At the same time, the negative impact on natural resources and some social environment, the project will provide advantages to the local people and whole society such as:

The whole project construction is take for 3 years; the project will increase income to the people of Cambodia through providing jobs to them especially, many local people in the project construction phase.

The project will recruit Cambodia Technician, Engineer to assist foreigner Experts in the project design, construction monitoring, and project construction which it causes of Cambodia Technician and Engineer to get experiences of construction of highway from the Japan's Engineers and Experts.

Other hand, through the Japan's Experts and Cambodia Officer of MoPWT will get new experiences and knowledge on survey, calculation, project design plan, monitoring, ESIA study as well.

Due to influence of road extending, there will become a Asian highway A-1, it will increase income to the people in the community through National and International Tourists come to Cambodia especially, the people come from the provinces which they pass on this road.

The NR5 improvement project is serving for many sectors such as: public works and transportation, Agriculture, Enterprise, and Industrial which it is based for National Economic development. Moreover, this project can assist to facilitate of travelling, access on time, less payment to the local people and also the Tourists.

10.2 RECOMMENDATIONS ON NR5 IMPROVEMENT SECTION PROJECT FROM SRI SOPHORN TO POIPET

To be smoothly for this project implementation and strengthening of responsibility for economic development sustainable on natural resources and social safety, the working team would like to give recommendations as below related to IESIA:

- The project owner should study on project design of whole elements project's which to be sure better according to the technical highway, to avoid occuring damages by accident to the people life and animal; it is also damage on environment in/around the prject area; should do additional calculation for local earthquake. The detail project design of whole elements project's should do whatever to avoid Banyan Tree of Yeay Mao and Nak Ta Krahomkorat the KP-397+090; in generally this place the people always come from in/out of the Banteay Meanchey province to pray here. Moreover, at the point of Kon Damrei, the project owner should study on water discharge for 50 years, because there is often flooded for every year especially in year 2013.
- The project owner (MoPWT) and provincial Authority should do cooperation together to delivery on traffic law and sefety including traffic light vehicle to the people living in/near the projetc area, let them clearly understanding on that and to delivery information on technical waste management.

- The project owner should solve for compensation to the affected people on the reserved land that the project required COI area for road improvement in davence before the project construction starting.
- Every phase of project, the relevant companies which the project owner selected for this project implementation should follow the relevant law of Cambodia in order to get project success and sustainability.
- To reduce traffic accident in effectiveness the Government should insert traffic law and traffic light vehicle into the program education for high school.
- The MoPWT and Provincial/Town authorities should do announcement to the people who tried to fill up soil on canal, drainage systems along the road; should do installing concrete ring with diameter proportion to water capacity which it can be released water out to avoid water blocks or inudated on the road caused to road damaged.
- Sameness, the project owner should require to business enterprises for sand and soil selling, concrete mixing factory, place trasferring cargos or big stores ect,..which there are big trucks in/out, they should spend their own money to connstruct a strong road on front of their locations to avoid road damaged that it was laoned from ODA of Japan for the Nation and then it destroyed by the private sector (merchant).

Finally, on be half of MoPWT and JICA working Team which they are studied project for the NR5 improvement project between Sri Sophorn and Poipet which it is a part of main NR5 and it is a Asian Highway-1, it is blood vessel of National economic, economic zone and connect to International also, to propose to MoE and relevant Minitries to authorize and acknowledge report of EIA.

Phnom Penh, October 02, 2014
Project Study Team: Jica Study Team
Team Leader/Road Traffic Plan

SAKURAI TATSUYUKI

Phnom Penh, September 29, 2014
EIA Study Team: SAWAC Consultants
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Phnom Penh, October 07, 2014
Project Owner: **Ministry of Public Works and Transport**
Director of Department of International Cooperation,
Project Director

CHHEUM PHALLA

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